

# Web-Based Public Street Lighting Complaint Application with Realtime Whatsapp Notification Using Prototype Method in Pemalang Regency

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**Abstract** - Public Street Lighting (PJU) plays an important role in transportation infrastructure, especially at night. Currently, complaints about PJU damage are only made using social media. This research designs and builds a web-based PJU complaint system with real-time notifications via WhatsApp in Pemalang Regency. Data was collected through interviews, observations, and questionnaires. This system is built with PHP and MySQL, with WhatsApp notification integration to ensure accurate and real-time complaint information. The system trial involved the community, showing the system's effectiveness in increasing reporting efficiency and officer response. The system provides easy online reporting and real-time notifications via the website and WhatsApp. This system is expected to improve community services and PJU management. The results can be a reference for the development of similar systems in other areas.

**Keywords** - Sistem, Pengaduan, PJU, Web, Notifikasi Real-time, WhatsApp

## 1. INTRODUCTION

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The margin Public street lighting is a very important facility in people's lives, because it functions to provide sufficient lighting at night so that activities on the highway can run smoothly and safely. Public street lighting is also an important factor in supporting traffic safety and security on roads [1], [2], [3]. However, we often experience problems with public street lighting that is not functioning properly, such as street lights that are dead or dim. Problems like this can cause inconvenience to road users and have a negative impact on traffic safety. [4], [5], [6], [7]. Therefore, we need a public street lighting complaint system that can make it easier for the public to report these problems and make it easier for the government or related parties to manage complaints from the public. Previously complaints were only made via social media platforms. one of the weaknesses that can be identified is that complaints are only made via social media [7], [8]. Although social media provides a wide platform for sharing information, complaints via social media have several disadvantages that need to be addressed [9], [10].

First, complaints via social media are often not centralized and difficult to track. People who report public street lighting problems via social media can spread across various platforms, such as Twitter, Facebook or Instagram [11], [12]. This causes difficulties for the government in monitoring and responding to complaints efficiently. Apart from that, it is also difficult for the

public to know the status and progress of their complaints because there is no official mechanism to manage these complaints [13]. Second, complaints via social media often lack structure and do not follow a clear process. People may post complaints or street lighting problems randomly without a consistent format. This makes managing and handling complaints more complicated and difficult to do effectively [14], [15], [16]. In some cases, these unstructured complaints can be missed or overlooked. Third, complaints via social media tend to be less transparent. Although some governments or agencies may try to respond to complaints via social media, the information provided is often incomplete or difficult to access for society as a whole [17]. The public does not have sufficient visibility into the handling of street lighting problems and often loses trust in the existing complaint system.

## **2. RESEARCH METHOD**

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### *2.1. Complaint Application*

A complaint application is an application or application designed to help the public report various problems or complaints related to public services or public facilities [15]. The main aim of developing a complaint application is to make it easier for the public to provide reports or complaints effectively and efficiently, so that problems or complaints that occur can be immediately followed up by the authorities. With this complaint application, it is hoped that the public can more easily and quickly report problems that occur, so that they can make a positive contribution in improving the quality of public services and creating a better and safer environment for the community [17].

However, in developing this complaint application we must also pay attention to the security and privacy factors of public data so that it is not misused by irresponsible parties. The use of technology in complaint applications allows people to report problems or complaints online via websites or applications, so that they no longer need to come to the office or public service location. Apart from that, complaint applications can also facilitate authorities in managing and processing reports or complaints more effectively and efficiently. With the complaint application, it is hoped that public services will be created that are better and more responsive to the needs and expectations of the community.

### *2.2. Real-time notifications*

Real-time notifications are a very important feature in modern internet-connected applications. This feature allows users to receive information or notifications directly or in real-time when an event or occurrence occurs, such as complaints submitted in the complaint application [12], [14]. In the context of public street lighting complaints, the real-time notification feature is very helpful in speeding up the response of relevant officers in handling public street lighting problems reported by the public. With real-time notifications, officers can immediately follow up on incoming reports and take the necessary actions to resolve the problem.

### *2.3. Web-based systems*

Web-based systems refer to the use of web technology in building a system or application. Web-based systems utilize the internet and the HTTP (Hypertext Transfer Protocol) protocol to connect users with applications running on servers [14]. In the context of this final project, the public street lighting complaint system uses a web-based approach, where users can access and submit complaints via a web interface accessed via a browser. This approach allows users to easily access the complaints system via devices with an internet connection, such

as computers, tablets, or smartphones. Implementation of a web-based system in this final project will involve the use of web technologies such as HTML, CSS, JavaScript, as well as relevant frameworks or web development platforms. Therefore, a deep understanding of web-based systems will be a relevant theoretical basis in developing a web-based public street lighting complaint system using real-time WhatsApp notifications. Relevant references regarding concepts, principles and technology related to web-based systems will form the theoretical basis needed to develop a complaint system in this final assignment. In the next section, we will explain further the basic concepts and principles of web-based systems which will be used as the theoretical basis for this final assignment.

#### 2.4. *WhatsApp API*

WhatsApp API is an application programming interface (API) provided by WhatsApp, which allows developers to integrate WhatsApp features into the applications they build [8]. With the WhatsApp API, developers have access to various functions provided by the WhatsApp platform, such as sending text messages, images, videos, as well as processing voice and video calls. This allows developers to create applications that can perform a variety of tasks, from marketing to customer service, using WhatsApp's extensive and popular communications infrastructure.

#### 2.5. *Blackbox Testing*

Blackbox Testing, also known as behavioral testing, is a phase used to test the smoothness of a system that is built with an emphasis on the functional requirements and specifications of the system. This test is important to do to avoid errors when running the program that has been created. Blackbox Testing focuses on application functional specifications, collecting input states and carrying out program functional testing (Siadari, 2018).

Reporting from the official Dicoding website, the following are the advantages of using Blackbox Testing :

- a. Testers don't really need to understand the system's programming language
- b. The test is conducted from the user's perspective.
- c. Unbiased, because testers and developers are not related.
- d. Testers don't need to check the code.

Apart from having advantages, Blackbox Testing also has disadvantages. The following are the disadvantages of Blackbox Testing:

- a. Errors may go undetected due to lack of accuracy or skill.
- b. Some parts of the backend have not been tested at all.
- c. The possibility of testing is carried out again by the programmer.

#### 2.6. *User acceptance testing (UAT)*

User acceptance testing (UAT) is the final and crucial testing stage in the four stages of software testing that are commonly carried out. UAT aims to ensure whether the system meets user needs and can support all business and user scenarios. This stage is carried out by clients and end users. UAT testing is closely related to payments made to software developers. The testing process using UAT involves checking and testing the results of the work to ensure that the requirements document has been implemented in the application features being tested. Apart from that, it is also tested whether all the elements contained in the application can meet the user's needs.

### 2.7. Data collection

Data collection is an important thing in research where this data is used as a source for conducting research. During the research process, there are techniques or processes used by the author to analyze data and explore solutions to the problems envisioned by the author. The procedures used by the author to collect data are:

1. Observation. Observation is applied as an initial stage in the data collection process. The author was actively involved in direct observation, with the aim of recording every detail related to the implementation of public street lighting complaints. Through this observation, the author can gain direct and in-depth insight into the situations and conditions that arise in the implementation of the complaint. This process provides advantages in documenting behavior, interactions, and environmental dynamics that may not be revealed through other data collection methods.
2. Standard Operating Procedure (SOP). Standard Operating Procedure (SOP) is a guide or procedure that has been established by related parties to carry out an activity in a standardized manner. In this research, the author uses the SOP that has been established by the Pemalang Regency Government. The SOP regulates the steps that must be taken in the process of collecting data on incoming public street lighting complaints through applications that have been created by researchers. SOP includes stages of complaints, handling complaints, recording data, and reporting complaint results. The steps involved in installing street lights are:
  - a. Street light installation and repair plans
  - b. Proposal
  - c. Surveys
  - d. Prepare facilities and infrastructure
  - e. Recap of technician attendance
  - f. Installation of lights on roads
  - g. Street light repair
  - h. Prepare work results reports
3. Interview. The interview method was carried out through verbal questions and answers between the researcher and the resource person. Interviews were conducted with Mr. Uri, a resident from one of the villages in Pemalang Regency, and with related managers who play a role in managing public roads in Pemalang Regency. The purpose of this interview is to obtain data related to designing web applications using real-time notifications via WhatsApp, as well as understanding the views and experiences from the perspective of users and related management. Before conducting the interview, the researcher had made preparation by making an appointment to meet with Mr. Uri and the relevant management separately. Interviews were conducted using previously prepared question guides. The interview with Mr. Uri will focus on users' understanding of the public road lighting complaint system that is being developed, while the interview with the relevant management will focus on aspects of public road management, related policies, as well as views and hopes for the complaint system that will be designed. Apart from interviews, researchers also carried out direct observations at the location to see the condition of public street lights and related data. These observations will provide relevant information to understand the problems and needs that exist in developing a public street lighting complaint system. By using this interview and field observation method, researchers can obtain valid data and can support the design of web applications with real-time notification integration via WhatsApp. Data obtained from interviews and field observations will be an important basis for developing a responsive complaint system, in accordance with

community needs, and taking into account the perspectives of users and related management in Pematang Regency.

## 2.8. Prototyping Model

Based on data from the table of questions and answers obtained from sources, the following are the conclusions for each step in the prototyping method for developing public street lighting complaint applications:

### 1. Gathering User Requirements

Public:

- Users can see all incoming complaints
- Users can add Complaints. Users can receive notifications via WhatsApp after inputting a complaint.

Admin:

- Admin can manage complaint types
- Admin can manage incoming complaints
- Admin can manage officer accounts
- Admin can print all complaints

Officer:

- Officers Manage complaints coming in from the public
- Officers can print complaint reports

### 2. Designing a system prototype

- System design using UML (Use Case, Activity, Sequence, Class Diagram)
- The system will be designed using PHP, Javascript programming languages
- User interface design using HTML, CSS, and Javascript with the Bootstrap framework

### 3. Implementation of the prototype system

- The system will be implemented as a web application
- The system will be on a local hosted server
- The database will be stored using MySQL

### 4. Test the system prototype

- Functional Testing
  - Ensure that all application features function correctly according to specified needs
  - Gives beta users access to fill out complaint forms, upload photos, and view complaint status.
- User Interface Testing. Checking the clarity, ease of use and responsiveness of the web application user interface. These include:
  - Verify the appearance and layout of the page, ensuring that buttons, links and forms function properly
  - Input validation testing to ensure users enter correct data
- Integration Testing. Check interactions between applications and other systems or services used. In this case, integration testing should be done with
  - Ensure that sending notifications via WhatsApp functions properly
  - Conduct integration testing with the WhatsApp API to ensure notifications are sent successfully.
- Security Testing. Verify that access to officer accounts is limited and only authorized officers can access them

- Performance Testing. Perform testing to check application performance in terms of response time, processing speed, and resource usage. This is important to ensure the application can handle a large user load well.
  - Compatibility Testing. Ensure the application functions properly across different platforms, devices and browsers. This involves testing across several commonly used operating systems, mobile devices, and browsers.
  - User Testing. Conduct testing by real users or users who represent the application's target users to gather feedback and ensure the application meets their needs.
5. Evaluation and improvement of system prototypes
- User Interface Evaluation:
    - Evaluate the clarity and ease of use of the user interface based on user feedback.
    - Improvements can be made by making interface design changes that are more intuitive, optimizing element layout, and simplifying navigation.
  - Functionality Evaluation:
    - Evaluate whether all expected features function properly and meet user needs.
    - Identify and fix bugs or functionality errors discovered during testing.
    - Make sure all required features have been implemented correctly.
  - Performance Evaluation:
    - Evaluate system performance in terms of response time, processing speed, and resource usage.
    - Identify and fix any bottlenecks or performance issues found, such as slow response times or excessive processing.
    - Optimize database queries or algorithms to improve performance efficiency.
  - Security Evaluation:
    - Conduct security evaluations to identify potential security vulnerabilities and possible attacks.
    - Fix discovered security vulnerabilities by implementing necessary security measures, such as input validation, data sanitation, and use of parameterized queries.
  - User Evaluation:
    - Conduct testing with real users or users who represent the application's target users to gather user feedback and evaluation.
    - Identify problems users face in using the system and improve them based on their feedback.
    - Fix deficiencies or features that do not meet user expectations.
  - Integration Evaluation:
    - Evaluate integration with third party services, such as the WhatsApp API, to ensure the integration runs smoothly.
    - Fix discovered integration issues, such as errors in sending notifications or communicating between the system and external services.
  - Integration Evaluation:
    - Evaluate integration with third party services, such as the WhatsApp API, to ensure the integration runs smoothly.
    - Fix discovered integration issues, such as errors in sending notifications or communicating between the system and external services.

By following the steps of this prototyping method, it is hoped that the public street lighting complaint system being developed can meet user needs well, increase effectiveness and efficiency, and provide a positive experience to users.

### 3. RESULTS AND DISCUSSION

All actors in this application are connected by a notification system integrated with WhatsApp, ensuring the latest information is delivered in real-time. In the developed complaint system, the Administrator plays an important role in managing various aspects of the system as shown in Figure 1. They have the authority to regulate and monitor complaints submitted by the public. Apart from that, they also have responsibility for determining the categories or types of complaints available in the system. Administrators are also responsible for managing the accounts of officers tasked with handling complaints. Meanwhile, officers have a special duty to handle and follow up on incoming complaints. When there is a change in status or update regarding a complaint, officers will receive a notification sent directly to their WhatsApp. This ensures that Officers always have the most up-to-date information as soon as a complaint is updated as shown in Figure 2.

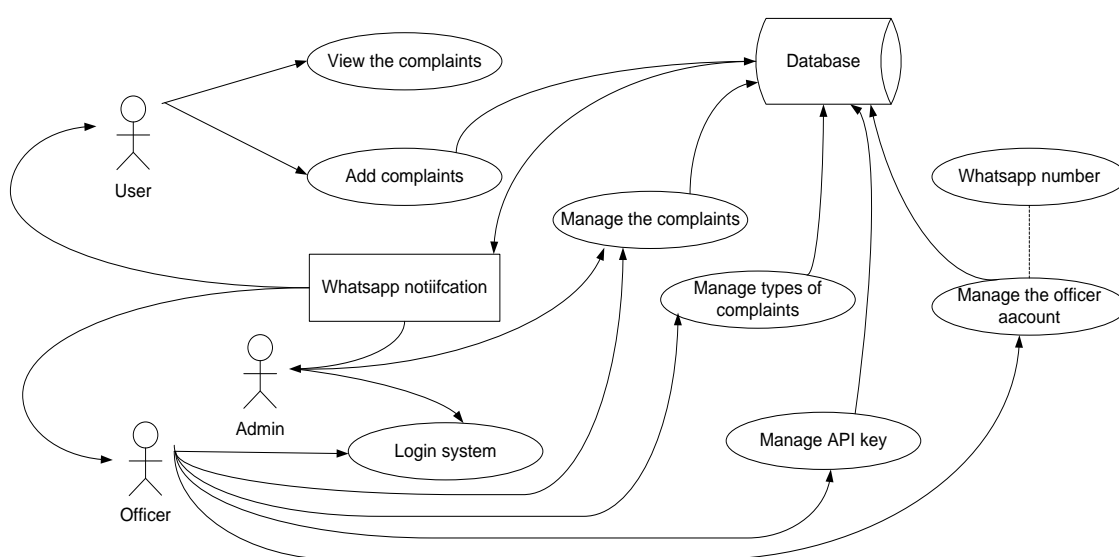


Figure 1. Use Case Diagram

Complainants, who represent the community, can submit Complaints through the system. The complaint submission process is enriched with a location selection feature using Google Maps, allowing Complainants to easily mark and submit the specific location of the problem they report. Once a complaint is submitted, whenever there is a change in status or update, the Complainant will also receive a Notification via WhatsApp, ensuring that they always have the latest information regarding their report. Integration with Google Maps ensures the accuracy of locations reported by Complainants. This feature makes it easier for officers to find the location of the problem and provide a more efficient and targeted solution.

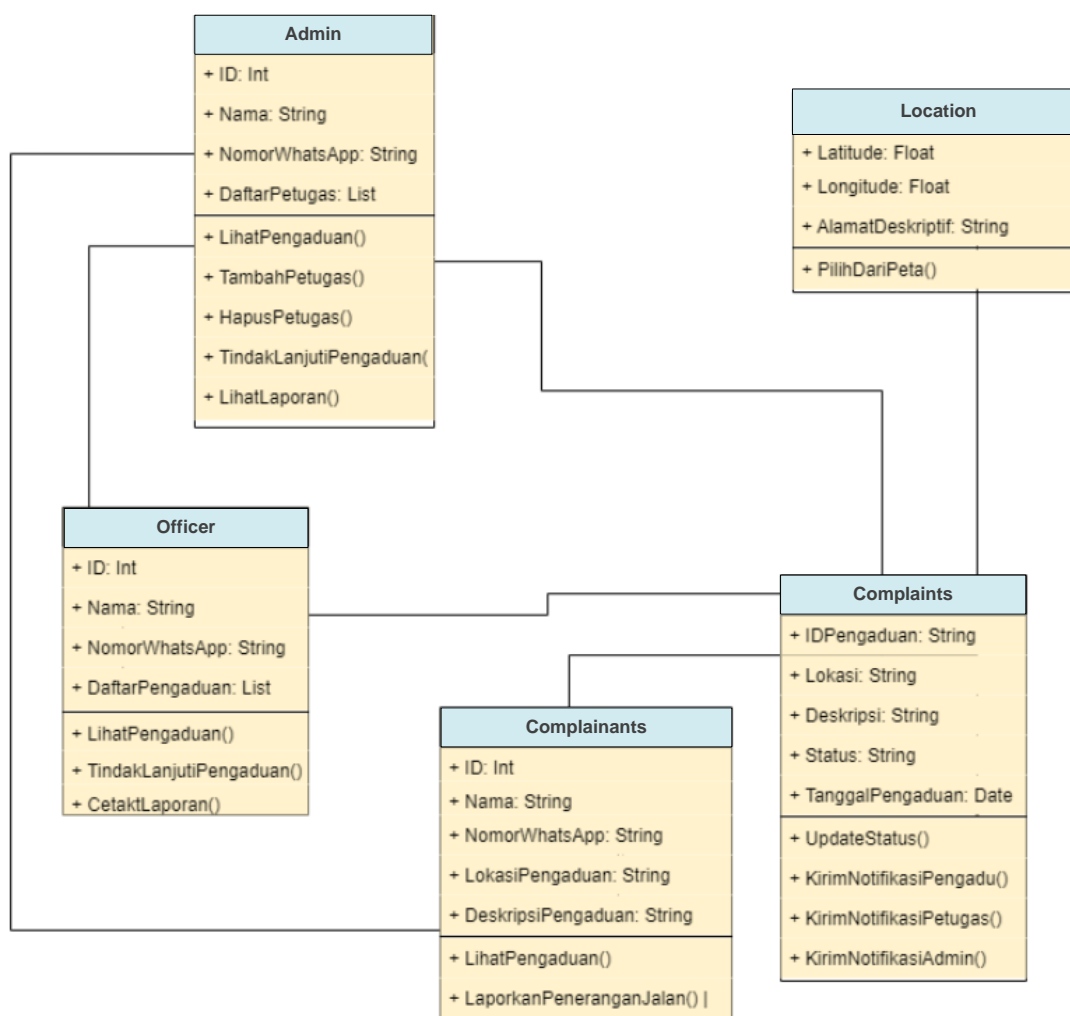


Figure 2. Class Diagram

In the "SIPENJALU" application, the main page provides a brief overview of the status of street lighting complaints in Pemalang Regency. There are four main information elements presented:

- Pending Complaints: Shows the number of complaints that have not received any follow-up, accompanied by a bell icon as a symbol.
- Complaints Responded: Indicates the number of complaints that have been responded to or are in the process of being handled, with a light icon as an indicator.
- Complaints Completed: Presents the number of complaints that have been resolved, indicated by a blue light icon.
- User Data: Displays the total number of users registered in the application, represented by a person icon.

The design of this page is simple but informative, using a starry background which gives a spacious and modern impression. Information elements are presented clearly using cards equipped with icons, making it easier for admins to get important information instantly.

- Send feedback
- Side panels
- History
- Saved
- Contribute



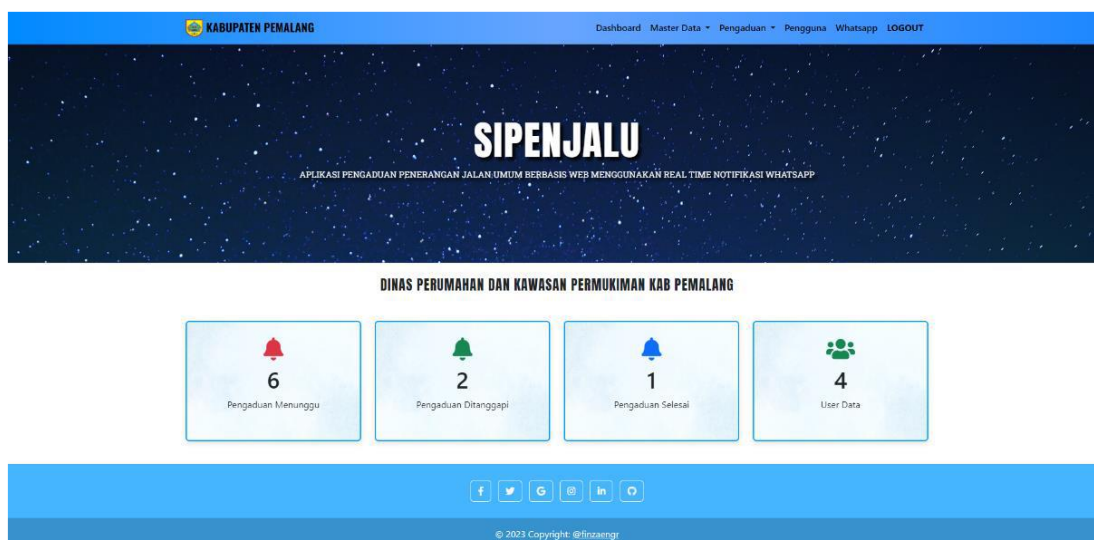


Figure 3. Dashboard Visualiation

The Complaint Type menu displays the types of complaints from the public. By default, there are 2 types of complaints, namely lamp repair and lamp addition. Apart from that, other types of maintenance can be added via the Add Maintenance Type menu as in Figure 4. This test uses a questionnaire which has several questions consisting of several features and systems. to respondents. The satisfaction assessment of respondents is determined based on the assessment index which can be seen in the Table 1.

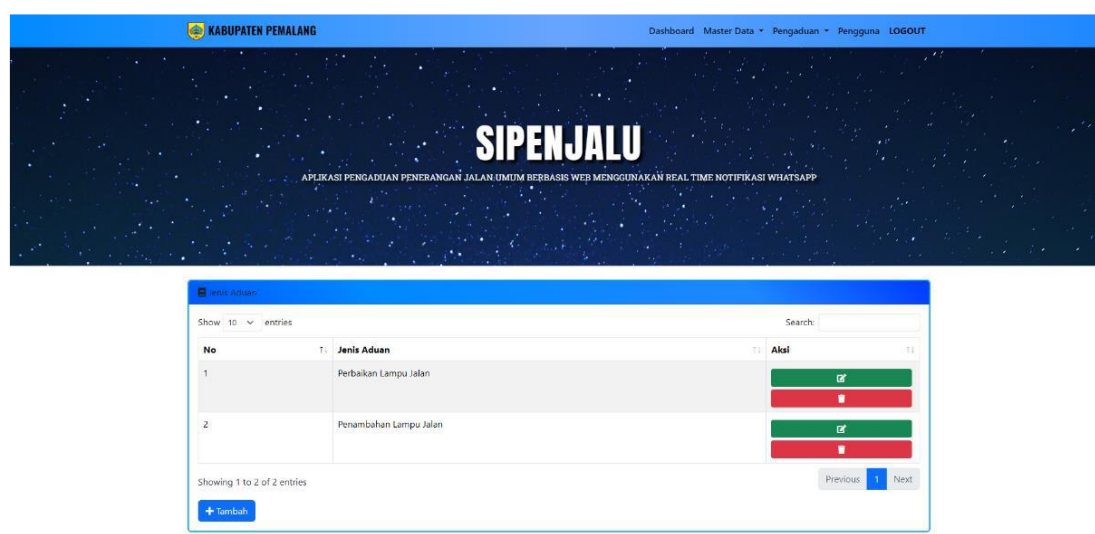


Figure 4. A Complain type page

Table 1. Assessment index

No	Answer	Value
A	Very easy/Good/Clearly Appropriate	5
B	Easy: Good/Appropriate/Clear	4
C	Neutral	3
D	Fair: Difficult/Good/Agreeable/Clear	2
E	Very: Difficult/Bad/Inappropriate Unclear	1

The STRONG test results obtained from the 10 respondents' answers can be seen in Table 2.

Table 2. UAT Result Assesment

No	Questions	Answer				
		A	B	C	D	E
1	Isn't the system display confusing?	6	3	1	0	0
2	Does the application make it easier to report and manage complaints related to street lighting?	8	2	0	0	0
3	How easy is it to access features?	7	1	2	0	0
4	Is this system able to provide comfort?	6	2	2	0	0
5	Do you think this system is fit for purpose?	8	2	0	0	0

Table 3. UAT Results After Multiplying by Value

No	Questions	Answer				
		A x 5	B x 4	C x 3	D x 2	E x 1
1	Isn't the system display confusing?	30	12	3	0	0
2	Does the application make it easier to report and manage complaints related to street lighting?	40	8	0	0	0
3	How easy is it to access features?	35	4	6	0	0
4	Is this system able to provide comfort?	30	8	6	0	0
5	Do you think this system is fit for purpose?	35	8	0	0	0
Total		170	40	15	0	0

Based on Table 3, analyze the first question. It can be seen the total score of the 10 respondents for the first question is 170. The average score is  $170/10 = 17.0$ . The percentage score is  $17/5 \times 100 = 340\%$ . The total value of the 10 respondents is for the second question is 40. The average score is  $40/10 = 4.0$  Percentage the value is  $4/5 \times 100 = 80\%$ . The total value of the 10 respondents is for the third question is 15. The average value is  $15/10 = 1.5$  The percentage value is  $1.5/5 \times 100 = 30\%$ . From the table above it can be seen that the total score of the 10 respondents for the fourth question is 0. From the table above it can be seen that the total score of the 10 respondents for the fifth question is 0. From the analysis of all the questions above you will get a total calculation of  $450/5 = 90$  Score.

#### 4. CONCLUSION

The designed application successfully provides an effective solution for data collection and maintenance of public street lighting. The use of the prototype method allows this application to be developed taking into account input from users, so that it is more in line with actual needs in the field. Integration with real-time notifications via WhatsApp improves coordination and responsiveness to incoming complaints, enabling fast and organized follow-up. The developed web base system makes it easier to access and manage data centrally, ensuring the latest information is available to all relevant parties. The use of Google Geolocation has enriched the way the application displays data, providing a clearer picture of existing problems and pointing out places that need more attention. Dalam rangka peningkatan hasil maka dalam penelitian selanjutnya perlu dilakukan exploring the potential for developing applications on mobile platforms such as Android, which will allow wider and more flexible use, especially by employees who are often in the field, optimizing the user interface to be more interactive and attractive, thereby increasing user engagement and ease of navigation and use of the application. Carry out further trials to ensure the application can be integrated with various operational systems in regional government, to create synergy and better work effectiveness.

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