Eliciting User Requirements to Design an Application: A Focus Group Study on Drain Waste Trap

Aimi binti Rusdi, Nurul Najiha binti Hamdan and Aqilah Hanim binti Mohd Taufik

School of Computing, Faculty of Engineering, Universiti Teknologi Malaysia,

81300 Skudai, Johor Bahru, Malaysia;

aimirusdi@gmail.com , najihah1414@gmail.com , qylahanym98@gmail.com

Abstract

Objective: To explore the users' insights that contributes to preventing flood caused by clogged drains and irresponsible act of littering in drains and the user requirements for an application designed specifically for the drain waste trap from the user's perspective.

Methods/Statistical Analysis: We conducted Focus Group Discussions, (FGD) on a few group of users by 10 people who are among the UTM staffs and students through advertisements and exposure. Open-ended questions were created and asked to stimulate the discussions more strategically. Transcripts of each discussion session were read multiple times, coded, categorized and analyzed thoroughly by identifying the themes according to the answers and opinions.

Findings: Results indicated that flood caused by clogged drains can be prevented through this application system and waste trap device, if and only if users are willing to help us successfully give feedbacks of the usefulness of the trap so it would alert the authorities when it has reached a designed mark with an installed camera as well as when it detects unpleasant pollutants caused by the wastes in an open channel flow or drains.

Application/Improvements: A framework designing our application will be formulated, which integrates the users' insights to preventing flood caused by clogged drains theories with the support of awareness exposure.

Keywords — *Waste Trap, Open Channel Flow, Alert Authorities, Clogged Drains, Prevent Flood*

1. Introduction

Solid waste and gross pollutants such as litter and debris are unattractive by nature. Their presence in drains and channel flows causes many problems such as damage to natural habitat, degradation of water quality, increase of flash flood problems, being aesthetically unpleasing and reducing amenity values ***(Allison Chiew and McMahon, 1997).*** Generation of solid waste is not a new phenomenon and with the advance in technology from the Industrial Revolution in the late 18th century until this day, solid waste contains biodegradable elements and toxic, hazardous components which has high cost for proper disposal.

This waste trap is a device that avoids solid waste from entering water bodies which will improve not only the water quality but also the environment. Finer pollutants such as dirt, chemicals, heavy metals and bacteria will have the data sent to the authorities detected by a chemical sensor. Waste traps are one of the suggested structural **Best Management Practices (BMP)** used to control solid waste and gross pollutants in urban drainage systems **(MASMA, 2000).**

Main parameters to be considered in designing waste traps are flow rates, maintenance requirements and loading. The main purpose of this study is to evaluate the effectiveness if waste traps in drains and open channel flows with the access of applications. To achieve this, five objectives are identified which is firstly, to determine the amount of rubbish and sediment that can be trapped in the waste trap. Next, accessing suspended solids (SS) parameter after application of the waste trap. Third, it is to determine the hydraulic characteristics of the waste traps in the drains. Then, studying the influence of dry and wet period using the amount of rubbish trapped and lastly is it to compare the different model designs of rubbish traps. It is known that this particular study was carried out before in various countries. As for Malaysia, this is one of the first new ways with different designs to be carried out. Hence, a study with the existing of an application is done to expand the fluency of the project.

The main purpose of this paper is to explore the users' insights that contributes to preventing flood caused by clogged drains and irresponsible act of littering in drains and the user requirements for an application designed specifically for the drain waste trap from the user's perspective. Storm water problems have become more severe due to the increase in urbanization. Not to mention the increment in the amount of the impermeable surface of urban areas produces more storm water runoff. Higher runoff volume also carries more pollutants from contributing drainage area. Guidelines for the selection and implementation of structural treatment measures involves the determination of objectives, site identification, short-listed and comparing potential treatments with detailed designs. The suggested solution consists of primary screen and secondary screen. Not to mention the addition of alerting systems and camera installments to the authorities regarding the condition of the traps and also pollutant percentage during situations when it has reached maximum capacity, high danger of water quality and discovery of living creatures to avoid unwanted deaths.

The procedure of the system basically are most of the rubbish or solid wastes will move according to the flow rate of the river or drainage water and open flow channels. Then it meets the primary screen with rotation mode in inclined of a 30 degrees. For the right way of disposal, when the camera shows the indication of a nearly fulfillment in the trap, it will signal the authorities to issue a physical checking to remove all the waste in order to have a smooth process. The rubbish is then collected by the excavator and dumps it into collection vehicles or any designated waste vehicles to be transported to a landfill. This system is using water flow as the natural energy to allow the rubbish flow. By the end of this study, the effectiveness of the proposed design waste trap in retaining and collecting rubbish and impact to the river as well as prevented floods will be known.

2. Materials and Methods

We conducted one FGD with 10 applicants for the research of this project. Some of the applicants are related to drain waste trap construction and others are community that agreed with the application. The selected applicants are of various age groups, gender, ethnicities, who very observant and concerned about environment.

Each FGD session lasted for 30-40 minutes and was guided by an interviewer. There were two sessions for applicants which is first session is interview and second session is questionnaire session. During the beginning of FGD session, interviewer asked all applicants to introduce themselves and brief a little what they knew drain waste trap about so that the session will be going smoothly. Open-ended questions were used to instigate the interview. The role of the moderator was to ask the questions only to stimulate the interview session and facilitate it. The applicants were encouraged to give their own opinions and point of view throughout the interview.

In the questionnaire session, a form had given to each of the applicants to answer the questions related to the project. The findings were divided into two different sections: who care about drain waste and who does not. Each discussion was audio-recorded and transcribed later. The faces of the applicants during the interview were also observed and considered. Last but not least, the date were coded, categorized, and analyzed by identifying the importance of drain waste trap. At the end of the interview, a token of appreciation was given to the applicants to thank them for their effort in this project in order for us to complete it.

3. Results

Drain Waste Trap Application survey of questionnaires were given out to 10 applicants for the FGD, all of them participated. The methods were assigned and was carried out for the requirements research. Characteristics and information of the participants are as stated in Table 1. The outcome of the Drain Waste Trap Application is divided into six themes – lifestyle and self-monitoring, education and awareness, motivation and commitment, attitude, social support and coaching and technology. These themes emerged from the responses of the

survey from the user requirements for the application system.

Table 1. Characteristics of 10 Participants

Characteristics	No.
Age (years):	
21 – 30	5
31 – 40	3
41 – 50	2
Gender:	
Male	6
Female	4
Ethnicity:	
Malay	5
Chinese	3
Indian	2

3.1 Lifestyle and Self-Monitoring

Five participants of this project mentioned that our lifestyle needed to be changed in order to manage and prevent the problem to occur. In many developing countries, drainage systems are chocked with litter and solid wastes. The people have little knowledge of the effects that can happen during a rainy or typhoon season. When heavy rain occurs, the drainage systems and sewer systems are flooded, and water finds its way into the streets and into people's homes. Education is therefore very important in this situation which is to inform and caution people about the dangers of floods, what causes floods, and what can be done to minimize its impact to the environment and river. A participant shared why he thought people have littering problems. *"Irresponsible people litter at public areas. Streets, parks, even by roadsides. The community looks worse because today, more irresponsible individuals litter, as it has become their habit. You will always see Malaysians litter, everywhere you go."*

All ten participants agreed for a proper education of preventing littering among the younger generation and also to adults with low sense of humanity and common sense. They shared that they were always on the look-out and were always observing if they spot any littering happening while taking a stroll or even just passing by a road. They changed their lifestyle by picking up litter and solid wastes, then discarding them whenever they see a rubbish bin nearby. Two other participants shared that they have become much more attentive to their surroundings. They were uncomfortable of the fact that their rubbish bins were full but not taken out yet, or even looking at small pieces of rubbish that was not thrown away properly.

A participant shared that she is now really taking care of her family's cleanliness. She tries to educate her children on littering and environmental care. She stated that her four-year-old son is now picking up random things on the street and throwing them into the nearest trash cans. She taught herself to always bring hand sanitizers and anti-bacterial wipes in her bag every time, just in case her son picks up random dirty things while going out. Slowly it became a very useful habit which can also be shared by the society with awareness.

In the long run, the study shows that commitment in self-management behaviorism is the maximum outcome influencing the success of improved environmental flood problem : managing a proper lifestyle and self-monitoring is essential in taking

responsibility for the society in preventing floods caused by littering in clogged drainage systems.

3.2 Education and Awareness

The participants acknowledged the fact that there was less awareness about the waste blockage problem causing drains to be clogged and the factors that causes this problem and with the dangerous water quality caused by pollutants in the open channel flows. Now, there is more awareness about the problem and managing the lifestyle. Presently, there are also more programs such as talks, forums and discussion sessions coordinated by the government as well as the non-government organizations to help educate the public and even expand the use of learning through mobile devices. The participants mentioned that even professionals and higher-ups are thoughtfully educating people regarding the issue of littering, separating wastes according to its' designated bins, what clogged drains can cause to the land and so on.

One of the participants mentioned these exact words: *"Attending talks expand our knowledge, watching them in a group expands our sense of connection and community. Not all talks may change your life, but you will still find one that can change your life in one way or the other."*

By attending these talks, participants are more observant and attentive of the way they get rid of their rubbish waste. An obsessive-compulsive disorder (OCD) participant said that there must be more awareness created among the younger generation. The participant mentioned: *"Littering is a thoughtless and selfish act. Kids nowadays should be attentive to their social surroundings. If they were, it would not have been a problem for exposure as well as creating awareness that we will be prone to flood if we keep doing what we are doing and don't take any measures to conceal the problem".*

3.3 Motivation and Commitment

There are a number of factors that provide towards the participants being motivated and giving full commitments to the application. They show that motivation and commitment are important to accept and adapt this new application. Commitment that we can obtain from this result is that the participants are attentive to what could happen in the future for example, if they do not care about the environment they are prone to have troubles during flash flood especially if their houses are involved. If they know about this application, they would be well prepared if the situation was bound to occur. One of the participant shared that: *Everyone in the society need to stay motivated to commit more and care about environment that we are living now. Without motivation and commitment, our environment is going to get worse and there is no future here for our children who deserves a clean place to play around and fresh air to breathe in.*

3.4 Attitude

Attitude is an essential theme in this research. Without good manners and attitude

towards the environment, it may lead to frequent flash flood happening. It is because of clogged drains caused by none other than the society itself. As one of the participant stated before *"Selfish and thoughtless acts may trouble us in the future."* If no one is wanting to change the attitude about taking care of the environment, the waste itself can spread diseases such as dengue which is a very rampant and worrying disease at the moment. Littering along the road, on the streets or by the bins, those chemicals and wastes can be washed and brought into rivers or sea that pollutes the waterways and it affects the aquatic life and its' environment.

3.5 Social Support and Coaching

From the result of the survey given out, six out of ten of the participants stated that this project and application needs more exposure and social support in order to give awareness and coaching to provide a drastic change and outcome towards the clogged drains problem. One of the answers that was received said that it could start off from family or even friends. They could start the coaching and give timely reminders about the awareness of flood and the uses of the Drain Waste Trap to prevent the society from the normality of littering.

One of the participant said: "Only a small number of people know about the exposure or the serious causes of floods and high chemical in water quality. This information could start off well from a small group, soon reaching out to a larger group for exposure". Another participant also shared that: "This could really save the amount of flood damages and even give an outcome of a cleaner environment. Not to mention a better water quality". Other participants shared that it is better to carry out the project first and get a confirmation of the result rather than assuming the possibilities of this application and device. Carrying out awareness about the importance of proper waste disposal from the citizens first was also recorded as an opinion in the survey as it was a better way of using the device efficiently for a faster result. By this way, they learn faster and efficiently to get motivated for a cleaner environment.

3.6 Technology

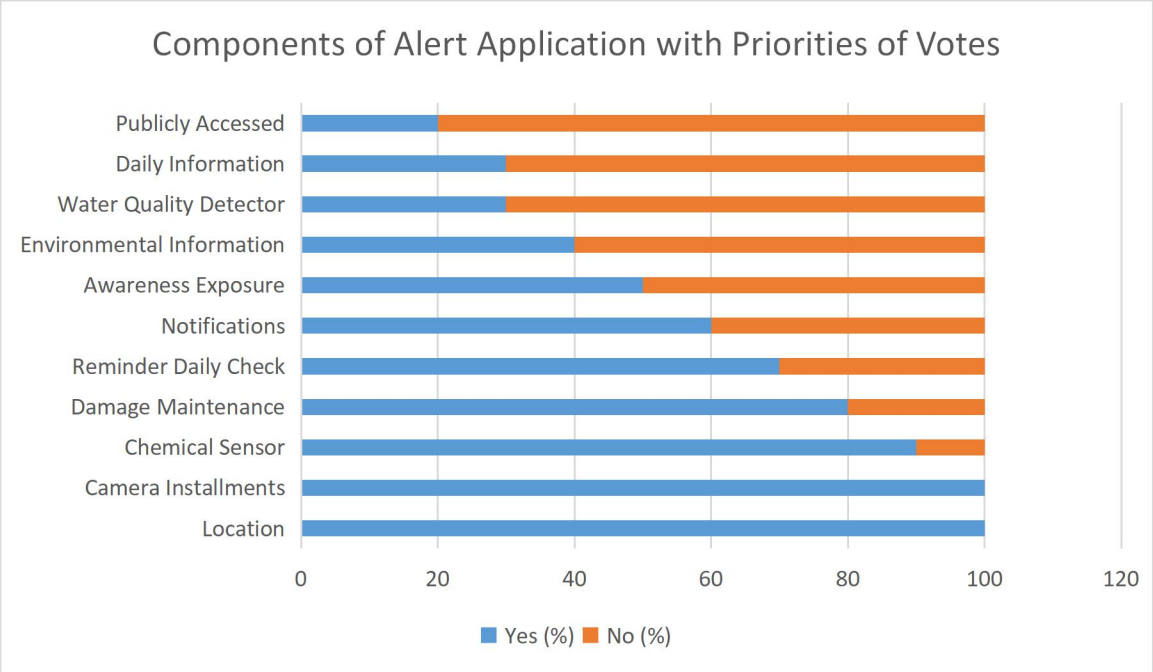
When technology was mentioned, most of the participants gave positive responses about the application combination with the trapping device. Although the application will not be connected to the public but instead higher authorities in regarding the update of the trap, involving the use of this modern technology was highly agreed upon as it is a faster responding way to be alert of the device. Instead, the citizens can comply by this project by downloading environmental disaster related applications from the Google Playstore or the Apple Store to read about the awareness on a daily basis. This was a suggestion made by one of the participants of the questionnaire: "I use my smart phone to read the causes of natural disasters and ways to prevent it from getting worse. It is actually very useful since it is on-the-go and you can learn about it anywhere at any time". Since the device application is created to alert the authorities regarding the condition of the traps at any location, the camera devices and detectors need to be applied at every trap

station with a link of its own to the application. This is to avoid any confusion of location and detecting the wrong data in order to do any physical checking when the detection reaches a red zone. A participant shared her viewpoint: “Nowadays, we do not read. Maybe we would if it is on the devices because most of us acquires a smart phone. So information can easily be accessed about this trapping device”. The participants said that the usage of smart phones and Internet or even applications often helps us in many ways. There are many self-care applications about the environment. It is found that some figures self-care applications should be multi-lingual so that many could use it. In addition, some mentioned that reminders regarding disposing trashes properly could also help this project improve in many ways.Components of the Proposed Drain Waste Trap Application: The participants highlighted the important components that they prefer in a alerted application by ranking the components. The priorities of the alerted application components have been divided to two votes: Yes and No. Priorities here means the most important to the least important components from the participant’s viewpoints. Table 2 shows the percentage of who voted for yes and no for each component. Figure 1 illustrates the comparison of each component between the two priorities.

Table 2. Priorities of participants on the alerting application of the Drain Waste Trap.

Components of Alert Application	Yes (%)	No (%)
Location	100	0
Camera Installments	100	0
Publicly Accessed	20	80
Notifications	60	40
Awareness Exposure	50	50
Reminder Daily Check	70	30
Environment Information	40	60
Water Quality Detector	30	70
Damage Maintenance	80	20
Daily Information	30	70
Chemical Sensor	90	10

Figure 1. Comparison between votes of Yes and No for the Components of Alert Application for the Drain Waste Trap.



Based on the participants' choices and votes, the location and camera installments stays as the top priority compared to the other components. Then, followed by chemical sensor as the second most agreed components, damage maintenance, reminder daily check, notifications, awareness exposure for the public, environment information, water quality detector and the daily information with the same results and lastly publicly accessed with the least amount of votes for yes. The same decreasing manner goes on for the votes of no. The lowest result for No as stated in the chart is for the components of publicly accessed. Followed by the same votes for daily information and water quality detector, environment information with 40% votes for no, awareness exposure, notification, remainder daily check, damage maintenance, chemical sensor and lastly with no votes of disagreement, camera installments and location. It is interesting to note that notification is not being considered as one of the top priority for the components along with the 100% votes for location and camera installments. Location, camera installments and chemical sensors are chosen as the top priorities because it requires to be the most important features in an application. It is personalized for each trap and also to keep track of the condition and situation of the waste trap while monitoring it visually from the application by using the camera installments. To not get confused of each whereabouts of the trap, they each will be provided with a location system to detect which section will be experiencing damages. Publicly accessed was the least in the priority because the participants find that this information and application is more important for the authorities compared to the exposure to the public. It is governments duty to keep

track of the process. Besides that, daily maintenance and daily reminder check are in the top priorities as the condition of the traps and sensors have to be in good condition in order to run without any errors. Lastly, it is also seen that the daily information and water detector as one of the least priorities before publicly accessed as they are irrelevant information needed.

4. Discussion

These FGD results highlight that majority of the participants would like to use technology as the main component of the application for the device to reduce the occurrence of flash floods due to clogged drainage systems. All the participants agreed with a unanimous vote for the use of location and camera installments which can be monitored through the application easily.

Majority of the society are not aware of the possibilities and how frequent flash floods occur during heavy rain seasons. They tend to bat an eye on the fact that even the slightest action of littering can comply to the phenomenon of natural disasters when they are the ones who can prevent it from happening. It is also known that even when they realize the action is wrong and have been urged about the circumstances, society still would not change their attitude to enhance the beauty and cleanliness of the environment. With the existent of the application as agreed by the applicants, this may help to induce some humanity and attitude into the society. For these reasons, we strongly believe that this application with the assigned components will be a stepping stone to prevent flash floods and increment of rubbish surrounding the environment. This is because the application is assigned to higher authorities and once the result can be seen, the citizens will then realize once more the comfort-ability of living in a clean environment.

Chemical sensors will be helpful in detecting data of pollutants and high chemical reading of the water flow. This can help to increase the water quality in river flows and open water after passing the drainage systems. In order to do this, a sensory detector will be placed at the water level of the channel and will give a reading pop up at the application about the condition of the water. On another note, none of these devices can function well if it is frequently damaged. With this, damage maintenance is important to always keep the devices in the traps in the good condition to allow smooth process during emergencies. Any failure could show that the application is not well prepared for exposure and will cause more trouble and errors to clear up. With this, damage care is one of the most frequent and agreed components that the applicants chose.

Since sometimes damage checks might be neglected, the reminder daily check would be the key to this process. Daily, the authorities will be notified to have a physical check to every section location every day in order to prevent any damage from happening. Not only that, in relation to these communications with the authorities, notifications are also to be known as a main connection. In any circumstances, a signal or notification will alert whenever the weight capacity reaches its limit, when the water quality is too high, or when there is a detection of unwanted living creatures located

in the trap. It will also notify whenever a checking is due or any damage happens.

Awareness exposure and environment information could also be categorized together as a way to expand the society's knowledge on the environmental issues as well as natural disasters. These information and features will help them to keep track of the surroundings and manage their littering more efficiently.

As for the idea of making this application publicly accessible, they did not show much interest as they said that the idea is only suitable for the use of the authorities regarding the Drain Waste Trap. If a person is not interested, then it would be difficult to change their opinion. Despite getting positive feedbacks on the idea of developing the application, about 20% of the participants showed less interest in the existence of the application. This is either because they are not technology savvy and do not own a smartphone or because they do not care about the surrounding issues that have been going on.

5. Conclusion and Future Work

Collecting the feedback on the idea of developing a trash trap application and their requirements for the application is essential to understand the needs and expectations of the target users so that a good trash trap application can be designed for them to keep track of the drainage system around them independently. Even though our Focus Group Discussion (FGD) study is based upon a small sample size, it provides us valuable insight into the participants' lifestyle, awareness on flood by littering, and how they get motivated to change their behavior. These insights help greatly to determine their expectations towards the currently available web technologies to take care of the environment.

The Focus Group Discussion study results supports our hypothesis that a trash trap application is a suitable tool in assisting the trash trap to prevent flood from happening. Our study also indicates that usage of technology is low among elder people but not all of them. Only a certain amount. Some from the group are technology smart. The outcome of this FGD will be used to develop a framework which integrates theories to design a trash trap application for the original trash trap created by Dr Shukur Bin Abu Hassan.

6. Acknowledgement

We are really grateful as we managed to complete our assignment within the time given by our lecturer, Professor Madya Dr Nor Azman Bin Ismail . We would also like to thank Dr Shukur Bin Abu Hassan for letting us build the brains of his original 'Trash Trap' project. This assignment would not have been completed without the effort and co-operation from our group members, Aimi Binti Rusdi, Nurul Najiha Binti Hamdan and Aqilah Hanim Binti Mohd Taufik. We also sincerely thank our lecturer, Professor Madya Dr Nor Azman Bin Ismail, for his guidance and encouragement in finishing this assignment. Last but not least, we would like to express our gratitude to our friends and respondents for the support and willingness to spend some time to fill in our questionnaires.

7. References

1. Shukur Abu Hassan, July 2008, *Effectiveness of Rubbish Traps in Open Channel Flow*, 6th Seminar on Water Management (JSPS-VCC).

2. Gary Hopkins, Mark Kirves, Summer 2006, *Storm Water Systems.*

3. Fattiha Ishak, Mohd Jahaya, Ir. Junadi Apandi, Juliza Abu Bakar, Muhamad Khairul, 2019, *The Effectiveness of Proposed Design of a Rubbish Trap System(Roll&Trap Gate).*

4. Zulfadhli Zulkifli, May 2019, *Malaysia flooded with plastic waste to send back some scrap to source*, New Strait Times, Reuters.

5. Metrro News, July 2019, *RM 500,000 to Install Rubbish Traps to Prevent Flood* The Star Online.

6. Lariyah MOHD SIDEK, September 2014, *A Study on Effectiveness and Performance of Gross Pollution Traps for Stormwater Quality Control for River of Life Project*

7. 2019, Arduino Website, *What is Arduino?* https://www.arduino.cc/en/guide/introduction

8. Jeremy Shiffman, Kathryn Quissel, Hans Peter Schmitz, David L. Pelletier, Stephanie L. Smith, David Berlan, Uwe Gneiting, David Van Slyke, Ines Mergel, Mariela Rodriguez, Gill Walt, *A Framework on the Emergence and Effectiveness of Global Health Networks,*- American University, Washington DC.

9. Mohd Nizam bin Othman, *April 2009, Design and Development of Waste Trap and Removal System for Monsoon Drains Application Using PLC - Based System* - Universiti Teknikal Malaysia Melaka.

10. Jordan Coombe, September 2019, *Netted Drainage Network*, Twitter.