

USER REQUIREMENTS ANALYSIS TO DESIGN WATER QUALITY DETECTOR USING APPLICATION

**MUHAMMAD AMIRUL FIRDAUS BIN MAT ARIF SHAH, AINA SYAHMIE BINTI RAHMAT,
MUHAMMAD AMIRUL FAHMI BIN NOOR ANIM, NUR ALIA BINTI MOHD SYEHAB**

ACUA GROUP

B19EC0019, B19EC0002, B19EC0018, B19EC0030

**miruldaus24@gmail.com , ainasyahmie @gmail.com , amirulfahmi1227af@gmail.com ,
aliasyehab98@gmail.com**

**Faculty of Engineering, School of Computing, Universiti Teknologi Malaysia, Skudai, 80990
Johor Bahru, Malaysia**

ABSTRACT

Water Detector Using Application is to improve community behaviour in maintaining water quality for improve their health care and user requirement for an application designed and specifically for the water detecting quality from user's perspective. By this application parameters, community enables to know their health condition and suitable water intake in daily life. In addition to point given, this application can be a better prevention to any kind of health problems that related to water quality. Accuracy data and result is needed as the application will be used for a long-term development. To achieve that, we conducted Focus Group Discussion (FGD) on a few participant among people who are concerned. The purpose of this water quality detector application is to improve the water quality intake in community to prevent any kind of illness and identify suitable water consume for body. Results indicated that suitable quality of water can prevent from certain infection related to water such as stomach-ache and more. The idea of a water detector application was well accepted by the participants and the components to be included were identified. The identified components are such as self-monitoring, activity planning, forum, reminders and water nutritional content. A framework for designing water detector application will be formulated, which integrates behavioural change theories. The application performance will be improved and update in time to time according technology advances.

Keywords: Behavioural Change, Water Nutrition, Quality Water, Mobile Application, Health, Water Sensors.

1. Introduction

Water quality from rivers is as importance as the reason for these water sources is often used for many things such as: drinking water and domestic water supply, agriculture (irrigation), hydroelectric power plants, transportation and infrastructure, tourism, recreation, and human ways, or other economy to use water [1]. The most popular body of water which is known to have a high rate of pollution in the Philippines is the Pasig River. It connects two bodies of water in Manila, Laguna de Bay and Manila Bay. In addition, the Pasig River has economic activity provide the main means of transportation, water sources and a place of protection for many types of fish. One of many because water bodies like the Pasig River have fallen pollution is due to wastewater factories and households as well as solid waste disposed in it. It is known that the water quality in Pasig the river got worse, but no attention into it. Part of this is the solution to this kind of problem requires an initial step. Monitoring and evaluation are possible be done first before having a definite plan on how to exterminate water pollution problem [2].

Water quality detector application can also have benefits in many aspects. It can give us the information or data we need like pH level, temperature, turbidity, mineral percentage and more. Basic parameters that can be measured through electronic methods can also specify further parameters such as bacterial growth that can be attributed to how contaminated the water is. This data can also be used to determine which one species capable of surviving on monitored water

environment. Measure water quality through this system can also ensure healthy and sustainable fish and plant growth, later, improve biodiversity.

Some studies [3-5] have running with promising results. Water quality monitoring system has been developed consists of sensors, and smartphones. It can be called data transmission from monitoring device to remote server which stores information such as pH level, temperature, turbidity and amount of dissolved oxygen to be determined the water quality.

At the end of this study, the water quality detector will be able to detect water quality and will assist consumers especially those who need to maintain water quality. This application can change their lifestyle and also be a prevention to any kind of health problems that related to water quality.

2. Material and Methods

We conducted one FGD with 12 participants at a Water and Environmental Engineering Department Universiti Teknologi Malaysia Johor Bahru and among the public through advertisement. Some of the participants are related to water quality management and others are community that use water in everyday life. The selected participants are of various age groups, gender, ethnicities, who active in sports and who faced with health problems.

Each FGD session lasted for 50 – 60 minutes and was led by an interviewer. There were two sessions for participants where first session is group discussion while next is for questionnaire session. At the beginning of FGD session, an ice

breaking activity are conduct by interviewer where the participants introduced themselves and briefed on their history of water consumed with various water quality experienced. Open-ended questions were used to prompt the discussion. The role of the moderator was to ask the questions only to stimulate the discussion session and facilitate it. The participants were encouraged to give their own comments and opinions throughout the discussion.

In the questionnaire session, a form had been given to each of participants to answer the questions related to the project. The findings were divided into two separate sections: who need care in water intake and who does not. Each discussion was audio-recorded and transcribed later. The faces of the participants during the discussion were also observed and considered. Finally, the data were coded, categorized, and analysed by identifying the recurrent health conditions. Then the analyser can recommend suitable water consume and water quality for each category. At the end of the discussion, a token of appreciation was given to the participants to thank them for their effort and participation.

3. Result

Twelve participants were scheduled for the water quality FGD, all of them participated. Twelve participants were selected; only three participants in health problems FGD. Characteristics of the participants are displayed in table 1. The outcome of the FGD is divided into five themes – lifestyle and self-monitoring, education & awareness, motivation and commitment, social support and coaching,

and technology. These themes emerged from the response of the participants.

Table1. Characteristics of the 12 participants

Category	No (%)
Age (Years)	
20-29	2
30-39	4
40-49	2
50-59	3
60-69	1
Gender	
Male	7
Female	5
Ethnicity	
Malay	5
Chinese	4
Indian	3
Active in Sports	
Active	5
Not active	7
Health Problem	
Yes	3
No	9

3.1 Lifestyle and Self-Monitoring

The importance of getting a good quality of water can lead to a better lifestyle. All the participants agreed with the statement that water quality does really matters in maintaining a good health condition. Proper intake and utilization of water need to be taken care of.

One participant shared his experienced using and consuming tap water in daily life: *"I used to drink directly from tap water every day for 4 years. I drank from the tap water because at my home does not have water filter, so I just take the tap water to drink. No doubt at first, I taught that the tap water is clean because the water is colourless, no odour, and taste normal. Even though the water is rust sometimes, I just drink it due to no water filter and thirsty. One day, after consuming tap water for a few years suddenly I'm no feeling so well. I realized that my body get dry and rashes are covering my body and I also get diarrhoea often. Then, I went to check up with the doctor and the doctor said that maybe the water that I'm using is not clean. The doctor also said that the tap water that I've been drinking contains harmful bacteria especially when it is rusty. So, the doctor advised to drink a good quality water to prevent this situation happened again".*

Another participant who is a hiker indicated that he used to consume river water when he was hiking. He does not know whether the water is clean or not. He just drinks from the river because he was thirsty and out of water. Another participant who diagnosed with diabetes shared that she must control her water intake every day in order to take care of

her disease from getting worse. If she drinks unclean water, she may get infected through the bacteria from the water especially at her wounded area. So, starting from that she really cares about the importance of water quality. She started to have water filter at home and only drink from the filtered water. All the participants were strongly in favour for proper quality of water to manage and prevent from health conditions. They shared that they always were on the look-out and were alert on when using and consuming the water. They changed their lifestyle by only drinking from tap water and for does who active in sports they bring filtered water from home.

Overall, the study indicated that engagement in self-management behaviours is the proximal outcome influencing the outcome of improved water quality: managing a proper intake of water quality and self-monitoring is essential in taking responsibility for their own health.

3.2 Education and Awareness

The participants claimed that there was less awareness about water quality and the consequences of ignoring the importance of water quality. Now, there is much awareness created about management of water quality. Currently, there are also more talk and discussion sessions organised by many government and non-government organizations (NGO) to educate the public. The participants said even the quality water issues nowadays that shows in media.

One of the participants said that: *"Nowadays people are tend to underestimate the quality of water that been used daily, but it's crucial for someone*

as it will be a mediation between someone have a good health or otherwise". By attending all these talks, the participants are more aware of important to take care water quality. One of them shared that: "Many advertisements on television or internet that aware of important to take care of water quality. Why many people still don't apply the guidelines that were given by media. Awareness to keep the quality of water that's had been shown in media.". Nevertheless, one of the health problem participants said there must be more awareness created among the younger generation. She said: "If we can get more information from primary school on awareness of water quality, it's easier for young people to adapt and apply it in their future lives".

3.3 Motivation And Commitment

There are several factors that help the participants to adjust their way of living and changes after learning about the importance of water quality. They say that motivation is one of the most important elements in changing their daily lives. Thinking about things that can motivate them such as thoughts about their family, illnesses that will be encountered if they don't maintain water quality, diseases such as rash on the body and other reasons makes them want to change it. They also point out that changes in themselves need to be made so they can keep motivated, for example installing water filter in their homes can help.

Other than that, check whether the water they used, or drink is clean from impurities and coming from the right source. Self-discipline is being considered as very important. One of the participants

stated: "Before this, I have never been interested in buying water filters. But after realization, I am interested in buying them. I say this because when I get sick, I realize that one of the causes is from using the dirty water. I bathed with it and cooked it with the poor water quality. I go to motivations that give talk about the importance of clean water and also support from my family helps me to stay motivated."

3.4 Social Support and Coaching

Half of 12 participants shared that they need some of social support from either family, friends or a support group. Family is an institution whereby they stick together even when we are having difficulty, so family support is important to them especially from their mom and wife for married participants. Besides that, they can also be our reminder. For an example, one of the married participants said: "My wife always prepared me mineral water (filtered water) before I went to work because my wife afraid that I use tap water to drink. In this situation our wife should be supportive and cooperative. Like my wife does." A prediabetes participant also shared that: "We really need support, maybe from support group, that we can contact and approach when we have any difficulties. Another half of the participants shared at they would rather discuss things with others and hear others share. In this way, they learn many people's success stories and are motivated. In addition, all participants wish to be contacted by their doctor or dietitian. They want to be trained and supported by the dietitians constantly.

3.5 Technology

When technology was mentioned, positive response was given by the 12 participants. About 86% of the participants own a smart phone. Some of them download pH tracker app from the Google Playstore or AppStore and use it daily. One participant who has a health problem shared how he uses his smartphone: *"I use my smart phone to check suitable pH quality for me to drink. Sometimes, when I wanted to drink something sweet, I can control my diet by using app that remind me of how much quantity of sugar that I can take on specific thing based on the pH quality of a water. I also can record my body pH level and know the condition of my health problem."*

Four participants browse water quality and health related websites by using the search engine Google or Safari to find information about their drinking water, especially on those which are suitable for health problem person. One of the participants, who is active in sports and has a Facebook account, follows some articles shared by his trainer and doctors on water quality and the effect towards health. Since then, he always making sure the water quality is in good condition before consuming it.

Five participants claimed that the information they got come from the Internet through WhatsApp. After reading the articles, they feel motivated and share it to the others for awareness. A participant shared her thought: *"Nowadays, we don't like to read. Most of the people would like to read if it is on their smartphones. So, if we can get the*

information easily, people will be more aware about the importance of water quality."

The participants shared that usage of smartphones and Internet really helps them in many ways. They said an application that detect the quality of water will be a good assistant to monitor their daily water consumption. A health problem participant shared her opinion that the applications should be multitasking so that many people will like to use it. In addition, some of them also mentioned that the application should give them reminders at a specified time.

Components of the Proposed Water Quality Detector Application: The participants mentioned the important components they wanted in the application by ranking the components. The priorities of the water quality detector application components have been divided: Health Problem and Non-Health Problem. Priorities here means the most important to least important components from participant's viewpoints. Table 2 shows the percentage of people who had health problem and non-health problem for each component. Figure 1 illustrate the comparison between the people who had health problem and non-health problem on their priorities.

Table 2. Priorities of health problem and non-health problem on water quality detector application components

Component of Water Quality Detector Application	Health Problem (%)	Non-Health Problem (%)
Self-monitoring	100	95
Water pH Measurement	100	98
Activity Planning	98	83
Mineral Percentage in Water Measurement	97	92
Personal Data	96	85
Water Turbidity Measurement	90	85
Water Temperature Measurement	89	72
Amount of Dissolved Oxygen in Water	84	77
Goal Setting	82	64
Online Education	79	60
Forum	75	58
Alerts/Reminders	72	55
Social Support	71	55
Coaching	70	50
Reward System	57	48

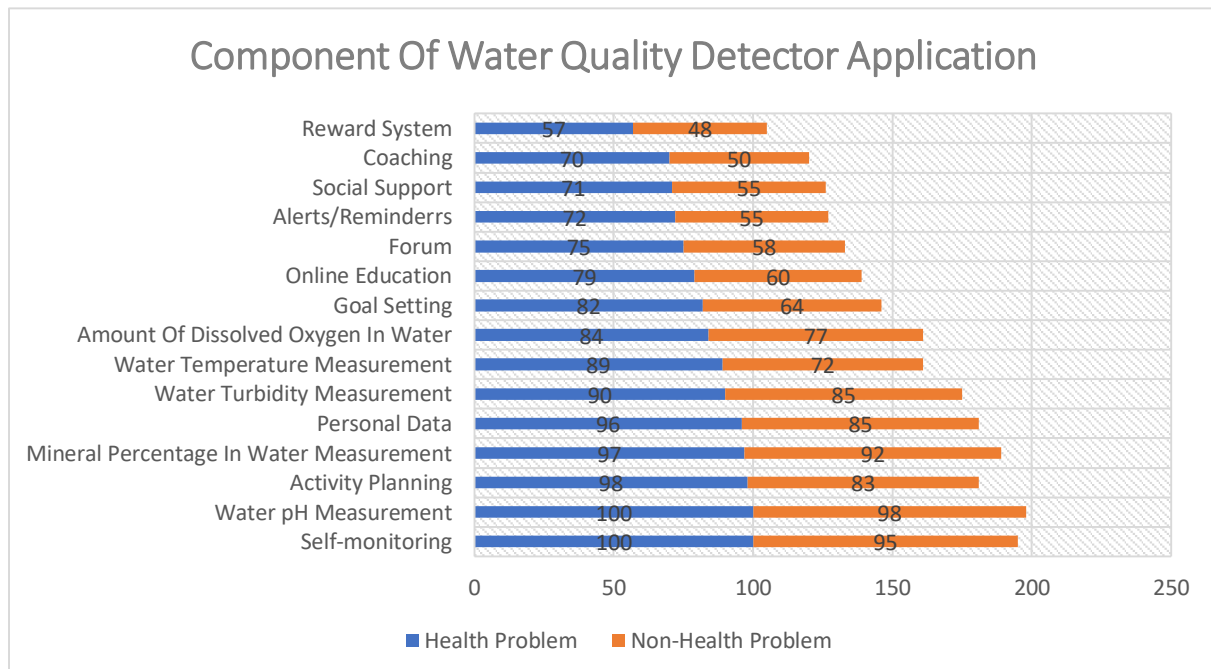


Figure 1. Comparison between prediabetics and diabetics priorities on self-care application components.

Based on the participants' choices, self-monitoring and Water pH Measurement stays as the top priority for both groups. This followed activity planning, mineral percentage in water measurement, personal data, water turbidity measurement, water temperature measurement, amount of dissolve oxygen in water, goal setting, online education, forum, alert/reminder, social support, coaching and reward system. For non-health problem, water pH measurement is followed by self-monitoring, mineral percentage in water measurement, personal data, water turbidity measurement, amount of dissolve oxygen in water, water temperature measurement, goal setting, online education, forum, alerts/reminder, social support, coaching and reward system. It is interesting to note that activity planning is not being considered as one of top priority for non-health problem compared to health problem. Health problem participants have chosen self-monitoring, water pH measurement and activity planning as their top priorities because they would like to have an application that monitor someone lifestyle and recommend activities for them to reduce their health problems.

The reward system is the least priority for both the groups. They mentioned that they should be self-motivated through their mindset about their own health and not through any reward system. Online education, social support and forum are in higher priority in non-health problem than health problem. It also seen reminders are in lower ranking for non-health problems compared to health problems.

4. Discussion

These FGD results highlight that majority of the participants would like to use technology as their aid in managing their way of living using good quality of water. All the participants take self-responsibility towards their healthcare. They prefer the idea of a water quality detector application which can be a 'one-stop centre' for all their needs as it can save time and cost. Most of the people are not aware of the importance of water quality and its effects towards health condition. During our selection session for simple medical check-up, we found that most people are not aware that they have a bad health condition and those who are already diagnosed with bad health condition are not willing to admit that they have health problem. Some are not willing to let others know that they have problems with their health and are scared to come forward to seek help. For these reasons, we strongly feel that a water quality detector application will be a good tool to guide towards healthy lifestyle.

To prevent water poisoning, as the application will be personalised to everyone with their own personal data and to monitor their own health condition. They still can get support and coaching online without meeting face-to-face with people. Online education will be helpful in creating awareness and as a source of knowledge to people who had health problem to gather more knowledge. Health condition can be managed, if and only if, the community are willing to change their lifestyle and behaviour. In order to this, they need knowledge and awareness about water, its information and advantage. Most participants

mentioned that they normally use Google to find out about water, to identify the quality water that suitable to use. The water which is deemed suitable varies among individuals. So, they suggested everyone should do their own research and find the food which helps them. They measure their quality water components by checking water to find out whether it suits their body or not. In this case, a component in the water quality detector application to record multiple entries of water components level will be very useful.

Since most of the participants agreed that they need family support to better manage their health, we should strive to include their families, friends and support group. For example, an alert email or message can be sent to a family member or support group, who can encourage them to exercise and drink proper water and find the reasons for not doing them. Forums will be useful too, as the participants said that they want a platform where they can communicate with others who are facing the same issue with them. They want to discuss what worked and what did not work with them and others. They also mentioned that they would appreciate direct coaching sessions with their doctors, so that they can discuss with their doctors about medication or any health-related issues they are facing in their daily life.

Considering most participants agree that they need family support to better manage their health, we should strive to involve their family, friends and support groups. For example, an email or a message can be sent to a family member or support group, which can encourage them to install a water filter in their home and avoid using rusty water or drinking dirty

water. The discussion will be helpful too, as the participants state that they want a place where they can communicate with others who have similar problems with them. They want to discuss what can be done and what is not possible with them and others. They also mentioned that they would enjoy session with their doctor, so that they could talk to their doctor about medication, the amount of water they should take, or any health issues they face in their daily life.

Determination of purpose and planning of activities also play an important role in water detector applications. For example, someone who is diagnosed with diabetes needs to control their intake of water to manage their blood glucose levels. Another example is that water detector applications can help dengue patients find the right amount of water to maintain a normal urine output. To achieve their target readings, they plan their schedules to determine the amount of water they need to take and the water quality. Adding these features will help them keep track of their goals and manage them more effectively.

About the idea of adding a reward system into a water detector application, they didn't show interest because they said the idea for change had to come from within. If someone is not interested, then no one can change it.

5. Conclusion and Future Work

Getting the user's feedback on the idea creating a water quality detector application for community and their requirements for the application is essential to understand the necessity and expectations of the target users so that a good self-monitoring application can be designed for them to manage their health and lifestyle independently. Even though our FGD is study based on a small information, it provides us valuable enlightenment into community's lifestyle, awareness of the importance of quality of water, and how they get motivated to change into healthy lifestyle. These insights help greatly to determine their expectations towards the currently available web technologies to take care of their health.

The FGD results support our research that a water quality detector is a suitable tool in assisting the health problem participants to reduce their health risk. Our study also indicates that usage of technology such as smart phones is low among older people but not all older people. Some from the same age group can accept modern technology with ease. The outcome of the FGD will be used to develop a framework which integrates behavioural change theories to design a water quality detector application for community.

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