

Development of a Web-based Water Supply Complaint Management System

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HIGHLIGHTS

- Having a clean water supply distribution is a must for any community across the world. Late response towards water supply problems can lead to health and financial issues.
- A web-based system was designed and developed to replace manual or inconsistent methods of accumulating public complaints towards local authorities.
- Complaints' statuses are also updated to users using Short Messaging Service (SMS) which is useful for limited mobile network coverage areas.
- Most participants concur that the proposed system can assist local authorities serve communities more quickly by responding to their needs.

ABSTRACT

Every neighbourhood must have access to clean water supply. Disturbances in the water supply may have negative effects on both the economy and public health. Currently there are various methods of filing a complaint to the local water supply distributor. Improper management of these complaints lead to slow responses to affected area, causing displeasure among the users. The aim of the research is to design and develop a web-based Water Supply Complaint Management System to assist users to file complaints related to water supply issues. The system was also designed to assist local authorities or water supply distributor company to properly manage complaints to act quickly. User acceptance testing is used to evaluate the proposed system after it has undergone numerous functional tests. The system was developed using the System Development Life Cycle (SDLC) and the waterfall model was chosen for the methodology. Thirty respondents from Sibu, Sarawak, were chosen to participate in the testing phase and were asked to complete questionnaires that were divided into four categories, including user interface satisfaction, ease of use, usability, and functionality. According to the results of the evaluation, most of the respondents gave positive feedbacks towards the overall functionality of the proposed system. Therefore, it is hoped that all features provided by the proposed system will benefit all users, particularly those who frequently have water supply related issues in their community.

Keywords: clean water supply, public complaints, community service, web-based system



INTRODUCTION

Our health, communities, and economy all depend on clean water. To have healthy populations downstream, we needed clean water upstream. Rivers, lakes, bays, and coastal waters are all dependent on the streams and wetlands that supply them. Every day, everyone on the planet was expected to require 20 to 50 litres of clean and safe water supply (Khalifa & Bidaisee, 2018). The process of supplying water by governmental utilities, commercial organisations, community activities, or individuals, is usually through a system of pumped and pipes, known as water supply. Continuity of supply, water quality, and water pressure were all aspects of service quality. In different countries and regions, institutional responsibility for water supply was organised differently. It usually deals with policy and regulation, as well as service delivery and standardisation. In Malaysia, there are various methods for filing a complaint and it is different across each state. For example, some states use Telegram channels to disseminate information regarding scheduled maintenance or to provide a platform for public to file a complaint for various water, electricity or any issues related to the community. Subsequently, public complaints typically covered a wide range of life goods and services that they had either used or purchased, including food, friends, jobs, housing, public transportation, and weather forecasting (Afify & Kadry, 2019). Dissatisfaction had always been a part of human nature, and certain people are particularly good at complaining. Previously, complaints were being filed via phone calls, which was not a reliable method (Suresh, Nashim, Thomas & Manuel, 2019).

An effective complaint management system is a skill that could be learned and improved through proper preparation and experience from the authorities. The widespread use of the Internet as a communication tool today has the potential to help narrow the gap between the people and the government. Utilizing an appropriate information system can offer users additional advantages, such as the capacity to identify and categorise each complaint in accordance with its severity level, the removal of fraudulent complaints, and the ability to receive complaints outside of regular business hours. Subsequently, online complaint or known as online complaint management system (OCMS) was a web-based system for resolving public complaints, saving time and reducing corruption (Nasr & Alkhider, 2015). An article by Aezion (2020) mentioned the adoption of web-based solutions in most firms results in the streamlining of corporate operations. Workflow-based solutions could frequently replace paper-based operations. Improvements in company processes could result in increased staff productivity and lowered cost.

Therefore, the aim of this research was to develop a web-based Water Supply Complaint Management System to assist users who were experiencing water supply issues. The system also informs the user that the complaints had been forwarded to responsible authorities, with added function such as receiving updates using Short Message Service (SMS) service. Local authorities can manage all complaints, thus enables them to respond more quickly. Moreover, users would also get news or information about when there would be water disruptions from the system, so they could prepare in advance.

LITERATURE REVIEW

Related works

This section discussed and described past studies conducted by other researchers on the topic of Water Supply Complaint Management Systems.

Electronic Complaint Management System for Municipal Corporation



Sudhir, Regina and Sajidabhanu (2015) created a web-based system called Electronic Complaint Management System (ECMS) which its major goal was to assist members of the public who were experiencing various challenges in their communities. Public complaints regarding public infrastructures, such as water supply, electricity, waste disposal or even public roads were chosen. This project had the ability to bridge the gap between citizens and the government. It had the ability to control unethical bribing work while also reducing processing time. This project entailed big problem-solving modules that served as the best remedy for incoming large-scale concerns. The time solution varies depending on the type of complaint and category. To avoid receiving anonymous complaint details, users were required to provide their contact information while filing a complaint. Meanwhile, the separation of system's functionality into layers was described by three detailed tiers that could be housed on a physically different computer is deemed suitable for both web and distributed applications.

Electronic Customer Complaint Management System (e-CCMS)

Meanwhile, Afify and Kadry (2019) proposed an electronic Customer Complaint Management System (e-CCMS) to deal with customer complaints and to be able to reduce additional similar complaints by including them as part of controlling the quality of service or goods offered. The researchers discovered WSDM (Web Site Design Method) as an appropriate model for creating e-complaint web services and combined it with Service-Oriented Architecture (SOA) standards and concepts. The researchers also divided the proposed model into three tiers to enable it handling complaints which were Storage-tier, Business-tier, and Presentation-tier. Five modules were identified as part of e-complaint cycle. The paper also proved that using SOA standards and concepts can help to transform how authorities address public complaints via e-government solution.

METHODOLOGY

Figure 1 below shows the overview of methodology used in this research. There is a total of six phases including planning, analysis, design, implementation, testing, and documentation phase.

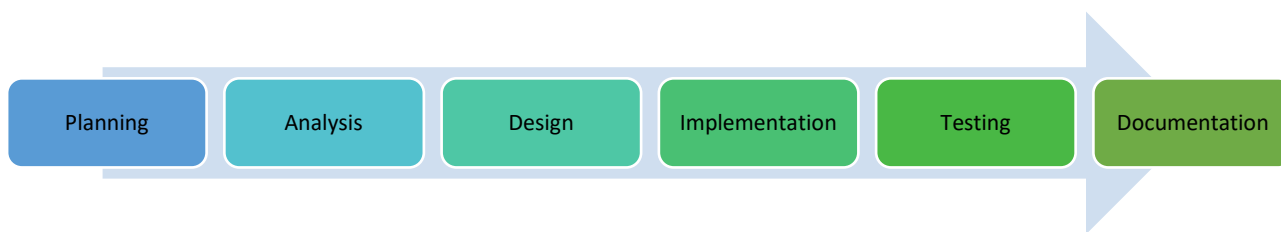


Figure 1: Methodology

The initiation part of the project begins with the planning phase. The area and title of the project has been discovered, including its objectives and context. The necessary prerequisites for building the system are derived from a literature review of different journal articles, conferences, and academic resources. Next is the design phase which involved designing the flow of the system as well as the user interface concept based on knowledge gathered from the previous phase. The development phase involves building the actual code based on various diagrams and interface mock-ups. Next, the testing phase is a mandatory phase to ensure the proposed system runs smoothly without errors and reach its intended purposes. The motive of the user acceptance testing is to get feedbacks from real users so improvements can be made. Before articulating discussions, testing results are finally recorded and assessed during the final phase so that they



can be thoroughly documented in the form of a report.

System Architecture

Figure 2 shows the system architecture for the proposed system.

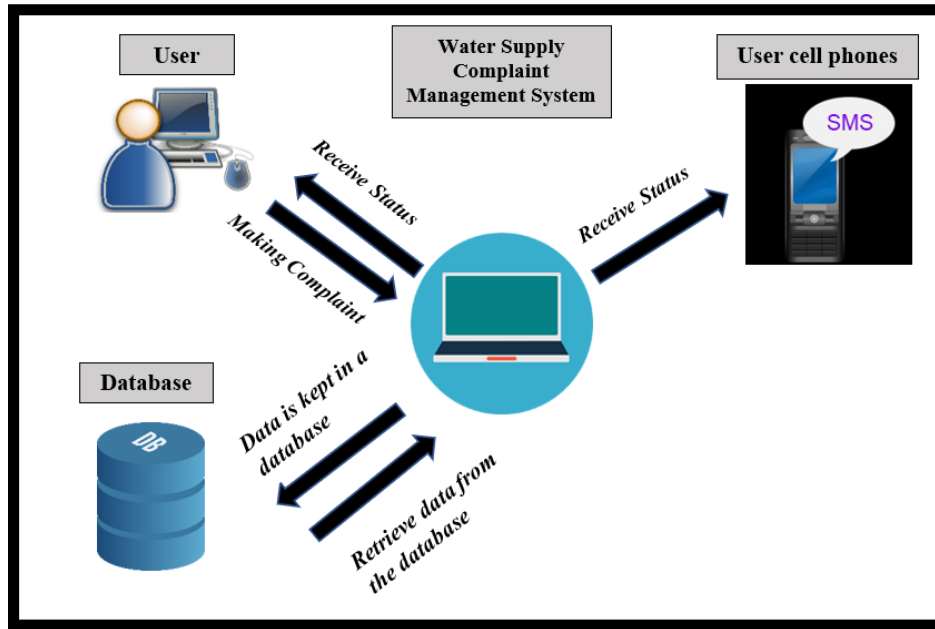


Figure 2: System Architecture for Water Supply Complaint Management System

The design of the proposed system involves setting up the actual online database in which details of the complaints can be recorded properly. Users must first register to enable them to file a complaint. After a complaint is successfully submitted, users can simply log into the system to check for the complaint status or progress. In addition, users can also receive a text message related to progress update. The admin can log in from the administration side to see the dashboard, which includes options to view all submitted complaints and modify the status.

The system is created using the Bootstrap CSS framework for the front end, while PHP is used to create the project's back end. To assist with SMS notification, a messaging system API is also incorporated into the code.

DEVELOPMENT

This section briefly explained some key important aspects of development of the Water Supply Complaint Management System. The two primary parts of the system are the user side, where complaints are registered, and the administrative side, where complaints are handled in accordance with requirements and priorities. Using an online database is important to ensure the data is secured and accessible for authorized users only. The design and development aspects of the system's designated function are thoroughly detailed in the next section.



Update SMS (Short Message Service) Page

The snippet of source code for the Update SMS (Short Message Service) page is shown in Figure 3. SMS updates are used to keep registered users up to date on the status of their complaints. The MessageBird API was utilised to create this page. MessageBird is a firm that provides communications platform-as-a-service (CPaaS). Through a REST API, MessageBird's SMS API allows researchers to send and receive SMS messages to and from any country in the world. Users can always verify the status of a message using the supplied URL because each message is identifiable by a unique random ID.

```
1
2 <?php
3 session_start();
4 include('include/config.php');
5 if(strlen($_SESSION['alogin'])==0)
6 {
7 header('location:index.php');
8 }
9 else{
10 date_default_timezone_set('Asia/Kolkata');// change according timezone
11 $currentTime = date( 'd-m-Y h:i:s A', time () );
12
13
14 ?>
15
16 <?php
17 require_once 'vendor/autoload.php';
18 if (isset($_POST["submit"])) {
19     $receiver = $_POST["receiver"];
20     $subject = $_POST["subject"];
21     $msg = $_POST["message"];
22
23     $messagebird = new MessageBird\Client('r2NU9Vprj0kKQj18os0vjctyI');
24     $message = new MessageBird\Objects\Message;
25     $message->originator = '+60143156312';
26     $message->recipients = [ $receiver ];
27     $message->body = $msg;
28     $response = $messagebird->messages->create($message);
29     var_dump($response);
30 }
31 ?>
```

Figure 3: Coding for Update SMS (Short Message Service) Page

The administrator of the system can use the Update SMS page to inform users about the latest status of their submitted complaint, as well as to send warning messages regarding water disruptions or scheduled maintenance. Therefore, this function can help to notify users even if they are located at remote places with poor Internet connection. As a result, users will be able to make plans, including conserving water. Figure 4 illustrates the actual look of the Update SMS interface, while a preview of sent SMS content in a smartphone is shown in Figure 5.



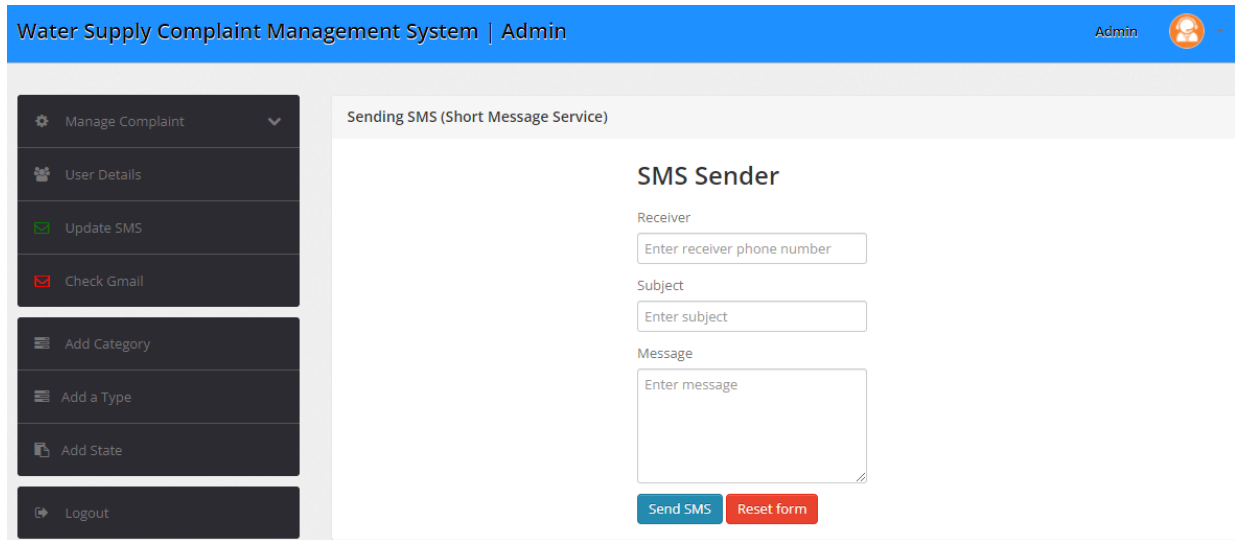


Figure 4: Update SMS Page Interface

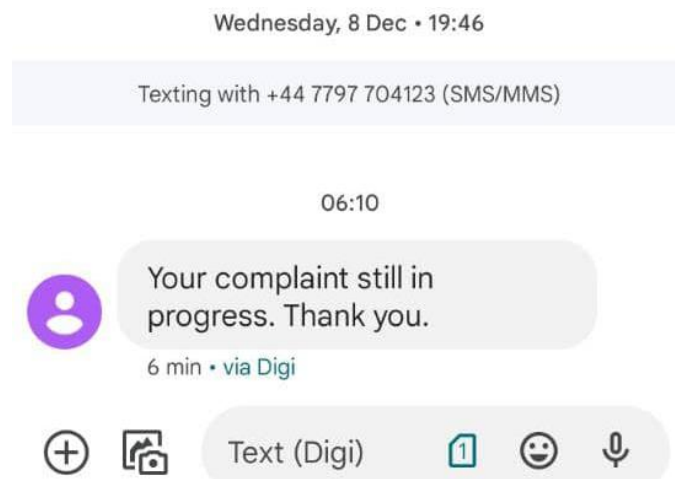


Figure 5: A preview of sent SMS on a smartphone

Complaint Status Page

After a user successfully registered into the system, he or she will be able to file a new complaint and then access the Complaint Status Page. Users can file more than one complaint and the system will display the list of complaints along with details such as complaint number, date and time submitted and current status. In addition, users can also click on "View Details" button to see the detailed view of a specific complaint. Figure 6 shows the interface mock-up design for the Complaint Status page and its actual interface is shown in Figure 7.



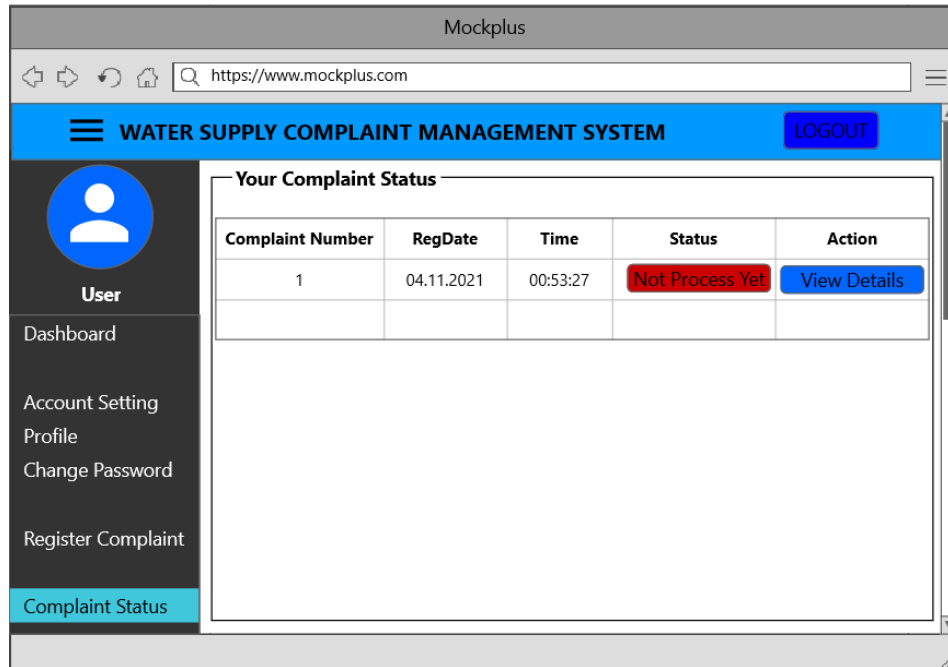


Figure 6: Mock-up Design of Complaint Status Page

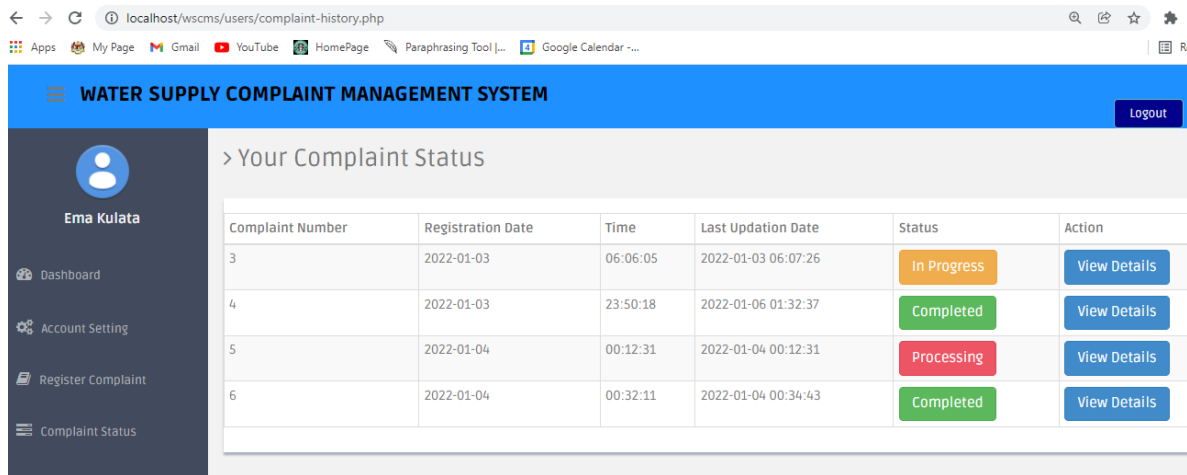


Figure 7: Actual Interface of Complaint Status Page

FINDINGS AND DISCUSSIONS

This section discussed the findings of this study. Before performing user acceptance testing, functionality testing was performed first to ensure all key components or modules of the proposed system worked properly.



Functionality Testing

Functional testing is a test that looks to verify if each system feature meets the software's requirements. Each function's output is checked against the related requirement to see if it meets the end user's expectations. Table 1 shows a part of functionality testing conducted before User Acceptance Test.

Table 1: Partial content of Functionality Testing

Item	Action	Expected Output	Result	Comments
1	Sending SMS to target phone number	Target phone number will receive SMS containing complaint status update	Success	Limited to one device for testing
2	Update status of user complaint (as Administrator)	Status of user complaint can be updated/changed within Manage Complaint page.	Success	
3	View profile of user / account	Users can view their details when clicking on Account Settings >> Profile using navigation bar on the left	Success	

User Acceptance Testing

Analysis of User Interface Satisfaction

The respondents were asked to score the system on a scale of one to five, with strongly disagree, disagree, neutral, agree, and strongly agree to be the most common responses. The scale of the usability testing questionnaire is depicted in Table 2. The mean was calculated using the respondents' input and a rating system ranged from one to five.

Table 2: User Acceptance Test Questionnaire Scale

1	2	3	4	5
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Table 3: Mean for User Interface Satisfaction Category

1. Interface for this system is simple to recognize.	1	2	12	15	4.36
2. The text is easily accessible and understandable.			13	17	4.56
3. The characters on this system's interface are clear to read.			13	17	4.56
4. The terminology used is the same throughout the system.		4	16	10	4.2



5. The system provided error messages that clearly explained how to resolve problems.				16	14	4.46
TOTAL MEAN						4.42

According to the results, Question 2 and Question 3 had the highest mean scores in the User Interface Satisfaction category, which is 4.56. Nevertheless, Question 4 has the lowest mean results with a mean score of 4.2. As a result, based on the total mean of 4.42 in Table 3, it can be concluded that the participants were satisfied with the system's user interface because the characters and alert messages used throughout the system were understandable and helpful, and the system's interface was manageable and simple.

Analysis of Usefulness and Ease of Use

Table 4 displays the results of the respondents' responses to the question concerning usefulness and ease of use. The mean was derived using the respondents' responses and the ratings on a scale of one to five.

Table 4: Mean for Usefulness and Ease of Use category

6. Using this system, it reduces my time to make a complaint about the water supply.				15	15	4.5
7. I can quickly learn how to use this system.				17	13	4.43
8. I think this system is very helpful.				17	13	4.43
TOTAL MEAN						4.45

According to the results, all the questions had a mean value which is greater than 4.0. However, Question 6 has the highest mean result, which is 4.5, while the other two questions have the lowest mean result of 4.43. The total mean for the second category of Usefulness and Ease of Use is 4.45. As a result, the Water Supply Complaint Management System was found to be simple to use and convenient.

Analysis of Usability of the System

The question concerning the usability category is shown in Table 5, depending on the participant's response. The average was derived using the respondents' input and a rating system of one to five.

Table 5: Mean Result for the Usability of the System

9. In this system, I can easily navigate from one page to the other page.				16	14	4.46
10. This system contains all the features I expected.			1	18	11	4.33
11. It is simple to locate information in the system.				18	12	4.4
12. I found the system's several functions were well integrated.				22	8	4.26



TOTAL MEAN	4.36
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The highest mean result for Usability of the System category is Question 9 with a mean result of 4.56 while Question 12 has the lowest mean result of 4.2. The overall mean was calculated using the data obtained, and it was found to be 4.36. Therefore, it shows that the respondents agreed that the Water Supply Complaint Management System was simple to be used and that it aided respondents in completing tasks when they were assessed.

Analysis of Functionality of the System

Table 6: Mean Results for Functionality

13. Update the latest progress status of customer complaints in the system, as well as using SMS to do so, is necessary.			1	17	12	4.36
14. I found that the SMS notification system is beneficial to the users.				18	12	4.4
15. Overall, I am satisfied with the system's functionality and use.				19	11	4.36
TOTAL MEAN						4.37

Table 6 shows the findings of the functional analysis. According to the data compiled, all questions had achieved mean value greater than 4.0. However, Question 14 has the highest mean result, which is 4.4, while the other two questions have the lowest mean result with mean results of 4.36. The total mean for the last category is 4.37. As a result, it can be verified that updating the system's newest progress status of customer complaints by using SMS, is useful and beneficial to the respondents.

Result Summary

Table 7 displays the four major categories used in survey instrument for the user acceptance testing, as well as the respective value of average mean for each category.

Table 7: Summary Result from Questionnaire

User Interface Satisfaction	4.42
Usefulness and Ease of Use	4.45
Usability	4.36
Functionality	4.37

According to the findings, the Water Supply Complaint Management System was evaluated in four categories which are user interface satisfaction, usefulness, and ease of use of the system, usability, and functionality. Most respondents agreed that the user interface, functions of the proposed system, and ability to update the status of user complaints in real-time as well as support for SMS notifications were all satisfactory. This is because the total mean results for all four categories were greater than 4.



CONCLUSION AND RECOMMENDATIONS

As a conclusion, the Water Supply Complaint Management System was able to assist users in making proper complaints related to water supply problems in the community conveniently. Furthermore, using the proposed system, users can view all submitted complaints and their status by logging into the system or via SMS notification. SMS notification is considered essential for areas with limited Internet coverage. Our daily lives depend on having access to clean water, so it is critical that local authorities act immediately whenever a water problem arises. For recommendation or future work, a better user interface is needed to improve the users experience while using this system as suggested by few respondents. For example, a few users would also love to have multiple languages support for the system.

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CONFLICT OF INTEREST DISCLOSURE

All authors declare that they have no conflicts of interest to disclose

REFERENCES

- The Benefits of Web-Based Systems for Business. (2022). Retrieved 27 August 2022, from <https://www.aezion.com/blogs/the-benefits-of-web-based-systems-for-business/>
- Afify, E. A., & Kadry, M. A. (2019). Electronic-customer complaint management system (e-ccms)—a generic approach. *International Journal of Advanced Networking and Applications*, 11(1), 4125-4141.
- Khalifa, M., & Bidaisee, S. (2018). The importance of clean water. *Sch J Appl Sci Res*, 1(7), 17-20.
- Nasr, O., & Alkhider, E. (2015). Online complaint management system. *International Journal of Innovative Science, Engineering & Technology*.



Sudhir, B., Regina, B., & Sajidabhanu, (2015). Electronic Complaint Management System for Municipal corporation. *Communications on Applied Electronics*, 2(8), 8–11.
<https://caeaccess.org/research/volume2/number8/sudhir-2015-cae-651817.pdf>

Suresh, A., Nashim, KN., Thomas, B. & Manuel, N. (2019). IoT based public water complaint management system. *International Journal of Networks and Systems*, 8(3), 50–54.
<https://doi.org/10.30534/ijns/2019/13832019>

