

*H2.0 inform and empower initiative*

## **HSW final report**

**Empowering Communities in East Africa in Water Service Provision through Information from Human Sensor Webs**



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# Contents

<b>Acknowledgement</b> .....	<b>7</b>
<b>1 Introduction</b> .....	<b>9</b>
1.1 Theory and concepts behind HSW .....	9
1.2 Mobile phones in Africa.....	13
1.3 Water services provision on Zanzibar.....	13
<b>2 Project Partners</b> .....	<b>15</b>
<b>3 Objectives of the project</b> .....	<b>17</b>
<b>4 Main outputs</b> .....	<b>19</b>
4.1 An operational Human Sensor Web for water services deployed in Zanzibar.....	19
4.2 Other outputs and activities according to contract.....	20
<b>5 Technical setup of HSW</b> .....	<b>25</b>
5.1 Human Sensor Web Design Concept.....	25
5.2 SMS-Gateway Application.....	25
5.3 Deployment of the Human Sensor Web component .....	26
<b>6 Implementation and Embedding of HSW</b> .....	<b>27</b>
6.1 Implementation on Zanzibar.....	27
6.2 Motivating participants .....	27
6.3 Quality of Volunteered Geographic Information.....	27
6.4 SMS usage.....	29
6.5 Water and cell phones.....	29
6.6 Reactions to water availability problems.....	30
6.7 Willingness to pay for water.....	32
6.8 The role of culture.....	33
6.9 Typing error .....	33
6.10 Similar human sensor cases in Zanzibar .....	35
<b>7 The way forward</b> .....	<b>37</b>
7.1 Scalability of a Human Sensor Web approach.....	37
7.2 HSW and eGovernance.....	38
7.3 The future of the Human Sensor Web .....	41
<b>8 References</b> .....	<b>45</b>

<b>Annex 1: Human Sensor Web Design Concept .....</b>	<b>49</b>
<b>Annex 2: SMS-Gateway Application .....</b>	<b>67</b>
<b>Annex 3: Deployment of the Human Sensor Web component.....</b>	<b>99</b>
<b>Annex 4: Implementation of the HSW on Zanzibar .....</b>	<b>117</b>

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# 1 Introduction

The report before you gives an overview of the activities and outputs that have emerged from the Human Sensor Web project. The outputs of project are partly tangible results of project implementation such as the online available “ Human Sensor Web” and partly the results are findings from the research component in the project. These findings are mixed in this report with the technical descriptions that accompany the tangible outputs. This report contains parts of work which has been published elsewhere as part of the research dissemination component of the project.

In January 2008, UN Habitat and Google.org launched the H2.O Monitoring Services to Inform and Empower program. Their aim is a participatory and transparent manner of collecting citizen-level data on the quality of water services. Their ambition is to roll out the program in East Africa. In 2009, our team conducted a pilot under this program in Zanzibar. Our aim was to explore the issue and experiment with a pilot project, a rudimentary ‘ Human Sensor Web’—the ‘measurement’ or ‘sensing’ part of a novel, bottom-up social indicator system for water services.

A ‘ Human Sensor Web (HSW)’ comprises ordinary citizens with mobile phones (‘human sensors’) and free & open source geographic web services. The concept is deceptively simple. Citizens send SMS messages via standard mobile phones to report the lack or poor quality of water at a public water point: ‘no’ for no water and ‘dirty’ for dirty water. These data is aggregated, anonymized and publicly disclosed in real time on the internet, through a Google Map™ interface. Officials of the water authority and citizens can visualize the data reports. Officials can respond by alerting citizens that the problem has been solved or divert them to working water points nearby. In principle, the open source and modularized architecture of the HSW can be extended to cover larger areas and populations and other public services (e.g. health). A HSW can complement other mass media in publicly disclosing location-based failures in government services, in a visual form that is easy to understand.

## 1.1 Theory and concepts behind HSW

*Adapted from Verplanke et al. (2010)*

Over the past decades, collecting the information of the water supply in Africa has been heavily relied on traditional labour work, without the aid of geo-information technology. In addition, the data of water access points have been available merely for the governmental officers. A recently developed method using mobile communication is investigated in Zanzibar, an island in the United Republic of Tanzania. The employed method is based on Human Sensor Web, which monitors a service by public activity as observers (Jürrens, Bröring et al. 2009). An evolution of data quality is studied as a fieldwork in Zanzibar. Currently cell phones are widely used in Tanzania; people deliver messages by voice and texts (Molony 2008). As cell phones being a popular communication tool, the proposed Human Sensor Web is applicable for monitoring water service and supply in Zanzibar. This research investigates the reliability of a system that human can be considered as sensors to provider volunteered geographic information.

Electronic government (eGovernment) research has focused mainly on individual government organizations and on the impacts of information and communication-technology (ICT) on the capabilities of single government units (Danzinger et al. (2002). Zouridis and Thaens (2005) argue that the four spheres of traditional government—policy, politics, organization, citizens—have been affected only partly by IT.

Current approaches of monitoring citizens' access to public services are being contested. According to UN Habitat (2010), attempts to improve them are "hampered by the lack of reliable information at the local level, resulting in statistics which mask the true picture on the ground." Citizens within a certain distance from a water tap or a clinic are considered adequately covered. But, the assumption that the tap is working or that the clinic is staffed is often not true. In Tanzania, administrative agencies in the water and public health sector often lack the resources to detect and remedy failures in public services. The prospect of citizens with mobile phones ('human sensors') reporting the shortcomings and publicizing them on the internet to exact accountability from officials is a novel alternative. The potential of this alternative for better governance of water and health is the focus of this integrated research program. Many of the millennium development goals are related to basic public services. At a national level, access of citizens to public services is monitored using a mix of observations and assumptions. For example, urban residents within 100 meters of a water tap are considered adequately covered. But, the assumption that the tap is working is often not true. As a result, aggregated national statistics often mask the true picture on the ground. In this research, citizens play a crucial role as collectors and publishers of data at the local level. Citizens send text messages, via Human Sensor Webs, to report failures of public services. These are publicized on Google Maps in real time. In 2009 we proved the concept of Human Sensor Webs in Zanzibar. The remaining challenges call for integration of concepts, methods and techniques from software engineering and social sciences and are the backbone of this proposal.

Electronic government (eGovernment) research has focused mainly on individual government organizations and on the impacts of information and communication technology (ICT) on the capabilities of single government units (Danzinger and Andersen, 2002). Zouridis and Thaens (2005) argue that the four spheres of traditional government—policy, politics, organization, citizens—have been affected only partly by ICT.

Table 1.1 summarizes the spheres of government and the rather limited loci of eGovernment. In the policy sphere, eGovernment concentrates mainly on policy implementation, not on agenda setting and policy development. In politics, ICT's role is mainly in democratic supervision (online access to laws and regulations). In public sector organizations, ICT plays a role only at the operational core of public administration, due to the emphasis on service delivery. In the citizens' sphere, eGovernment is mostly concerned with citizens as passive consumers of services.

eGovernment has been studied in the North, mainly. In the South, research about that is scarce, and the situation of such efforts is uncertain. Heeks (2001) estimates that eGovernment projects are 35% total failures, 50% partial failures and 15% successes. He attributes failure to the gap between hard rational design and soft political realities caused by the three-way association of IT, universalist modernization and Western rationalism. His argument resembles Avgerou's (2002), who claims that different rationalities coexisting within and around ICT projects are a major issue for their understanding, and development.

**Table 1.1 Locus of traditional government and of eGovernment (adapted from Zouridis and Thaens 2005)**

<b>Spheres</b>	<b>Traditional Government</b>	<b>Electronic Government</b>
<b>Policy</b>	Problem acknowledgement and agenda setting, policy development and decision making, policy implementation, policy control	Policy implementation
<b>Politics</b>	Representation, idea generation and consideration, decision making and deliberation in parliament, democratic supervision	Democratic supervision
<b>(Public) Organization</b>	Executives; Strategic top; Operating Core; Techno-structure; Support Staff	Operating core
<b>Citizens</b>	Citizens as rulers (voters & participants in policy processes). Citizens as ruled (subject to authority, consumers of services)	Citizens as consumers of services

Despite their narrow focus and the limited success to date, eGovernment initiatives around the world still aim to transform all spheres of government, especially the interface between different stages of the policy cycle—problem acknowledgement and agenda setting, policy development and decision making, policy implementation, policy control—and citizens. In problem acknowledgement and agenda setting, significant visibility gains may accrue to citizens and policy makers alike if they can collectively “visualize” places identified as problem areas—places signalled and tagged by citizens’ grievance reports or places where complaints are acknowledged. Locating and visualizing these places requires geographic ICT (geoICT) to be integrated to the eGovernment system.

Since the launch in June 2005 of Google Earth (GE), commercial virtual globes have been hailed for making the “benefits of accessibility, interactivity, and engagement in landscape visualisation to millions, with the promise of greater representativeness in the views seen by users, improved accuracy of 3D imagery, and accelerated learning”. Citizens stand a realistic chance to influence policy & decision making, not because of intended government action, but due to unintended consequences (Beck, 1992) of action taken by global market actors, driven by advertising revenue and market share. Are these developments inverting the panoptic power of the state and vesting surveillance power to citizens? What are the social and political implications? Due to the novelty of virtual globes, empirical research, especially in the South, is practically non-existent.

Here, we discuss the extent to which virtual globes can expand the limited focus of eGovernment, based on preliminary findings and insights from our own research in two empirical cases, in an Indian city and on Zanzibar. We focus on the potential role of geoICT and virtual globes in improving citizen participation in problem acknowledgement and agenda setting.

Human Sensor Web is the open system based on public human observation to monitor real time service. Based the Sensor Web technology and common availability of mobile communication network, human observations can be imported to a shared system which is opened to everyone. Since East Africa has rapid growth of mobile phone users (International Telecommunication Union 2009), every human with cell phones is able to act as an intelligent sensor to report his or her own observation with geographic knowledge of the area where he or she lives (Goodchild 2007). All coming observations are processed by Sensor Event Service (SES) using a trust model based on reputation of each user who submitted an observation to system via mobile phones. Based on the knowledge of each human sensor, Human Sensor Web can improve and empower the service quality.

Because of the real/ near real time observation data, Human Sensor Web is not only to monitor community events, but also monitor what people need about their environment. Table 1.2 illustrates the difference between human active or inactive behaviour on report and their result on active or inactive water usages. If there is no human active behaviour on report and water usages, the outcome is like technically system of water availability; hence, there are no reporter’s opinions involved. If human is with inactive behaviour on active water usage report, the technique system only can collect water consumption data on each water point; hence, the system would be like water meter, only record the time and amount of water usages. If there is human with active behaviour on report but without active on water usages, the outcome is like flood disaster control. People’s responses are passive about water happened around them. So the active reporter cannot express their opinions of flood. If human is with active behaviour on reporting active water usages, the technique system is not only record water consumption but only what people need about water. However, because of different motivation and situation of individuals, everyone has different water need. Hence, this will cause different report about water they need.

**Table 1.2 Human behaviour on report and water usages**

	<b>Humans inactive on report</b>	<b>Humans actives on report (human sensors)</b>
<b>Humans inactive on water usages</b>	Water availability	Disaster control ( flood)
<b>Humans active on water usages</b>	Water consumption (water meter)	Water needs ( Human Sensor Web)

This research is basically empirical. To monitor what people need and their manners about water complaint, this research used test-retest method to evaluate if citizens’ answers about water complaint are consistent or not in the two tests. By analyzing the results from history of water complaining, water consumption from water meter, and the initial result from Human Sensor Web system, this research points out the reasons and factors influencing citizens sending messages.

## 1.2 Mobile phones in Africa

Because of insufficient coverage of the traditional and fixed telephone line, there are now more and more people in Africa using mobile phones with Global System for Mobile Communications (GSM) coverage across the continent. In 1995, there are only 2 fixed phone lines per 100 inhabitants in Africa. This limited accessibility of fixed telephone line had done only little effect to people in Africa (ITU Telecom Africa 2009). And the slowly upgrading of the availability of fixed line made insufficient state worst. For example, a wait of four to five years to have a line installed was apparently common in Zanzibar (Hancock 2005). The slowly upgrading of fixed line aggravates the digital divide in Africa (Dickinson 2003). All this has directly impacts on the growth of mobile phone use in Africa; four in ten people now have mobile phones.

The mobile phone diminishes the digital divide of traditional fixed telephone lines to improve poor people's lives. Being able to make and receive a call means people are not isolated, even they are in poor area without sufficient infrastructure. In the place with bad roads, unreliable postal service, few trains and rare landlines, it is difficult for poor people to access the latest information. But now, it is a big advantage for people to use mobile phone. Mobile phones can substitute for travel; allow quicker and easier access to information on prices enable traders to reach wider market boost personal entrepreneurship. For instance, fish is one of income source in Zanzibar. Fishman in Zanzibar now carry mobile phone while they are at sea, and they use mobile phones to check the market price. At that time, if there are too many fish in Zanzibar, they will sail to Dar es Salaam to get better price to make more money (Hancock 2005).

As mobile phone become commonplace, service providers use mobile phone to offer multiple services to facilitate people's lives. M-PESA is the product of a money transfer service via mobile phone in Kenya. People can complete basic transactions by their mobile phones without the need to visit a bank branch. M-PESA customer can use e-money to deposit and withdraw money, transfer money to other users and non-users, pay bills, and purchase airtime. M-PESA first becomes popular as a way for young, male urban migrants to send money back to their families in the rural area. Those migrants are the money-senders, and then they influence recipients, who are usually female, less educated, and poorer in the rural area, to use M-PESA. The recipients are usually considered as "technology laggards", who are always less access and adapt to an innovation (Rosenberg 2008). Because of the non-direct relationship with a bank, M-PESA has lead to m-banking, which benefit people that there is no need to queue up at the bank every month to hand over a wad of bills, and carry lots of money. It is a fast, cheap, and safe way to transfer money than the traditional alternative, which is slow and costly to carry money through public transport to arrive the bank. Because of the convenience of using M-PESA, people use to pay for everything from school fees to tax, and the recipients in rural area can spend their time on more productive issues (The Economist 2009).

## 1.3 Water services provision on Zanzibar

Piped water was first installed in Zanzibar (in the Stone Town) in the 1920's, the initial sources being Bububu and Mtoni spring intakes. Later water supply systems were installed in the urban centres of Wete, Chake Chake and Mkoani in Pemba. Each town has a separate water supply system. Over time a number of ground water abstraction points have been developed which

now form the main water source for both islands. The urban schemes altogether serve about 300,000 inhabitants. Despite improvements through Government and donors' initiatives over the past two decades, the conditions of the schemes and service standards have not been able to satisfactorily meet demand. There are distribution interruptions mainly due to old and worn-out infrastructure and poor maintenance. About 25 per cent of the urban population has no access to a safe water supply, hence the need for measures to rehabilitate, improve and expand the urban water infrastructure. Through funding from Japanese Government, the Government of Zanzibar is in the process of implementing urban water rehabilitation and expansion programmes. The project is being undertaken in two separate phases and upon completion, the water production will be increased by 11,000m<sup>3</sup>/day, water distribution network expanded by 20km and additional water reservoir capacity of 8,000m<sup>3</sup> will be installed.

As far as rural water supply is concerned, most of the infrastructure developments took place after 1964 with the exception of a few rural areas – Donge, Mkokotoni, Chwaka, Konde and Kengeja – which already had water supply. The Government of Zanzibar undertook the Zanzibar Rural Water Supply Project, with the assistance of donors, through which 16 schemes were developed in rural areas with a population of over 220,000 people. Other rural schemes have been developed in Unguja and Pemba islands through direct funding from bilateral and international agencies. However, despite remarkable achievements, 51 per cent of the rural population is still without access to safe and clean water supplies. People mainly draw their water from hand-dug shallow wells, although a few who have access to hand pumps. Most of ZAWA rural schemes are motorised with a functionality rate of 80 per cent. ZAWA also has the challenging task of ensuring effective water conservation to guarantee the long-term sustainability of ground water sources, but infrastructure development to preserve surface water is largely inadequate. (UN-HABITAT, 2009)

## 2 Project Partners

The consortium has brought together the complementary experience and expertise of three institutions. The implementation of the project has been done in close collaboration between the partners. Besides the three main partners ITC, TI-WMC and 52N two local partners ZANTEL and ZAWA have played an important role in the project with respect to its implementation on Zanzibar

### **University of Twente. Faculty of Geo-information Science and Earth Observation – ITC ([www.itc.nl](http://www.itc.nl))**

ITC is an internationally recognized centre of excellence in international education, research and capacity building in the field of geo-information science and earth observation. ITC aims at capacity building and institutional development of professional and academic organizations and individuals specifically in countries that are economically and/or technologically less developed. The education is based on knowledge exchange between scientific and professional organizations in less developed countries on the one hand and those in the Western world on the other, whereby ITC acts as a two-directional gateway for knowledge exchange. ITC's approach is application-oriented, directed at finding solutions for and strengthening civil society in addressing issues of local, national and global dimensions such as the multifunctional use of scarce resources, including space, the effects of climate change, environmental and food security, water management, urban development, natural disasters and geo-information science for governance.

### **Twente Institute for Mobile and Wireless Communications (TI-WMC) ([www.ti-wmc.nl](http://www.ti-wmc.nl))**

TI-WMC (Twente Institute for Wireless and Mobile Communication) was formed in January 2003 as a technology R&D spinoff from Ericsson EuroLab Netherlands BV. Its employees are highly qualified, former Ericsson personnel, who have been working in the R&D areas of wireless mobile communications systems (UMTS, Bluetooth, DECT). TI-WMC carries-out research and development in order to build and maintain a knowledge infrastructure on wireless and mobile communications in The Netherlands. Its main areas of interest are in the fields of Software Radio and Smart Antenna Technology for radio communications, as well as Quality of Service, Security and Routing in wireless and fixed networks. As integral part of the European and Dutch knowledge infrastructure the mission of TI-WMC is research and development of communication technologies to provide a competitive edge in a world where communication is increasingly ever-present. TI-WMC explores the frontier of wireless and mobile technology in leading edge research and development projects together with a large group of academic and industrial partners.

### **52°North Initiative for Geospatial Open Source Software (52N) ([www.52N.org](http://www.52N.org))**

52°North Initiative for Geospatial Open Source Software GmbH is an international research and development company whose mission is to promote the conception, development and application of free open source geo-software for research, education, training and practical use. 52°North backs a partner initiative, which is driven by leading research organizations and individuals in the international GIS field. Partners participate in the development of open source

innovations and the transformation of these into practical technological solutions. The current focus is on Sensor Web Enablement (SWE), Web Security and Digital Rights Management (DRM), as well as Web Processing. Principal partners are con terra - Gesellschaft für Angewandte Informationstechnologie GmbH, Münster (Germany), Faculty of Geo-Information Science and Earth Observation (ITC) of the University of Twente, Enschede (The Netherlands), the Institute for Geoinformatics of the University of Münster (Germany), and ESRI Inc., Redlands (California, USA). The partners have a long and outstanding record in the domain of geo-informatics, spatio-temporal modelling, spatial data infrastructures, software architectures, and standardization processes. 52°North partners are actively involved in the OGC standardization process for Sensor Web Enablement and Digital Rights Management as well as in drafting teams for the Infrastructure for Spatial Information in Europe (INSPIRE).

### **The Zanzibar Water Authority (ZAWA)**

The Zanzibar Water Authority (ZAWA) is a corporate authority formed by the Government of Zanzibar in 2006 through the enactment of the Water Act No 4. It was formed as a follow-up to the recommendations of the Zanzibar National Water Policy of 2004, with the jurisdiction of providing clean, reliable and good quality water supplies through the operation and maintenance of water infrastructure, and development of new waterworks in urban and rural areas of Unguja and Pemba islands. ZAWA is also responsible for the management and regulation of water resources and effluent discharges in Zanzibar. The Water Act gives ZAWA enough powers to operate and effectively carry out its mandated functions

### **Zanzibar Telecom Ltd. (ZANTEL) ([www.zantel.com](http://www.zantel.com))**

Zantel was not a partner in the consortium but acted as a very cooperative local counterpart in the implementation of this project by providing the dedicated telephone number for the HSW service and most importantly organizing signboards for each of the 50 waterpoints on Unguja island.

Zanzibar Telecom Ltd. (ZANTEL) is a joint venture between the government of Zanzibar, Emirates Telecommunications Corporation (ETISALAT) and Meeco International of Tanzania. Zanzibar Telecom Ltd was launched on 19th July 1999. Zantel was the first to introduce wireless internet in Tanzania. Zantel was the first to introduce per second billing in Tanzania. Zantel offers Internet and High Speed Data Network in Dar es Salaam and Zanzibar enabling customers to browse the Internet and access business applications such as Internet based e-mail accounts. Zantel has recorded tremendous growth upon introduction of its services in the Tanzania Mainland.

### **iNet, Zanzibar Datacom Ltd. (iNet)**

iNet is a local internet provider in Stonetown, Zanzibar. iNet have been very helpful to the HSW project by providing a safe and secure environment for the HSW system. HSW equipment is running connected to the iNet servers to allow a stable internet connection for HSW.



## 3 Objectives of the project

Our objective for this project was to build a value-adding process that brings reliable information from communities to service providers and decision makers, and at the same time improves information provision from the latter parties to communities. Key to the project was the synthesis of collaborative, community-embedded local information and geospatial information systems. ‘Empowered citizens’ and ‘informed decision makers’ are engaged in mutual processes in such a framework.

Our outputs support the following higher level objectives:

### Citizen and Community Empowerment

1. Informing individuals and communities of their rights, entitlements, choices, and quality of public services.
2. Providing tools and information to increase access to and use of available services
3. Supporting civil society organizations that strengthen links between communities and policy makers.
4. Building a shared ‘ideology’ between communities that will serve the sustainment of the water services information cycle in the long term

### Responsive Providers

5. Increasing transparency in local budgeting and performance for improved resource allocation,
6. Improving data quality to better inform planning,
7. Expanding service delivery with innovative information-based tools,
8. Ensuring that data are used to drive change through advocacy and policy related actions.

### Informed Decision Makers

9. Developing local capacity for data collection and analysis to inform decision making,
10. Making existing information more public and useful for planning and advocacy,
11. Generating evidence on “what works” and sharing this widely”

Based on these objectives the project was expected to deliver the following tangible results:

- A. Insight in mechanisms to establish two-way communications with communities and individuals using the Human Sensor Web approach with special reference to water and water services.
- B. An operational Human Sensor Web for water services deployed in Zanzibar.



## 4 Main outputs

The project outputs are described here according to how they were defined as activities in the contract. The main output however, the operational Human Sensor Web system, is described first as it is derived from a combination of activities and features the most tangible output.

### 4.1 An operational Human Sensor Web for water services deployed in Zanzibar

The pilot design allowed for 50 of the available public water taps on Unguja island to be included in a geo-spatial database. These fixed point locations were fitted in such a way that citizens could report about. At each of the 50 water points a signboard was placed (fig. 4.1) on which people were informed about the project and were asked to report by SMS problems with the water provision at that specific location. SMS messages would be sent to a special phone number and were required to contain a specific code as indicated on the signboard. Messages are relayed through a computer stationed at a local internet provider.



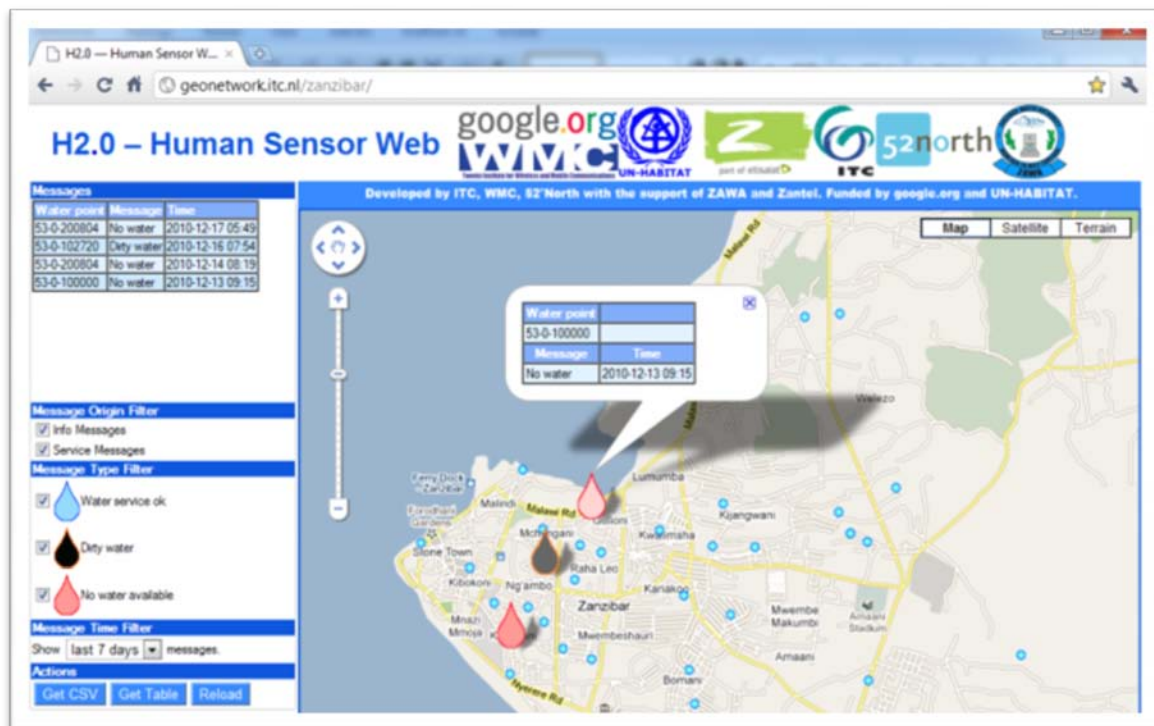
The main process sequence of HSW consists of the following simplified steps:

→ Individual reports problem → System logs the report → System responds to individual about message reception → System assesses validity of report → Valid report is visualized on HSW website (fig. 4.2) → System broadcasts (sms) a warning about service problem to subscribers and the service provider.

Next, the HSW operation depends on action by the service provider. On receiving a reported problem technicians should take action to investigate the reported problem and if possible provide a solution. Service provider technicians have specific codes at their disposal to report back to the system on the status of the problem. If the cause has been identified or if the problem is solved, technicians send a sms to the system and the system sequence starts again:

**Figure 4.1 Signboard located at one of the 50 water points on Unguja island, Zanzibar**

→ Technician reports solution → System logs the report → System assesses report from technician automatically as valid → Solution is visualized on HSW website → System broadcasts a message (sms) about service restoration to subscribers and the service provider.



**Figure 4.2: Screenshot from the HSW live web interface:**  
<http://geonetwork.itc.nl/Zanzibar>

The HSW website (fig. 4.2) is updated live. Reports are displayed within several minutes after a report is confirmed by the system. The map interface shows the locations of all the water points that are monitored. Reports are shown in the form of 'droplets' which can be clicked to reveal information about the report. The site can show reports from different time intervals to prevent an information overload on the screen. The site shows the reports also in table format and the table can also be exported to analyze it outside of the HSW environment. The details of the system are explained in annex 1, 2 and 3

## 4.2 Other outputs and activities according to contract

### 1.1 System Analysis

The system has been developed on the basis of many assumptions and was fine tuned during the three field visits that have been made. Most of the work has gone into practical problem solving for occasions where the theoretical system could not be implemented. This was not unexpected but did provide the need to plan more field visits. Proper system analysis is only possible on the ground.

**Output / Result:** Overview of the recommended system.

The main set-up and design ideas can be found in Annex 1 and 2 of the midterm report

### 1.2 Desk study of existing approaches and SE data)

Existing socio-economic data, mainly collected from the National Bureau of statistics and ZAWA is currently being used by ITC Master students. Two students have taken it upon them to try to

answer several research questions of the HSW project related to water consumption and data quality. To this effect they have also collected new data during fieldwork on Zanzibar.

**Output / Result:** Overview of prevailing WATSAN conditions.

Final output of these studies (theses) is planned for March 2011 (graduation date) but the main findings can be throughout this report.

### *1.3 Coordination with Google*

In February 2009 a meeting was arranged at Google HQ. The aim of the meeting was to intensify the h2.0 network, report on progress, and discuss further action. The meeting was attended by a cross-section of Googlers, water & sanitation people, and from the international development scene. Authorities, Innovation for Poverty Action (IPA) a development oriented research foundation connected to US top-universities, GTZ, Manobi Development Foundation (Alleviating global poverty and diseases, empowering women, and supporting the rights of children through mobile technologies, situation-specific content, and community-led service provision.), The Human Sensor Web (HSW) was represented by Hartmut Benz (Twente Institute for Wireless & Mobile Communications), Andreas Wytzisk (52N) and Robert Becht (ITC).

**Output / Result:** Agreement on the technical lay-out and functionality of the proposed system H2.0 link

The aim has been to coordinate activities but this has appeared difficult. Work plans of the different organizations are difficult to combine and joint activities have not emerged. Relations have however been established and new cooperation can easily be explored again.

### *1.4 Coordination Zanzibar field office*

The Zanzibar Water Authority (ZAWA) has been contracted as the local counterpart which does all it can to facilitate the project. A local coordinator, Mr. H. Kimara, has been employed by the project to coordinate between the different local counterparts. All the available data necessary for the project has been obtained and several reconnaissance visits have been conducted. The initial work on the project was slow, and with regular visits from ITC staff activities on the ground appear to move faster. Specific attention has been paid to establish effective communications and responsibility protocols between the local counterparts. This unfortunately did not speed up the project execution. In 2010 therefore a no-cost extension to the project was requested until December 2010.

**Output / Result:** Effective contact established and responsibilities discussed

### *1.5 System Design*

**Output / Result:** Document describing operational and functional design of the system. Strategies for user participation and the technical set-up of the system are explained in **Annex 1 and 2**.

### *1.6 Programming/coding*

**Output / Result:** Prototype of the proposed system, available, including operational technical design. The programming and coding sequences are provided in **Annex 1 and 2**.

### *1.7 Testing*

The pilot applications that are explained in Annex 1 and 2 have been made operational and are installed and functioning. The main SMS gateway is installed with the i-net service provider on Zanzibar and the data are sent to Enschede and Münster for analysis and processing. This remote operation reduces server maintenance time.

**Output / Result:** Practical feed-back of the proposed system

### *1.8 Hardware*

The required hardware has been purchased and has been distributed to the various partners to employ for the system. The current hardware running the system consists of a dedicated PC which is placed with the iNet internet provider on Zanzibar. This PC is connected to a basic cell phone which receives all the text messages about the water service on the Island. The data received on the phone is downloaded continually by the PC and processed according to the protocols described in Annex 2. The data is uploaded via internet to computers in Germany and the Netherlands for further processing and then sent back to the dedicated PC on Zanzibar to send response messages to the subscribers (users) of the system. After some initial data connection problems the hardware is operating nominally since end of September and data is being received.

**Output / Result:** Hardware present and operational

### *2.1 Field testing*

Part of the field testing results are described in Annex 2 of the midterm report as the final setup of the system is derived on the basis of testing phases

**Output / Result:** Deployed pilot application, and tested and monitored results of the system

[a] Pre-system testing (mobiles only): simple cell phones and monitor the workings of the protocols and data connections, and

[b] in The Netherlands test messages were sent by different persons to monitoring results from test observations in the field and feeding these into the proposed system to trigger responses. Testing phases [a] and [b] were mainly executed to detect flaws in the system and to analyze responses to false messages.

In Tanzania the testing phase consisted of actual field tests on the basis of existing water points. Results were fed into the proposed system and the resulting working system is described under 1.8. With this testing the pilot application has been actively deployed in the field. The advanced

testing phase where smart phones were used to test and monitor results of the system started in October 2009 but were discontinued due to a lack of data. The use of smart phones was however included as an extra research option and not required to fulfil the pilot phase.

## *2.2 Institutionalisation*

Much activity has gone into the institutionalisation of the project. Signboards were produced locally to explain the system to the population of Zanzibar. These boards are placed near 50 public water points and water kiosks on the island. Sign board production was difficult and the initial lot of boards produced contained errors and were not of the desired quality. Zantel, a local cell phone provider has offered the use of a special phone number where the text messages can be sent to. They also offered to produce the sign board as part of their corporate advertisement and public awareness campaigns. The first boards did not reflect the corporate image of Zantel and combined with the fact that the information on the boards was partly false it was decided to produce new boards. The first lot of new boards were installed by the end of 2009.

**Output / Result:** Acceptance of the proposed system

Main activities to achieve institutionalization can be found in ***Annex 4***

## *2.3 Link and integrate with other H2.0 components*

The h2.0 platform was publicly launched during World Water Week in Stockholm, Sweden in September 2010. The launch featured data samples from each of the component pilot initiatives: MajiData, Urban Inequities Surveys, Waterpoint Mapping, Utility Benchmarking, Citizen Report Cards, the Water Quality Monitoring methodology and the Human Sensor Web. Some of the datasets were presented through Google Earth Tours, which provide the user with the experience of taking a guided flight over the featured areas, with analysis supported by animated charts and images. It is possible to view these recorded tours by visiting the h2.0 platform.

**Output / Result:** Prototype online Human Sensor Web

The output envisioned here for HSW was indeed successful and an operational prototype has been launched and is available online since September 2010. It has however not yet been achieved to have a seamless integration of HSW data into the h2.0 platform. Data transfer is possible but not yet automatic updating through fusion tables.

## *2.4 Implementing the system*

Full deployment of the technical system and integration of the socio-economic fabric

**Output / Result:** Prototype online Human Sensor Web + evaluation of the Human Sensor Web initial performance;

The deployment of the system is described in chapter 5 which refers to the annexes of this report. The integration of the socio-economic fabric is described in chapter 1, 6 and 7 and Annex 4 of this report.

### *3.1 Preparation of user manuals, reports, etc.*

Writing of user manuals and preparing technical reports

**Output / Result:** Report on findings of Phase 1

See this report including all annexes

### *3.2/3.3 Platform presentation*

**Output / Result:** Presentation of methodology and first results of the pilot study

Results of the project have been presented at the WWW10 in Stockholm as part of the h2.0 launch. Furthermore the project was presented and disseminated in several occasions:

#### Paper presentation at OneSpace 2009 in Berlin, Germany:

A Human Sensor Web for Water Availability Monitoring. OneSpace 2009 - 2nd International Workshop on Blending Physical and Digital Spaces on the Internet. Berlin, Germany. By: Jürrens, E. H., A. Bröring, et al. (2009).

#### Paper presentation at the World Computer Congress 2010 in Brisbane, Australia;

Citizen surveillance of the state : a mirror for e-government. In: J. Berleur, M.D. Hercheui and L.M. Hilty eds. What kind of information society: governance, virtuality, surveillance, sustainability, resilience. IFIP Advances in Information and Communication Technology. Berlin: Springerlink, 185-201 . ISBN 978-3-642-15478-2. 328 pages. By: Verplanke, J.J., Martínez, J.A., Miscione, G., Georgiadou, P.Y., Coleman, D., and Hassan, A., (2010).

#### Paper presentation at the Annual International Conference of the Royal Geographic Society in London, UK;

Managing Citizen Visibility in eGovernance. Journal of Location Based Services. By: Verplanke J.J. – Forthcoming 2011



## 5 Technical setup of HSW

### 5.1 Human Sensor Web Design Concept

The full design concept is described in *Annex 1*. It deals with an overview of all used components in the Human Sensor Web application as schematically represented in Figure 5.1, how they operate, and how they interact.

This figure shows an overview of the whole architecture. The GSM network is connected to the HSW application via a bridge (see section 2.1). This component provides access to the SWE services and manages the communication between these. The Sensor Observation Service (SOS) stores the observed data and provides spatio-temporal functions to access the data via standardised and interoperable interfaces (see section 2.3). The validation and processing of the incoming data is realized in the Sensor Event Service (SES, see section 2.2). The possible information output (waterpoint status information and alarm messages) will be published using a Web Notification Service (WNS, see section 2.4). The visualization and water point management for the water operator is described in section 2.5.

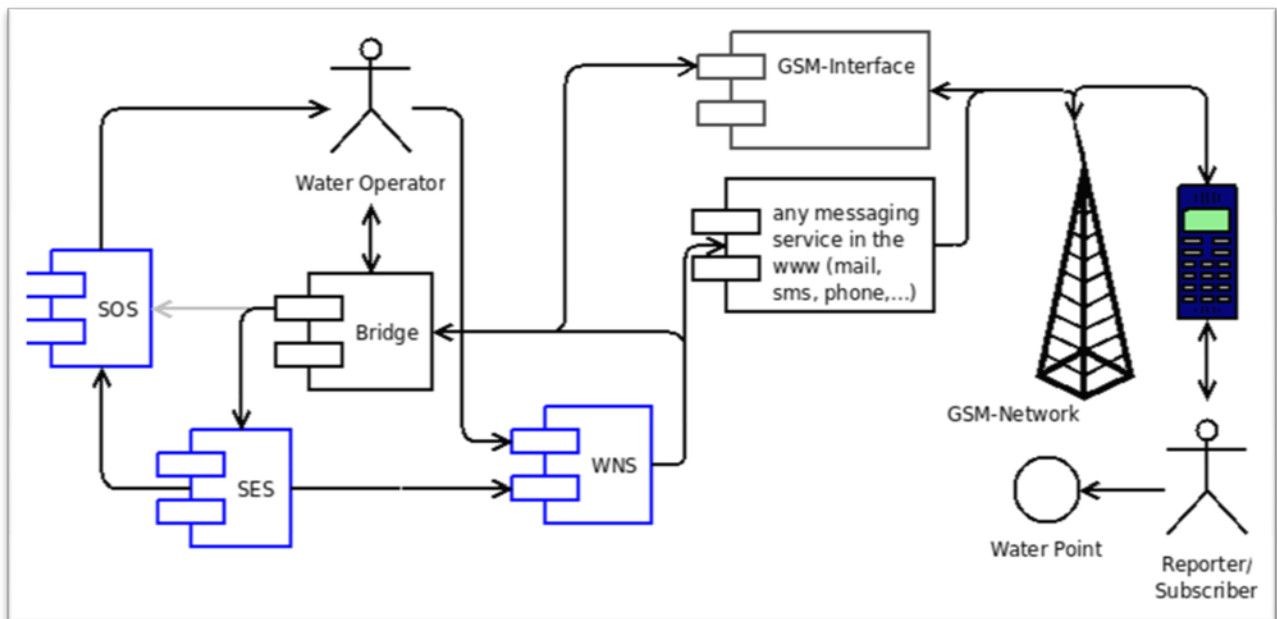


Figure 5.1: Schematic representation of the HSW components

### 5.2 SMS-Gateway Application

The SMS gateway is described in *Annex 2*. It contains information on how the SMS Gateway application was installed on a laptop that was deployed in Zanzibar. Connected to the laptop was a Nokia mobile phone to send and receive SMS messages related to water point monitoring and administration. The laptop is prepared (protected) to be connected to the Internet on a permanent basis and could be administered remotely.

The job of the SMS Gateway application is to interface between the GSM/UMTS network and the HSW application. The SMSGateway receives SMS messages from Users (water point reporters, ZAWA service technicians, ZAWA-Maji-Managers), parses them, and forwards Sensor Observations and Subscription Management messages in a suitable format to the other components of the HSW application. The SMSGateway sends response SMS messages to users' requests, and dispatches Sensor Notification SMS messages to subscribers. The Notification messages are generated by the HSW application. The SMSGateway locally manages water point subscriptions, and group membership (service technician, administrator). It translates water point tags to internal ZAWA code representation.

This document provides the full documentation to operate the SMS gateway

### **5.3 Deployment of the Human Sensor Web component**

All required steps to deploy the GIS server backend of the H2.0 project are described in **Annex 3**. It outlines required components such as:

- Java Runtime Environment (RE) - 1.6.0 14 - Section 2.1
- Apache Tomcat 6.0.18 - Section 2.2
- PostgreSQL 8.3 - Section 2.3
- 52North Sensor Observation Service 3.1 - Section 2.4
- 52North Sensor Event Service latest development build - Section 2.5

Section 3 of this annex describes the required steps to setup the HSW component. Additionally, possible configuration settings are explained.

# 6 Implementation and Embedding of HSW

## 6.1 Implementation on Zanzibar

For day to day activities in this project a local counterpart was employed by the project. Mr. Hakeem Kimara was attracted for this function. For 50% he was employed by ZAWA to serve part-time as customer relations officer. The other 50% of Mr. Kimara's appointment was paid by the HSW project to serve as liaison and local coordinator.

Day to day activities related to the HSW implementation are summarized in *Annex 4*.

## 6.2 Motivating participants

The information of water availability and quality has been sent by reporters since October 2009. With ordinary sensors, correct data/information should be a representation of the real situation, but with a 'human sensor' the observation is subjective and this will influence the correctness of the information or the value of the information. The Human Sensor Web has a system that can judge the trust ranking of the information according to the principle "Fast decrease and slow increase of trust" that deals with the technical reliability of the information (Jürrens, et al., 2009). Even though the system tackles the trust and reliability with a systematic rule, whether the root of the information is reliable or not depends on the people themselves.

A simple comparison is to compare human sensors with mechanical sensors. Unlike any electric and mechanic sensor which only needs electricity or other type of energy to work, human sensors need motivation in order to work. The Human Sensor Web project in Zanzibar is very much depending on the people to send the information. A study by Subur Yusra is forthcoming on this subject in March 2011

## 6.3 Quality of Volunteered Geographic Information

Moving to a globally interactive participation, citizen interests and international agendas become entangled drivers for political and social participation. The relative ease to provide location information with complaints through embedded GPS devices offers interesting opportunity for virtual globes to organise information spatially. Visualization of localized themes of grievances could provide citizens and policy-makers a different view into objectives and demands.

Goodchild (2007) has proposed to use "human sensors" and web2.0 to unlock the vast pool of local spatial knowledge as Volunteered Geographic Information (VGI). A VGI Network is a combination of a community of individuals who report observations through existing, widespread (mobile) communication technology and a set of (web) services that provide means to disseminate observations and means to receive feedback. Mobile phones are becoming the most widespread sensor device in the world offering the possibility to capture voice, pictures, video and location data in combination with a versatile interface to connect to global

communication networks. The emerging framework in figure 7.1 is particularly appealing for this idea. Virtual globes offer a wide variety of ways to include VGI .

VGI can be dubbed “participatory sensing” given the nature of geo-data generation by dispersed volunteers, where the voluntary aspect and the personal interest and motivation to contribute information are central. As argued by Craglia et al (2008), platforms like Google Maps and Google Earth are combining both voluntary and institutional data. Without a mechanism to clearly distinguish the different nature of the data (through metadata), it will be difficult for citizens to take action and for administrators and policy makers to make accountable decisions on the basis of such data. If citizens are to be engaged or involved more in government decisions by sharing their knowledge (data, information and understanding) it should be done in a manner that maintains accessibility but also improves reliability and backs trust. It is of course not only trust in the platform and whether that platform displays the “truth” (Parks, 2009). Governance innovations are required for VGI to be put to relevant use and citizens to be trusted to provide the reliable information. This organic relation between citizens, geoIT and service providers pinpoints to the importance of ‘validation’ of data produced by undefined users. Those who advocate for openness stress the self-regulation of open systems. Such position is opposed by formally structured organizations, which legitimize themselves on exclusionary basis. A possible third way would be the adoption of automatic ranking mechanisms which select and rate information on the base of previous behaviours.

As VGI is reported by volunteer citizens, how to find out the trustworthy information is essential of VGI data quality. Contributors may post VGI in constructive way. Goodchild (2009) and Kramer (2009) categorise the motivation of users contributing VGI as their personal reputations/rewards, self-promotion, personal satisfactions, and reduce community crime. However, because we cannot assume that one VGI item is based on well-being or report is trustful, we still cannot make sure the data collected is still trustworthy. Especially with anonymous reporting, a decision maker cannot discriminate true and false report on the basis of reporter ID. In analyzing the civil event reports (CER) in Iraq and Afghanistan conflicts, Kramer (2009) found out discouragement through social pressure, threat and intimidation may be the challenges. Hence, a better way to find out the trustworthy information is to understand the motivation of individuals to impede VGI information. Coleman et al. (2009) classify several factors impede VGI information, such as mischief, agenda, and malice and/or criminal intent.

Coleman et al. (2009) define a mischievous person or vandals as “ *hoping to generate scepticism or confusion by replacing legitimate entries with nonsensical or overtly offensive content* ” Viégas et al. (2004) give five common types of vandalism in Wikipedia, such as mass deletion, offensive copy, phony copy, phony redirection, and idiosyncratic copy. Mass deletions are the actions to remove most of the contents of a page. Offensive copy is insertion of vulgarities or slurs. Phony copy is the insertion of unrelated text to the page topic. Phony redirection often occurs in pages which contain a redirect link. Those links should redirect to a more precise term, but those redirects linking to an unrelated or offensive term. Idiosyncratic copy is the action of adding text that is related to the topic of the page, but with one-side, not of general interests, or inflammatory (Viégas, Wattenberg et al. 2004).

## 6.4 SMS usage

Mobile phone is considered as a new hope to upgrade communication ability in developing countries, as discussed by many researchers (Buys, Dasgupta et al. 2009). However, the impact of SMS on people in Zanzibar has not been substantiated empirically.

**Table 6.1 SMS frequency in one month**

Never	0-10	11-20	>21	Total
1 (1%)	50 (54%)	6 (6%)	36 (39%)	93

Familiarity with the technology environment is the key factor in achieving automaticity. Automaticity relies on the retrieval of stored information accumulated after practice in a consistent environment (Benbunan-Fich and Benbunan 2007). Novice users of a technological production may take more time to carefully think about how to perform the steps to carry out the tasks. In contrast, the experienced users can draw from their familiarity with the domain and perform the automaticity. It is desirable to know how people in Zanzibar are familiar with using SMS to report water availability. A gap has been observed between the use of mobile phone and the reporting of water availability.

Normally, if people expose themselves to cell phone more often, they will be more familiar with this communication technology and make fewer mistakes in sending SMS. That means people would have no difficulty to send SMS while they using cell phones. Table 6.1 illustrates the SMS usages in Zanzibar. There is only 1 respondent that never used SMS before. Most respondents have experience of using SMS service via mobile phone. In this case, the users of 0-10 SMS per month are considered as novice users, and users with more than 11 SMS usages per month are considered as experienced users. There are 50 (54%) respondents claim that they send or receive SMS 0-10 times (novice users) per month. It illustrates that more than half respondents have basic usages of SMS per month.

The actual use of SMS still depends on other factors such as literacy, cost and culture. Low literacy levels in an area could favour voice calls and explain why people are not using SMS. This is particularly the case when people do not own a phone and have to borrow a phone to send a message. It can be argued that people who own a phone have a higher income which suggests higher levels of education and therefore higher literacy. Another issue is the cost of sending an SMS. When this project was conceptualised the cost of a 1 minute phone call was more expensive than sending a SMS message. Currently (2010) with some providers the price of one SMS message is higher than a short phone call. This might make people reluctant to send SMS messages.

## 6.5 Water and cell phones

In urban and rural areas, there are various sources of water including pipeline, local (private or public) wells, water vendors and kiosks, and natural springs. Different water sources result in different behaviours in collecting water. Between urban and rural areas there are differences. Most households in urban area have water accessibility by connecting to the public water pipeline or by buying water from a vendor. Because there is poor accessibility to the public

pipeline in rural area, households there tend to collect water from local wells and natural springs.

In Zanzibar, housewives and children are responsible for collecting water, but most of the cell phone users/owners are men. Thus, there is a gap in the information transfer due to different tasks by the household members. In some occasions this had lead to a discrepancy in reporting water problems and the actual availability of water. Women collecting water would observe a problem in the afternoon, but would only be able to report when their husband would return in the evening. At the moment of actually sending the report by SMS the water service could already have been restored

More than 90% of urban water supply in developing countries is provided by public water provider (United Nations Development Programme 2003). Table 6.3 illustrates the water source of each household in urban and rural area. In rural area, majority claim that public tap (62%) or tube well (72%) is one of their water source. Compared to rural areas, city water supply is the main water source (63%) of each household in urban area. This unbalanced water supply causes the high time consumption of water collecting (table 6.4). In rural area, 31% of respondents claim that they spend more than one hour to collect sufficient water per day while 79% of respondents from urban area reported to spend less than 30 minutes to have sufficient water per day. People from rural area hope ZAWA can take care of their region, and achieve 24 hours water supply.

**Table 6.3 Water source of each household**

	City water supply (ZAWA)	Public tap	Tube well	Total respondents
Rural	0	26 (62%)	31 (72%)	42
Urban	38(63%)	24(40%)	3(5%)	60

**Table 6.4 time consumption of water collecting in each household**

	less than 30 minutes	31-60 minutes	more than one hour	Total respondents
rural	20 (48%)	9 (21%)	13(31%)	42
urban	42 (79%)	7 (13%)	4 (8%)	53

## 6.6 Reactions to water availability problems

It is abstractive that individuals think about specific activities, especially personal definition of water problems. People usually try to solve or report the water problem when facing serious problems about collecting water. Whether or not the problems are reported to some extend depends on the seriousness of the problems and the level of willingness to report problem.

Normally, because of the poor accessibility to customer services office or even because of poor water availability, people who live in rural area have different complaining behaviour and habits from people in urban area.

To determine people’s reaction to water availability problems to consequently understand the way people choose to complain about this is complex. The water problem in the rural area comes from aged pumps, few water sources, and insufficient availability of water (Millennium Challenge Account-Tanzania 2008). The insufficient water availability cause people complain a lot. Generally, in Zanzibar, people have 3 ways to complain about water (table 6.5), including write to ZAWA, go to ZAWA directly, or complain to the Sheha. The Sheha is the locally elected leader of the smallest administrative unit.. In urban areas, 50% of respondents claim that they ever wrote to ZAWA or complained to the Sheha about water problems, and only 19% of respondents claim that they went to ZAWA directly to complain. In contrast, people from rural areas preferred to go to ZAWA (87%) when they have water problems. It appeared that people from rural areas think they have to show their anger and problems directly to the water provider, or else the water provider will ignore the opinions from rural people.

From 2008/07 to 2009/09, there are 916 water complaining reports. Table 6.6 illustrates the amount of complaints are taken over by which department. The commercial department of ZAWA takes over the majority of complaints (65%), such as no water in household. Technical department takes the case of leakages or broken pipelines. The financial department handles cases where customers are unable to pay their water fee. The legal office takes over the case if it is about illegal taps into public pipeline.

**Table 6.5 Complaining Method**

	<b>write to ZAWA</b>	<b>go to ZAWA directly</b>	<b>compliant to Sheha</b>	<b>Total</b>
<b>Rural</b>	7	33	15	38
<b>Urban</b>	13	5	13	26
<b>Total</b>	20	38	28	64

**Table 6.6 Complaints by customers handled by different ZAWA departments**

<b>Category</b>	<b>Commercial</b>	<b>Financial</b>	<b>Legal Officer</b>	<b>Technical</b>	<b>Total</b>
<b>Complaints</b>	593 (65%)	40(4%)	20 (2%)	260 (28%)	916

Doubt or trust in the institution behind the system will cause people willing or not willing to send SMS to report events. People do not believe ZAWA can improve water availability if the problem is still not yet solved. If they complained, and they do not get a response or any information, and the problem still not be solved ZAWA loses the trust from people. Most of respondents have the experience of complaining about the water problem to Sheha or ZAWA,

however, they did not get any response or information about when or how the water problem can be solved.

People in rural area already lost the faith of government in water availability issue. Mr. Haji , who lives in Nungwi, has his own business of selling fruit. He claims that he never got any water from ZAWA. He sometimes complained to the Sheha, and hoped the local community leader can improve their water availability, and until now, he didn't get any response from Sheha or ZAWA. He thinks that those urban people already forgot about the rural area. Even rural people can send SMS to complain about water.

The other reason causes people do not trust ZAWA is the policy of water payment. ZAWA charges residents water fee at first, instead of improving water availability. The new water payment policy is made since September 2008. Each household had to pay water fee to ZAWA (4000 Tsh) each month, no matter how much water each household used. The majority of people complained the water fee was too high for them. ZAWA decreased the water fee to 2000 Tsh in July 2009. However, people still complain about the payment because of the insufficient water supply. People with insufficient water supply still have to pay the same water fee as those people have 5 or 7 days water supply. This unfair policy for water fee causes people to be angry with ZAWA. In most places, there is no 24 hrs water supply or even water supply by rations. In urban area, people have to find out the other water source or pay to water vendor to collect enough water. Mrs. Othman lives in Mwembe Shauri, where has a public water tap. Her family uses 300-400 litres water per day, but there is no pipeline connection in her household. As a housewife, she has the duty to collect enough water for her family every day. She complains that even this public tap almost with water everyday, water is only available between 6 AM to 7AM, and then the supply is closed. It would be lucky to get water during the daytime and around 8 PM to 9 PM in some days. If there is no water in public tap, she has to go to other place or pay 300 to 500 Tsh per bucket (around 20 litres per bucket) to a water vendor.

## **6.7 Willingness to pay for water**

Because of the insufficient water supply, people have to spend time on checking if water is available in water supply points. For instance, customers without an in-house connection to the city supply system, have to check the public taps in their neighbourhood several times per day to make sure if water is available or not. A system like HSW could let them know exactly if public water supply is available or not. This would save them a lot of time. However, the question then becomes how much people are willing to pay for this information.

From a survey of water information affordability it appeared that most people in rural and urban areas are willing to pay for this information. A few people liked the water availability information via SMS and felt this could improve their lives, however, they were of the opinion that this information should be free to the public. Majority of people claim that they do not care about the payment of water information, but they want to have the water immediately if they use the service to know water availability information. During our surveys it was also noticed that customers usually bargain and argue with regular (market or taxi) purchases to the amount of one SMS message. This means that such an amount of money is not trivial to them.



**Table 6.7 Willingness to pay water information**

	yes	no	total
rural	40	0	40
urban	50	3	53
total	90	3	93

## 6.8 The role of culture

Culture may be one reason to adopt or resist the information exchange. Hofstede (1997) mentioned five culture factors that affect how people interact. One of these five factors is the power distance. Power distance is a measure of how much people at the lower castes of society differ from those at top. Hofstede gave two examples of power distances societies, Africa and United States. In Africa, a high power distance societies, " whoever holds the power is right and good." It causes majority member of non-ruling and no power class follow those with high power position. Hence, majority people from high power distance society are more likely to obey the e-service. In contrast, lower power distance culture like the US government as a serving system to people. Because of the equality of everyone, citizens in societies with great power are more likely to adopt available e-government services (Hofstede 1997).

In Zanzibar, people obey the will of the Sheha. This powerful local leader can not only collect and accept citizens' complaints and opinions, but also be the representative of one community to complain about any issue to government. In one case we saw that the Sheha's willingness to pay for water would influence the citizens' willingness to pay their water bill. Around 40% of the respondents ever expressed their complaints to the Sheha. People may not trust government, but they are more willing to talk and express their opinions to the Sheha, especially in rural area. The local leader may play an important role to influence people's willingness to use Human Sensor Web system in future. To get the support and understanding from each Sheha will help the Human Sensor Web to operate more smoothly and receive more data from citizens to achieve the purpose of empowering every citizen. Activities to involve the Sheha are described in Annex 4.

## 6.9 Typing error

Among the messages received by the Human Sensor Web there is still a large number of SMS (52%) considered as wrong messages. Those SMS cannot be identified and recognized by the system automatically, because of typing error or being SPAM messages. For example, the system was corrected in an early stage to understand messages such as sent by Reporter 046:

(Reporter 046) | 2009-11-29 08:11:09+03 | Maji ( A 046 ).

(Reporter 046) | 2009-11-29 08:19:50+03 | Maji D 046.

In the first SMS, this reporter also used brackets () in his/her text sentence. In the second SMS, he/she finished the report as “.”. Another example from Reporter 427. This reporter also used “.”, but not “ ” (space) in the text sentence, and he/she also typed some words to explain the time and the location of water problems in the first SMS. Those typing problems cannot be recognized by system automatically and have to be monitored otherwise:

(Reporter 427) | 2009-11-16 23:20:12+03 |  
MAJI...A....427.LEO.JIONI.HAYAKUTOKA.TUKESHO.ASUBUHI

(Reporter 427) | 2009-11-17 07:24:22+03 |HAKUNA.MAJI..MAJI.A.427

(Reporter 427) | 2009-11-17 10:21:52+03 |HAKUNA.MAJI..MAJI.A.427

(Reporter 427) | 2009-11-27 20:16:08+03 |MAJI.A.427

It is occurring frequently that customers send long sentences in their SMS report to explain their water problems:

2010-01-17 17:47:21+03,A michenzani jumba namba 5 tobo la tatu

It explains the location with water problem but this location did not belong to the public water points. Another long sentence received was the following:

2009-11-28 13:15:28+03 | ASALAM ALAYKUM HABARI YA SKUKUU KUBWA HUKU ERIA YA  
MWEMBE SHAURI MAJI HATUPATI TANGU SAA 1 ASUBUHI PROBLEM HATUIJUI TUNAOMBA  
MUJE MTUSAIDIE

Tafadhali Nipigie! Kutoka: +25575XXXX319

-----  
*Greetings, how are you this holiday? I would like to advice you that in a large part of Mwembe Shauri we did not receive water since 7 o'clock this morning. We pray you come and help us with this problem.*

*Call me please! From: +25575XXXX319*

Such messages contain a wealth of information about the problem, but the HSW is designed to respond to concise coded messages. The HSW pilot application could not respond to these kinds of messages. It is our intention for future work that we develop an application based on this pilot which is more ‘context’ sensitive and therefore can interpret such elaborate SMS reports

Since Human Sensor Web is open to public, it has to be avoided to receive spam SMS. Those SMS cannot, be distinguished from messages like the previous, nor be recognized or identified by Human Sensor Web system automatically. To avoid SPAM the HSW system had to be transferred to a post paid subscription. With such a subscription SPAM messages could be blocked permanently.

## 6.10 Similar human sensor cases in Zanzibar

As mobile phones are becoming popular, there are some more additional usages to improve people's living quality in Zanzibar via mobile phones. In Zanzibar, there are already several similar cases using mobile phones to for instance regularly report about health conditions in one community.

**“Wired mothers”** is the use of mobile phones to improve maternal and neonatal health in Zanzibar. It uses mobile phone to link pregnant women with their newborns to the health system. Midwives will remind those pregnant women to come back to a primary health care centre for free health care through SMS regularly. Even most Zanzibar women delivery babies in a health facility, they stay there less than one day. More than 50% of Zanzibar women do not receive postnatal care (Lund 2009). Those pregnant women will still receive SMS reminders for free health care until 45 days after delivery, so women and their infant babies also receive health care. In this period, through person-to-person intervention, midwives can send SMS to pregnant women not only remind them for free health care, but also provide medical information. However, women in rural area rarely have their own cell phones. Midwives have to contact relatives or husbands who own a cell phone to pass on the health care information.

**Zanzibar Malaria Control Program (ZMCP)** is developed to quickly respond to the unusual occurrence of Malaria cases in Zanzibar through the weekly report from health facilities via mobile phones. Malaria is the leading cause of morbidity and mortality in all health facilities in Zanzibar. 50% of all outpatient attendance is due to malaria (Ali 2004). Malaria is characterized by perennial stable transmission. In this case, one early detection system will help to prevent and control malaria transmission. First, a health facility records on paper of the amount of daily tests and whether the malaria test is positive or negative. Secondly, they weekly report the amount of patients, with positive and negative malaria test cases via SMS to a system. The server will automatically generate graphical images viewable on a secure web site. An engineer will visit these health facilities routinely to check the accuracy of SMS reports. If increased numbers of malaria cases are reported, representatives from the district health management team and ZMCP will visit the health facility within 24 hours after notification to rule out false alarms (President's Malaria Initiative 2009). Once a malaria case is confirmed, a key step is to rapidly make the community and health care system aware of the confirmed increases in malarial transmission. This step aims to treat to probable malaria cases as quickly as possible to alleviate illness and control the transmission of malaria.



# 7 The way forward

## 7.1 Scalability of a Human Sensor Web approach

Current approaches of monitoring citizens' access to public services are being contested. According to UN Habitat (2010), attempts to improve them are "hampered by the lack of reliable information at the local level, resulting in statistics which mask the true picture on the ground." Citizens within a certain distance from a water tap or a clinic are considered adequately covered. But, the assumption that the tap is working or that the clinic is staffed is often not true. In Tanzania, administrative agencies in the water and public health sector often lack the resources to detect and remedy failures in public services. The prospect of citizens with mobile phones ('human sensors') reporting the shortcomings and publicizing them on the internet to exact accountability from officials is a novel alternative. The potential of this alternative for better governance of water and health is the focus for a future research program that builds on insights from this HSW pilot project.

Empirically, we would like to continue tackling water services with the ambition to scale up to health services. We combine expertise from geo-information, computer & political science to study 'Human Sensor Web' design & scalability, the generation and sustenance of citizens' trust and bureaucratic behavior in Tanzania related to water and health information. We would particularly like to focus our research on the following themes:

### *1. Context modelling for Human Sensor Webs*

A 'human sensor' must be considered in relation to her physical and social environment, to other human sensors and to in-situ non-human sensors (e.g. water meters). The deployment of information on these relationships is relevant to determine the context of the human sensor and can contribute to (i) better understanding of individual & collective human sensor behaviour and to (ii) improved trustworthiness of this information.

### *2. Citizens and trust*

The HSW is the 'measurement' part of a bottom-up social indicator system mobilized by a coalition of scientists, professionals, enlightened administrators, and commercial actors (MacRae, 1985). In shaping the HSW, alignment with the production of political meaning in public debates around issues of water and health management in Tanzania, is a precondition for generating trust between citizens as the 'users' and the advocacy coalition as 'operators' of the indicator system (Stone, 2002). Further, analyzing trust at different scales allows the tracing of how different stakeholders distribute their trust over time.

### *3. Public organization and accountability*

Water and health officials are ruled by different codes of official behaviour simultaneously. To cope with uncertainty, they assume culturally hybrid attitudes and behaviours in their diverse accountability relationships to local, national and foreign overseers. Cultural theory predicts combinations of (core) beliefs, attitudes and types of strategic behaviour (Thompson et al, 1990; Verweij and Thompson, 2006). Cultural theory will be applied to issues of public management,

control and accountability relations (Hood, 1998) and to the information behaviour in different styles of public organization (Thompson & Wildavsky, 1986).

## 7.2 HSW and eGovernance

*Adapted from Verplanke et al. (2010)*

eGovernment initiatives in industrialized and developing countries hold the promise of a more citizen-centric government with reduced operational cost (Saxena, 2005). Governments use ICT to deliver efficient and cost effective services, information and knowledge (Fang, 2002). Some authors claim that the adoption of a private sector management model, emphasizing the accountability of managers and a results orientation, will transform the public sector (Criado et al., 2002). With online public services, especially through the internet, increasingly seen as part of a broader service (improvement) strategy, citizen dissatisfaction with the quality of the services may quickly become a major political issue (Ho, 2002; Verdegem 2009). Although, the telephone and face-to-face contact are still more frequently used and are rated higher than internet contacts (Van Deursen and Pieterse, 2006), many studies reveal the increasing use of internet for service provision to citizens (Thomas and Streib, 2003; Horrigan, 2004), as well as improved citizens' interaction with government (Reddick, 2005; McNeal et al., 2008). Citizens usually contact local government to request a service or information, to lodge a complaint, voice their opinions, among other reasons. The contacts tend to be "geared toward matters of everyday service delivery rather than large-scale policy" (Sharp, 1984). Good contact experiences are important to both citizens and governments. The government may learn about the concerns of its citizens, their "contents and discontents." Citizens may learn of government services and benefits, how government functions, who is responsible for certain decisions. A satisfactory contact experience may improve a citizen's feeling of trust towards their government (Cohen, 2006). Other values, hailed as constituting "good governance", such as participation, transparency, responsiveness, equity and inclusiveness, effectiveness, efficiency, and accountability may also be upheld in government-citizen contacts (Parigi et al., 2005; Thomas and Streib, 2003). Specifically, one of the ways ICT is expected to change the relationship between citizens and local governments is by facilitating participation. Citizen participation in local governance is significant in two respects: citizen participation reveals their collective preferences, ensures that local government is responsive to their needs, strengthens representative institutions and enhances democratic legitimacy (Chen et al., 2006; OECD, 2003). Out of the two main streams identified for eGovernment adoption—the supply side (government to citizen) and the demand side (citizen to government)—only the supply side is well documented in the literature (Moon, 2002; Edmiston, 2003; Gil-Garcia and Martinez-Moyano, 2007; Kumar et al., 2007). The demand side of eGovernment adoption is less explored (Pieterse and Van Dijk, 2007; Cohen, 2006).

eGovernment was spurred by the need to regain public trust in government. Much of the effort however has gone into electronically connecting different parts of government to improve efficiency and effectiveness (G2G). To reclaim public trust eGovernment provides services to citizens (G2C) and the business (private) sector (G2B) (see table 7.1). Schematically, eGovernment = G2G + G2C + G2B.

In principle, eGovernment is also offering citizens an opportunity (platform) to voice their

issues and complaints (grievances). Feedback mechanisms from public and private sector fall under eGrievance systems, which we represent schematically as eGrievance = G2C + G2B. eGrievance systems enable societal actors to voice their concerns. Some of them have been designed years ago from a top-down perspective, therefore we label them G2C. More recent ones, adopting Web 2.0 approach and tools, can be labelled C2G because the initiative comes from users; we are introducing an example later. Citizens are in general responsive to questions that governments ask about policies or societal issues. eGrievance also facilitates feedback mechanisms to redress complaints on the malfunctioning of a pre-defined set of services. On the other hand, when citizens seize initiative to confront government with issues it is not commonly done through e-channels. Social networks and mass media play a role to collect grievances and to pool them. Particularly media play an important role to raise public attention to grievances. Media visibility is essential for grievances to reach government. But currently more and more social issues are pooled through electronic social networks and brought to the attention of international agencies. Interest groups and (multinational) NGOs are also using these same social networks to push or pull at the relevant issues for their own agenda setting.

**Table 7.1. Key features of information flows, adapted from Craglia et al. (2008)**

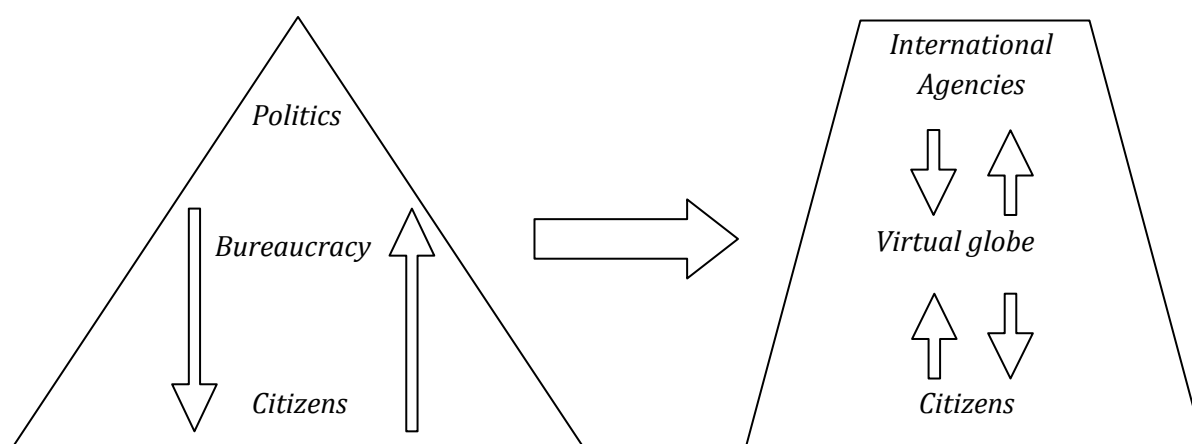
	<b>Lead Actors</b>	<b>Key Drivers</b>	<b>Main Target Audience</b>	<b>Implementation mechanism</b>
<b>eGovernment</b>	Public sector	Public trust	Citizens + private sector	Services to citizens
<b>Virtual globes</b>	Private sector	Market share & Advertising Revenue	Mass market	Market + voluntary
<b>VGI</b>	Citizens	Social networking	Citizens	Voluntary

*Surveillance power from the state to the citizens?*

Traditionally, bureaucracy has the role of bridging the formal political sphere and citizens. Its main legitimation lays in the aim of rationalizing society by channelling social relations in formal procedures, based on formal rationality, rather than value rationality. Ideally, it guarantees equal and universal access to public administration, and downplays the role of tradition and charismatic figures. Weber (in “The Protestant Sects and the Spirit of Capitalism” 1920) expresses his concerns about the bureaucratization of society with his famous metaphor of the “iron cage”. The last century showed that such a modernization path is not necessary, as different rationalities continue to exist and proliferate, being Foucault an exemplar author on such line.

Indeed, the universal institutionalization of formal rationality is not likely to happen any time soon, nor societies are going that way. Information systems as those being discussed here - based on perceived needs and wants and may sideline bureaucracy- do not seem to bring us towards an iron cage. Rather, mutual visibility and continuous negotiation appear as the way

ahead of citizens and decision makers. Hoogenboom and Ossewaarde (2005) argue that such relation between state and citizens was legitimized by a 'legal-rational authority' which cannot be taken for granted in 'late modernity', characterized by different and competing rationalities. Late modernity sees the rise of reflexive organizations, which are more dependent on their actual environments. "Reflexive organizations further democratization because they force a bureaucratic elite to take the personal and social needs of the lay people seriously and they force them to communicate openly" (Hoogenboom and Ossewaarde, 2005). On the other side, this kind of organizations risk to be less universalistic, and more affected by individual qualities as mobilizing capacity of parts of society. With this framework in mind, we will introduce two examples of eGovernment efforts, which go in line with the idea of reflexive authority.



**Figure 7.1. An emerging setting for eGovernment, from traditional to a setting with geoICT acting as an intermediary**

Citizen empowerment through eGovernment would entail the inversion of the grievance system (eGrievance-1). Such a bottom up approach depends on citizens or private sector to take initiative and find a platform to confront government with their grievance (eGrievance-1 = C2G + B2G). Few examples exist of such inverted systems and there are several consequences to take into account for such a system to work.

Traditional eGovernment and eGrievance structures in particular can be represented with a classic top down scheme where information travels down and up between policy makers and citizens through the bureaucratic filter of public administration (figure 7.1). With the constitution of a more visible and vocal citizenship where information exchange between citizens is growing increasingly through accessible and easy to use applications, the individuality of citizen grievance can be pooled through platforms by themes and preferably also location. International agencies set these themes as well concerning wide issues ranging from water and sanitation to women emancipation or health. On the one hand International agencies follow MDG's to set their agendas, on the other hand they can follow citizen inputs (Google Earth Outreach, 2008).

This emerging setting fits well with the concept of eParticipation. eParticipation uses ICT as a utility to get citizens more involved in improving the public service, public administration and social cohesion. More and more links are made between governments and citizen communities. Poelmans and Van der Linde differentiate three forms of eParticipation:

1. *Political participation.* How to involve citizens in the decision-making process?



2. *Policy participation.* Citizens and governments cooperate together at the implementation and maintenance of policy.
3. *Social participation.* How to reinforce the mutual involvement of citizens?

On the traditional (left) side of figure 7.1 these three forms of participation are dependent on the bureaucracy to govern information flows. Particularly social participation depends on the agility and transparency of that bureaucracy. If the bureaucracy is not equipped to captivate citizens, eParticipation will lose its momentum and its effect. Even if bureaucracy is functioning optimally it can act as a filter to both sides of the system. Probably not a deliberate filter, but the eGovernment system is not equipped to organize all citizen demands into policy input, nor can it give enough transparency to policy objectives.

Moving to eParticipation with a wider perspective, citizen interests and international agendas become interdependent drivers for political and social participation. The relative ease to provide location information with complaints through embedded GPS devices offers interesting opportunities to organise information spatially through virtual globes. Virtual globes are places where citizens and private sector gather to provide and acquire geo-located knowledge, experiences and information about services. The specific nature of information provided on virtual globes is the spatial information attached to all available data. Combining data sources provides possibilities to discover business opportunities or enable the identification of hotspots (Thorp, 2009; McNeil Jr., 2009) for all sorts of purposes.

Visualization of localized themes of grievances could provide citizens and policy-makers a different view into objectives and demands.

Rather than going into the details of systems that are under continuous development, we stress how our cases aim at affecting service provision activities by managing stakeholders' mutual and external visibility differently. With respect to eGrievance, the Human Sensor Web example (or eGrievance<sup>-1</sup>) positions the interactions it mediates and data hereby produced, outside of the conventional bureaucratic procedures that eGrievance systems are designed upon. With this the old idea of control (Mansell, 2010) is possibly reverted, or becoming exploitable by the controlled.

By becoming a side addition to the existing tools like eGrievance, human sensed data on virtual globes act as a mirror through which policy-makers and citizens become more visible to each other. Accountability lines are therefore affected. Bureaucracy is likely to keep filtering citizen pressure, and the same citizens are likely to find workarounds to affect agenda setting. The virtual globe acts on the well known mechanism of showing and blaming: facilitating the public visualization of public interest issues like service provision, they leverage the public opinion in a less ad-hoc fashion than mass media. Quite likely, corporations or groups of citizens will be able to exploit the virtual globe to "sell" their point of view or product to a potentially broader audience. On the other hand, citizens become more visible to the state. The mediating role of the private sector is expected to focus itself on the transparent development and management of such platforms.

### **7.3 The future of the Human Sensor Web**

This Human Sensor Web project has been successful in most aspects. It's primary objective was to deliver a working prototype of a system that could be used to monitor and visualize water

services provision on Zanzibar. During the implementation of the project it however became apparent that there are many more practical issues that could be improved to enable better functionality and applicability of the system. To further develop and improve the system there are a number of priorities we recommend for follow-up projects:

The present pilot runs on a mobile telephone connected to a laptop and internet. The laptop is located in the server-room of a third party internet provider. This offers a secure environment and a stable internet connection. This is however also dependant on the willingness of the provider to continue offering this service. The small maintenance and bandwidth required to operate the system have been supplied at no cost during the project but would require a fee to continue the service.

The information flow is currently between several nodes and servers. Reconfiguring the system in a different location requires partly reinstallation and redesign on the laptop which requires expert knowledge. In short HSW works fine, but changes and deployment elsewhere are difficult. We therefore suggest the following developments for HSW

1. *Working copy of HSW on Android.*

This is regarded as the first priority. Although many mobile operating systems exist, our experiences with Android and it's compatibility with other Google developments make it the best mobile platform for this system. Developing HSW for Android would enable the system to work solely on a smart phone with connectivity to cloud computing. Such a development would reduce many of the current impracticalities of the system.

2. *Analysis of other Android based open source SMS systems to identify re-useable components*

This would be a logical step in the light of the previous. Close contact with and support by Google is required in any case to enable a successful version of HSW on Android. Re-using components of existing Android apps and code will reduce cost of development.

3. *Analysis of Open Data kit (ODK) on reusability of components.*

Specifically for cloud computing and connectivity to other systems and platforms an analysis of ODK is important. Data from HSW should be available as fusion tables and easily integrate with other data.

4. *Extension of functionality as presented already to H2.0*

It has become apparent that HSW should not be limited to text based messaging from simple mobile phones. For people using smart phones additional functionalities should be available such as specific forms and GPS location. But more importantly the system should also allow an interactive voice operated system where the user can make an ordinary voice call and then interact with a computer by keying responses to questions from the computer or leaving a voicemail message.

The HSW consortium has enjoyed working on the development of this prototype and will investigate avenues to further develop its application and implementation.

HSW consortium, 2010

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52°North Initiative for Geospatial Open Source Software (52N)

Twente Institute for Mobile and Wireless Communications (TI-WMC)

The Zanzibar Water Authority (ZAWA)



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# Annex 1

Human Sensor Web

## Design Concept

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### Contents

<b>1 Introduction</b>	<b>2</b>
<b>2 Components Overview</b>	<b>2</b>
2.1 GSM2SWE Bridge	3
2.1.1 Explanatory Notes	3
2.1.2 InsertObservation	3
2.1.3 Subscribe	5
2.1.4 Unsubscribe	6
2.1.5 GetMessages	7
2.1.6 Error Handling	9
2.2 Sensor Event Service	10
2.3 Sensor Observation Service	10
2.4 Web Notification Service	10
2.5 Water Operator	11
<b>3 Interaction Between Components</b>	<b>11</b>
3.1 GSM2SWE and SES	11
3.2 GSM2SWE/SES and SOS	11
3.3 SES and WNS	11
3.4 HSW and Water Operator	11
<b>References</b>	<b>11</b>
<b>GSM2SWE XML-Schema</b>	<b>12</b>

### List of Figures

1 Component Overview	3
2 Insert Observation Request	4
3 Insert Observation Response	4
4 Subscribe Request	5
5 Subscribe Response	5
6 Unsubscribe Request	6
7 Unsubscribe Response	7

8	GetMessages Request	8
9	GetMessages Response	8
10	Exception Response	9
11	event notification system	10
12	sensor observation service with core and transactional operations	10
13	web notification service with used operations; data source is on the left and data sink on the right	11

## Listings

1	InsertObservation Request	3
2	InsertObservation Response	4
3	Subscribe Request	5
4	Subscribe Response	6
5	Unsubscribe Request	6
6	Unsubscribe Response	6
7	GetMessages Request	7
8	GetMessages Response	8
9	Exception response with no stack trace	9
10	GSM2SWE XML-Schema	12

## List of Tables

1	Insert Observation Message Codes	5
2	GetMessage Response Message Codes	7

## 1 Introduction

This document describes the design of the Human Sensor Web (HSW) application. The next section (section 2) will give an overview on all used components. Each component will be explained shortly. The interaction between the components will be explained in section 3.

## 2 Components Overview

This section deals with an overview of all used components in the Human Sensor Web application. Figure 1 shows an overview of the whole architecture. The GSM network is connected to the HSW application via a bridge (see section 2.1). This component provides access to the SWE services and manages the communication between these. The Sensor Observation Service (SOS, [3]) stores the observed data and provides spatio-temporal functions to access the data via standardised and interoperable interfaces (see section 2.3). The validation and processing of the incoming data is realized in the Sensor Event Service (SES, [1], see section 2.2). The possible information output (waterpoint status information and alarm messages) will be published using a Web Notification Service (WNS, [4], see section 2.4). The visualisation and water point management for the water operator is described in section 2.5.

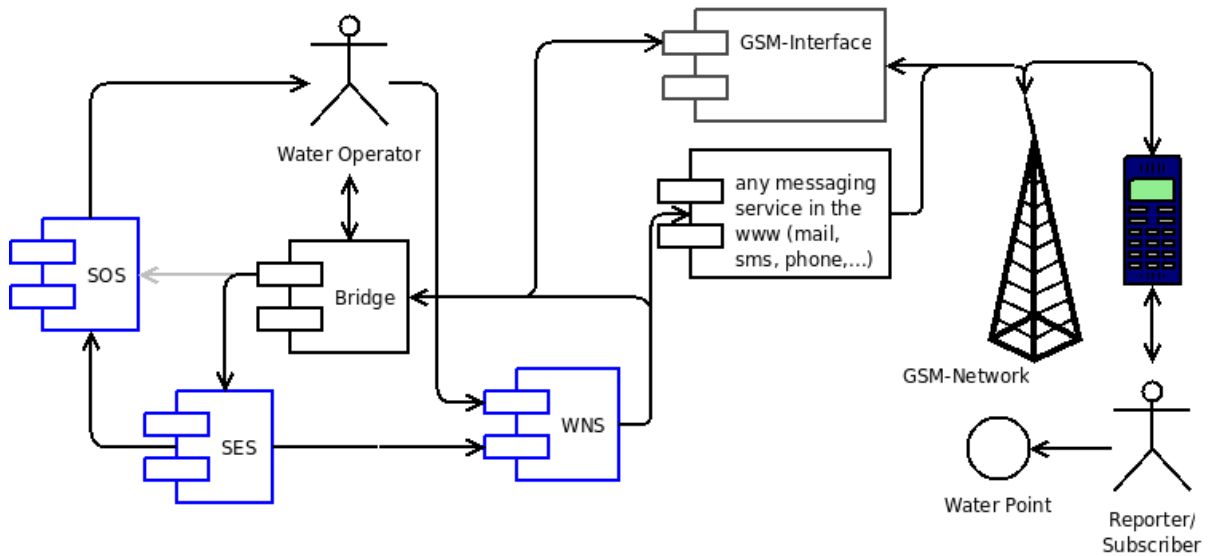


Figure 1: Component Overview

## 2.1 GSM2SWE Bridge

The GSM2SWE Bridge interacts with the GSM network. It handles all incoming sensor data from the *reporters* and forwards it to the suitable components. On the other hand the processed data will be send back to the *subscribers*. It also manages the subscriptions and offers functions to manage the features of interest (FOI, in our case the waterpoints). Four different types of operations are offered by the bridge and will be explained in the following sections. The last part will deal with some error handling issues.

### 2.1.1 Explanatory Notes

The `<locationId>` will use the WAZA Standard which looks like

```
<two digits>-<one digit>-<six digits>.
```

The dates in `<time>` are in ISO8601<sup>1</sup> format.

The value attribute of the `<result>` tag will contain one of the following values: {failed, success}.

The `<code>` will only contain a defined set of values (see section 2.1.5).

The `<certainty>` will contain values from 0..100.

### 2.1.2 InsertObservation

The request (see listing 1 and figure 2) is used to provide an observation performed by a human sensor. The observation will contain a `<sensorId>`, a `<measurement>` containing a `<time>`, a `<locationid>`, and a `<value>`. The allowed values are the same that will be used by the GetMessages operation (see table 1 in section 2.1.5 for more details).

The response (see listing 2 and figure 3) contains a `<result value="success"/>` which will hold a value attribute. This value will indicate if the submission was successful. If not, failed will indicate that a problem occurred which is described by the value: `<result value="failed">Error Code</result>`.

```
1 <?xml version=" 1.0" encoding="UTF-8" ?>
2 <InsertObservation xmlns=" http://schemas.52north.org/hsw/gsminterface"
3   xmlns:xsi=" http://www.w3.org/2001/XMLSchema-instance"
4   xsi:schemaLocation=" http://schemas.52north.org/hsw/gsminterface">
5   <sensorId>+33123456789</sensorId>
```

<sup>1</sup>[http://en.wikipedia.org/wiki/ISO\\_8601](http://en.wikipedia.org/wiki/ISO_8601)

```

6 <measurement>
7 <time>2009-02-26T17:44:15+00:00</time>
8 <locationId>10-1-100001</locationId>
9 <value stateCode="INFO_WATER_BAD">We always have to wait two hours to get
  water.</value>
10 </measurement>
11 </InsertObservation>
12 <!-- Version without a comment by the reporter -->
13
14 <InsertObservation xmlns="http://schemas.52north.org/hsw/gsminterface"
15   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
16   xsi:schemaLocation="http://schemas.52north.org/hsw/gsminterface">
17 <sensorId>+33164587900</sensorId>
18 <measurement>
19 <time>2009-02-26T18:44:15+00:00</time>
20 <locationId>10-1-100000</locationId>
21 <value stateCode="SERVICE_WATER_GOOD" />
22 </measurement>
23 </InsertObservation>

```

Listing 1: InsertObservation Request

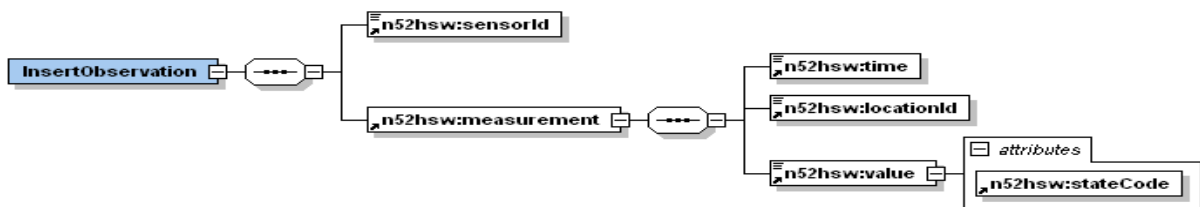


Figure 2: Insert Observation Request

```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <InsertObservationResponse xmlns="http://schemas.52north.org/hsw/gsminterface"
3   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4   xsi:schemaLocation="http://schemas.52north.org/hsw/gsminterface">
5 <result resultValue="success"/>
6 </InsertObservationResponse>

```

Listing 2: InsertObservation Response

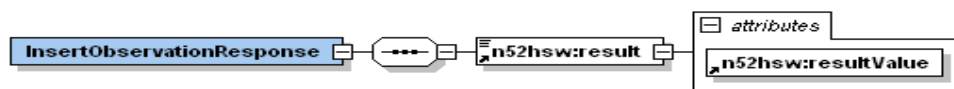


Figure 3: Insert Observation Response

Table 1: Insert Observation Message Codes

Code	SMS Code/command	Sender	Message
INFO_WATER_BAD	d,D,e,E,f,F	user	dirty water
INFO_WATER_NONE	a,A,b,B,c,C	user	no water available
INFO_WATER_GOOD	not assigned	user	good water available
SERVICE_WATER_BAD	x,X	ZAWA tech	water is dirty WP is/will be serviced (in some future)
SERVICE_WATER_NONE	t,T	ZAWA tech	no water (trusted) WP is/will be serviced (in some future)
SERVICE_WATER_GOOD	r,R	ZAWA tech	WP repaired
SERVICE_POWER_FAILING	majitec power fail	ZAWA tech	no water due to power failure
SERVICE_POWER_GOOD	majitec power good	ZAWA tech	power failure cleared

### 2.1.3 Subscribe

This request (see listing 3 and figure 4) is sent from the GSM interface to the GSM2SWE bridge to register the given `<notificationTarget>` for information retrieval for the given waterpoints identified by a `<locationlist>`. This list MUST contain at least one (1) entry.

The response (see listing 4 and figure 5) from the bridge will contain a list containing ALL subscriptions for this `<notificationTarget>`. This information could be send to the *subscriber* to inform him/her about all running subscriptions. The response `<locationlist>` MUST contain at least one (1) entry (the newly added `locationIds`).

```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <Subscribe xmlns="http://schemas.52north.org/hsw/gsminterface"
3   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4   xsi:schemaLocation="http://schemas.52north.org/hsw/gsminterface">
5   <notificationTarget>+33123456789</notificationTarget>
6   <locationlist>
7     <locationId>10-1-100000</locationId>
8   </locationlist>
9 </Subscribe>

```

Listing 3: Subscribe Request



Figure 4: Subscribe Request



Figure 5: Subscribe Response

---

```

1 <?xml version=" 1.0" encoding="UTF-8" ?>
2 <SubscribeResponse xmlns=" http://schemas.52north.org/hsw/gsminterface"
3   xmlns:xsi=" http://www.w3.org/2001/XMLSchema-instance"
4   xsi:schemaLocation=" http://schemas.52north.org/hsw/gsminterface">
5   <locationlist>
6     <locationId>10-1-100000</locationId>
7     <locationId>10-1-100001</locationId>
8     <locationId>10-1-100002</locationId>
9   </locationlist>
10 </SubscribeResponse>

```

---

Listing 4: Subscribe Response

#### 2.1.4 Unsubscribe

This request (see listing 5 and figure 6) is sent to the GSM2SWE bridge to end a subscription for the given <notificationTarget> and the submitted <locationlist> which MAY have zero (0) entries.

Having zero entries will be interpreted as “remove all” command and all subscriptions for the given <notificationTarget> will be removed. The response will be a reponse having an empty <locationlist> of left subscriptions.

The response (see listing 6 and figure 7) contains a <locationlist> of all left subscriptions which MAY be zero (0).

---

```

1 <?xml version=" 1.0" encoding="UTF-8" ?>
2 <UnSubscribe xmlns=" http://schemas.52north.org/hsw/gsminterface"
3   xmlns:xsi=" http://www.w3.org/2001/XMLSchema-instance"
4   xsi:schemaLocation=" http://schemas.52north.org/hsw/gsminterface">
5   <notificationTarget>+33123456789</notificationTarget>
6   <locationlist>
7     <locationId>10-1-100000</locationId>
8   </locationlist>
9 </UnSubscribe>

```

---

Listing 5: Unsubscribe Request



Figure 6: Unsubscribe Request

---

```

1 <?xml version=" 1.0" encoding="UTF-8" ?>
2 <UnSubscribeResponse xmlns=" http://schemas.52north.org/hsw/gsminterface"
3   xmlns:xsi=" http://www.w3.org/2001/XMLSchema-instance"
4   xsi:schemaLocation=" http://schemas.52north.org/hsw/gsminterface">
5   <locationlist>

```

```

6     <locationId>10-1-100001</locationId>
7     <locationId>10-1-100002</locationId>
8 </locationlist>
9 </UnSubscribeResponse>

```

Listing 6: Unsubscribe Response



Figure 7: Unsubscribe Response

### 2.1.5 GetMessages

This request (see listing 7 and figure 8) is used to get all cached messages from the GSM2SWE bridge. These messages have to be cached because there is not possibility to use a push approach (the normal way for message forwarding done by the WNS, see section 2.4).

The response (see listing 8 and figure 2.1.5) will contain always a `<messagelist>`. This list MAY contain zero (0) elements if no new messages are available at the moment. The `<message>` contains four (4) children: `<code>`, `<certainty>`, `<locationId>`, and `<notificationTargetlist>`. The `<code>` child will identify the type of message which will be translated into a textmessage on the GSM side (see table 2). The `<certainty>` expresses the result of the validation process. Values lower than 40<sup>2</sup> will result in additional information added on the GSM side; something like “The data we have is too old or we are not sure about the state of the waterpoint so you have to go on your own risk”. The `<locationId>` identifies the waterpoint that is concerned by the message.

Review SMS  
commands for  
POWER\_FAIL  
POWER\_GOO

Table 2: GetMessage Response Message Codes

Code	Certainty	Message
INFO_WATER_NONE	%	Water point <i>Miembeni (53-2-076309)</i> has NO water, thank you for your patience. This is a message from ZAWA.
INFO_WATER_BAD	%	DIRTY water at water point <i>Mwanakwerekwe (53-2-062101)</i> . This is a message from ZAWA.
INFO_WATER_GOOD	%	Water point <i>Mwanakwerekwe (53-2-062101)</i> is operating again. This is a message from ZAWA
INFO_POWER_FAILING	%	Some water points may malfunction in coming hours due to electricity failure, thank you for your patience. This is a message from ZAWA.
INFO_POWER_GOOD	%	Water points should be working again (electric failure repaired). This is a message from ZAWA.

```

1 <?xml version=" 1.0" encoding="UTF-8" ?>
2 <GetMessages xmlns=" http://schemas.52north.org/hsw/gsminterface"
3   xmlns:xsi=" http://www.w3.org/2001/XMLSchema-instance"

```

<sup>2</sup>The border between uncertain knowledge and no knowledge need to be defined and is set to 40% in the beginning.

4     xsi:schemaLocation=" http://schemas.52north.org/hsw/gsminterface" />

Listing 7: GetMessages Request

**GetMessages**

Figure 8: GetMessages Request

```
1 <?xml version=" 1.0" encoding="UTF-8" ?>
2 <GetMessagesResponse xmlns=" http://schemas.52north.org/hsw/gsminterface"
3   xmlns:xsi=" http://www.w3.org/2001/XMLSchema-instance"
4   xsi:schemaLocation=" http://schemas.52north.org/hsw/gsminterface">
5   <messagelist>
6     <message time=" 2009-02-26T17:46:15+00:00">
7       <code>INFO_WATER_GOOD</code>
8       <certainty>72.5</certainty>
9       <locationId>10-1-100000</locationId>
10      <notificationtargetlist>
11        <notificationTarget>+33123456789</notificationTarget>
12        <notificationTarget>+33164587900</notificationTarget>
13      </notificationtargetlist>
14    </message>
15  </messagelist>
16 </GetMessagesResponse>
```

Listing 8: GetMessages Response

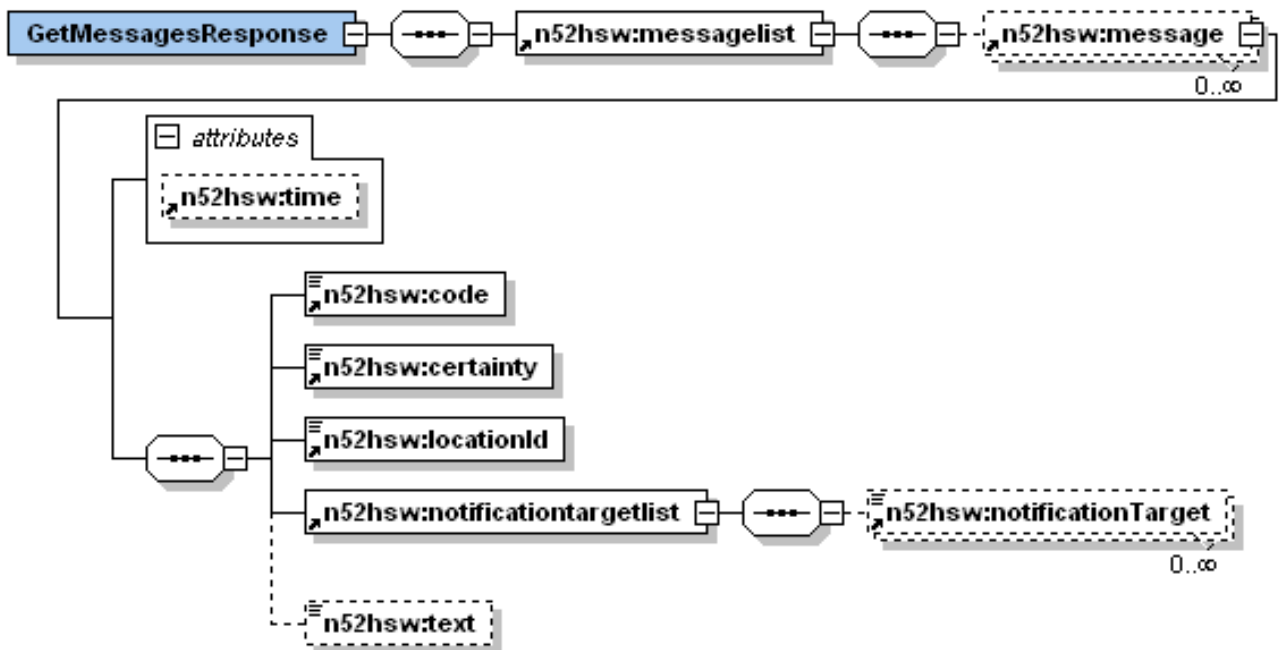


Figure 9: GetMessages Response



### 2.1.6 Error Handling

Occurring errors and exceptions will be encoded using the form shown in listing 9 and in figure 10. The `<exceptionTrace>` MAY contain nothing if the stacktrace is not available.

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <ExceptionResponse xmlns="http://schemas.52north.org/hsw/gsminterface"
3   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4   xsi:schemaLocation="http://schemas.52north.org/hsw/gsminterface">
5   <error>
6     <exceptionCode>Request Not Supported</exceptionCode>
7     <exceptionTrace></exceptionTrace>
8   </error>
9 </ExceptionResponse>
```

ExceptionCode

Listing 9: Exception response with no stack trace



Figure 10: Exception Response

## 2.2 Sensor Event Service

The SES could be seen as part of an event notification system [1, p. 6] where the SES is the information broker (see figure 11). The difference between the SES and the WNS is that the SES processes the data which is published by the information producer. The current specification offers three different levels of filtering (processing of *events* ← incoming data).

The SES will be used for processing the incoming data. This will be realised with optional Level 3 filtering with EML [2]. Event stream has to be processed and not only single events to apply the trust and reputation model. All data will be stored but the reputation model for social networks will be used to validate the data. We will also give the user information of certainty of the status information. “The data about waterpoint 52387342648 is too old. You have to go on your own risk.” for example.

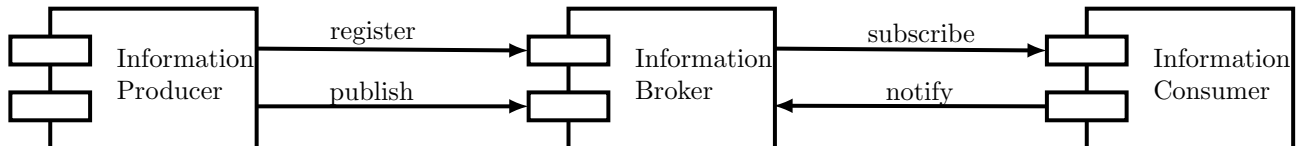


Figure 11: event notification system

## 2.3 Sensor Observation Service

The SOS offers operations to access sensor data in a standardised way collected from remote, in-situ, fixed, and mobile sensors. The core operations are **GetCapabilities**, **DescribeSensor**, and **GetObservation**. The **GetCapabilities** operation offers service metadata of the specific service instance. To get more specific information about contained sensors the **DescribeSensor** operation is used. The last core operation **GetObservation** is used to query the service to retrieve sensor data. These operations are mandatory.

The SOS specification offers some optional operations for advanced data retrieval which will not be explained here (see [3, p. 38] for more details).

The transactional operations are used to insert data into the SOS. First a sensor system has to be registered using the **RegisterSensor** operation (containing a description of the sensor system using SensorML and an observation template which will be used to insert observations). After registration the **InsertObservation** operation could be used to insert sensor data into the SOS.

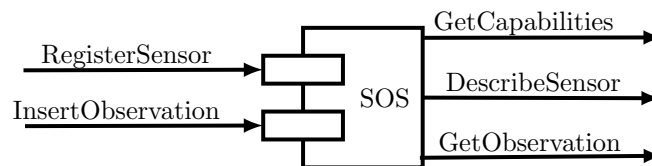


Figure 12: sensor observation service with core and transactional operations

## 2.4 Web Notification Service

The WNS is a transport transducer to change the protocol between the data source and sink. It is a multiplexer, too. The WNS offers operations to manage subscriptions. The **Register** operation is used to register a data sink which could be a group or a single user (**Unregister** is the opposite operation). To manage a registration the not mandatory operation **UpdateMultiUserRegistration** could be used (depends on the implementation of the WNS). To publish data a data source will call the **DoNotification** operation providing the ID of an previously registered data sink. A potential operation to download large messages is the **GetMessage** operation to offer an asynchronous way of data retrieval. Figure 13 gives an overview of the used operations.

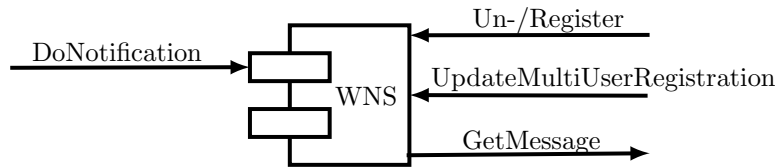


Figure 13: web notification service with used operations; data source is on the left and data sink on the right

## 2.5 Water Operator

This component will offer operations to monitor the water quality management system. This includes calling a manual alarm for a given set of waterpoints. This alarm will be send to all *subscriber* of the set of waterpoints. The other part of this component will be a visualisation tool to take a look at the observation made by the *reporter*. This will be a web client.

## 3 Interaction Between Components

### 3.1 GSM2SWE and SES

The GSM2SWE component will forward all incoming observations to the SES. Additionally all new *reporters* will become *subscriber* for the water point they report of. Incoming subscriptions will be forwarded, too. The GSM2SWE component takes two roles in the event notification system (see figure 11) because the SES is used for defending the SOS from bad data. The GSM2SWE is both, a information producer and information consumer.

The interaction is described via the `Register`, `Subscribe`, `Publish`, and `Notify` operations of the SES.

### 3.2 GSM2SWE/SES and SOS

The GSM2SWE component will register all *reporter* as new sensors. Before doing that GSM2SWE will check if the *reporter* is not already registered to the SOS. The second type of communication takes place when the SES *notifies* GSM2SWE. After that GSM2SWE will insert the according observation.

The interaction is describe via the `RegisterSensor`, and `InsertObservation` operations of the SOS-T<sup>3</sup>.

### 3.3 SES and WNS

The processed data that is validated by the SES will be send to the WNS. The WNS will forward all messages to the GSM network.

### 3.4 HSW and Water Operator

The water operator will be able to retrieve all observations stored in the SOS. Export this data, visualise and analyse it. If a manual alarm is triggered the GSM2SWE component will cache it until the GSM component pulls it. This is one of the constraints we have. *We cannot push messages to the GSM network*. The GSM component has to pull frequently for new messages.

## References

- [1] Echterhoff, J. and T. Everding (2008, October). Opengis sensor event service interface specification. Technical Report OGC 08-133, [http://portal.opengeospatial.org/files/?artifact\\_id=29576](http://portal.opengeospatial.org/files/?artifact_id=29576).
- [2] Everding, T. and J. Echterhoff (2008, December). Event pattern markup language (eml). Technical Report OGC 08-132, [http://portal.opengeospatial.org/files/?artifact\\_id=29566](http://portal.opengeospatial.org/files/?artifact_id=29566).

<sup>3</sup>The T identifies the transactional SOS which offers operations to insert data. This is additional to the core query only operations.

- [3] Na, A., M. Priest, H. Niedzwiadek, and J. Davidson (2007, October). Sensor observation service. Technical Report OGC 06-009r6, [http://portal.opengeospatial.org/files/?artifact\\_id=26667](http://portal.opengeospatial.org/files/?artifact_id=26667).
- [4] Simonis, I. and J. Echterhoff (2006, November). Draft opengis web notification service implementation-specification. Technical Report OGC 06-095, [http://portal.opengeospatial.org/files/?artifact\\_id=18776](http://portal.opengeospatial.org/files/?artifact_id=18776).

## GSM2SWE XML-Schema

---

```

1 <?xml version="1.0" encoding="UTF-8"?>
2 <xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:n52hsw="http://
  schemas.52north.org/hsw/gsminterface" targetNamespace="http://schemas.52
  north.org/hsw/gsminterface" elementFormDefault="qualified"
  attributeFormDefault="unqualified">
3 <!-- BASE TYPES -->
4 <xs:element name="locationId">
5   <xs:simpleType>
6     <xs:restriction base="xs:string">
7       <xs:pattern value="[0-9]{2}-[0-9]{1}-[0-9]{6}" />
8       <!--
9       <xs:pattern value="[0-9]{11}" />
10      -->
11     </xs:restriction>
12   </xs:simpleType>
13 </xs:element>
14 <xs:element name="notificationTarget">
15   <xs:simpleType>
16     <xs:restriction base="xs:string" />
17   </xs:simpleType>
18 </xs:element>
19 <xs:element name="sensorId">
20   <xs:simpleType>
21     <xs:restriction base="xs:string" />
22   </xs:simpleType>
23 </xs:element>
24 <xs:element name="exceptionCode">
25   <xs:simpleType>
26     <xs:restriction base="xs:string" />
27   </xs:simpleType>
28 </xs:element>
29 <xs:element name="exceptionTrace">
30   <xs:simpleType>
31     <xs:restriction base="xs:string" />
32   </xs:simpleType>
33 </xs:element>
34 <xs:element name="request">
35   <xs:simpleType>
36     <xs:restriction base="xs:string" />
37   </xs:simpleType>
38 </xs:element>
39 <xs:element name="time">
40   <xs:simpleType>
41     <xs:restriction base="xs:string" />
42   </xs:simpleType>
43 </xs:element>

```

```

44 <xs:element name="certainty">
45   <xs:simpleType>
46     <xs:restriction base="xs:byte">
47       <xs:minInclusive value="0" />
48       <xs:maxInclusive value="100" />
49     </xs:restriction>
50   </xs:simpleType>
51 </xs:element>
52 <xs:element name="code">
53   <xs:simpleType>
54     <xs:restriction base="xs:string">
55       <xs:enumeration value="INFO_WATER_NONE" />
56       <xs:enumeration value="INFO_WATER_BAD" />
57       <xs:enumeration value="INFO_WATER_GOOD" />
58       <xs:enumeration value="INFO_POWER_FAILING" />
59       <xs:enumeration value="INFO_POWER_GOOD" />
60     </xs:restriction>
61   </xs:simpleType>
62 </xs:element>
63 <xs:attribute name="stateCode">
64   <xs:simpleType>
65     <xs:restriction base="xs:string">
66       <xs:enumeration value="INFO_WATER_BAD" />
67       <xs:enumeration value="INFO_WATER_NONE" />
68       <xs:enumeration value="INFO_WATER_GOOD" />
69       <xs:enumeration value="SERVICE_WATER_BAD" />
70       <xs:enumeration value="SERVICE_WATER_NONE" />
71       <xs:enumeration value="SERVICE_WATER_GOOD" />
72       <xs:enumeration value="SERVICE_POWER_FAILING" />
73       <xs:enumeration value="SERVICE_POWER_GOOD" />
74     </xs:restriction>
75   </xs:simpleType>
76 </xs:attribute>
77 <xs:attribute name="resultValue">
78   <xs:simpleType>
79     <xs:restriction base="xs:string">
80       <xs:enumeration value="failed" />
81       <xs:enumeration value="success" />
82     </xs:restriction>
83   </xs:simpleType>
84 </xs:attribute>
85 <xs:attribute name="time" type="xs:string" />
86 <!-- COMPLEX TYPES -->
87 <xs:element name="value">
88   <xs:complexType>
89     <xs:simpleContent>
90       <xs:extension base="xs:string">
91         <xs:attribute ref="n52hsw:stateCode" use="required" />
92       </xs:extension>
93     </xs:simpleContent>
94   </xs:complexType>
95 </xs:element>
96 <xs:element name="result">
97   <xs:complexType>

```

```

98     <xs:simpleContent>
99         <xs:extension base="xs:string">
100             <xs:attribute ref="n52hsw:resultValue" use="required" />
101         </xs:extension>
102     </xs:simpleContent>
103 </xs:complexType>
104 </xs:element>
105 <xs:element name="error">
106     <xs:complexType>
107         <xs:sequence>
108             <xs:element ref="n52hsw:exceptionCode" />
109             <xs:element ref="n52hsw:exceptionTrace" />
110             <xs:element ref="n52hsw:request" minOccurs="0" />
111         </xs:sequence>
112     </xs:complexType>
113 </xs:element>
114 <xs:element name="message">
115     <xs:complexType>
116         <xs:sequence>
117             <xs:element ref="n52hsw:code" />
118             <xs:element ref="n52hsw:certainly" />
119             <xs:element ref="n52hsw:locationId" />
120             <xs:element ref="n52hsw:notificationtargetlist" />
121             <xs:element name="text" type="xs:string" minOccurs="0" />
122         </xs:sequence>
123         <xs:attribute ref="n52hsw:time" use="optional" />
124     </xs:complexType>
125 </xs:element>
126 <xs:element name="measurement">
127     <xs:complexType>
128         <xs:sequence>
129             <xs:element ref="n52hsw:time" />
130             <xs:element ref="n52hsw:locationId" />
131             <xs:element ref="n52hsw:value" />
132         </xs:sequence>
133     </xs:complexType>
134 </xs:element>
135 <!-- SOME LISTS -->
136 <xs:element name="notificationtargetlist">
137     <xs:complexType>
138         <xs:sequence>
139             <xs:element ref="n52hsw:notificationTarget" minOccurs="0" maxOccurs="
                unbounded" />
140         </xs:sequence>
141     </xs:complexType>
142 </xs:element>
143 <xs:element name="messagelist">
144     <xs:complexType>
145         <xs:sequence>
146             <xs:element ref="n52hsw:message" minOccurs="0" maxOccurs="unbounded" />
147         </xs:sequence>
148     </xs:complexType>
149 </xs:element>
150 <xs:element name="locationlist">

```

```

151     <xs:complexType>
152     <xs:sequence>
153     <xs:element ref="n52hsw:locationId" minOccurs="0" maxOccurs="unbounded
154         "/>
155     </xs:sequence>
156 </xs:complexType>
157 </xs:element>
158 <!-- REQUESTS -->
159 <xs:element name="GetMessages">
160     <xs:complexType/>
161 </xs:element>
162 <xs:element name="InsertObservation">
163     <xs:complexType>
164     <xs:sequence>
165     <xs:element ref="n52hsw:sensorId" />
166     <xs:element ref="n52hsw:measurement" />
167     </xs:sequence>
168 </xs:complexType>
169 </xs:element>
170 <xs:element name="Subscribe">
171     <xs:complexType>
172     <xs:sequence>
173     <xs:element ref="n52hsw:notificationTarget" />
174     <xs:element ref="n52hsw:locationlist" />
175     </xs:sequence>
176 </xs:complexType>
177 </xs:element>
178 <xs:element name="UnSubscribe">
179     <xs:complexType>
180     <xs:sequence>
181     <xs:element ref="n52hsw:notificationTarget" />
182     <xs:element ref="n52hsw:locationlist" />
183     </xs:sequence>
184 </xs:complexType>
185 </xs:element>
186 <!-- RESPONSE -->
187 <xs:element name="ExceptionResponse">
188     <xs:complexType>
189     <xs:sequence>
190     <xs:element ref="n52hsw:error" />
191     </xs:sequence>
192 </xs:complexType>
193 </xs:element>
194 <xs:element name="GetMessagesResponse">
195     <xs:complexType>
196     <xs:sequence>
197     <xs:element ref="n52hsw:messagelist" />
198     </xs:sequence>
199 </xs:complexType>
200 </xs:element>
201 <xs:element name="InsertObservationResponse">
202     <xs:complexType>
203     <xs:sequence>
204     <xs:element ref="n52hsw:result" />

```

```
204     </xs:sequence>
205   </xs:complexType>
206 </xs:element>
207 <xs:element name="SubscribeResponse">
208   <xs:complexType>
209     <xs:sequence>
210       <xs:element ref="n52hsw:locationlist" />
211     </xs:sequence>
212   </xs:complexType>
213 </xs:element>
214 <xs:element name="UnSubscribeResponse">
215   <xs:complexType>
216     <xs:sequence>
217       <xs:element ref="n52hsw:locationlist" />
218     </xs:sequence>
219   </xs:complexType>
220 </xs:element>
221 </xs:schema>
```

---

Listing 10: GSM2SWE XML-Schema



# Annex 2



SMS-Gateway Application  
Final Report

Doc. No.: H2O/UnHabitat  
Revision: 0.9  
Date: 20. September 2010

---

## **SMS-Gateway Application**

*Final Report*

## ABSTRACT

This document describes the results of the components of the H2O Human Sensor Network project that have been developed by WMC.

The primary result of the project is the SMS Gateway application installed on a laptop deployed in Zanzibar. Connected to the laptop is a Nokia mobile phone to send and receive SMS messages related to water point monitoring and administration. The laptop is prepared (protected) to be connected to the Internet on a permanent basis and can be administered remotely.

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## Table of Contents

1 SMS Messages.....	5
1.1.1 Water-point Reporting Commands.....	5
1.1.2 Subscription Management Commands.....	5
1.2 Service Technician Commands.....	6
1.3 ZAWA H2O Manager Commands.....	6
1.4 Overview of Subscriber Notification messages.....	7
2 Operations and Maintenance of the Sms Gateway.....	8
2.1 System Access.....	8
2.2 Database Management.....	8
2.2.1 Examine, Change, or Add Water Points.....	8
2.2.2 Examine or Change Command characters.....	9
2.2.3 Remove dead subscriptions.....	9
2.2.4 Change Group Membership.....	9
2.2.5 Change User Alias Names.....	9
2.3 Update the SmsGateway software.....	9
3 The SMSGateway (GSM2SWE Bridge).....	11
3.1 SW Components Overview.....	11
3.2 SmSGateway Java Application.....	12
4 Database.....	19
4.1 GNOKII Tables.....	19
4.1.1 Inbox.....	19
4.1.2 Outbox.....	19
4.2 H2O Tables.....	19
4.2.1 Location2sensorid.....	19
4.2.2 subscriptions.....	20
4.2.3 usergroups.....	20
4.2.4 useraliases.....	21
4.3 valueref2value.....	21
4.4 _allreports.....	21
4.5 Functions.....	22
4.5.1 stopallsubscriptions(phone).....	22
4.5.2 stopallsubscriptions(phone,sensorid).....	22
4.6 Views.....	22
4.6.1 Replies.....	22
4.6.2 Reports.....	22
4.6.3 SensorOverview.....	23
4.6.4 ShowDoubleSensorids.....	23
4.6.5 ShowDoubleSensorReferences.....	23
4.6.6 StaleSubscriptions.....	23
5 Messages and Translations.....	24
5.1 messages.properties.....	24
5.2 messages_sw_TZ.properties.....	26
6 System Monitoring.....	29
7 Installation Requirements.....	31
7.1 Package Contents.....	31

---

7.2 Site Requirements.....	31
7.3 IT-Requirements.....	31
7.4 Installation Procedure.....	31
8 Final Comments.....	33
8.1 Delivery actions.....	33
8.1.1 Hand over Passwords.....	33
8.1.2 Install ssh certificate on the laptop.....	33
8.1.3 Change Password.....	33
8.1.4 Adapt Firewall.....	33
8.1.5 Adapt allowed hosts.....	34
8.1.6 Update Dynamic host name support.....	34
8.1.7 Change Alerting email Addresses for Monit.....	34
8.1.8 Change Notification email Address For Daily Notification of SMS activity.....	34
8.2 Non-Expiring Subscriptions.....	34

## 1 SMS Messages

The SMSGateway understands three types of messages distinguished by the message prefix:

- |   | English               | Zwahili                   |
|---|-----------------------|---------------------------|
| 1. ZAWA H2O Manager messages starting with:     | <b><i>admmaji</i></b> | <b><i>utawalamaji</i></b> |
| 2. ZAWA Service technician messages start with: | <b><i>majitec</i></b> | <b><i>majiufundi</i></b>  |
| 3. Sensor reading messages start with:          | <b><i>maji</i></b>    | <b><i>maji</i></b>        |

Both the message prefixes as shown here, the command names, and the messages sent to the users can be configured to the desired language using the file `messages.properties` (defining the default; see below). Each new locale (=desired country and language; set with the OS) requires a copy of this file with the appropriate translations (i.e., `messages_sw_TZ.properties` for Swahili in Tanzania; see below).

### 1.1.1 Water-point Reporting Commands

Water-point Reporting messages are sent by regular users. Regular users can submit sensor readings about arbitrary water points and manage their subscription.

When a user first reports data about a specific water point, (s)he is automatically subscribed to updates about this water point.

Users can furthermore stop the subscription, explicitly start it, list all their subscriptions, and ask for help.

With all messages, users may attach free text comments, which end up in the database. At this moment, there is no structured (web-available) user interface to retrieve these comments.

The following Sensor Reading Messages are recognized:

- maji A TAG for GOOD water at water point TAG
- maji D TAG for NO or BAD water at TAG

The tags TAG are posted at the water points, for instance 001, 145.

All text after this (and following) commands is treated as a general comment as reported in the database.

When a user reports about a water point for the first time, (s)he receives this answer:

Thank you for your report on water point Hengelo (101). You will receive free update reports. To unsubscribe send "MAJI 101 stop". For info send "MAJI HELP". This is a message from ZAWA. Kind regards.

On subsequent reports, the reply is:

Thank you for reporting about water quality. Kind regards, ZAWA

Users subscribed to this particular water point receive the following message:

Water point Hengelo (101) has NO water, ZAWA is servicing, thank you for your patience.

### 1.1.2 Subscription Management Commands

Users can also send the following (subscription) management commands:

<b>maji TAG stop</b>	Stops the particular subscription for water point TAG
<b>maji stop all</b>	Stops all current subscriptions of this user
<b>maji list</b>	Lists all subscriptions of this user
<b>maji help</b>	Sends a short help message

## 1.2 Service Technician Commands

Service Technician Messages report authoritative (=implicitly trusted) reports about the current status of a water point. Furthermore, they can declare general (un-)availability of water as a result of power failures.

Service technicians can send the following messages:

<b>majitec p TAG</b>	Power failure (expected) at TAG
<b>majitec g TAG</b>	Power restored at TAG
<b>majitec t TAG</b>	Confirm no water at TAG
<b>majitec x TAG</b>	Confirm bad water at TAG
<b>majitec r TAG</b>	Water point TAG is repaired
<b>majitec no power TEXT</b>	for wide-spread power failure; sent to all subscribers; TEXT is an optional additional message
<b>majitec power back TEXT</b>	when the wide-spread power failure is solved
<b>majitec msg TEXT</b>	To send TEXT as a general announcement sent to all subscribers
<b>majitec msg TAG TEXT</b>	To send TEXT as an announcement for subscribers for TAG
<b>majitec help</b>	Sends a short help message

In order to be able to submit Service Technician Messages, the sending mobile phone must be registered as member of the 'majitic' group by an H2O Manager Messenger.

## 1.3 ZAWA H2O Manager Commands

An H2O manager can (un)register mobile phones to be Service Technician. Furthermore, a manager can add additional managers, or remove them (including himself).

Initially, the system has no H2O Manager assigned. The first "admmaji" message makes the sender H2O Manager.

An H2O manager can send the following messages:

<b>admmaji add +259... GROUP</b>	Adds the telephone(number) +259... to group GROUP
<b>admmaji rem +259... GROUP</b>	Removes phone from GROUP
<b>admmaji list GROUP</b>	Lists all phones in GROUP
<b>admmaji help</b>	Sends a short help message

Group can be admmaji or majitec.

## 1.4 Overview of Subscriber Notification messages

This section gives an overview of the messages that users subscribed to a waterpoint can expect to receive:

- Water point *wp-name (TAG)* has NO water, ZAWA is servicing, thank you for your patience.
- Water point *wp-name (TAG)* has DIRTY water, ZAWA is servicing, thank you for your patience.
- Water point *wp-name (TAG)* is operating again.
- Some water points may malfunction in coming hours due to electricity failure, thank you for your patience.
- Water points should be working again (electric failure repaired).
- Message from ZAWA: *TEXT from the majitec operator*
- Message from ZAWA about Water point Hengelo (101): *TEXT from the majitec operator*

The string '*wp-name (TAG)*' is adapted based on the waterpoint a message is about. *TEXT* is replaced with the text that the majitec sent with his/her command.

Subscription notifications from the GIS server that are older than 5 Minutes (configurable in SmSGateway.java) are ignored by default.

## 2 Operations and Maintenance of the Sms Gateway

Management of the SMS Gateway requires some limited skills in using Linux (log in, start applications, use of text editor) and editing a Postgres database (with GUI-Tool `pgadminIII`, or via command line).

The main tasks of the O&M manager (called *operator* for short) are

- Add, remove, modify the definition of water points in the database
- Change delivery addresses of the daily notification mails
- Change notifications from the *monit* system monitor (different email addresses)
- Check/restart services or the system after error messages from *monit*
- Fix subscriptions (see Section 8.2)

### 2.1 System Access

The operator can log in interactively at the laptop or remotely via `ssh`.

The `ssh` daemon is listening on port 287 and allows only certificate-based logins.

See Section 8.1 for information about getting/modifying system access.

### 2.2 Database Management

A system operator can manage the database contents either via the command line

```
h2o@h2o-smsgw:~$ psql smsd
```

or a GUI-based tool `pgadminIII`

```
yourLocalMachine$ ssh -p 287 -L7539:localhost:5432 h2o@hsn.dnsalias.com
```

Then start on your local machine `pgAdmin III` and connect to a server `localhost` at port 7539. The `ssh` tunnel created before re-routes traffic to the laptop in Zanzibar.

#### 2.2.1 Examine, Change, or Add Water Points

The SMS Gateway translates between HSW codes (the TAGs printed on the boards at the water points) and the official ZAWA Reference number (something like 53-0-107201).

Each water point in the field with its unique TAG must be registered together with its unique ZAWA code and a human-readable name. The ZAWA code must be registered also in the GIS backend.

To *examine* (and potentially export) the list of current associations use the view `h2o.sensoroverview` (or via command line: `select * from SensorOverview;`)

This view shows for each known water point its *name*, the HSW code (=TAG on the board), its ZAWA reference, and—if exists—the telephone number and alias of a registered Reporter for this water point. If multiple reporters are registered for a water point, one row is shown for each of them.

To verify that HSW codes are unique, use the view `h2o.ShowDoubleSensorids` (`select * from h2o.ShowDoubleSensorids;`).



To verify that all ZAWA codes are unique, use the view `h2o.ShowDoubleSensorReferences` (select \* from `h2o.ShowDoubleSensorReferences`;) )

To *add, remove, or change* associations, edit the table `h2o.location2sensorid`;

### 2.2.2 Examine or Change Command characters

Users and technicians use single-letter commands with the SMS gateway (e.g., a for no water, p for power failure). The mapping between these command letters and the codes used with the GIS backend system are stored in `h2o.valueref2value`.

Allowed entries for the value column of this table are determined by the GIS backend. Strings are case sensitive.

### 2.2.3 Remove dead subscriptions

Currently there is only one method to delete an active subscription: fake an unsubscription message by inserting a suitable record into the inbox:

```
h2o@h2o-smsgw:~$ ./fakeIncomingSms.sh +255number 'maji stop all'
```

(or the respective Zwahili commands)

A list of subscriptions whose subscriber has not send an SMS in more than 90 days can be obtained like this:

```
h2o@h2o-smsgw:~$ ./subscribersQuitetForMoreThan.sh '90 days'
```

Other time intervals like '2 months' or '1 year' are also possible.

### 2.2.4 Change Group Membership

Basically, group membership should be managed via the SMS message interface (cf. Section 1.3). If necessary, an operator can also edit the table `h2o.usergroups`.

### 2.2.5 Change User Alias Names

User aliases are generated automatically. The GIS backend known users only by their alias.

It is possible to add user aliases ahead of time (before the first report from that phone). This is useful to add the term "(Reporter TAG)" into the name to flag this person as a registered reporter (makes him show up in the view `h2o.sensoroverview`)

It is also possible to *change* the user alias of an existing user, but this requires that this user first stops all his/her subscriptions (see Section 2.2.3) and only then change the name in the table `h2o.useraliases`. Otherwise, the backend system treats him/her as a new user but continues to send notifications to the old name.

## 2.3 Update the SmsGateway software

In eclipse, create the `SmsGateway.jar` (right-click on `SmSGateway.jar` desc) and copy the new jar to the laptop like this:

```
scp SmSGateway.jar h2o@hsn.dnsalias.com:incoming/
```

The laptop (the monit process) automatically detects the new version and within 2 to 4 minutes installs and starts it on the laptop. Monit will generate several emails during the replacement indicating the progress.

## 2.4 Changing Operational Parameters of the SMS Gateway

The SMS Gateway application reads a set of properties that can modify its default behavior. The properties are defined in the class `nl.wmc.h20.SmsGateway`. To change the runtime parameters (without re-compiling), the parameters can be passed to the JVM in the file `/etc/init.d/smsgateway`.

The following properties are defined

`smsgateway.MESSAGE_DELIVERY_CUTOFF_AGE`

The maximum age (in milliseconds) a message retrieved from the server can have. Messages older than this time will not be sent to customers, but discarded.

Default: 50minutes

`smsgateway.POLLING_INTERVAL_GIS`

The time (in milliseconds) between consecutive checks for new GIS messages on the server.

Default: 10s

`smsgateway.POLLING_GIS_TASK_TIMEOUT =`

The time that the task polling for GIS messages from the server can take before being considered 'stuck'. A stuck process is automatically terminated and restarted.

Default: 2 minutes

`smsgateway.POLLING_INTERVAL_GIS_OFFSET`

The (initial) time difference between polling for SMSs and GIS messages (in milliseconds). The time difference is not constant because the timers are not synchronized and run in 'fixed-delay' mode. Further changes occur when the watchdog restarts one of the tasks.

Default: 3 seconds

`smsgateway.POLLING_INTERVAL_SMS_INBOX =`

The time between consecutive checks for new SMSs (in milliseconds) .

Default: 10s

`smsgateway.POLLING_SMS_TASK_TIMEOUT =`

The timeout for reading new SMSs from the database (in milliseconds). If the task reading new SMS has not succeeded to read new SMS from the inbox after this time period, the respective task is assumed to be stuck and is terminated & restarted.

Default: 2 minutes

`smsgateway.acceptUnknowZawaReferences`

Boolean indicating whether direct references to Zawa codes are accepted, that are not configured in the database. Setting this property to `true` would allow "maji D 53-12-12345" even if 53-12-12345 does not appear in the database table `Location2sensorid` (see below).

msggateway.GIS\_CONNECTION\_FAILURE\_COOLDOWN

The cool-down period after a server connection timed out (in milliseconds). During the cool-down period, clients are discouraged to attempt connection attempts.

Default: 3 minutes

msggateway.GIS\_CONNECTION\_TIMEOUT

The connection time out when connecting to the GIS server (in milliseconds). Default: 45s

msggateway.GIS\_SERVER\_ADDRESS

The address of the GIS server.

Default: <http://giv-ows.uni-muenster.de:8080/GSM2SWE/gsm>

msggateway.db.name

The name of the database of the SMS Gateway.

Default: sms

msggateway.db.server

The hostname or IP address of the host running the postgres database

Default: localhost

msggateway.db.port

The port where postgres is running.

Default: 5432

msggateway.db.passwd

The password to use for accessing the database.

Default: <hidden>

### 3 The SMSGateway (GSM2SWE Bridge)

The job of the SMS Gateway application is to interface between the GSM/UMTS network and the HSW application.

The SMSGateway *receives* SMS messages from Users (water point reporters, ZAWA service technicians, ZAWA-Maji-Managers), parses them, and forwards *Sensor Observations* and *Subscription Management* messages in a suitable format to the other components of the HSW application.

The SMSGateway sends response SMS messages to users' requests, and dispatches Sensor Notification SMS messages to subscribers. The Notification messages are generated by the HSW application.

The SMSGateway locally manages water point subscriptions, and group membership (service technician, administrator). It translates water point tags to internal ZAWA code representation.

#### 3.1 SW Components Overview

The SMSGateway installation consists of the following components:

- Java application SmSGateway – performs the main functionality of reading incoming SMS from the inbox and handling them, and receiving alert messages from the HSW system and translating them to SMS messages to users.
- Postgres Database – manages tables for the GNOKII SMS daemon (inbox & outbox) and several tables for the Java application:
  - h2o.valuesref2value* translates sensor value references used by users (a,d,x, etc.) to internal HSW values (INFO\_WATER\_NONE etc.)
  - h2o.location2sensorid* translates sensor tags used by users (100, 259, etc.) to internal HSW values (ZAWA WP codes of the form 12-3-456789)
  - h2o.subscriptions* manages the currently active subscriptions
  - h2o.usergroups* manages user groups; currently only two user groups are managed: ZAWA service technicians (majitec) and ZAWA HWS managers (admmaji). Membership is based on the telephone number
  - h2o.useraliases* translates between the telephone numbers of the users and their random text alias used towards the HSW application.
  - h2o.\_allreports* contains processing information of all SMS messages processed by the Java application
- Package *monit Service Manager* to monitor the services comprising the SMSGateway and the computer itself. The monitor (re)starts services when necessary and send email warnings when unusual behavior is detected.

The package monitors the processes *postgresql*, *smsd*, *msgateway*. It monitors the log file of *msgateway* for regular activity and ERROR/FATAL messages. Furthermore, it watches the timestamp of */home/h2o/incoming/SmSGateway.jar* and, when it changes, installs this

jar in /etc/smsgateway and re-starts the service.

- GNOKII SMS daemon – manages the communication with the mobile phone (reading and writing SMSs). It stores SMS messages received by the mobile phone in a Postgres database table *public.inbox* and sends SMS messages inserted in the table *public.outbox* via the phone.

The gnokii SMS daemon retrieves SMSs from the connected phone every 10 seconds. This can be configured in /etc/init.d/smsd.

The gnokii configuration file resides in /home/h2o/.gnokiirc

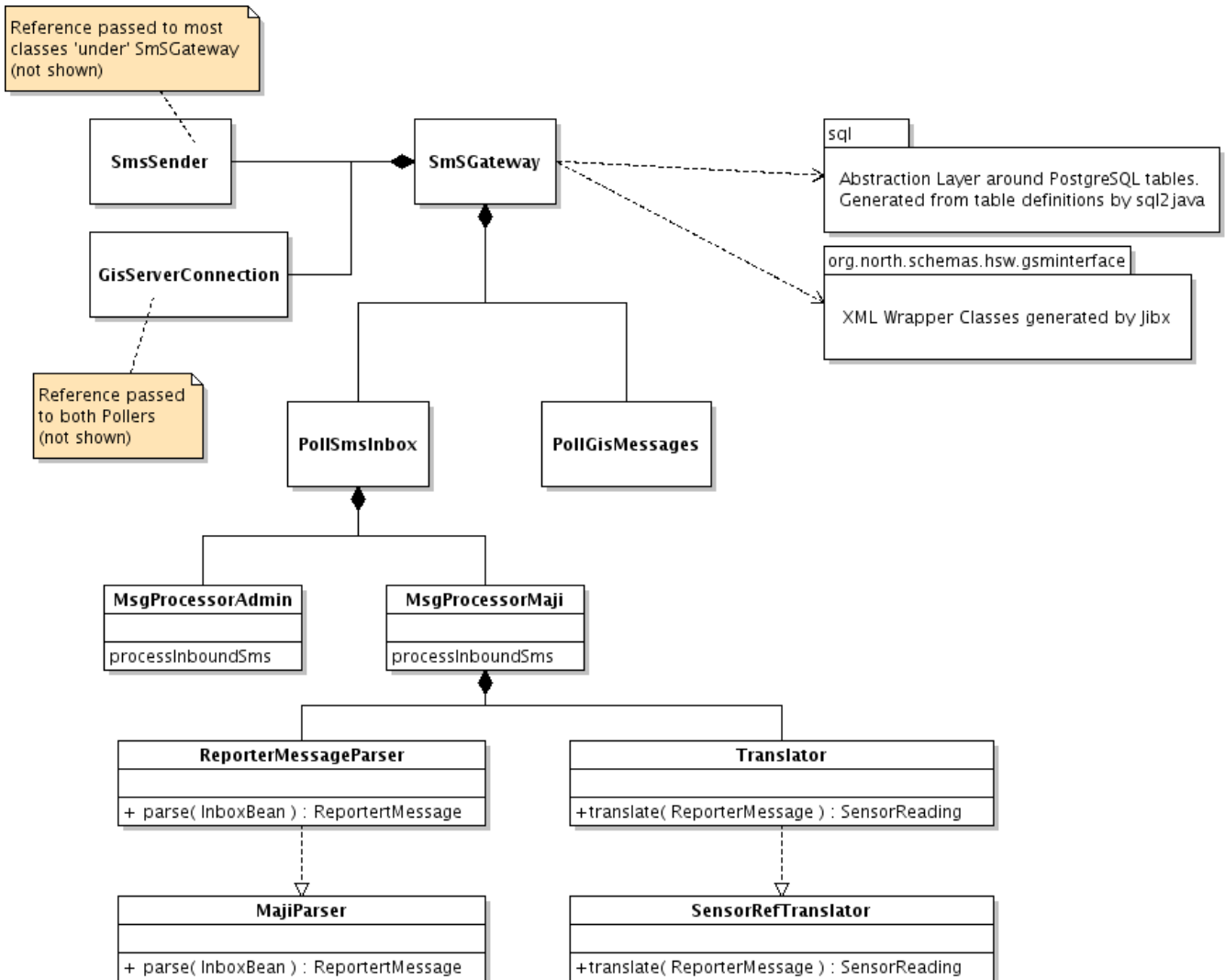
The SMS Gateway uses a patched version of “GNOKII Version 0.6.26”. The patch was necessary because of communication problems with the chosen mobile phone. At the end of phase 1 of the project, the GNOKII developers appear to have discovered the problem and were in the process of fixing it. Since then, multiple new revisions have been published by the GNOKII community, but none has been tested with the deployed laptop.

### 3.2 SmSGateway Java Application

The main application of the system is the SmsGateway object. It creates two interface object which provide the interfaces to the SMS retrieving and delivery system (SmsSender), and to the GIS-Server in Muenster (GisServerConnection). Both objects are used by many of the following object and their relations are therefore not shown in the Drawing 1.

To perform the main part of the work, SmsGateway creates two TimerTask objects: PollSmsInbox processes incoming SMSs, PollGisMessages retrieves notifications from the GIS server. The jobs in both these objects run in independent threads at regular intervals. Furthermore, SmsGateway creates a watchdog TimerTask (not shown in the figure) that monitors the former two for activity and restarts them when necessary.

The inbox processor has two associated message-processing objects (MsgProcessorAdmin for adm:majj-commands; MsgProcessingMaji for maji- and majitec-commands).

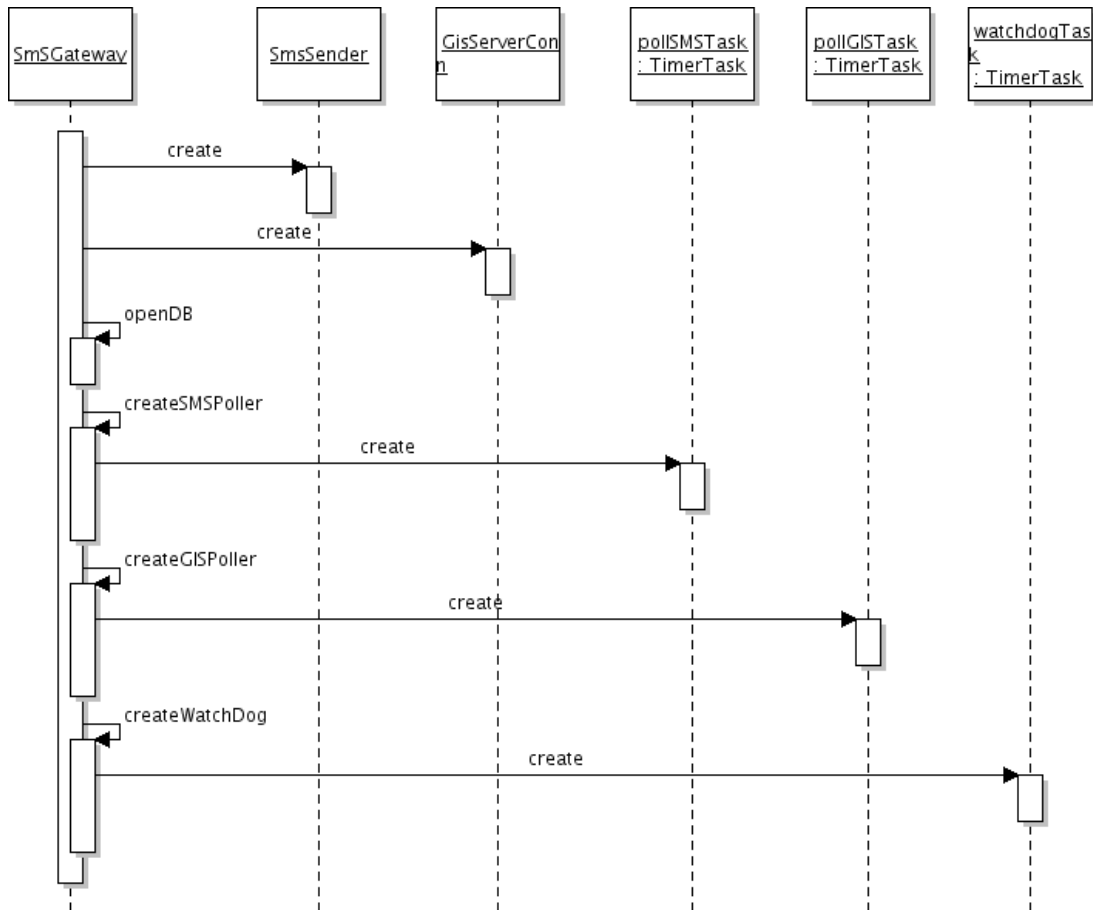


Drawing 1: Overview class diagram of SmSGateway

The Maji message processor uses a parser and a translator (both Strategy pattern) to parse the raw text retrieved from the user, and—in case of a sensor reading report—translate the resulting ReporterMessage to the internal values for sensor references and values. Next to the two implementation shown for these classes (MajiParser, SensorToRefTranslator), several additional classes have been implemented to allow for a variety of message structures, sensor references, and value references. An alternative translator uses, for instance, the combination of telephone number and value reference to identify the water point and reported value.

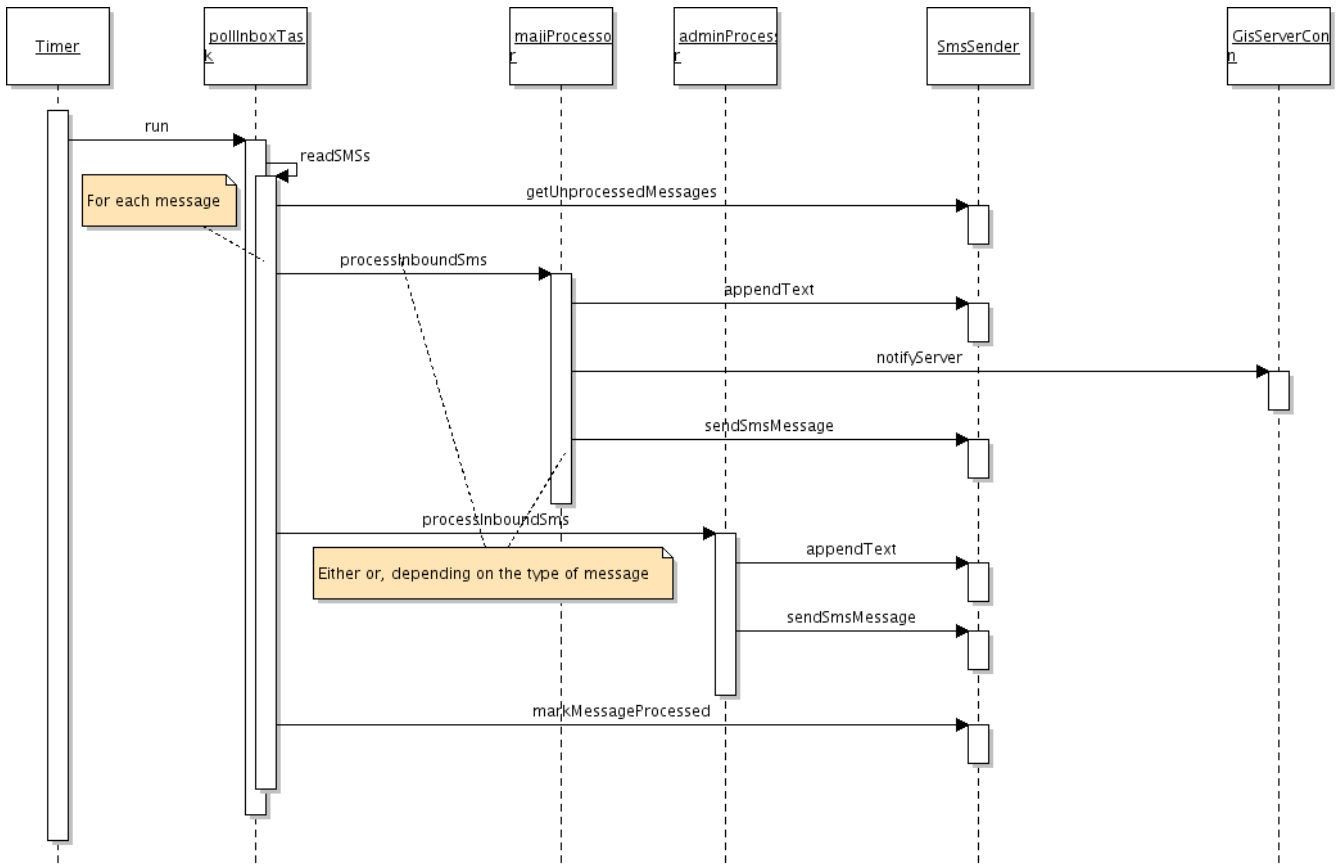
Furthermore, the application makes use of a package of generated classes abstracting from the (Postgres) database (nl.wmc.h20.sql), and wrapper classes for the various XML documents exchanged with the GIS server (org.north.schemas.hsw.gsminterface). The SQL wrappers (Java classes) and binding definition are generated directly from the database schema by *sql2java*. The XML wrappers were initially generated from the XML Schema definition and later hand-optimized slightly. The XML (un-)marshaller is automatically generated by *sql2java*.

When the SmSGateway application starts, it first opens the connection to the database and then creates three regularly activated tasks polling for incoming SMSs, alerts from the GIS systems, and monitoring the activity/aliveness of the former two (see Drawing 2).



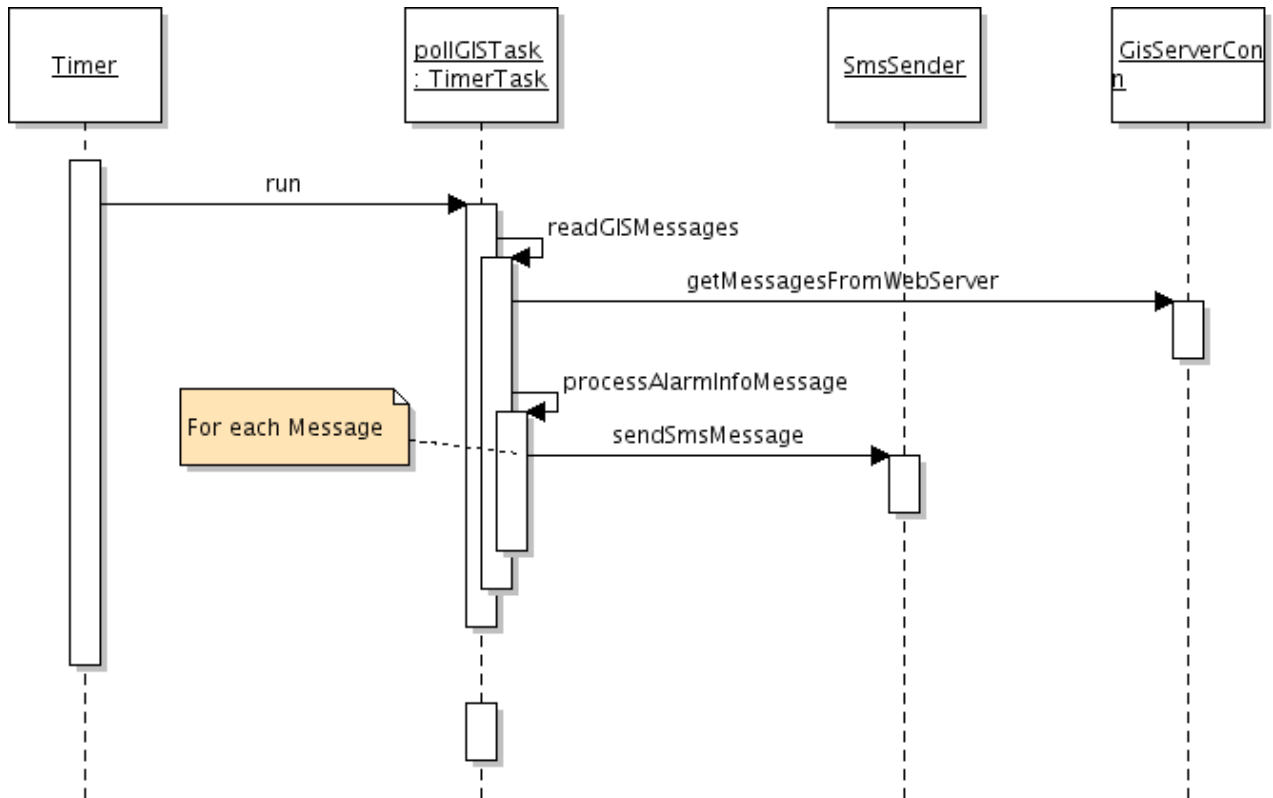
*Drawing 2: Message sequence diagram application initialization*

The thread polling for incoming SMSs from users regularly retrieves all un-processed SMSs from the inbox database and—depending on the command prefix—processed each with the appropriate message processor (see Drawing 3). Each incoming SMS is acknowledged by an SMS-reply.



Drawing 3: Message sequence diagram of thread polling SMSs from users





Drawing 4: Message sequence diagram of thread polling alerts from GIS system

The thread polling for sensor alerts from the GIS system first retrieves all currently available messages from the GIS web server and the processes each message. Each alarm info message from the GIS server results in one or several SMSs to subscribed users (see Drawing 4).

Messages from the GIS system that are older than 5 minutes are not delivered to subscribers. This value can be changed by passing `-Dmsgateway.MESSAGE_DELIVERY_CUTOFF_AGE=<time in milliseconds>` to the Java Virtual Machine (`/etc/init.d/msgateway`)

## 4 Database

### 4.1 GNOKII Tables

The GNOKII tables are created as part of the GNOKII installation and configuration process. See the GNOKII manual for more details.

#### 4.1.1 Inbox

The table inbox receives all incoming SMS messages.

```
CREATE TABLE inbox
(
  id                serial NOT NULL,                --serial number of the message
  "number"         character varying(20) NOT NULL,   -- phone number of the sender
  smsdate          timestamp without time zone NOT NULL DEFAULT now(), -- date and time the SMS has been sent
  insertdate       timestamp without time zone NOT NULL DEFAULT now(), -- date and time the SMS was inserted into the table
  "text"           character varying,              -- text of the SMS
  phone            integer,
  processed         boolean DEFAULT false,          -- flag if SmsGateway has processed this SMS already
  CONSTRAINT       inbox_pkey PRIMARY KEY (id)
) WITH (OIDS=TRUE);
ALTER TABLE inbox OWNER TO smsd;
GRANT ALL ON TABLE inbox TO "smsdUsers";
GRANT ALL ON TABLE inbox TO smsd;
```

#### 4.1.2 Outbox

All messages written to the table outbox will be processed by the GNOKII smsd and sent out. Processed messages are marked 'true' in the 'processed' field. If sending an SMS generated an error (from the phone or the telephone operator), the field 'error' contains a value other than "0".

```
CREATE TABLE outbox
(
  id                serial NOT NULL,
  "number"         character varying(20) NOT NULL,   -- phone number to send to
  processed_date    timestamp without time zone NOT NULL DEFAULT now(),
  insertdate       timestamp without time zone NOT NULL DEFAULT now(),
  "text"           character varying,              -- text of the SMS to send
  phone            integer,
  processed         boolean DEFAULT false,          -- flag if smsd processed this SMS
  error            smallint NOT NULL DEFAULT ((-1))::smallint, -- 0 if no error occurred
  dreport          smallint NOT NULL DEFAULT (0)::smallint,
  not_before       time without time zone NOT NULL DEFAULT '00:00:00'::time without time zone,
  not_after        time without time zone NOT NULL DEFAULT '23:59:59'::time without time zone,
  CONSTRAINT       outbox_pkey PRIMARY KEY (id)
) WITH (OIDS=TRUE);
ALTER TABLE outbox OWNER TO smsd;
GRANT ALL ON TABLE outbox TO "smsdUsers";
GRANT ALL ON TABLE outbox TO smsd;
```

```
CREATE INDEX outbox_processed_ix ON outbox USING btree (processed);
```

### 4.2 H2O Tables

The H2O tables are used by the SmsGateway application to store its own data.

#### 4.2.1 Location2sensorid

This table is used to translate sensor references used by reporters (water point tags; e.g., 100) to internal values (ZAWA water point codes; e.g., 1-23-456789).

```
CREATE TABLE h2o.location2sensorid
(
  phonenumber    character varying,           -- The phone ID (inbox.phone) of the phone receiving the sms, or NULL if
                                                    not relevant
  sensorreference character varying,           -- The short GUI-name used by users for reporting, or NULL if not relevant
  valueref        character varying,           -- The value sent by the reporter, or NULL if not relevant
  sensorid        character varying NOT NULL, -- The sensor ID in the GIS backend system
  longsensorname  character varying,           -- The long name of the sensor used in alerts to the users
  "comment"       character varying,           -- Human readable comment about this rule
  "value"         character varying           -- The GIS value
) WITH (OIDS=TRUE);
ALTER TABLE h2o.location2sensorid OWNER TO h2o;
GRANT ALL ON TABLE h2o.location2sensorid TO "smsdUsers";
GRANT ALL ON TABLE h2o.location2sensorid TO h2o;
```

The SmsGateway implements a number of different translators that each use different fields from this table:

The *SensorRefTranslator* is the most simple translator and currently in use. It uses just the *sensorreference* to determine *sensorid/longsensorname*. For instance, the row

```
(null,100,null,1-23-456789,Enschede, comment, null)
```

translates the water point tag *100* to the ZAWA water point ID *1-23-456789* with the name *Enschede*. In addition, the *SensorRefTranslator* will also translate *1-23-456789* to itself.

The *PhoneSensorRefTranslator* assumes that *(phoneNumber,sensorReference)* encodes for the *sensorid/longsensorname*. This translator would allow the re-use of sensor tags for different reporting phone numbers.

The *FullTableTranslator* assumes that *(phoneNumber,sensorReference,valueRef)* encodes for the *sensorid/longsensorname/value*. With this translator, the both the sensor reference and the value reference are translated.

**Note:** It would be nice to have constraints in this table assuring the unique use of tags and ZAWA references. Due to the flexibility of the *MajiTranslator* (different translators have been implemented), this is not possible. The currently used translator requires both *sensorreference* and *sensorid* to be unique. But for another translator, this should be any combination of *onenumber*, *sensorreference* and *valueref*.

#### 4.2.2 subscriptions

This table is used to locally managed the active and disabled subscriptions to water-point status updates.

```
CREATE TABLE h2o.subscriptions
(
  phonenumber    character varying NOT NULL,           -- The telephone number of the subscriber
  sensorid        character varying NOT NULL,           -- Sensor ID subscribed to
  since           timestamp with time zone,             -- Starting time of the subscription
  isuserdisabled boolean NOT NULL DEFAULT false,       -- Flag indicating if the user manually explicitly disabled the subscription. In
                                                    that case, auto-subscription should not be applied.
  CONSTRAINT     "subscriptionsKey" PRIMARY KEY (onenumber, sensorid)
) WITH (OIDS=FALSE);
ALTER TABLE h2o.subscriptions OWNER TO h2o;
GRANT ALL ON TABLE h2o.subscriptions TO "smsdUsers";
GRANT ALL ON TABLE h2o.subscriptions TO h2o;
```

#### 4.2.3 usergroups

This table manages which phones belong to which user groups and are thus allowed to execute special commands.

---

```
CREATE TABLE h2o.usergroups
(
  phonenumber    character varying NOT NULL,          -- The phone number this entry is about
  usergroup      character varying(20) NOT NULL,     -- The user group the phone number belongs to
  CONSTRAINT     usergroups_pkey PRIMARY KEY (phonenumber, usergroup)
) WITH (OIDS=FALSE);
ALTER TABLE h2o.usergroups OWNER TO h2o;
GRANT ALL ON TABLE h2o.usergroups TO h2o;
GRANT ALL ON TABLE h2o.usergroups TO "smsdUsers";
```

Multiple entries per *phonenumber* are allowed. Currently, the groups *admmaji* and *majitec* are used.

#### 4.2.4 useraliases

This table maps the user's telephone numbers to their (text) aliases that are used towards the HSW application.

As a convention, known/trusted/assigned reporters for a water point contain (*Reporter TAG*) in *their alias*.

```
CREATE TABLE h2o.useraliases
(
  phonenumber    character varying NOT NULL,          -- The phone number this entry is about
  alias          character varying NOT NULL,         -- The alias for the phone number
  CONSTRAINT     unique_alias PRIMARY KEY (alias),
  CONSTRAINT     unique_phone UNIQUE (phonenumber)
) WITH (OIDS=FALSE);
ALTER TABLE h2o.useraliases OWNER TO h2o;
GRANT ALL ON TABLE h2o.useraliases TO h2o;
GRANT ALL ON TABLE h2o.useraliases TO "smsdUsers";
```

#### 4.3 valueref2value

This table is used to translate value references used by reporters (e.g., 'a') to internal values (e.g., INFO\_NO\_WATER).

```
CREATE TABLE h2o.valueref2value
(
  valueref      character varying(15) NOT NULL,     -- The value-references used by reporters
  "value"       character varying NOT NULL,        -- The value used in the GIS system
  CONSTRAINT     valueref2valuekey PRIMARY KEY (valueref)
) WITH (OIDS=FALSE);
ALTER TABLE h2o.valueref2value OWNER TO h2o;
GRANT ALL ON TABLE h2o.valueref2value TO "smsdUsers";
GRANT ALL ON TABLE h2o.valueref2value TO h2o;
```

#### 4.4 \_allreports

This table is used to log all processed SMS for debugging purposes

```
CREATE TABLE h2o._allreports
(
  phonenumber    character varying NOT NULL,          -- The telephone number of the reporter
  insertdate     timestamp with time zone NOT NULL,  -- Date an time when this message was inserted/processed
  smsdate        timestamp with time zone NOT NULL,  -- Date an time when this message was sent
  sensorref      character varying,                 -- The sensor reference detected by the parser
  valueref       character varying,                 -- The parsed value or NULL if no legal value could be obtained
  rawmessage     character varying,                 -- The raw text message received from the reporter
  operation       character varying(30),            -- The name of the operation recognized by the parser
  istransactionsuccessful boolean NOT NULL DEFAULT true, -- Flag indicating if the SMS was processed successful
  "comment"      character varying                  -- Any comment, the sender attached to his/her SMS
) WITH (OIDS=FALSE);
ALTER TABLE h2o._allreports OWNER TO h2o;
GRANT ALL ON TABLE h2o._allreports TO "smsdUsers";
GRANT ALL ON TABLE h2o._allreports TO h2o;
```

---

## 4.5 Functions

### 4.5.1 stopallsubscriptions(phone)

This function stops all subscription of a user (phone number) by modifying the *subscriptions* table setting the user's 'disabled' flag.

```
CREATE OR REPLACE FUNCTION h2o.stopallsubscriptions(phone character varying)
  RETURNS void AS
$BODY$ UPDATE subscriptions SET isuserdisabled=true, since=NOW()
  WHERE not isuserdisabled AND $1=phonenumber$BODY$
  LANGUAGE 'sql' VOLATILE
  COST 100;
ALTER FUNCTION h2o.stopallsubscriptions(character varying) OWNER TO h2o;
GRANT EXECUTE ON FUNCTION h2o.stopallsubscriptions(character varying) TO public;
GRANT EXECUTE ON FUNCTION h2o.stopallsubscriptions(character varying) TO h2o;
```

### 4.5.2 stopallsubscriptions(phone,sensorid)

This function stops the subscription of a user (phone number) for a given sensorid by modifying the *subscriptions* table setting the user's 'disabled' flag.

```
CREATE OR REPLACE FUNCTION h2o.stopallsubscriptions(phone character varying, sensorid character varying)
  RETURNS void AS
$BODY$ UPDATE subscriptions SET isuserdisabled=true, since=NOW()
  WHERE not isuserdisabled AND $1=phonenumber AND $2=sensorid$BODY$
  LANGUAGE 'sql' VOLATILE
  COST 100;
ALTER FUNCTION h2o.stopallsubscriptions(character varying, character varying) OWNER TO postgres;
GRANT EXECUTE ON FUNCTION h2o.stopallsubscriptions(character varying, character varying) TO public;
GRANT EXECUTE ON FUNCTION h2o.stopallsubscriptions(character varying, character varying) TO postgres;
```

## 4.6 Views

### 4.6.1 Replies

A simplified view on outbox (all sent SMS) with telephone numbers replaced by user aliases.

```
CREATE OR REPLACE VIEW h2o.replies AS
SELECT useraliases.alias, outbox.insertdate, outbox.text, outbox.processed::text AS processed
  FROM useraliases
  RIGHT JOIN outbox ON useraliases.phonenumber::text = outbox.number::text;

ALTER TABLE h2o.replies OWNER TO postgres;
GRANT ALL ON TABLE h2o.replies TO postgres;
GRANT ALL ON TABLE h2o.replies TO h2o;
GRANT ALL ON TABLE h2o.replies TO "smsdUsers";
```

### 4.6.2 Reports

A simplified view on *\_allreports* with telephone numbers replaced by user aliases.

```
CREATE OR REPLACE VIEW h2o.reports AS
SELECT useraliases.alias, _allreports.insertdate, _allreports.smsdate, _allreports.sensorref, _allreports.valueref,
_allreports.rawmessage, _allreports.operation, _allreports.istransactionsuccessful, _allreports.comment
  FROM useraliases
  NATURAL RIGHT JOIN _allreports;

ALTER TABLE h2o.reports OWNER TO h2o;
GRANT ALL ON TABLE h2o.reports TO h2o;
GRANT ALL ON TABLE h2o.reports TO "smsdUsers";
```

---

### 4.6.3 SensorOverview

Generates an overview over all sensors known by the SMS gateway with their mapping to HSW codes and a list of user aliases that contain the sensor name (=known reporters)

```
CREATE OR REPLACE VIEW h2o.sensoroverview AS
SELECT location2sensorid.longsensorname AS "Name", location2sensorid.sensorreference AS "HSW Code",
location2sensorid.sensorid AS "ZAWA Reference", useraliases.phonenumber, useraliases.alias
FROM location2sensorid
LEFT JOIN useraliases ON useraliases.alias::text ~* location2sensorid.sensorreference::text
ORDER BY location2sensorid.sensorreference;
```

```
ALTER TABLE h2o.sensoroverview OWNER TO postgres;
```

### 4.6.4 ShowDoubleSensorids

A view showing double-uses of sensor id's, which indicate a consistency problem in the location2sensorid table.

```
CREATE OR REPLACE VIEW h2o.showdoublesensorids AS
SELECT location2sensorid.sensorreference, location2sensorid.sensorid, location2sensorid.longsensorname
FROM location2sensorid
NATURAL JOIN ( SELECT location2sensorid.sensorreference
FROM location2sensorid
GROUP BY location2sensorid.sensorreference
HAVING count(location2sensorid.sensorreference) > 1) foo
ORDER BY location2sensorid.sensorreference;
```

```
ALTER TABLE h2o.showdoublesensorids OWNER TO postgres;
```

### 4.6.5 ShowDoubleSensorReferences

A view showing double-uses of sensor references, which indicate a consistency problem in the location2sensorid table.

```
CREATE OR REPLACE VIEW h2o.showdoublesensorreferences AS
SELECT location2sensorid.sensorid, location2sensorid.sensorreference, location2sensorid.longsensorname
FROM location2sensorid
NATURAL JOIN ( SELECT location2sensorid.sensorid
FROM location2sensorid
GROUP BY location2sensorid.sensorid
HAVING count(location2sensorid.sensorid) > 1) foo
ORDER BY location2sensorid.sensorid;
```

```
ALTER TABLE h2o.showdoublesensorreferences OWNER TO postgres;
```

### 4.6.6 StaleSubscriptions

A view showing the telephone numbers of subscribers that have not sent an email during the last 90 days. This list can be used to forcefully unsubscribe these users.

```
CREATE OR REPLACE VIEW h2o.stalesubscriptions AS
SELECT inbox.number, to_char(now() - max(inbox.smsdate)::timestamp with time zone, 'DDD'::text) AS "Quiet days"
FROM inbox, subscriptions
WHERE inbox.number::text = subscriptions.phonenumber::text
GROUP BY inbox.number
HAVING max(inbox.smsdate) < (now() - '90 days'::interval);
```

```
ALTER TABLE h2o.stalesubscriptions OWNER TO postgres;
```

## 5 Messages and Translations

All messages/texts recognized and sent by the SMS Gateway are stored in the file `nl/wmc/h20/messages.properties`. The initial version of the application comes with English messages. The deployed version of the gateway will be translated and stored in a file `.../messages_sw_TZ.properties`.

### 5.1 messages.properties

```
#
# General messages
#
SmsGateway.Signature           =This is a message from ZAWA. Kind regards.
SmsGateway.ShortSignature      =Kind regards, ZAWA
SmsGateway.UnknownCommand     =Unknown command: %s
SmsGateway.UnknownValue       =Unknown value: %s
SmsGateway.UnknownWaterpoint  =Unknown water point: %s
SmsGateway.GisUnavailable     =Thank you for your report. Due to a transient technical problem we
will process it at a later time.

#
# maji-related messages
#
SmsGateway.Help=ZAWA maji commands. Send\n\
'maji A TAG' for GOOD water, 'maji D TAG' NO or BAD water. TAG=code marked at the waterpoint;\n\
'maji TAG stop' or 'maji stop all' to stop (all) updates. 'maji list' lists all subscriptions,\n\
'maji help' this message; Add comments at the end of a message.
###'maji TAG status' or 'maji status all' reports the current state of (subscribed) water points,\n\

#
# Reporting values
SmsGateway.UnknownValue_1Prefix_2Value=Unknown value '%2$s'. Send '%1$s help' for help.
SmsGateway.ThankYouForReporting=Thank you for reporting about water quality.
SmsGateway.UnknownWaterpointName=unknown
#
# Subscription
SmsGateway.SubscribedTo_1SensorTag_2SensorName=Thank you for your report on water point %2$s (%1$s).
\
You will receive free update reports. To unsubscribe send 'maji %1$s stop'. For info send 'maji
help'.
SmsGateway.UnsubscribedAll=You are now unsubscribed from all water points.
SmsGateway.NotSubscribed=You are not subscribed to any water points.
SmsGateway.Unsubscribed_1Tag_2_SensorName=You are now unsubscribed from water point %2$s (%1$s).
SmsGateway.SubscriptionList_list=You are currently subscribed to %d waterpoint(s): %s.

#
# majitec-related messages
#
SmsGateway.NotMajitec=Sorry, but your phone is not registered as Service. Please contact your
administrator. Message ignored.
SmsGateway.majitec.welcome=Welcome, your phone is now registered as waterpoint service technician,
which allows you to send new commands.
SmsGateway.majitec.goodBy_1Phone=Hello, this phone has been removed from the list of water point
service technicians by %1$s.
SmsGateway.majitec.help=ZAWA majitec commands\
'majitec VAL TAG'. TAG=code marked at the waterpoint. VAL=\n\
'p' for power failure (expected) at TAG;\n\
'g' for power restored at TAG;\n\
't' confirm no water\n\
'x' confirm bad water\n\
'r' for a repaired water point\n\
'no power TEXT' for wide-spread power failure (optional TEXT sent to all subscribers)\n\
'power back TEXT' when power is back\n\
'msg TEXT' general announcement\n\
```

---

'msg TAG TEXT' announcement for TAG

```
#
# admmaji-related messages
#
SmsGateway.admmaji.help=ZAWA admmaji commands start with 'admmaji'.\n\
'add +259... group' adds phone to group.\n\
'rem +259... group' removes phone.\n\
'list group' lists all phones in group. Group can be admmaji or majitec.
SmsGateway.UserAdded_1Phone_2Group=Added %s to group %s.
SmsGateway.UserAlreadyMember_1Phone_2Group =User %s was already member of %s.
SmsGateway.UserRemove_1Phone_2Group=Removed %s from group %s.
SmsGateway.CannotRemoveSelf=You cannot remove yourself from the administrator group. Use other
admmaji-phone.
SmsGateway.GroupMembers_1Group_2Members=Group %1$s has these members: %2$s
SmsGateway.GroupMembership_1Phone_2Groups=Phone %1$s is in these groups: %2$s
SmsGateway.admmaji.welcome=Welcome, your phone is now registered as waterpoint manager, which
allows you to send new commands.
SmsGateway.admmaji.goodBy_1Phone=Hello, this phone has been removed from the list of waterpoint
administrators by %1$s.

#
# Alarm-info message codes
#
# WP-Name: %1$s
# WP-Code: %2$s
# Probability: %3$d
# Additional text: %4s
SmsGateway.AlarmInfoCode.INFO_WATER_NONE =Water point %2$s (%1$s) has NO water, ZAWA is
servicing, thank you for your patience.
SmsGateway.AlarmInfoCode.INFO_WATER_BAD =Water point %2$s (%1$s) has DIRTY water, ZAWA is
servicing, thank you for your patience.
SmsGateway.AlarmInfoCode.INFO_WATER_GOOD =Water point %2$s (%1$s) is operating again.
SmsGateway.AlarmInfoCode.INFO_POWER_FAILING =Some water points may malfunction in coming hours due
to electricity failure, thank you for your patience.
SmsGateway.AlarmInfoCode.INFO_POWER_GOOD =Water points should be working again (electric failure
repaired).
SmsGateway.AlarmInfoCode.INFO_MESSAGE_GLOBAL=Message from ZAWA: %4s
SmsGateway.AlarmInfoCode.INFO_MESSAGE =Message from ZAWA about Water point %2$s (%1$s): %4s

#
# AdmMaji Commands
#
SmsGateway.command.adm.help=help
SmsGateway.command.adm.add=add
SmsGateway.command.adm.remove=rem
SmsGateway.command.adm.list=list

#
# maji(tec) Commands
#
# \\W* stands for none, one, or more spaces
# a|b stands for a OR b
SmsGateway.command.maji.unsubscribeAll=stop\\W*all
SmsGateway.command.maji.noPower =no\\W*power
SmsGateway.command.maji.powerBack =power\\W*back
SmsGateway.command.maji.stop =stop|no
SmsGateway.command.maji.start =start|yes
SmsGateway.command.maji.help =help
SmsGateway.command.maji.list =list
SmsGateway.command.maji.message =msg
SmsGateway.command.maji.query =status
SmsGateway.command.maji.queryAll =status\\W*all

#
# The command prefixes
# The group name is the last element of the name (maji, majitec, admmaji)
```



```
#
SmsGateway.command.prefix.maji=maji
SmsGateway.command.prefix.majitec=majitec
SmsGateway.command.prefix.admmaji=admmaji

#
# Group name translations
#
# Every group name automatically translates to itself
SmsGateway.groupName.1=maji
SmsGateway.groupName.2=majitec
SmsGateway.groupName.3=admmaji
```

## 5.2 messages\_sw\_TZ.properties

```
#
# General messages
#
SmsGateway.Signature           =Huu ni ujumbe kutoka ZAWA. Tunakushuruku.
SmsGateway.ShortSignature      =Tunakushuruku, ZAWA
SmsGateway.UnknownCommand     =Ombi halifahamiki: %s
SmsGateway.UnknownValue       =Hali ya maji haifahamiki: %s
SmsGateway.UnknownWaterpoint  =Mfereji haufahamiki: %s
SmsGateway.GisUnavailable     =Ahsante kwa kutujulisha,kutokana na matatizo ya kiufundi tatizo lako
litashughulikiwa punde.

#
# maji-related messages
#
SmsGateway.Help=Idara ya ufundi ZAWA inawataka. Kutuma\n
'maji A na nambari ya mfereji' kama maji yanapatikana, 'maji D na nambari ya mfereji' kama hakuna
au maji machafu.\n
'maji SIMAMA' kama hujajulishwa kinachoendelea. 'maji idadi' idadi ya wote walioorodheshwa,\n
'maji msaada' ujumbe huu ; Weka mapendekezo mwisho wa ujumbe
##'maji TAG status'/ 'magi status all' Tafadhali wajulishe hali ya maendeleo ya mferejihuo,\n

#
# Reporting values
SmsGateway.UnknownValue_1Prefix_2Value=Haijulikani '%2$s'. Tuma '%1$s Msaada' kwa kupata msaada.
SmsGateway.ThankYouForReporting      =Asante kwa kutujulisha kuhusu ubora wa maji.
SmsGateway.UnknownWaterpointName    =haijulikani
#
# Subscription
SmsGateway.SubscribedTo_1SensorTag_2SensorName=Ahsante kwa kutujulisha kuhusu mifereji %2$s (%1$s).
\
Utapokea ujumbe wa bure kwa ripoti zinazoendelea. Kujifuta tuma neno 'maji kujifuta' kwa msaada tuma
'maji msaada'.
SmsGateway.UnsubscribedAll           =Sasa umeorodheshwa katika mifereji yote.
SmsGateway.NotSubscribed             =Hujaorodheshwa na mfereji wowote.
SmsGateway.Unsubscribed_1Tag_2_SensorName=Sasa umejifuta kutoka mifereji %2$s (%1$s).
SmsGateway.SubscriptionList_list     =Sasa umejiandikisha katika %d mifereji(s): %s.

#
# majitec-related messages
#
SmsGateway.NotMajitec               =Samahani, simu yako haijasajiliwa katika huduma hii. Tafadhali
wasiliana na mtoa huduma wako. Ujumbe umeachwa.
SmsGateway.majitec.welcome          =Karibu, simu yako imesajiliwa kama fundi wa huduma za mifereji,
inayokuruhusiwa kutuma amri mpya.
SmsGateway.majitec.goodBy_1Phone=Habari, simu hii imeondolewa kutoka idadi ya simu za mafundi
mifereji %1$s.
SmsGateway.majitec.help              =Idara ya Ufundi ZAWA inawataka kuandika herufi zifuatazo kutokana na
hali ya maji uliyokuwa nayo hapo.\n
'p' kama kuna hitilafu za umeme (mfereji unaotarajiwa;\n
'g' kama kurudi kwa umeme katika mfereji;\n
't' Thibitisha hakuna maji\n
```

```
'x' Thibitisha maji ni machafu\n
'r' Matengenezo ya mfereji\n
'hakuna umeme andika' kama ni kwa sehemu kubwa ya mji(nyongeza TEXT imetumwa kwa watumiaji wote)\n
'umeme umerudi andika' kama umeme umerudi\n
'msg TEXT' tangazo kwa ujumla\n
'msg TAG TEXT' tangazo kuhusu mfereji

#
# admmaji-related messages
#
SmsGateway.admmaji.help=ZAWA maji utawala ombi anza na 'utawalamaji'.\n
'weka +259... kundi' andika nambari katika kundi.\n
'ondoa +259... kundi' ondoa simu.\n
'idadi ya makundi' andika simu zote katika makundi. Mfano majiufundi au utawalamaji.
SmsGateway.UserAdded_1Phone_2Group =Imeongezwa %1$s katika kundi %2$s.
SmsGateway.UserAlreadyMember_1Phone_2Group =Mtumiaji %1$s tayari ni mtumiaji wa %2$s.
SmsGateway.UserRemove_1Phone_2Group =Amejiondoa %1$s kutoka kundi %2$s.
SmsGateway.CannotRemoveSelf =Huwezi kujiondoa katika kundi la Utawala. Tumia simu
nyengine ya utawalamaji.
SmsGateway.GroupMembers_1Group_2Members =Kundi %1$s lina wanachama : %2$s
SmsGateway.GroupMembership_1Phone_2Groups =Simu %1$s ina makundi: %2$s
SmsGateway.admmaji.welcome =Karibu, simu yako sasa imesajiliwa kama msimamizi wa
mifereji, unaruhusiwa kutuma amri.
SmsGateway.admmaji.goodBy_1Phone =Habari, simu hii imeondolewa kutoka idadi ya
wasimamizi wa mifereji %1$s.

#
# Alarm-info message codes
#
# WP-Name: %1$s
# WP-Code: %2$s
# Probability: %3$d
SmsGateway.AlarmInfoCode.INFO_WATER_NONE =Mfereji %2$s (%1$s) hauna maji, ZAWA inautengeneza,
asante kwa uvumilivu wako
SmsGateway.AlarmInfoCode.INFO_WATER_BAD =Mfereji %2$s (%1$s) una maji machafu, ZAWA
inautengeneza, asante kwa uvumilivu wako
SmsGateway.AlarmInfoCode.INFO_WATER_GOOD =Mfereji %2$s (%1$s) is unafanya kazi tena.
SmsGateway.AlarmInfoCode.INFO_POWER_FAILING =Baadhi ya mifereji itasitisha ufanyaji kazi wake
kutokana na Hitilafu za umeme, asante kwa uvumilivu wako.
SmsGateway.AlarmInfoCode.INFO_POWER_GOOD =Mfereji huu unatakiwa uanze kazi tena(Khitilafu ya
umeme imeshughulikiwa)
SmsGateway.AlarmInfoCode.INFO_MESSAGE_GLOBAL=Ujumbe kutoka zawa: %4s
SmsGateway.AlarmInfoCode.INFO_MESSAGE=Ujumbe kutoka zawa kuhusu mfereji nambari %2$s (%1$s): %4s

#
# AdmMaji Commands
#
SmsGateway.command.adm.help =msaada|help
SmsGateway.command.adm.add =ongeza|add
SmsGateway.command.adm.remove =ondoa|rem
SmsGateway.command.adm.list =idadi|list

#
# maji(tec) Commands
#
# \\W* stands for none, one, or more spaces
# a|b stands for a OR b (use for synonyms, for instance: STOP and NO
SmsGateway.command.maji.unsubscribeAll =simama\\W*yote|stop\\W*all
SmsGateway.command.maji.noPower =hakuna\\W*umeme|no\\W*power
SmsGateway.command.maji.powerBack =umeme\\W*umerudi|power\\W*back
SmsGateway.command.maji.stop =acha|hapana|stop|no
SmsGateway.command.maji.start =anza|ndio|start|yes
SmsGateway.command.maji.help =msaada|help
SmsGateway.command.maji.list =idadi|list
SmsGateway.command.maji.message =msg
SmsGateway.command.maji.query =status
SmsGateway.command.maji.queryAll =status\\W*all
```

```
#  
# The command prefixes  
#   The group name is the last element of the name (maji, majitec, admmaji)  
#  
SmsGateway.command.prefix.maji=maji  
SmsGateway.command.prefix.majitec=majiufundi  
SmsGateway.command.prefix.admmaji=utawalamaji  
  
#  
# Group name translations  
#  
# Every group name automatically translates to itself  
SmsGateway.groupName.1=maji  
SmsGateway.groupName.2=majitec  
SmsGateway.groupName.2.alias.1=majiufundi  
SmsGateway.groupName.3=admmaji  
SmsGateway.groupName.3.alias.1=utawalamaji
```

## 6 System Monitoring

The SMS system is monitoring its state and functionality via the monit package. The monit package monitors

- that process msggateway is running and not consuming too much CPU/load
- that msggateway.log is accessed regularly (by msggateway) and does not contain any of a set of error messages
- that the postgres database is running and available via sockets
- that the process smsd is running and not over-consuming CPU
- that the process sshd is running and accepting connections on its assigned port (287)
- that the laptop is connected mains power and that the battery power is not dropping too low (sending alerts when either does)

The SMS system is reporting the SMS it received and the replies it sent every night through by running a script from crontab (see below). In the first line, the recipients of this mail can be configured:

```
RECIPIENTS="Hartmut.Benz@ti-wmc.nl hsw.zanzibar@gmail.com h.kimara@zawa.go.tz"
rm -f /tmp/daylyExport.* /tmp/daylyExport2.*
echo "BEGIN;
CREATE TEMP TABLE daylyExport AS
  SELECT * FROM reports WHERE date_trunc('day',insertdate) = CURRENT_DATE - interval '1 day' ORDER BY smsdate;
CREATE TEMP TABLE daylyExport2 AS
  SELECT * FROM replies WHERE date_trunc('day',insertdate) = CURRENT_DATE - interval '1 day' ORDER BY insertdate;
\COPY daylyExport TO '/tmp/daylyExport.csv' CSV header
\COPY daylyExport2 TO '/tmp/daylyExport2.csv' CSV header
ROLLBACK;" | psql --quiet smsd `whoami`
# Optionally encrypt the message
#/usr/bin/gpg --no-use-agent --quiet --batch --no-tty --yes --passphrase RIQQtR0q2qq7nWL2UluAowf3JphtzPpW --symmetric --armor
/tmp/daylyExport.csv
```

```
echo "Date: `date --rfc-2822`
From: h20monitor@zanzinet.com
MIME-Version: 1.0
To: $RECIPIENTS
Subject: [H2O] new messages recieved until `date +%Y-%m-%d`"
Content-Type: multipart/mixed;
boundary="-----010003000503020100070004"
```

```
This is a multi-part message in MIME format.
-----010003000503020100070004
Content-Type: text/plain; charset=ISO-8859-1
Content-Transfer-Encoding: 7bit
```

Hallo,  
these are the SMSs recieved and sent during the last 24 hours.

```
Regards
H2O SMS Gateway
-----010003000503020100070004
Content-Type: text/plain;
name="daylyExport_`date +%Y-%m-%d`.csv"
Content-Transfer-Encoding: 7bit
Content-Disposition: inline;
filename="daylyExport_`date +%Y-%m-%d`.csv"
```

```
`cat /tmp/daylyExport.csv`
```

```
-----010003000503020100070004
```

```
Content-Type: text/plain;  
name="dailyExportReplies_`date +%Y-%m-%d`.csv\  
Content-Transfer-Encoding: 7bit  
Content-Disposition: inline;  
filename="dailyExportReplies_`date +%Y-%m-%d`.csv"
```

```
`cat /tmp/dailyExport2.csv`
```

```
-----010003000503020100070004  
" | esmtp -f h20monitor@zanzinet.com -- ${RECIPIENTS}
```

## 7 Installation Requirements

### 7.1 Package Contents

The installable product consists of:

1. One Dell Vostro Laptop CTO A860 (installed and pre-configured)
2. One Dell Power Supply for the laptop
3. One *Nokia 3109 classic* Mobile Phone
4. One Power Supply for the Nokia 3109 classic
5. One USB cable to connect the Nokia 3109 to the laptop
6. One installation CD kubuntu 9.04

### 7.2 Site Requirements

The installation of the computer system requires

1. a secure, climate-controlled location with good mobile phone coverage
  - access to the laptop should be limited
  - the temperature around the laptop should be so low that the internal ventilator *stays off* (most of the time)
  - to improve cooling of the laptop, it is advisable to raise its back (and front) about a centimeter or two to allow air to flow under it
  - the mobile phone should show a good antenna signal at its permanent location
2. two power connections (power supply of laptop and mobile phone)
3. an Ethernet network connection to an Intranet/Internet with DHCP
4. a mobile phone (GSM) card with the telephone number of the H2O project printed on the boards installed at the water points
5. one additional mobile phone acting as maji-manager

### 7.3 IT-Requirements

1. Network access for the laptop so that it can receive an IP address (DHCP)  
MAC-Address: 00:22:19:e7:6b:b3
2. Internet connection (Firewall rules configured in the Intranet)
  - Outgoing: Ports 80, 8080
  - Incoming: Port 287  
The incoming connection is used for a remote ssh connection protected by a certificate. Username/password login via this service is disabled!
  - The installation site may choose to map an arbitrary, but fixed external port to port 287 of the laptop.
3. A local email address (for instance h2omonitor@...) and SMTP address/port for the SMS-Gateway to send alerts and status reports to
4. The following information needs to be communicated to [Hartmut.Benz@ti-wmc.nl](mailto:Hartmut.Benz@ti-wmc.nl)
  - Public IP address of the installation site
  - External port mapped to the laptop's port 287
  - email address enabled on the local email
  - SMTP server where this email can be delivered

### 7.4 Installation Procedure

1. Unpack the hardware and check for external damage.
-

2. Place the laptop in the selected location.
3. Connect the laptop to mains power
4. Connect the mobile phone to mains power
5. Connect the USB cable to the bottom of the mobile phone and the other side to a USB connection of the laptop
6. Insert the GSM card into the mobile phone
7. Switch the mobile phone on, enter the PIN code if necessary
8. Verify that the signal strength is optimal at the phone's selected location. If it is not, you may have to change to a different location or use a USB extension cable to reach a more optimal location for the phone.
9. Switch the laptop on
10. The mobile phone now states that a USB connection is plugged in and requests the user to *select its mode of operation*. Press OK, then select *Nokia Mode*.
11. Use the other Mobile phone and send the following SMS message to the H2O-telephone number:

admmagi help

Within no more than a minute you should receive a reply stating:

Added +31613820119 to group admmaji.

Messages start with 'admmaji'. 'add +259... group' adds phone to group. 'rem +259... group' removes phone. 'list group' lists all phones in group. Group can be admmaji or majitec.

This is a message from ZAWA. Kind regards.

Now this phone is a *Management Phone* capable of adding other management phones, and declaring/revoking *Service Technician* status.

It is important to perform this step immediately because *any* phone SMSing the first admmaji-SMS to the system becomes administrator.

## 8 Final Comments

### 8.1 Delivery actions

The following actions have to be taken on delivery to ITC / other managing parties

#### 8.1.1 Hand over Passwords

1. User account h2o
2. User account postgres
3. Database postgres
4. Database uesr h2o

#### 8.1.2 Install ssh certificate on the laptop

The new operator must add his/her ssh public key in the laptop in the file

```
/home/water/.ssh/authorized_keys2
```

To prevent previous operators from accessing the system, remove all other authorized keys but the one from the new operator. The new operator can find his/her key on a Linux system in the file `~/.ssh/id_dsa.pub` or `~/.ssh/id_rsa.pub`. If missing, this key can be generated using `'ssh-keygen -t rsa'` or `'ssh-keygen -t dsa'`.

#### 8.1.3 Change Password

The single user account “h2o” has a simple password that can be used to obtain administrative rights. The password will be passed to the new operator upon delivery. This password should be changed.

The h2o-password is known to the support person at the ISP in Zanzibar where the Laptop is located.

#### 8.1.4 Adapt Firewall

The firewall allows access only from certain addresses and is set very restrictive. Be sure to add all new access methods before removing the ones currently in use, both in the `ufw`-firewall and the `/etc/hosts.allow` filter (next section).

Use `sudo ufw status` to list all current firewall rules

To	Action	From
--	-----	----
[ 1] 287/tcp	ALLOW	217.114.97.45
[ 2] 287/tcp	ALLOW	85.145.118.140
[ 3] 287/tcp	LIMIT	Anywhere
[ 4] Anywhere	ALLOW	10.0.0.0/8
[ 5] Anywhere	ALLOW	172.16.0.0/12
[ 6] Anywhere	ALLOW	192.168.0.0/16

Rules 1 and 2 allow remote access for the WMC operator. Rule 3 forms a mild protection against brute force attacks on the ssh port. Rules 4-6 allow full access from all RFC1918 networks.

To allow the new operator's static (!) IP address



---

```
sudo ufw allow proto tcp from <OPERATORS_STATIC_IP_ADDRESS> to any port 287
```

To remove the WMC operator execute this (be sure that you have added your new access before):

```
sudo ufw delete allow proto tcp from 217.114.97.45 to any port 287  
sudo ufw delete allow proto tcp from 85.145.118.140 to any port 287
```

### 8.1.5 Adapt allowed hosts

The file `/etc/hosts.allowed` list all hosts that are allowed to access the system. This host-based filter acts *before* the rules of the `ufw` firewall.

To allow access to the new operator, add the following lines

```
sshd: <OPERATORS_STATIC_IP_ADDRESS>  
ALL: <OPERATORS_STATIC_IP_ADDRESS>
```

To remove the WMC operator access remove all lines containing `ti-wmc.nl`, or `85.145.118.140`.

### 8.1.6 Update Dynamic host name support

The laptop automatically registers its public address with a Dynamic Host Name provider. It is currently using `Dyndns` with a free account registered to a WMC email address, which cannot be transferred. WMC will release the current host name (`hsn.dnsalias.com`) to be used with the new account

The new operator should create a new account with `Dyndns` or any other similar service and re-configure the laptop to use it, or disable the service.

The service is configured in the file `/etc/ddclient.conf`

To disable the service, edit `/etc/default/ddclient` and set `run_daemon` to "false"

### 8.1.7 Change Alerting email Addresses for Monit

Edit the file `/etc/monit/monitrc`.

Search for the string `set alert` and change the email address. You can add additional email addresses to be alerted by adding additional "set alert" lines.

### 8.1.8 Change Notification email Address For Daily Notification of SMS activity

Edit the file `/home/h2o/reportSMSfromPreviousDay.sh`

Change the definition of `RECIPIENTS` in the first line and replace the current operator's email address with the new one(s).

## 8.2 Non-Expiring Subscriptions

Subscriptions do not expire automatically. If a user changes telephone number or loses the number, his/her subscriptions will continue indefinitely and create/increase the cost for the operator.

It is important to implement a new function that automatically retires subscriptions after either

- no SMS has been received for a certain number of time
- more than a certain number of SMS delivery errors have been received (further research is necessary to determine if unavailable phone numbers do produce sms delivery errors)



## Annex 3

# H2.0 Project

Human Sensor Web component

– **Deployment** –

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# Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
<b>2</b>	<b>Preconditions</b>	<b>3</b>
2.1	Java RE . . . . .	3
2.2	Apache Tomcat . . . . .	3
2.3	PostgreSQL and Postgis . . . . .	4
2.4	52°North Sensor Observation Service . . . . .	4
2.5	52°North Sensor Event Service . . . . .	6
<b>3</b>	<b>Human Sensor Web component</b>	<b>7</b>
3.1	Installation Steps . . . . .	7
3.2	General Properties . . . . .	8
3.3	Message Properties . . . . .	9
3.4	SOS Properties . . . . .	10
3.5	SES Properties . . . . .	11
3.6	SML Properties . . . . .	12
3.7	PostgreSQL Scripts . . . . .	12
3.7.1	Script: Table Structure . . . . .	13
3.7.2	Script: Water Points . . . . .	15

## Listings

1	HSW Component Table Setup Script . . . . .	13
2	HSW Component Water Points . . . . .	15

# 1 Introduction

This document describes all required steps to deploy the GIS server backend of the H2.0 project. The next section outlines the required components which are:

- Java Runtime Environment (RE)  $\geq$  1.6.0\_14  $\mapsto$  Section 2.1
- Apache Tomcat  $\geq$  6.0.18  $\mapsto$  Section 2.2
- PostgreSQL  $\geq$  8.3  $\mapsto$  Section 2.3
- 52°North Sensor Observation Service  $\geq$  3.1  $\mapsto$  Section 2.4
- 52°North Sensor Event Service latest development build  $\mapsto$  Section 2.5

Section 3 describes the required steps to setup the HSW component. Additionally, possible configuration settings are explained.

## 2 Preconditions

This section explains all required software which needs to be installed before the HSW component can be deployed.

### 2.1 Java RE

An actual Java Runtime Environment is required, version 1.6.0\_14 or newer. It can be downloaded from <http://java.com/en/download/>. To install the current Java RE from SUN, type the following command:

```
sudo apt-get install sun-java6-jre
```

### 2.2 Apache Tomcat

The Apache Tomcat servlet container is required, version 6.0.18 or newer. It can be downloaded from <http://tomcat.apache.org/download-60.cgi>. To install<sup>1</sup> the current version 6 Apache Tomcat on Ubuntu just type the following:

```
sudo apt-get install tomcat6 tomcat6-admin
```

The startup parameter need to be adjusted to increase the amount of memory the tomcat is given by the operating system. Use the following Java Options:

```
-Djava.awt.headless=true -Xmx512M -Xms256M
```

---

<sup>1</sup>For alternative installation instructions check this web page:  
<http://tomcat.apache.org/tomcat-6.0-doc/setup.html>

The parameter `-Xmx512M` sets the maximum amount of memory useable by the tomcat to 512 Megabyte. `-Xms256M` sets the minimal amount of memory used by the tomcat to 256 Megabyte. If using a Ubuntu Server Environment to run the applications, this values have to be added to the `JAVA_OPTS` parameter in the file `/etc/default/tomcat6`. After adding this line using an editor like `nano`, `vi`, or `joe`, the tomcat needs to be restartet:

```
sudo /etc/init.d/tomcat6 restart
```

## 2.3 PostgreSQL and Postgis

The whole system requires two (2) spatially enabled databases (one for the Sensor Observation Service and one for the HSW component itself). For this, an actual version of the PostgreSQL database server is required, version 8.3 or newer. It can be downloaded from <http://www.postgresql.org/download.html>, or installed<sup>2</sup> on Ubuntu via

```
sudo apt-get install postgresql-8.3
```

A GUI to manage PostgreSQL is pgAdmin III (<http://www.pgadmin.org/download/>). Furthermore, postgis is required, version 1.4 or newer. Postgis can be download from <http://postgis.refractions.net/download/>, or installed on Ubuntu via

```
sudo apt-get install postgresql-8.3-postgis
```

After creating two new databases (with pgAdmin III, or using `psql`), these databases need to be spatially enabled. To do so, two SQL scripts (`lwpostgis.sql` and `spatial_ref_sys.sql`) need to be run on these two databases. On Ubuntu, they are located in `/usr/share/postgresql-8.3-postgis/`. Do not forget to setup a user for the HSW component.

## 2.4 52°North Sensor Observation Service

Version 3.1 of the 52°North Sensor Observation Service (SOS) is required. It can be downloaded from <http://52north.org/sos> → Download. Please follow the installation instructions ([52north.org/sos](http://52north.org/sos) → Installation Instructions) to setup the SOS correctly. The HSW component requires the following listeners to be activated (check the SOS manual how to do it; parameter `LISTENERS`):

- `org.n52.sos.GetCapabilitiesListener`
- `org.n52.sos.GetObservationListener`
- `org.n52.sos.DescribeSensorListener`
- `org.n52.sos.GetResultListener`
- `org.n52.sos.GetFeatureOfInterestListener`
- `org.n52.sos.GetFeatureOfInterestTimeListener`

---

<sup>2</sup>For alternative installation instructions check this web page:  
[http://wiki.postgresql.org/wiki/Detailed\\_installation\\_guides](http://wiki.postgresql.org/wiki/Detailed_installation_guides)

- `org.n52.sos.GetDomainFeatureListener`
- `org.n52.sos.UpdateSensorListener`
- `org.n52.sos.InsertObservationListener`
- `org.n52.sos.RegisterSensorListener`

Add the following values to the `EASTINGFIRST` parameter:

```
4326,false;31467,false;21037,true
```

The configuration file is located in the installed environment here:

```
<TOMCAT_WEBAPPS_FOLDER>/<SOS_APP_NAME>/WEB-INF/conf/sos.config
```

Do not forget to adjust the values in the `GetCapabilitiesSkeleton`. This file is located in the installed environment here:

```
<TOMCAT_WEBAPPS_FOLDER>/<SOS_APP_NAME>/WEB-INF/conf/capabilities/  
capabilities_skeleton.xml
```

## 2.5 52°North Sensor Event Service

The Sensor Event Service (SES) development snapshot can be downloaded from:

- [http://ifgi.uni-muenster.de/~e\\_juer01/SES\\_snapshot/SES-2009.war](http://ifgi.uni-muenster.de/~e_juer01/SES_snapshot/SES-2009.war) (28MB)

After deploying this web archive, the web application needs to be stopped and config files need to be adjusted. The configuration file is located in the installed environment here:

<TOMCAT\_WEBAPPS\_FOLDER>/<SES\_APP\_NAME>/WEB-INF/classes/ses\_config.properties

The following Table 1 defines the values which have to be set:

Table 1: SES properties

Property Name	Value to Set or <description>
POSTGRES_PORT	default
POSTGRES_USER	<The <i>user</i> defined during PostgreSQL setup (see 2.3)>
POSTGRES_PWD	<The <i>password</i> defined during PostgreSQL setup>
POSTGRES_DATABASE	<A PostgreSQL <i>database</i> build with the postgis template>
USED_FILTER_ENGINE	org.n52.swe.ses.filter.EsperClassProvider
PERSISTENCY_DB_PATH	<Absolute <i>path</i> where to store the databasefile of the SES>
SES_INSTANCE	http://<Server hosting the SES>:<Tomcat Port>/<SES web app name>/services/SesPortType
RESUBSCRIBE_ON_STARTUP	YES
TIME_TO_WAKEUP	1000



## 3 Human Sensor Web component

The current version of the Human Sensor Web component can be downloaded from:

- [http://ifgi.uni-muenster.de/~e\\_juer01/HSW/GSM2SWE.war](http://ifgi.uni-muenster.de/~e_juer01/HSW/GSM2SWE.war) (50MB)

### 3.1 Installation Steps

1. Use the Tomcat manager web application (reachable via `http://your.tomcat:YourTomcat-Port/manager/html/`) to deploy the HSW component.
2. Stop the HSW component.

<http://your.tomcat:yourtomcatport/manager/html/stop?path=/GSM2SWE>

3. Take an editor of your choice and open the files:

- `<webapps folder of your tomcat installation>/GSM2SWE/res/conf/configuration.xml`
- `<webapps folder of your tomcat installation>/GSM2SWE/WEB-INF/classes/log4j.xml`

The next tables show the properties divided in different sections. Table 2 shows some general properties.

4. Install HSW component databases in PostgreSQL database server using the scripts explained in Section 3.7
5. Restart the HSW component

<http://your.tomcat:yourtomcatport/manager/html/start?path=/GSM2SWE>

6. Go to <http://your.tomcat:yourtomcatport/GSM2SWE/>  
If you see the HSW component TestClient, the installation is finished.  
If NOT please check the logfiles of the HSW component and the tomcat logs.

## 3.2 General Properties

The general properties section defines the connection to the PostgreSQL database server and some additional settings.

Table 2: HSW component - general properties

Property Name	Value to Set or <description>
REPLACEMENT_TAG	@ID@
waterpoint_CRS_EPSG_code	21037
datastore_url	jdbc:postgresql://localhost:5432/<DB_name_defined_during_installation>
datastore_driver	org.postgresql.Driver
datastore_user	<name of the user of the postgres DB>
datastore_password	<password of DB user>
datastore_initconn	5 <number of initial open connections>
datastore_maxconn	50 <maximum number of open connection>
simple_forward	true <if set to true, all incoming messages will be directly forwarded to all others without filtering. If set to false, the SES will be used to filter.>
default_epsg_code	21037 <default EPSG code if not defined in waterpoint table>

### 3.3 Message Properties

The message properties define the settings of the WNS wrapper. This includes lists of message code which identify the different user groups. Furthermore, the message types, which will be forwarded to the defined mail receivers, can be defined.

Table 3: HSW component - message properties

Property Name	Value to <b>Set</b> or <description>
zanzibar_country_wp_code	00-0-000001 <ID of the artificial water point to manage messages to all subscribers>
technician_message_codes_cs	<comma separated list of messagecodes used by techs.>
hsw_mail_message_codes_to_mail	<comma separated list of messagecodes which will be mailed>
hsw_mail_zawa_tech_mail_addresses	<comma separated list of mail recipients>
hsw_mail_address	hsw.gis.server@googlemail.com
hsw_mail_smtp_server	smtp.googlemail.com
hsw_mail_smtp_server_port	465
hsw_mail_smtp_server_ssl_enabled	true
hsw_mail_smtp_server_username	hsw.gis.server
hsw_mail_smtp_server_password	hum4ns3ns0r\$!
hsw_mail_user_category_normal	NORMAL <ID for the group of normal users>
hsw_mail_user_category_special	SPECIAL <ID for the group of technicians>
hsw_mail_template_subject	[HSW-GISServer] Water Point @ID@ - State observed: @ID@
hsw_mail_template_body	Dear Technician, the Water Point @ID@ (@ID@) seems to have problems. The observed state is: @ID@ The user category is: @ID@ The users ID is: @ID@ Possible comment from the user: @ID@ Time of observation: @ID@ This message is automatically generated. Human Sensor Web Component - OWS Server Backend - by order of ZAWA
hsw_mail_debug_mail_api	false <if set to true the java mail API will print debug info to std_out>

### 3.4 SOS Properties

These properties define the required values to configure the connection to the Sensor Observation Service. Additional, properties needed to insert data into the SOS are defined.

Table 4: HSW component - SOS properties

Property Name	Value to Set or <description>
sos_url	http://localhost:8080/<SOS_WEBAPP_NAME>/sos
sos_offering_not_validated_data	NOT_VALIDATED_ALL
sos_offering_not_validated_data_name	Not validated Data
sos_offering_validated_data	VALIDATED
sos_offering_validated_data_name	Validated Data
sos_version	1.0.0
sos_exception_already_registered_msg_part	is already registered at ths SOS
sos_foi_desc_tmpl	a water point (ID:@ID@)
sos_comment_observation_id_reference_tag	Ref:@ID@: <template to link observed water point states and comments>
sos_crs_coordinate_order_easting_first_cs	default@false,4326@false,21037@true

### 3.5 SES Properties

Table 5: HSW component - SES properties

Property Name	Value to Set or <description>
ses_reg_publisher_lifetime	2999-12-31T23:59:59+00:00
ses_registered_as_subscriber	false
ses_subscription_id	
ses_default_message_dialect	http://www.opengis.net/ses/filter/level3
ses_default_topic	ses:Measurements
ses_default_topic_dialect	http://docs.oasis-open.org/wsn/t-1/Topic Expression/Simple
ses_url	http://localhost:9090/SES-2009/services
ses_basic_port_type_path	/SesPortType
ses_notification_consumer_path	/SubscriptionManagerContextPath
ses_version	0.0.0
ses_model	hsw_model_eml.xml
sesl_servlet	http://jordsand.uni-muenster.de:8080/GSM2SWE/sesl

### 3.6 SML Properties

Dies ist ein Fulltext um zu gucken wie breit eine Zeile gemacht wird und deshalb sollte es hier einfach so weiter gehen.

Table 6: HSW component - SML properties

Property Name	Value to Set or <description>
sml_longname_template	Human Sensor Web Sensor @ID@ (reporter)
sml_foi_prefix	urn:ogc:object:feature:OGC:0.1:Human SensorWeb:WaterPoint:ZAWA:
sml_shortname_template	HSW Sensor @ID@
sml_reference_frame_prefix	urn:ogc:def:crs:EPSG::
sml_sensor_id_prefix	urn:ogc:object:feature:Sensor:Human SensorWeb:Reporter:
sml_sensor_id_postfix_not_validated_data	_not_validated_data
sml_codespace_observation	<a href="http://www.52north.org/hsw/messagecodes">http://www.52north.org/hsw/messagecodes</a>
sml_codespace_comment	<a href="http://www.52north.org/hsw/comment">http://www.52north.org/hsw/comment</a>
sml_unique_id_definition	urn:ogc:def:identifier:OGC:uniqueID
sml_urn_observed_property_wp_state	urn:ogc:def:phenomenon:OGC:0.1:Human SensorWeb:WaterPointState
sml_urn_observed_property_user_reputation	urn:ogc:def:phenomenon:OGC:0.1:Human SensorWeb:UserReputation

### 3.7 PostgreSQL Scripts

The first sql script (see Listing 1) creates the table structure in the prior created database required by the HSW component. It can be downloaded from

[http://ifgi.uni-muenster.de/~e\\_juer01/HSW/gsm2swe\\_struct.sql](http://ifgi.uni-muenster.de/~e_juer01/HSW/gsm2swe_struct.sql)

Within pgAdmin III select the HSW component database and run the sql script. After installing the structure you can install a presetting of water points (see Listing 2) with the script from

[http://ifgi.uni-muenster.de/~e\\_juer01/HSW/gsm2swe\\_waterpoints.sql](http://ifgi.uni-muenster.de/~e_juer01/HSW/gsm2swe_waterpoints.sql)

**At least one water point is required because the HSW component accepts only messages for known water points!**

### 3.7.1 Script: Table Structure

Listing 1: HSW Component Table Setup Script

```
1 | i>>-- Copyright (C) 2009
2 | -- by 52 North Initiative for Geospatial Open Source Software GmbH
3 | --
4 | -- Contact: Andreas Wytzisk
5 | -- 52 North Initiative for Geospatial Open Source Software GmbH
6 | -- Martin-Luther-King-Weg 24
7 | -- 48155 Muenster, Germany
8 | -- info@52north.org
9 | --
10 | -- This program is free software; you can redistribute and/or modify it under
11 | -- the terms of the GNU General Public License version 2 as published by the
12 | -- Free Software Foundation.
13 | --
14 | -- This program is distributed WITHOUT ANY WARRANTY; even without the implied
15 | -- WARRANTY OF MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU
16 | -- General Public License for more details.
17 | --
18 | -- You should have received a copy of the GNU General Public License along with
19 | -- this program (see gnu-gpl v2.txt). If not, write to the Free Software
20 | -- Foundation, Inc., 59 Temple Place - Suite 330, Boston, MA 02111-1307, USA or
21 | -- visit the Free Software Foundation web page, http://www.fsf.org.
22 | --
23 | -- Author: Juereens, Eike Hinderk
24 | -- Created: 08.04.2009
25 | -- This script is used for updating installations.
26 | -- There is another script to create a new database with all the postgis stuff.
27 | --
28 | -- Deleted possible old tables first
29 | DROP TABLE IF EXISTS message_cache CASCADE;
30 | DROP TABLE IF EXISTS queried_message_cache CASCADE;
31 | DROP TABLE IF EXISTS obs_cache CASCADE;
32 | DROP TABLE IF EXISTS subscriptions CASCADE;
33 | DROP TABLE IF EXISTS users CASCADE;
34 | DROP TABLE IF EXISTS waterpoints CASCADE;
35 | -- Create the tables
36 | -- Queried Message Cache
37 | CREATE TABLE queried_message_cache (
38 |     qm_id integer NOT NULL,
39 |     message text NOT NULL
40 | );
41 | ALTER TABLE public.queried_message_cache OWNER TO postgres;
42 | CREATE SEQUENCE queried_message_cache_qm_id_seq
43 |     START WITH 1
44 |     INCREMENT BY 1
45 |     NO MAXVALUE
46 |     NO MINVALUE
47 |     CACHE 1;
48 | ALTER TABLE public.queried_message_cache_qm_id_seq OWNER TO postgres;
49 | ALTER SEQUENCE queried_message_cache_qm_id_seq OWNED BY queried_message_cache.qm_id;
50 | ALTER TABLE queried_message_cache ALTER COLUMN qm_id SET DEFAULT nextval('queried_message_cache_qm_id_seq'
51 | ::regclass);
52 | ALTER TABLE ONLY queried_message_cache
53 |     ADD CONSTRAINT qm_id PRIMARY KEY (qm_id);
54 | -- Message Cache
55 | CREATE TABLE message_cache (
56 |     published timestamp with time zone NOT NULL,
57 |     send timestamp with time zone,
58 |     m_id integer NOT NULL,
59 |     state text NOT NULL,
60 |     message text NOT NULL
61 | );
62 | ALTER TABLE public.message_cache OWNER TO postgres;
63 | COMMENT ON COLUMN message_cache.message IS 'contains the message as xml formatted java.lang.String';
64 | CREATE SEQUENCE message_cache_m_id_seq
65 |     INCREMENT BY 1
66 |     NO MAXVALUE
67 |     NO MINVALUE
68 |     CACHE 1;
69 | ALTER TABLE public.message_cache_m_id_seq OWNER TO postgres;
70 | ALTER SEQUENCE message_cache_m_id_seq OWNED BY message_cache.m_id;
71 | ALTER TABLE message_cache ALTER COLUMN m_id SET DEFAULT nextval('message_cache_m_id_seq'::regclass);
72 | ALTER TABLE ONLY message_cache
73 |     ADD CONSTRAINT m_id PRIMARY KEY (m_id);
74 | -- Observation Cache
75 | CREATE TABLE obs_cache (
76 |     received timestamp with time zone NOT NULL,
77 |     processed timestamp with time zone,
78 |     obs_id integer NOT NULL,
79 |     is_processed boolean DEFAULT false,
80 |     observation text
81 | );
82 | ALTER TABLE public.obs_cache OWNER TO postgres;
83 | CREATE SEQUENCE obs_cache_obs_id_seq
84 |     INCREMENT BY 1
85 |     NO MAXVALUE
86 |     NO MINVALUE
87 |     CACHE 1;
```

```

87 ALTER TABLE public.obs_cache_obs_id_seq OWNER TO postgres;
88 ALTER SEQUENCE obs_cache_obs_id_seq OWNED BY obs_cache_obs_id;
89 ALTER TABLE obs_cache ALTER COLUMN obs_id SET DEFAULT nextval('obs_cache_obs_id_seq'::regclass);
90 ALTER TABLE ONLY obs_cache
91     ADD CONSTRAINT obs_id PRIMARY KEY (obs_id);
92 -- Subscription management
93 CREATE TABLE subscriptions (
94     notification_target text NOT NULL,
95     station_id text NOT NULL
96 );
97 ALTER TABLE public.subscriptions OWNER TO postgres;
98 COMMENT ON TABLE subscriptions IS 'management_of_sensorsubscriptions';
99 ALTER TABLE ONLY subscriptions
100     ADD CONSTRAINT subscription_id PRIMARY KEY (notification_target, station_id);
101 -- Waterpoint management
102 CREATE TABLE waterpoints (
103     location_id text NOT NULL,
104     location geometry NOT NULL,
105     description text
106 );
107 ALTER TABLE public.waterpoints OWNER TO postgres;
108 COMMENT ON TABLE waterpoints IS 'management_of_the_waterpoints';
109 ALTER TABLE ONLY waterpoints
110     ADD CONSTRAINT waterpoints_pkey PRIMARY KEY (location_id);
111 -- User management
112 CREATE TABLE users (
113     registered_to_sos boolean DEFAULT false NOT NULL,
114     registered_to_ses boolean DEFAULT false NOT NULL,
115     registered_to_wns boolean DEFAULT false NOT NULL,
116     reputation double precision DEFAULT 0.50 NOT NULL,
117     user_id text NOT NULL,
118     muse_id text
119 );
120 ALTER TABLE public.users OWNER TO postgres;
121 COMMENT ON TABLE users IS 'used_for_user_management';
122 ALTER TABLE ONLY users
123     ADD CONSTRAINT u_id PRIMARY KEY (user_id);
124 --
125 REVOKE ALL ON SCHEMA public FROM PUBLIC;
126 REVOKE ALL ON SCHEMA public FROM postgres;
127 GRANT ALL ON SCHEMA public TO postgres;
128 GRANT ALL ON SCHEMA public TO PUBLIC;
129 --

```



### 3.7.2 Script: Water Points

Listing 2: HSW Component Water Points

```
1 |>!-- Copyright (C) 2009
2 |-- by 52 North Initiative for Geospatial Open Source Software GmbH
3 |--
4 |-- Contact: Andreas Wytzisk
5 |-- 52 North Initiative for Geospatial Open Source Software GmbH
6 |-- Martin-Luther-King-Weg 24
7 |-- 48155 Muenster, Germany
8 |-- info@52north.org
9 |--
10 |-- This program is free software; you can redistribute and/or modify it under
11 |-- the terms of the GNU General Public License version 2 as published by the
12 |-- Free Software Foundation.
13 |--
14 |-- This program is distributed WITHOUT ANY WARRANTY; even without the implied
15 |-- WARRANTY OF MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU
16 |-- General Public License for more details.
17 |--
18 |-- You should have received a copy of the GNU General Public License along with
19 |-- this program (see gnu-gpl v2.txt). If not, write to the Free Software
20 |-- Foundation, Inc., 59 Temple Place - Suite 330, Boston, MA 02111-1307, USA or
21 |-- visit the Free Software Foundation web page, http://www.fsf.org.
22 |--
23 |-- Author: Juereens, Eike Hinderk
24 |-- Created: 26.01.2010
25 |-- This script installs a preset of water points used in the H2.0 project
26 |-- There is another script to create a new database with all the postgres stuff.
27 |--
28 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-115206', '0101000020
29 |E610000032674B0D7D9B4340DFB6C6CC97A518C0', 'KWA_KIJAJI,_AMANI,_5301_URBAN');
30 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-100001', '0101000020
31 |E6100000A0867178BE994340B7914A8955A218C0', 'MABLUU,_GULIONI,_5301_URBAN');
32 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-100000', '0101000020
33 |E6100000179F36EACA994340F3E75995C2A218C0', 'ZAWA_office,_GULIONI,_5301_URBAN');
34 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-103521', '0101000020
35 |E6100000D1699338DC9A4340B033C54571B218C0', 'KITOSANI,_JANG'OMBE,_5301_URBAN');
36 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-104021', '0101000020
37 |E6100000A99AFDC5019C4340971BDF5EAA9218C0', 'KARAKANA,_KARAKANA,_5301_URBAN');
38 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102420', '0101000020
39 |E6100000AAC3D927C8984340EE6D743E1BAA18C0', 'KIFULIONI,_KIKWAJUNI_BONDENI,_5301_URBAN');
40 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102421', '0101000020
41 |E6100000EDCA104AF398434056AE6659F4AF18C0', 'KWA_HASSAN_MACHICHA,_KIKWAJUNI_JUU,_5301_URBAN');
42 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-101422', '0101000020
43 |E610000002B69B027A9C4340E811D10E79A418C0', 'KILIMAHEWA_JUU_SKULI,_KILIMAHEWA_JUU,_5301_URBAN');
44 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102123', '0101000020
45 |E6100000F5539039C2994340B9B5EEEBACB418C0', 'KILIMANI,_KILIMANI,_5301_URBAN');
46 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102520', '0101000020
47 |E6100000B7839AAF4C994340CC6E53E8B8AB18C0', 'MSIKINITI_GONGONI,_KISIMAMA_JONGOO,_5301_URBAN');
48 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-104521', '0101000020
49 |E6100000066D11E4219943408DB4299581AA18C0', 'MSIKITI_MAKUTI,_KISIWANDUI,_5301_URBAN');
50 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-203312', '0101000020
51 |E6100000F298F3999C9D43404BC1D582EDD418C0', 'BI_FAIZI,_KISAUNI,_5302_WEST');
52 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-103028', '0101000020
53 |E6100000D7717F3FC09A434091187C2492A918C0', 'KWA_MALIM_MWITA,_KWA_ALAMSHA,_5301_URBAN');
54 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-101821', '0101000020
55 |E6100000D9ABA687369C4340EC9B6EA535B418C0', 'SHAFI_KOMBO,_MAGOMENI,_5301_URBAN');
56 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-101321', '0101000020
57 |E61000006D1808695B9C43400252377CAFA218C0', 'KWA_MTIPIRA,_KWA_MTIPIRA,_5301_URBAN');
58 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-104202', '0101000020
59 |E6100000BCE59654149943403CEAF82369F18C0', 'MALINDI_FUNGUNI,_MALINDI,_5301_URBAN');
60 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-109204', '0101000020
61 |E6100000CF14E5A67E9A43403CDA37634A418C0', 'MAKA_RANGER,_MAKADARA,_5301_URBAN');
62 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-105204', '0101000020
63 |E6100000D1F1663D49994340E44E9AE723A418C0', 'MCHANGANI,_MCHANGANI,_5301_URBAN');
64 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-104321', '0101000020
65 |E6100000E874FE15D09A4340EC1A18F4D6BC18C0', 'ZONE_9,_MIGOMBANI,_5301_URBAN');
66 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-203716', '0101000020
67 |E610000041F55EF2F29B43401965FA477DCA18C0', 'SOS,_MOMBASA,_5302_WEST');
68 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-202301', '0101000020
69 |E6100000105BE29DFE9B43405B39041CEF8118C0', 'KIGOMENI,_MTONI,_5302_WEST');
70 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-225303', '0101000020
71 |E6100000580811C15C9C43407B16B0C85B9218C0', 'GARAGARA,_MTONI_KIDATU,_5302_WEST');
72 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-103324', '0101000020
73 |E6100000EB8C133B3D9B43405749ECA81AAB18C0', 'MFUUNI,_MUUNGANO,_5301_URBAN');
74 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102639', '0101000020
75 |E61000001D7D61B1419C4340C79DD297136F18C0', 'UWANJA_WA_JAZIRA,_MWANYANYA,_5301_URBAN');
76 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-104328', '0101000020
77 |E6100000668E1AFF4E9B43402F8153DBF79618C0', 'BIKAZIJA,_MWEMBE_MAKUMBI,_5301_URBAN');
78 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-101625', '0101000020
79 |E61000001E60D229A99C43404B1AFA2D8DB018C0', 'MFEREJI_DOMO,_NYERERE,_5301_URBAN');
80 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102920', '0101000020
81 |E610000058D5ABAA9D9943402A833FBE33A818C0', 'M-KISONGE,_RAHALEO,_5301_URBAN');
82 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-201510', '0101000020
83 |E610000045BDC150D19E434002C148D3EBF018C0', 'OCCM_BRANCH,_SHAKANI,_5302_WEST');
84 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-101203', '0101000020
85 |E61000007CCE0663079843404A2B62D835A518C0', 'FORODHANI,_SHANGANI,_5301_URBAN');
86 |INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-202832', '0101000020
87 |E61000004A77098ED29C4340BB9A11BF40C418C0', 'ZONI_C,_TOMONDO,_5302_WEST');
```

```

58 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102021', '0101000020
E610000057049F0B9B9A4340086154C92FFB718C0', 'MFEREJI_DOMO,_URUSI,_5301_URBAN');
59 INSERT INTO waterpoints (location_id, location, description) VALUES ('00-0-000001', '0101000020
E610000002B69B027A9C4340E811D10E79A418C0', 'ZANZIBAR_COUNTRY');
60 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-100042', '0101000020
E6100000FB230C03969C43402FF99FFCDDDB1A1C0', 'Giraffe_Ocean_View_Hotel');
61 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-3-200801', '0101000020
E61000000C683398D09943407DB3CD8DE9A118C0', 'MABLUU_KIOSK');
62 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-200802', '0101000020
E61000003989F7D2CA9943408A096287CEAE18C0', 'MIEMBENI_KIOSK');
63 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-200803', '0101000020
E61000000F92AA926D9A4340C286A757CAA218C0', 'MAKADARA_PRIMARY_SCHOOL');
64 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-200804', '0101000020
E610000070500CDAF59843400D9577BC66AD18C0', 'KIKWAJUNI_JUMBA_LA_MIGUU');
65 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-103721', '0101000020
E610000051E91557CD9A4340F6FF5CE5ADAF18C0', 'M-HOSPITAL,_MATARUMBETA,_5301_URBAN');
66 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-115205', '0101000020
E61000005437599BAD9B434092E07DBD11A718C0', 'KWA_BI_RIZIKI,_AMANIL');
67 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102220', '0101000020
E61000005C6F1F937F9943402DCA7928EAAAD18C0', 'MSINGINI,_MIEMBENI,_5301_URBAN');
68 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-217107', '0101000020
E6100000288217013E9C4340879F58D703E218C0', 'DUKANI,_CHUKWANL');
69 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-103221', '0101000020
E61000000C5239D7B0C9B434088C665987FA518C0', 'TRADE_SCHOOL,_MKELE,_5301_URBAN');
70 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102201', '0101000020
E6100000663C7B9787984340D7F753043CA718C0', 'MKUNAZINI,_MKUNAZINI,_5301_URBAN');
71 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-106201', '0101000020
E6100000A3842A5AAC99434009F77D3364A518C0', 'KWA_KAMALI,_MLANDEGE,_5301_URBAN');
72 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-217110', '0101000020
E61000009E5E29CB109C434082B212BB02F418C0', 'MWEMBENI,_CHUKWANL');
73 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102211', '0101000020
E6100000990A3ED0709D4340C20437EDE6B518C0', 'KWA_SHEHA,_MWANAKWEREKWE,_5301_URBAN');
74 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-112201', '0101000020
E61000005166834C329C4340823E7A8BD39B18C0', 'MSIKITINI,_CHUMBUNL');
75 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-112202', '0101000020
E6100000A3305A0D2A9C43409E21756B349D18C0', 'KIDUKANI,_CHUMBUNL');
76 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102720', '0101000020
E610000085D9722451994340FE22C39963A718C0', 'MAPEMBEAN,_MWEMBE_TANGA,_5301_URBAN');
77 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-107201', '0101000020
E6100000E44327D1E4994340563693F7FFA518C0', 'GULIONI,_MWEMBELADU,_5301_URBAN');
78 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-209103', '0101000020
E61000009DCA3715089F434006C849C1506018C0', 'BONDENI,_DOLE');
79 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-108202', '0101000020
E61000005DB5BE8A049A4340A7C662D3FEA418C0', 'WAOSHA_MAGARI,_GULIONI');
80 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-108204', '0101000020
E61000000C4213C56009A4340238C2F7200A318C0', 'KIAMBAZANI,_GULIONI');
81 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-101021', '0101000020
E61000009619C2AF289B4340C37CA6E60AA218C0', 'KWA_SHEHA,_SHAURI_MOYO,_5301_URBAN');
82 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-108205', '0101000020
E6100000B0389CF9D5994340FC9CF2502AA318C0', 'LUMUMBA,_GULIONI');
83 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-203301', '0101000020
E610000045565F39369C43402D0709805A5F18C0', 'KWA_DANIEL,_BUBUBU,_5302_WEST');
84 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-217101', '0101000020
E61000007566DB3BD99B4340BC1D438DBC0F18C0', 'MKARAFUUNI_KWA_SHEHA,_CHUKWANI,_5302_WEST');
85 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-209101', '0101000020
E6100000BBE8D80C76A0434076D675889E6D18C0', 'DOLE_SCHOOL,_DOLE,_5302_WEST');
86 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-208101', '0101000020
E610000007581A5CBEA143404B8ED308B0D118C0', 'BIN_OMARI,_FUONI_KIBONDENI,_5302_WEST');
87 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-209109', '0101000020
E6100000913752EF8CA043404EC131EBAB8418C0', 'KIANGA,_KIANGA,_5302_WEST');
88 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-101612', '0101000020
E610000044B03129DC9A4340EED601DA9D218C0', 'TIMOTH,_KIEMBE_SAMAKI,_5302_WEST');
89 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-232103', '0101000020
E61000007F852C3E1D9C43401F592D18B45318C0', 'MELI_8,_KIHINANI,_5302_WEST');
90 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-200002', '0101000020
E6100000B36897C7439F43408C195E4BC2C118C0', 'MSIKITINI,_KIJITO_UPELE,_5302_WEST');
91 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-232104', '0101000020
E61000007071BF09269C43407B17960FA65418C0', 'GENGENI,_KIHINANI');
92 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-202431', '0101000020
E61000001744C2283F9E43400BF63B6067AE18C0', 'MAGOGONI_B,_MAGOGONI,_5302_WEST');
93 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-303641', '0101000020
E6100000B86102432D9E4340520FFDF912C218C0', 'UZI,_MELI_NNE,_5302_WEST');
94 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-232105', '0101000020
E61000001503E27D6E9C434098126090A85518C0', 'MELI_8_MWANZO,_KIHINANI');
95 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-104127', '0101000020
E6100000BC87D737A89C4340505BCA929A518C0', 'KILIMAHAWA_JUU,_KILIMAHAWA_JUU');
96 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102122', '0101000020
E610000013ABD426AD994340F1E44C7328B418C0', 'BRANCH,_KILIMANI');
97 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-109201', '0101000020
E6100000A4F9A5766D9A4340B2702292D2A218C0', 'P-SCHOOL,_MAKADARA');
98 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-109205', '0101000020
E61000006D00572E2B9A43407E033A63FDA218C0', 'M-WILAYA,_MAKADARA');
99 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-202911', '0101000020
E6100000D19A354DF29C4340E1837C3CB4A018C0', 'KWA_SHEHA,_WELEZO,_5302_WEST');
100 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-212102', '0101000020
E6100000889A2A10249D434032404951CC4D18C0', 'KWANYANYA,_MBUZINI');
101 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-212103', '0101000020
E6100000EDB90A31B09D4340F156E4779D4C18C0', 'KILIMANI,_MBUZINI');
102 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102638', '0101000020
E6100000321E63F6CB9C434043789DD54E6F18C0', 'CHEMICHEM,_MWANYANYA');
103 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102634', '0101000020
E6100000DD2009C669C4340889D29745E7318C0', 'MSIKITINI,_MWANYANYA');

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104 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102636', '0101000020
E610000027591C08289D434080010B00587418C0', 'MWANYANYA_JUU, _MWANYANYA_');
105 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-204027', '0101000020
E6100000F7464295F99B4340357BB7B18D7518C0', 'NKURUMA, _BETRASI_');
106 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-102637', '0101000020
E6100000A16B3E32469D4340D0170BDB007218C0', 'KIJICHI, _MWANYANYA_');
107 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-103421', '0101000020
E61000001FDB11D2439B434050C2637735AE18C0', 'ZIWATUE, _AMANI_');
108 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-203818', '0101000020
E6100000115E50195E9E43405575DDFB1EBC18C0', 'TAVETA, _NYARUGUSU_');
109 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-207102', '0101000020
E61000002594002D449F434043639F60FC2D18C0', 'GENGENI, _MNDO_');
110 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-115202', '0101000020
E61000009AD066CD769C434080608E1EBFA718C0', 'DARAJANI, _AMANI_');
111 INSERT INTO waterpoints (location_id, location, description) VALUES ('53-0-200415', '0101000020
E61000008B174D5FB69C4340B3FC72C62D4718C0', 'CHUINI, _CHUINI_');

```



# Annex 4: Implementation of the HSW on Zanzibar

Reporting by Hakeem Kimara

## INCEPTION SURVEY

### BACKGROUND

From Monday 3<sup>rd</sup> to Friday 15<sup>th</sup> August 2009 Hakeem Kimara, with the Help of Miss Amina A Daud (ZAWA PRO) conducted a survey to 10 Shehia's in both urban and rural regions concerning people awareness about Human Sensor Web and their willingness in participation in sending sms when they are experiencing problems with water . The survey was divided into three parts which are observation; interview and questioner whereby on Observation he went to places such as Kikwajuni, Rahaleo and Mazizini, while interview and questioner was done to another 10 shehias in Zanzibar. So all Shehias we conducted a survey are 13.

### SURVEY OBJECTIVES

1. To Know peoples awareness concerning Human Sensor Web?
2. To know how many people in different areas in Zanzibar own and use mobile phones
3. To know peoples willingness to participate in helping ZAWA (Sending msn)

Survey Conducted Dates: AUG 2009

Sun	Mon	Tue	Wed	Thur.	Fri	Sat
2 <sup>nd</sup>	3 <sup>rd</sup> Shangani Mkunazini	4 <sup>th</sup> Makadara Kwahani	5 <sup>th</sup> Kivunge Mkokotoni	6 <sup>th</sup> Mfenesini Mwakaje	7 <sup>th</sup> Mwanakwerekwe Miembeni	8 <sup>th</sup>
9 <sup>th</sup>	10 <sup>th</sup> Kikwajuni	11 <sup>th</sup> Rahaleo	12 <sup>th</sup> Mazizini	13 <sup>th</sup> Report Writing	14 <sup>th</sup>	15 <sup>th</sup>

### OVERALL RESULT

People awareness towards Human Sensor Web is NIL (nobody knows it), but it seems like they are willing to help the government when they get a chance to do that.

Conclusions: Public awareness should be improved and different media channels should be used. Public relation Office should work extra hard to provide information to the people.

## 2<sup>nd</sup> REPORT

## ACTIVITIES

From Dec 2009 to May 2010:

1. Collecting 50 signboards from Zantel and continue with Installation of 20 to areas where there is availability of water by rationing (so that people could report when they don't get water. Replaced the former (those rejected signboards) ten billboards and later installed to other ten areas.
2. Working with ZAWA and JICA on identifying (still doing) water points that are found in the urban areas where we can use as our source of getting information. Typical example is kiosk at Miembeni, Jumba la Miguu, Zawa Kiosk and Makadara primary school.
3. Worked hand in hand with Olaf and Canisius (Inet specialist) whenever there was a problem in receiving messages from our agents to their system. There was a time when the computer was disconnected with the phone and there was also a time when there was a problem with generator as well as changed their system from using Iburst to Fiber.
4. As HSW local Coordinator organized the launch of HSW in Zanzibar. Dr Anna Tibaijuka and Mr. Graham Alabaster from UN Habitat came on January 7<sup>th</sup> for the official launch of the project. This opportunity was used to talk to media about what this project is all about. It was printed in the national newspaper (daily news) and the interview is available online at: <http://www.mzalendo.net/sauti/sautimahojiano-na-hakim-kimara>
5. Been searching for people who could help us sending SMS and even paid them (2000/month) for their services but their participation was still poor there. Considered using local administrators (Shehas) whereby I found out if we teach them about this research they will help us by teaching others and tell them the main aim of this research and the benefits people will get if it is approved.
6. Since I'm also a ZAWA/JICA KIOSK coordinator I inter-related these kiosks and HSW whereby everywhere we are planning to have a Kiosk we will also have a HSW signboard. The purpose of this is that first of all these things are interrelated and secondly according to JICA, they are supposed to have 100 kiosk by the end of June. This means that by late June HSW will have accomplished one important thing which is installation of all 50 sign boards.
7. Conducted public meeting to the following Shehias -: kilimani, Kisima Majongoo, Miembeni, Malindi and Makadara. These are the areas where many of our signboards will be installed due to the availability of KIOSKS. I kept and still do keep telling them about this project but the rate of participation is still low.
8. Meter reading is another activity that I have been doing for the last five months. I have been doing it after every two weeks to all those areas we have installed our meters.
9. Coordinated a workshop to 20 shehia and invited 50 people who are on one way or another are involved with HSW. I invited 40 Shehas, two people from different media houses, Zawa staff as well as Zantel and I net (since they play a big role to this)the workshop was a success whereby it helped people to know what is this program is all about and also it also helped us to get a lot of people as our agents.

## SUCSESSES

So far a large number of people have been educated by their Shehas towards this project and if we have noticed we will see that at list now there is an improvement of the rate of sending messages.

During the workshop Shehas have been giving different advices o how to make this project work (refer to the HSW workshop report)

Media people have been calling me for an interview and as a matter of fact early this morning I conducted an interview with the hottest radio in Zanzibar (Hits radio) it was a live show which also allowed callers. I'm proudly saying that all the callers were happy with this program since they are tired with coming to ZAWA and they promised to inform HSW when they don't get water or when they get dirty water.

Good cooperation from ITC. I must put this as a success whereby you have been giving me a big support whenever I need it.

### **CHALLENGES**

Electricity problem in Zanzibar has been out of power for 90 days from December 10<sup>th</sup> to March 9<sup>th</sup>. This did not only affect water supply to Zanzibar islands but it affected HSW a lot, whereby people did not see the need of sending messages due to the fact that it wasn't ZAWA's fault.

People still don't understand the message of HSW properly, though we have been talking and talking but I don't think the mass know what they are supposed to do because if you take a look at the Daily export you will see that people are still sending a long message instead of a Maji A or Maji D

Lack of adequate standpipe codes, we have many stand pipes but we lack codes. When Jeroen was here we designed on how to code those areas and we picked 50 areas randomly, but when he came here last November and we paid a visit those areas we found out that some areas didn't even exist and therefore I decided to look for other areas. The problem is it is very difficult to rely on JICA coordinates that could help us identify these areas and give them codes since they are not reliable.

Another problem is misunderstanding between ITC and ZAWA towards the whole concept of HSW whereby to ITC this is just a research by which it needs people to send a message so as to make it approved while with ZAWA this is a complete project officially launched by UN-HABITAT director. This has giving people a lot of questions of which are true? Is it a research or a full project?

Another problem is about Meter reading, according to the contract it states that one of my tasks is to install meters and to make them operated. I do that frequently but ZAWA wants me to translate the reading and reporting every week I haven't done that because its definitely not my profession. Let me make it clear that I'm a just social scientist and not an engineer therefore I can only read and save it to the computer (according to what Robert taught me)

### **RECOMMENDATIONS**

I would ask ITC to have a budget for newspapers, if we have a HSW advert on how to send an SMS it will help not only Shehas but everyone who reads the newspaper. Since this is also under ZAWA I will also ask ZAWA to sponsor it

## **WORKSHOP REPORT**

### **BACKGROUND**

On Thursday 13<sup>th</sup> I conducted a workshop to people who are on one way or another are involved with Human Sensor Web. The main purpose of this workshop was not only to increase awareness towards them but also to see if they are willing to help us making this research work smoothly by sending messages and educating their people about HSW which will lead to community participation. I invited 50 people but it the turn up was more than I had anticipated. There were 40 Shehas from 20 Shehias (where we have and still planning to install sign boards) reporters from 2 media houses, Zantel and Inet were represented by two people, and lastly but not least ten ZAWA staff (Refer to the attendance sheet). On the Administration part of ZAWA was represented by Mr. Omar Ali Yusuf, commercial director. His attendance was important because he is the one concerning with customer complaints. The workshop was then divided into two parts; the first one was introduction and explanation about the research, which later came into discussion. After lunch break came to the second part which involved discussing ten question (five from your side and I added five)

### **THE FIRST PRESENTATION**

I started by explaining the whole inform and empower projects by UN-HABITAT and its three parts (Utility Benchmarking, Citizen Report Card and HSW). I also tried to explain to them how other countries have benefited from this program whereby I took an example of India and Ethiopia on the case of Citizen report card whereby this system has successfully changed the behavior of the people who are working at the public institutions. After I explained to them about HSW they wanted to how the SMS reaches the system of internet. Here I drew a diagram from the sender to the Geoserver. All in all I told them this is just a research on how to help both ZAWA and Zanzibaris and it needs us to cooperate by sending messages whenever we don't get water or when the water coming is dirty. I also explained to them that this system will help them to save time especially for those who are living far from ZAWA and also will avoid cue, and will increase accountability to the public institutions, will increase a good relation between ZAWA and Shehas

### **THEIR RESPONSE**

Though they rose questions but they all fall in the following -:

1. They wanted to know if this system could help them to get information if they will not get water due unavoidable reason such a pumping and electricity. this means that the system should send an SMS to Shehas informing them that ZAWA is facing a problem with pump or electricity therefore they will not get water until after a certain period of time.
2. They also want us to introduce to the media and let everybody knows about this whereby if we succeed on that will lead to public participation and they can't do it on their own
3. Meeting like this should be conducted frequently so that Shehas should know if there are some changes and if the system is has some successes and if there is a way they could help it to make it work.

### **SUCCESSSES**



I managed to get more than 50 people who are willing to be our agents I also told them that we will assist them with 2000/month for sending these SMS.

I'm invited for an interview with radio Hits FM, it's one of the hottest radio station this Tuesday where the show involves Callers therefore it will be easier for them to get the message and also if they don't understand they will call and I will do some clarifications.

It was successful and was ended with a prayer whereby in Zanzibar if the participants ask to end the meeting it's a good sign. They promised me to make this project never ending

## **PROBLEMS**

### *Late*

It was late due to the fact that there was a short visit of the Regional Commissioner to ZAWA and he visited some sites where there is a new project on clean water to urban areas

### *Absence*

There was an absence of important people such Mr Hemed and Mr Ayoub due to the fact there was a meeting in Pemba with ADB(Africa Development Bank) that they had to attend but there were two ADB members in the workshop

## **SECOND PRESENTATION**

This involved giving them the questioners, discussing the question whereby some of them didn't understand what was some questions about

1. On the Water use, the majority said that they depend on ZAWA pipes to both their households and their Shehias and the approximately use 10 to 15 buckets everyday.
2. On the water accessibility they depended on both public standpipe and in house from ZAWA but sometimes when there is no water they buy from vendors.
3. On water availability they all admitted that they get water, some of them know their timetable for water and some of them don't know when and they would like to get a timetable so that they will know when to report. They mentioned that if they don't get water, they wait for awhile and if there is no sign of getting water anytime soon they decide to buy from vendors.
4. On water problem they mentioned that they observe all of the mentioned i.e. there is no water, sometimes water are coming but with particles or even stinks. But the main problem is irregularities where the majority said that they wish they could know when do they get water and when is not. They have also mentioned that they normally go to ZAWA offices and complain but some of them like 10% mentioned that they do call people from ZAWA but it always take forever to solve it .none of them has ever used SMS. When they complain to ZAWA they normally report about water leakages and water availability. They have decided not to report because they think that ZAWA is always quite and they think they don't care about them.
5. On the case of the SMS system they all wanted it to be a free service and they wanted it to be in both SMS and voice call. They mentioned that when they send an SMS they expect two

things. First the problem will be solved shortly the problem is already solved. They mentioned that using SMS system is good but they are also asking for another way such as mobile announcements like other organizations do.

6. I also asked them if they are satisfied with ZAWA services, they all say NO because they said that they pay for something they don't get and they always get bad hospitality whenever they come to ZAWA on either reporting or even when they come to pay.
7. I asked them what kind of information they would like to hear from ZAWA, they mentioned that they will appreciate if ZAWA could send a message earlier to their customers when they found out that tomorrow there will be pump or pipe fixing so that they will prepare themselves by looking for water for the next day.
8. When I asked them what role will they play on this the HSW they mentioned and all agreed that they will conduct small meetings to their shehias and try to educate others on how to send their complaints via SMS and how are they going to benefit if the research is approved.

## **CONCLUSIONS**

On my side as coordinator was proud that people participated and they show their willingness to help in reporting whenever they experience problem with water. i will also play an important part of sending an SMS to every agent everyday asking him/her if she gets water and if not they should not hesitate to let ZAWA know. I will also work hand in hand with ZAWA whenever i find a complaint SMS and will push ZAWA to act upon it.this will encourage people to send more SMSs

## **RECOMMENDATIONS**

1. I would advise you to send me a copy immediately after the system receives an SMS that there is No Water or there is Dirty water. This will help me reporting to the customer complaints whereby if they will go check immediately will help people regain their faith towards ZAWA. Now I only receive a 24/hr report where it's always too late to report it to ZAWA.
2. The system should find a way to send an SMS to the agents of HSW (which are now Shehas) whenever there is a problem of water due to unavoidable reason such as electricity problem, pumping or even leakages.
3. We should also send an SMS asking if the problem is solved and he is satisfied with ZAWA services to an agent complaining about water
4. We should also send an SMS to every agent asking if he has clean water today if not he has to send an SMS to us. On this matter I have started doing it whereby every morning I send a message to all HSW agents asking them if the have water whereby if they don't I ask them to report immediately .
5. ITC should also have a small budget for newspapers whereby if people could see HSW sign on the newspapers they will understand that now people should send a msg instead of coming to ZAWA

## 4<sup>TH</sup> REPORT

### INTRODUCTION

In the past two months three main things were conducted, such as increasing public awareness, finishing installation of the remaining 30 HSW signboards, registration of agents for the water points, survey to the areas where we installed signboards as well as signing contract with Zantel for making HSW number as post paid.

### PUBLIC AWARENESS

Public awareness towards Human Sensor Web was among my duties for the past two months whereby it involved conducting of workshop of 50 participants from local administrators (shehas) HSW agents as well as ZAWA workers, conducted a public meeting at Makadara Shehia (pilot area for meter installation) conducting interviews (live coverage and recorded) with both local (Hits FM) and international broadcasts (BBC Swahili).

#### *The workshop*

On the 13<sup>th</sup> May I conducted a workshop by which I invited local administrators (shehas), ZAWA workers, some HSW agents as well as two reporters from Radio and TV station the aims were to see how these people perceived this research and also to see if they are willing to help us not only to educate people about the research but also to see if they are willing to act as our agents. The workshop was a successful whereby though they addressed a lot of problem that they were facing but at the end of the workshop all of the participants agreed to work with ZAWA on the HSW case whereby they would report by sending SMS to ZAWA whenever they experience problem with water.



### Giving presentation about HSW

#### *Radio Interviews*

18<sup>th</sup> May I conducted an interview with the hottest radio station in Zanzibar known as Hits FM whereby it was a live interview and it also allowed callers to asked me questions. Some of them

responded positively and they were glad that Zanzibar has reached that technological development, while some thought that this is just another technique used by politicians to get voters in the next election (this October) therefore this research will last after the election.

On the 27<sup>th</sup> June I had an interview with a BBC Swahili reporter Mr. Ali Saleh, he wanted to know who is involved in this research, how does it work, how will this research help the people of Zanzibar politically, socially and economically as well as challenges facing the research. The interview was aired on BBC Swahili on the same day at 15HR GMT; he also put it in the Zanzibari website so that if people could not hear it from the radio they will also have a chance to get it in the website [www.mzalendo.net/sauti/sautimahojiano-na-hakim-kimara](http://www.mzalendo.net/sauti/sautimahojiano-na-hakim-kimara) or one can just go to google.com and search for Hakim kimara or Human Sensor Web.

#### *Public meeting at Makadara*

I decided to conduct a small public meeting at Makadara Shehia due to the following facts: - First of all this was the Shehia that HSW was officially launched by Dr. Anna Tibaijuka and Mr. Graham Alabaster on the 7<sup>th</sup> January, this is a Shehia where there are many signboards due to the fact that this is the area which has the highest rate of water availability in the Urban West district, and also this is a pilot area for meter installation. A lot of people came to the meeting though some of them related it as a political campaign that some of them refused to come but at the end of the meeting due to peoples participation in asking questions and giving suggestions I realized that but people are willing to participate so long as the research will produce a positive response. This means that the research should help people to push ZAWA to fix the problem whenever they appear.

#### **INSTALLATION OF HSW SIGNBOARDS**

In the mid May, with the help from ZAWA I managed to install all 50 signboards and removing those ten that they were in a bad quality. While installing those signboards I realized that some of the water points that ZAWA and JICA proposed for public standpipes do not even have water. Therefore it took more time to look for different areas both from the Urban and West region and finally got those areas and installed them. ZAWA assisted with financial, material as well as construction for the installation of those 50 signboards. Installation of signboards also involved changes in the HSW database whereby some water points had to be omitted because they had no water and some of them had to be edited because the coordinates that we used were from JICA and unfortunately they had a lot of errors therefore I had to work with ZAWA again and look for areas that will be suitable for water points.



### Installation of Signboards

#### REGISTRATION OF AGENTS FOR HSW

While I was installing those billboards I thought I should also find people who will not only taking a care of the standpipes but also would be agents for the project. They all agreed with my proposal but with condition that they will not report unless I send them 2000/month. I agreed due to the fact that I once discussed this with Dr. Verplanke last year and he even bought 10000 top up cards which I distributed to five agents. I began sending those cash beginning of June and July and so far their participation is good whereby they not only help Human Sensor Web by sending SMS but also report to us whenever they experience problem concerning water.

STANDPIPE NAME	ZAWA CODE	POINT_X	POINT_Y	AGENT'	CODE
KWA BI RIZIKI	530115205	523827.58	9319057.141	+255772624104	831
DUKANI	530217107	524312.46	9312693.564	+255773482539	808
MWEMBENI	530217110	524159.046	9310750.942	+255777707831	315
MSIKITINI	530112201	524276.087	9320270.675	+255773316537	824
KIDUKANI	530112202	524248.181	9320121.894	+255777437097	825
DOLE SCHOOL	530209101	527964.692	9325257.263	+255777861049	494
BONDENI	530209103	526729.547	9326693.999	NIL	899
WAOSHA MAGARI	530108202	522392.465	9319281.595	+255777486642	833
KIAMBAZANI	530108204	522378.364	9319496.826	+255773860116	5
LUMUMBA	530108205	522235.323	9319479.224	+255773887160	834
CCM BRANCH	530103521	523120.125	9317829.686	+255773520469	810
KWA BI CHULU	530103522	523201.153	9317752.476	+255773985905	84
KARAKANA	530104021	524112.653	9321259.705	+255777423436	196
MAGARI	530232109	524208.177	9328056.592	+255778200204	812
GENGENI	530232104	524237.842	9327954.529	+255777816831	813
MELI 8	530232105	524482.471	9327845.415	+255776465251	820
MSIKITI.DUARA	530102421	521547.433	9318481.939	+255653307260	807

KIFULIONI	530102420	521324.038	9318730.266	+255773474747	53
KIKWAJUNI	530102425	521477.341	9318370.832	NIL	804
KILIMAHWEWA JUU	530104127	524673.801	9319262.569	+255773258051	827
MFEREJI DOMO	530101422	524517.833	9319337.179	+255777180852	163
KILIMANI	530102121	522175.386	9317655.778	+255658500400	101
BRANCH	530102122	522096.813	9317644.864	NIL	806
MSIKINITI	530102520	521771.443	9318555.664	NIL	57
MSIKITI MAKUTI	530104521	521609.803	9318704.645	NIL	59
MAKADARA	530109201	522746.832	9319516.013	NIL	803
MAKADARA	530109205	522523.023	9319498.062	+255777494188	809
MALINDI	530104202	521581.662	9319906.155	+255786797090	114
KWANYANYA	530212102	525095.949	9328693.708	+255776816831	814
MBUZINI	530212103	525569.219	9328821.207	+255773197200	815
MCHANGAN	530105205	521832.954	9319343.524	NIL	23
MIEMBENI KIOSK	530102230	522196.066	9318218.604	+255682601748	802
MIEMBENI	530102233	521943.172	9318318.926	NIL	190
TRADE SCHOOL	530103221	523283.625	9319226.976	NIL	135
MWANYANYA	530102638	524,796.95	9,325,076.35	+255773720025	821
MWANYANYA MSIKITINI	530102634	524,454.53	9,324,638.08	+255777642373	822
MWANYANYA JUU	530102636	525,107.60	9,324,532.59	NIL	823
MWEMBETANGA	530102720	521,786.66	9,319,023.44	+255777450801	28
MWEMBELADU	530107201	522,285.32	9,319,173.22	+255777844562	
NKURUMA	530204027	524,086.26	9,324,402.43	+255786130767	826
GARAGARA	530104027	524,026.09	9,320,695.04	WILL UPDATE SOON	
MABULUU	530108202	522,392.47	9,319,281.59	+255713871727	801
KIJICHI	530102636	525,209.56	9,324,785.21	+255778423223	819
MANG'OMBE	530102637	523,500.25	9,320,475.09	+255773234473	
ZIWATUE	530103421	523,470.10	9,318,286.55	+255777868312	829
TAVETA	530203818	526,151.17	9,316,783.57	+255777876202	290
MNDO GENGANI	530207102	526,934.94	9,332,127.11	+255777822909	818
AMANI DARAJANI	530115202	524,506.86	9,318,983.76	+255776539794	830
CHUINI	530200415	524,725.83	9,329,408.42	+255784215280	817
MKANYAGENI	530200416	524,879.03	9,329,311.60	NIL	

## SIGNING CONTRACT WITH ZANTEL

After I realize that there was a problem with using prepaid service for our number consulted Dr. Becht if I could register it as Postpaid. He agreed and I went to talk to the Zantel Marketing Manager Mr. Mohammad Mussa he agreed that we should use it as post paid and later he will convince Zantel decision makers to allow us to get this service for free. The advantage of using post paid is that it reduces the rate of being disconnected from server due to lack of cash in the phone. Mr. Mohammed also promised me that in the near future Zantel will also need the

number of our agents whereby they will send messages to ask them about the quality and availability of water in their respective areas whereby if they don't get water they should report it to HSW. Zantel are in the negotiation process with ZAWA concerning using Zantel newly introduced service known as ZPesa whereby a person will be able to pay for his water bill using his phone number.

## **SURVEY**

With the help Miss Amina Daud (ZAWA PR) we have conducted a random survey to know if people have received message about HSW from different sources, if there are willing to participate for the betterment of the country, we also wanted to know if people have faith in this project and lastly we allowed them to give us advice.

<b>SHEHIA</b>	<b>AWARENESS</b>	<b>PARTICIPATION</b>	<b>FAITH</b>	<b>ADVICE</b>
MALINDI	90%	100%	100%	ZAWA should respond quickly
CHUWINI	20%	100%	100%	ZAWA should punish all irresponsible
MCHANGANI	90%	100%	100%	ZAWA should report a day before
MLANDEGE	90%	100%	100%	ZAWA should respond quickly
KWAHANI	40%	100%	100%	More advertisements
KWARARA	30%	100%	100%	Improve on water ration
KILIMANI	90%	100%	100%	Nothing to advice
KIKWAJUNI	80%	100%	100%	Water for free
K'MAJONGOO	80%	100%	100%	This is politics

## **ACHIEVEMENT**

### *Public Awareness*

I'm proudly saying that the number of people who knows about this project has increased due to what we have found out when we conducted the survey. People admitted that they used to see those signboards but they never bothered to read because they thought that it's just a Zantel advert which had nothing to do with them. But after radio stations have announced and the interview I have conducted it has increased the public awareness.

### *Good Relation*

In the last year's survey report it showed that people did not have faith in ZAWA because they didn't provide what people expected and some of them did not even know if ZAWA existed but again according to the survey we have found out that people have regained their trust with ZAWA and they are will to help and they even have faith that they will make this project work. The main reason is that a large number of areas have been provided water by ZAWA and also there are many projects on the way that will lead to allow people to get water 24hr a day.

### *Work Performance*

People at ZAWA have increased their work performance due to the fact that this research has created some kind of threats to workers. In all interviews I have conducted I mentioned that one of the aims of this research is to punish anyone who is not responsible to his duty therefore

after hearing this people at ZAWA have become extra careful and increase their work performance.

### *Community Participation*

Though we have selected agents so that they have to report to us whenever they don't get water or they get water but in a bad quality we have been receiving messages from anonymous people who are not agents but they also report.

This means that people has started realizing that HSW is for everyone therefore they should not wait until an agent report it while they can also do that.

## **CHALLENGES**

On the case of challenges they can be categorized into administrative, technical and financial and they are all interdependent

### *Administrative challenge*

Here I'm talking about Human resource, sometimes I receive a report regarding lack of water in a certain shehia whereby after I contact the agent it shows that there is a water leakage in that area. Normally this needs more than 5 people to fix but the there are times when all people from technical department are out doing other works therefore the problem remains unsolved.

Another problem is that I always get a report from HSW after 24hr, this is another problem due to that fact that we don't know when the message was sent, how crucial the issue is and how soon the problem needs to be solved. This may lead to people lose faith in this project and refuse to cooperate.

### *Technical Challenge*

In the past two months we have been experiencing this problem whereby they are in two areas. There was time whereby all of our cash in the phone disappeared and when we inquired information from Zantel they said that someone was using to enter in a promotion for world cup. But in reality there was no one to do such a thing because the phone is locked and have been there for almost a year and nothing like that has ever happened. After I talked personally to the people at Zantel they admitted that there was a problem that caused a lot of people to loose their airtime in their phone but they were refunded.

Another problem is due to Inet. In the beginning they were using cable but two months ago they changed it to Fiber by which it is supposed to be faster than the cable but this has been opposite and has been affecting us because there is frequently disconnection from server due to these changes.

### *Financial Challenge*

The problem is I never get cash from ITC on time and also I don't get what I'm supposed to get. When I signed the contract I was supposed to get 2000\$ but I only received 1950\$, then I also sent an invoice of claiming the cash I spent for the workshop, recharging the phone as well as transport due to the fact some of our signboards are installed far from town but I only received a quarter of the amount and it was about a month late.



## RECOMMENDATIONS

First of all I would still insist that I should receive a message immediately after the reporter informs us.

I would suggest that we should add two people in this research, a guy from customer service and a guy from technical department. They should also receive a message immediately after it has been reported.

Different channels should be used apart from radio. Newspapers and even TV should be used to make people understand their task and the main purpose of this research

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# FINAL report

## INTRODUCTION

In this final report I would talk about activities that I have conducted for the past 3 months, achievements, problems as well as recommendations on what should be done on the matter of developing Human Sensor Web

## ACTIVITIES

### *Students participation*

From early September to mid January ZAWA received students from the University of Twente whereby they were doing research for their Masters program. I assisted them with finding suitable and affordable house for them, transport from their base camps to their areas of researches everyday as well as translation and data collection.

One of them was doing research concerning Human Sensor Web. When assisting him on this matter we discovered that though a lot have been done so as to increase public awareness to the people but the number of the people aware of this program is still low whereby some of them didn't even know if it existed. Though they admitted that this will help them to complain in a technological way but they still complained that they haven't received an adequate information and education to the mass concerning this project.

Therefore after this survey I thought I should use another way which was installation of cheap written announcements to the areas where we pick them as our water points so that people should see the announcements that will attract them to go to the signboards and read what they are supposed to do.

At the same time I used public meetings, in collaboration with JICA(Japanese development cooperation) radio interviews with Zenji Fm and our public radio station (Sauti ya Unguja), mobile announcements(ZAWA car) so as to increase public awareness towards Human Sensor Web.

### *ZAWA and JICA*

On the 30<sup>th</sup> November with the assistance from ZAWA and JICA we conducted a public meeting at Makadara (where Human Sensor Web was officially launched) and we talked about the advantages as preserving water as well as peoples participation on the water issues. Local administrators (shehas), ZAWA workers and some HSW agents as well reporters from Radio and TV station attended. The meeting was a successful whereby though they addressed a lot of problem they were facing but at the end of the workshop all of the participants agreed to work participate.



**Public meeting at ZAWA with Makadara people**

**Interviewed by UN-HABITAT production team**

#### *UN-HABITAT*

In October UN-HABITAT production team came to Zanzibar for the purpose of producing a documentary about projects that are funded by UNHABITAT in % countries in Africa where Tanzania was represented by Zawa.water and sanitation in Africa Public awareness towards Human Sensor Web was among my duties for the past two months whereby it involved conducting of workshop of 50 participants from local administrators (shehas) HSW agents as well as ZAWA workers, conducted a public meeting at Makadara Shehia (pilot area for meter installation) conducting interviews (live coverage and recorded) with both local (Hits FM) and international broadcasts (BBC Swahili).

#### *ZANTEL and HSW*

Zantel is playing a very crucial role in the Human Sensor Web project. Whereby it doesn't not only participate by giving us the number (0778700700) which is used to send and receive message but also helps us in the public relation too(by providing signboard by which we installed them to our water points. But that was not enough for people to send an SMS since SMS is not for free. Therefore what I have done here, I went to talk to the man in charge Mr. Muhammad Mussa trying to convince him so as to make the HSW messages for free. Fortunately he agreed with the condition that we have to buy their product known as SMS bundle whereby this will allow us to send messages in advance to all our customers whenever think that we might experience a problem with water. This means that from now onwards ZAWA will inform her customers if there will be a shortage of water even before the person sends a message of complaining via HSW

### **ACHIEVEMENTS**

#### *Public awareness*

After conducting public meetings, radio interviews as well as installation of the small announcements to the areas where we have our water points, the rate of public has increased and now people have started to send messages to ZAWA. It should be noted that we used to rely on HSW agents but now anyone can participate to send message instead depending on the HSW agents.

#### *Relation*

Human Sensor Web has helped to improve the good relationship between ZAWA and Zantel. Now we are in the last stage of negotiation of the project known as ZPESA whereby it will help people to pay for their bills via SMS and not necessarily come to ZAWA. Therefore soon people will not only send message to complain when they experience problem with water but also send a message to pay their water bills

#### *Work Performance*

This is another achievement of Human Sensor Web; there are some areas such as Mwembetanga Mapembeani and Kikwajuni Kifulioni that have been getting water but with very bad quality. Sometime they come with dusts, particles and sticky. Now the problem is solved and people get clean and safe water.

### **CHALLENGES**

#### *Inadequate staff*

Sometimes we received messages that certain areas have problems with water but it happens that the engineers and plumbers that were supposed to go to the areas reported have already been given a task to go to somewhere more important than the one that has been reported by HSW. This can be said as a problem because people get tired to send messages when they realized that none has been done to solve it.

#### *Participation*

The participating rate is still poor, I have discovered that people are not used to complain using SMS. They'd rather come or send their administrative leader (Sheha) but not sending SMS. Though I have conducted several public meetings and workshops leave alone radios and newspapers people still do not send messages. This could be due to the fact that they don't get a quick response from ZAWA whenever they report or they think that it is not their task. I must admit that people send messages but only if you would remind them (by conducting a workshop or Public meeting)

#### *Technical Problems*

Sometimes we way face some technical problems from Zantel, Inet or even in Netherlands that makes Human Sensor Web not working for days. Sometimes it takes a lot of time to get a reply due to technical problems and up to this moment we have not find a way of sending a feedback when the problem is solved or a message to inform them that they should wait for a certain period

#### *Destruction of Signboards*

People have started destroying our Human Sensor Web signboards. This has happened to Miembeni Kiosk water point number 808. what they did was removing the cover and now they are using it as an announcement board. Have already reported to ZAWA management and Sheha too and they are looking for a person concerned

