Management of artesian wells at bumi purnawira housing sukabumi city with water distribution application

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ABSTRCT

The problem of clean water supply to meet the needs of the community is the main obstacle experienced by residents of Bumi Purnawira housing. Water management is completely left to the residents starting from installation of pipes to each house, installation of water meters, calculation of the cost of water usage per cubic meter, as well as administration and maintenance of the artesian well. Some problem that arise include: frequent miscalculation of cost to be paid; monthly meter recapitulation records in the form of paper prone to damage and data lost; meter recapitulation records is only kept by the treasurer, so if the residents want to know the history of meter records and the payment, they have to see the treasurer; the meter's monthly status is vulnerable to manipulation whether done by the residents or the treasurer; There is often a discrepancy between the financial recapitulation recorded and the physical cash; and financial expenditures are sometimes not properly recorded, so that it triggers the discrepancy between the recorded amount and the physical cash. Seeing the existing reality, an idea to make an application for the management of artesian well administration has arisen. The initial step is to form two teams, namely the development team and the socialization team. The development team is responsible for developing the management system of the artesian well's administration and finance. Meanwhile, the socialization team is responsible for conducting the socialization and the application training. The result of this project is an application and socialization that can help both the administrators and the residents in managing the administration and finance of the artesian well.

Keywords: management; developing; management; the making of application; artesian well.

INTRODUCTION

The availability of water is one of things that has to be fulfilled in human life. Water becomes a resource that needed by living beings. Indonesian people especially use surface water which is water from rivers and wells (Saputri, Pranotoc, & Nikolaevich, 2022). In the Ministerial Decree of the Minister of Health of Republic of Indonesia Number 1405/MENKES/SK/XI/2002 on the Health Requirements for Office and Industrial Work Environment , clean water is defined as water that is used for daily needs and its quality meets the health requirements of clean water according to applied laws and regulations and can be consumed if it is boiled (the Ministry of Health of Republic of Indonesia, 2002) (ARIADI, 2021). According to the Government Regulations of Republic of Indonesia Number 82 year 2001 on the Control of Water Pollution (Government Regulations of Republic of Indonesia, 2001), there are 4 groups of classification of water based on its allocation, which are: 1) Group A water; which is water that can be used as drinking water directly without processing. 2) Group B water; which is water that can be used as raw drinking water. 3) Group C water; which is water that can be used for fishery and farm. 4) Group D water; which is water that can be used for farming, industry, and hydro electric power plant (Fitriana & Ardiansyah, 2022).

Water becomes an issue that need to be paid attention for and handled seriously (Nasution, Rambe, & Nurmaidah, 2022). In Indonesia, clean water supply especially on large scale at present time is still centered in urban areas, and managed by the Water Company of cities and regions and the number is still insufficient relatively small, which is 16,08% (Widayat, 2019). For areas that have not got clean water service from the Water Company, they generally use groundwater (wells), river water, rain water, spring water, etc. The problem that arises is that the quality of whether groundwater or river water used by the community is frequently found less or not qualified as healthy drinking water. Even in some places it is not qualified to use in daily needs such as bathing and

washing (Nasution et al., 2022).

Water that is qualified to drink has standard requirements which are physical, chemical, and bacteriological requirements (the Ministry of Health of Republic of Indonesia, 2010), and those requirements are unity. So if there is one of the parameters that does not meet the requirements, the water is not qualified to drink (Paikun & Kurniawan, 2021). The usage of drinking water that does not meet the standard quality can cause health disorder, whether it is directly and rapidly or indirectly and slowly (Ginanjar, 2008), so that it reduces the quality of life (Melani Rizki Utami, 2022).

The construction of artesian well in Bumi Purnawira housing, Cipanengah urban village, Lembursitu district, Sukabumi city was started to be constructed in 2019. It is an aid from the government of Sukabumi city. In Bumi Purnawira housing, there are 360 houses in total with 320 that are inhibited. Bumi Purnawira housing officially has one Citizens Association, which is RW 05 with 6 Neighborhoods in Cipanengah urban village.

Since the housing was first built, the main problem faced by the residents was the water supply service from the Water Company that frequently did not work. Various attempts had been done such as discussion and negotiation with the Local Water Company. Eventually, through the residents' discussion, a decision to make an artesian well was agreed. A residents' representative submitted a proposal to make an artesian well to the government of Sukabumi city that was finally approved and made in 2019. In the making of the well, started from the drilling to the construction of the water tower were done by the residents. For the pipes installation and the water distribution to the residents' houses as well as the management, all were done by the residents independently.

The water management is entirely left to the residents, started from the pipes installation to each house, the installation of water meters, the calculation of the cost of water usage per cubic meter, as well as the administration and maintenance of the artesian well. At every beginning of month, an officer goes around the housing to check the position of the water meters and invoices are made by the financial section which are then recorded on a sheet of paper or a notebook and then calculated based on the position of the meters in the previous month. The calculation results show how much cost must be paid by the residents in the current month.

In this era of digital information and communication, the management of administration and maintenance of the artesian well can be more effective and efficient. A process or activity can be increased by using technology devices (Kadir, 2016).

Based on interviews with the Neighborhood administrators and residents of Bumi Purnawira housing, it was revealed that the management of payment administration as well as the financial management still use manual method. Every month, an officer records the status of water meters at the financial section that is then written down on monthly payment record paper. So is the management of income and expenditure still recorded on financial report paper.

Such method of management causes some problems, such as:

a. miscalculation of cost that must be paid which is caused by several things including the high rate of human error in calculating and the incorrect meter records of the previous month.

b. monthly meter recapitulation in the form of paper is prone to damage and data lost. There was time when data needed to be re-recapitulated bacause the record paper was damaged and exposed to water.

c. the monthly meter status is vulnerable to manipulation whether it is done by the residents or the treasurer.

d. discrepancy of finacial recapitulation between the recorded amount and the physical cash.

e. financial expenses are sometimes not recorded properly that it triggers the discrepancy between the recorded amount and the physical cash**.**

Based on the problems above, there are several alternative solutions that hopefully can help the residents of Bumi Purnawira housing to realize the management of administration and distribution

of artesian well and its financial management. Information technology that can be used to support the development of this system is a software application system that is addressed for real-time dynamic image processing for customers by inputting data to the water meters.

User Centered Design

UCD (User Centered Design) is a new paradigm in developing web-based system. User Centered Design (UCD) is a term used to describe the philosophy of designing. The concept of UCD is user as the center of system development process, and the system's purpose/traits, context and environment are all based on user's experience. The target of UCD is more than merely creating a useful product **(Sari, Purnama, &** Ritonga**, 2021)**. Principles that must be considered in UCD is the focus on user, integrated designing, user testing, and interactive designing **(He, Zhang, & Bian, 2020)**.
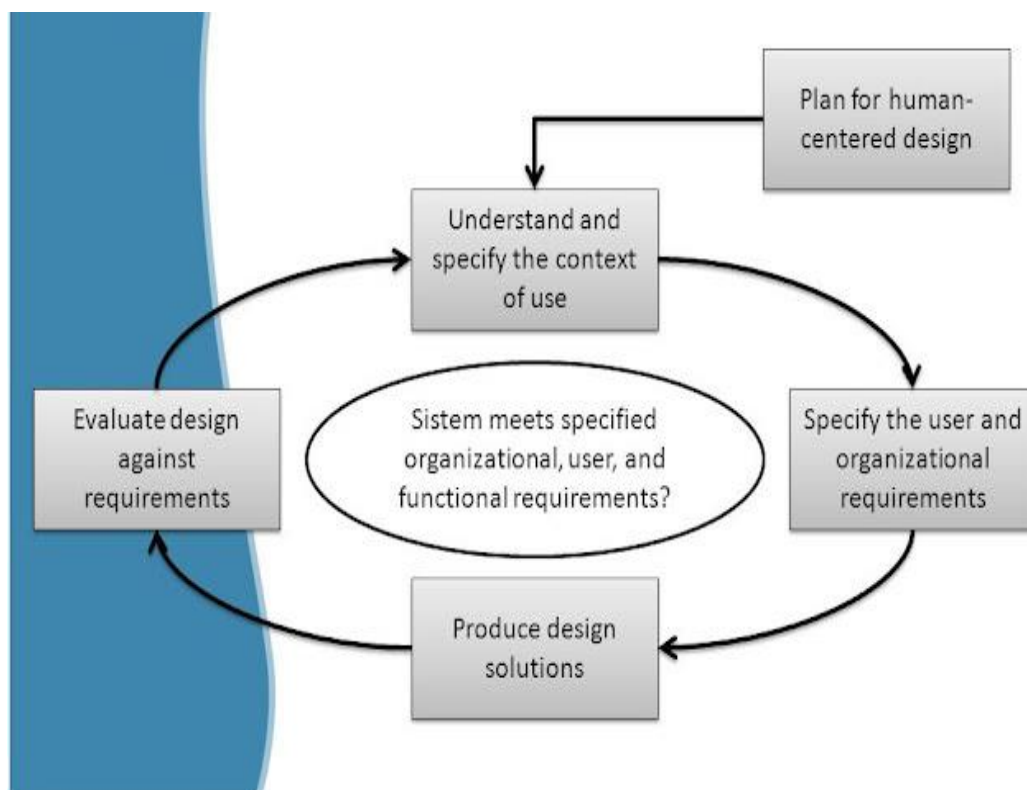
Figure 1. The Process of UCD (User Centered Design)

UCD has a concept that user is the center or focus of the existing system. The system is designed and establlished based on user's experience and needs in user interface. Principles in designing user interface are: user familiarity, consistency, minimal surprise, recoverability, and user guidance (Huda, Winarno, & Lutfi, 2018).

Android

Android is an operational system that consists of a group of commands to manage various mobile devices such as smart phones and laptops (Jabbar et al., 2019). This system is developed by Google based on Linux kernel. Because of its open-source nature, Android becomes one of the platforms that develop very fast. At first, Google Inc. Bought Android Inc., a newcomer that made software for cellphones (Primawaty, 2019). To develop Android, Open Handset Alliance, a consortium of 34 companies of hardware, software, and telecommunication including Google, HTC, Intel, Motorola, Qualcomm, T-Mobile, dan Nvidia, was formed (Adzima, 2019). Android is a Linux-based operational system for mobile devices that includes operational middleware, and application.

Android was first developed by a small company in Silicon Valley named Android, Inc. after that, Google took over the operational system in 2005 and declared it as an open-source operational system (Cahyo Widekso, 2022).

The architecture of Android is divided into 5 layers, which are: Application Widget, Application Framework, Libraries, Android Runtime, dan Linux Kernel (Setiawan, 2018).

RESEARCH METHODS

In the development process of software that was used in this research, User Centered Design (UCD) approach was used based on ISO 13407:1999. This model focuses on user as the base of software product development. User's characteristics will be the base in designing process that in accordance with the needs of the user. The process on UCD is an iterative process where the designing and evaluating stages are developed from the early stage to the implementation stage of the project (Syahputra & Kurniawan, 2017). The method used in UCD was by doing the following activities, which are distributing questionnaires and conducting interviews. The method used in carrying out the research was by doing several steps, which are (Lestari, 2022):

Data Collection

The data collection process was done with several methods such as observation, interview, and literature study. In observation process, observer performed two roles at once, as an observer and the head of the research group. In this research, researchers got the data by observing the object under study directly in the research location, Bumi Purnawira Asri Housing, Cipanengan Urban Village Lembursitu District Sukabumi City.

The interview process was conducted by the researchers of the research group. Researchers interviewed the residents who were appointed to manage the recording and billing of water usage from the artesian well. The collection process was done with several methods suc as observation, interview, and literature study.

In the creation of the application, literature study was needed to do to get the basic theory that was related to the development of server application, android application, the creation of web service system, and the concept of Volley's library usage. The literature that was used as references are in the forms of journals, books, and various loose articles on the internet.

System Development

The system development method done in this research was object-oriented modelling because this method is developed as an analysis and designing tool that is frequently used in developing mobile-based system. Specifically system development method used by the writer was prototyping method. Prototyping method is a software development method that allows interaction between the system developer and the system user, that it can overcome the incompatibility between developer and user (Mulyani, 2017).

The steps of prototyping development method are as follow:

a. Collecting the Needs

Developer together with customer define the format of the entire software, identify all needs and the outline of the system to be made.

b. Building the Prototype

Building the prototype by making a temporary design that focuses on presentation to the customers.

c. Evaluating the Prototype

Evaluation is done by the customers whether the prototype that has been built is in accordance with the customers expectation. If it is, then the 4th step will be taken. If it is not, the prototype will be revised by repeating the 1st and the 2nd steps.

d. Coding the System

In this stage, the approved prototype is translated into the corresponding program language.

e. Testing the System

After the system is ready to use, there has to be a test first before it is used.

f. Evaluating the System

Customer evaluate whether the system has meet their expectation. If it has, it is continued to step g. If it has not, steps d and e ar repeated.

g. Using the System

Using the software system that has been tested and approved by customers is ready to use.

RESULTS AND DISCUSSION
The results and discussion can be explained as follow:

Composer

Composer is an application that is installed to a device to facilitate the developer using open-source library belongs to other people in the project under construction (Primaswara, n.d.).

In a PHP project, using library makes the process of code writing easier. However, sometimes one library and another need each other so that it can be used. It is called dependency. This is where the role of Composer to connect PHP project and the required external library (Rahayu, Fajri, & Hambali, 2019).

Figure 2. Composer

Bootstrap

Bootstrap is a framework HTML, CSS, and JavaScript that focuses on simplifying the development of webpage or website. Generally. *Bootstrap* is used to implement various choices of colors, fonts, and layouts in the framework into a website.

In its early development, *Bootstrap* had other name, which is Twitter Blueprint. Mark Otto and Jacob Thornton eveloped Bootstrap to increase consistency in various internal devices used in website development.

As a framework, Bootstrap provides templates to define the basic style of the entire HTML elements

in a website. It will simplify website creation with visual harmony without having to define the attribute style for every HTML element repeatedly.
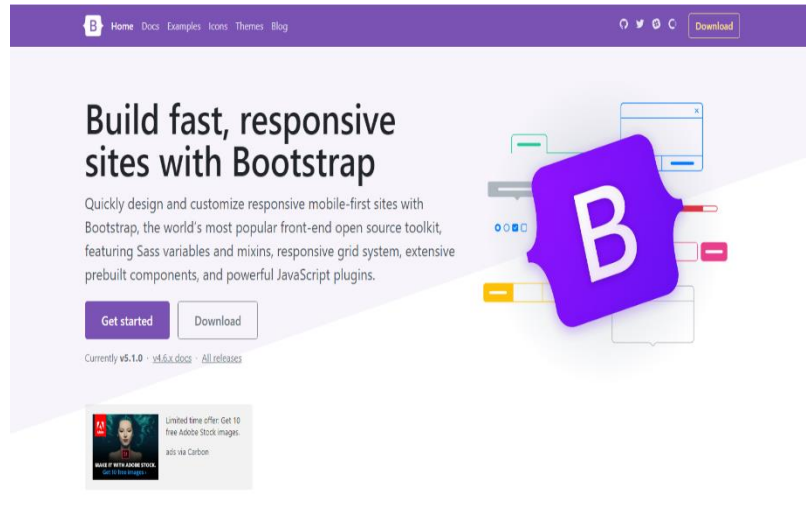

Figure 3. Bootstrap

Vcode text editor

Visual Code Studio is a free code editor that can be operated on Windows, Linux, and MacOS-based desktop devices. This code editor is developed by one of the world's technology giants, Microsoft.

Visual Code as a powerful software editor but remains light when it is used. It can be used to create and edit source code in various programming languages such as *JavaScript, TypeScript, dan Node.js*.
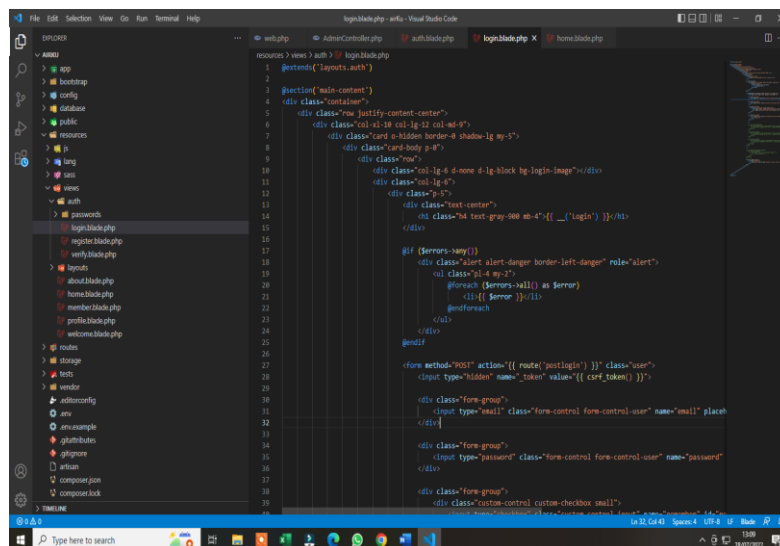

Figure 4. Vcode Text editor

Xampp

XAMPP is a web server-based opensource software that consists of various programs. This application supports various operational system suh as Linux, Windows, MacOS, dan Solaris. XAMPP functions as a local/localhost server in which includes Apache, MySQL dan PHP programs.

The emergence of XAMPP was triggered by the difficulty in installing Apache and adding PHP dan MySQL support. It causes the birth of XAMPP, as an application to make it easier for developers who need web server in local host by using only one application.
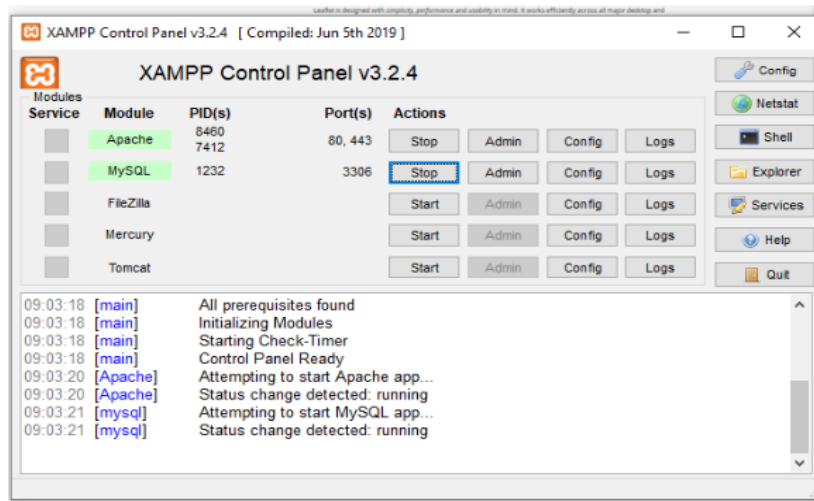
Figure 5. Xampp

Browser

Browser is one of types of software that are generally used to open website page on internet. Browser is also called web browser. Of websites pages such as Fundamentally, browser has ability to perform semantic code (programming language) of website pages such as HTML, CSS, Js, etc., making them pages that are understood by everyone. Popular browsers that are used nowadays are Google Chrome dan Mozilla Firefox.
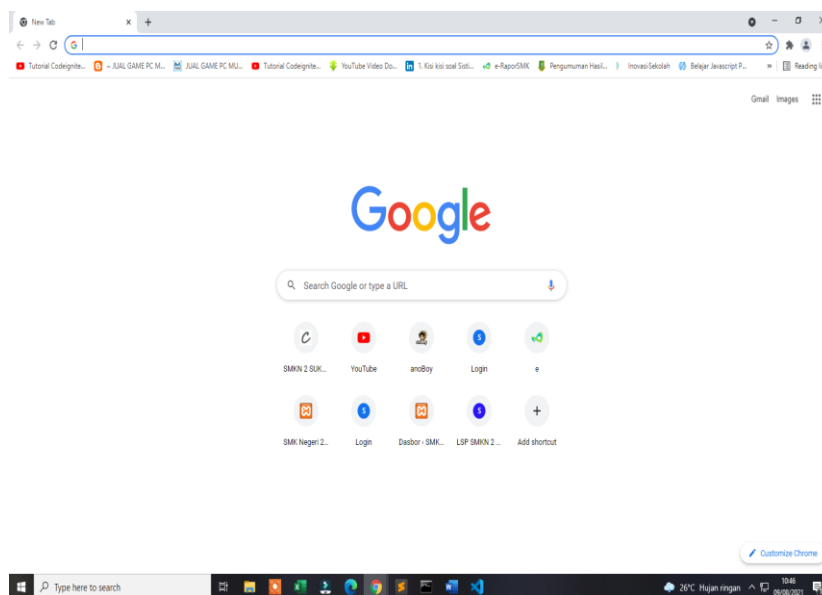

Figure 6. Browser

Framework Laravel

Laravel is the only framework that helps you to maximize the usage of PHP in the process of website development.

PHP has become a very dynamic programming language, but since there is Laravel, it becomes more powerful, faster, safer, and simpler. Everytime it releases its latest versions, Laravel always brings up new technology among other PHP frameworks.

Laravel focuses on end-user part, which means it focuses on clarity and simplicity in both writing

and display, as well as produces web application that functions as it should. This makes both developer and company use this framework to build anything, started from small projects to the scale of high class company.
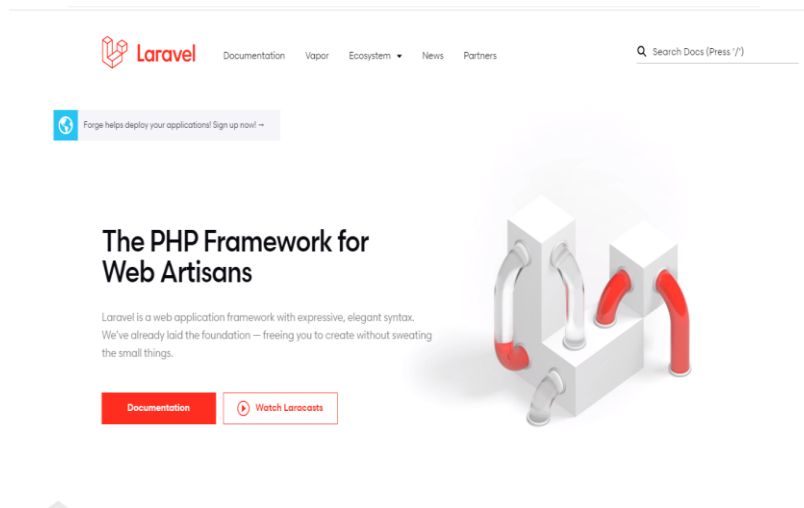

Figure 7. Framework Laravel

Flutter

Flutter is a platform used by developer to make multiplatform application with only only one codebase. It means the generated application can be used on various platforms, whether it is mobile Android, iOS, web, or desktop. Flutter has two main components, which are Software Development Kit (SDK) and framework user interface. Software Development Kit (SDK) is a group of tools that function to allow application operated on various platforms. Framework UI is UI components, such as text, button, navigation, etc., that can be customized based on needs. Flutter is also a free and open-source platform. If you want to use Flutter, you need to learn Dart programming language.
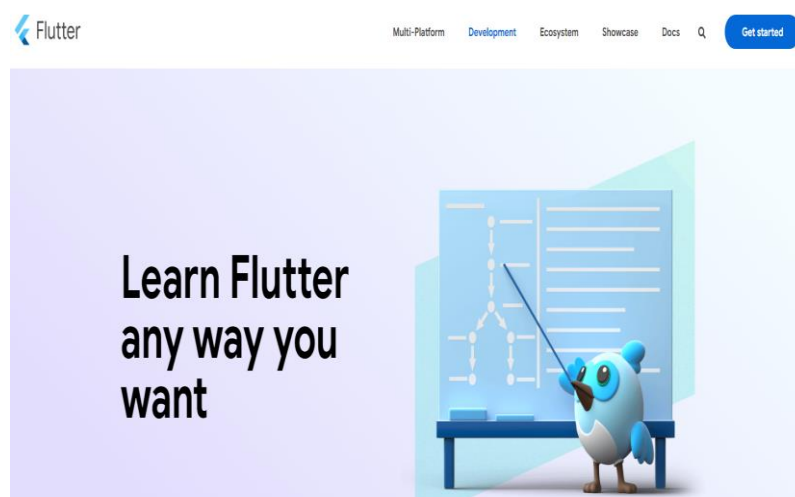

Figure 8. Flutter

Introducing to Administrator Feature

Form login

To access payment application of water usage, customers are required to enter a registered username and password.

Figure 9. Form Login

Manage customers

On this menu, customers' data and transaction history will be displayed. An administrator can add, change, and delete customers' data, An administrator can also print the data.
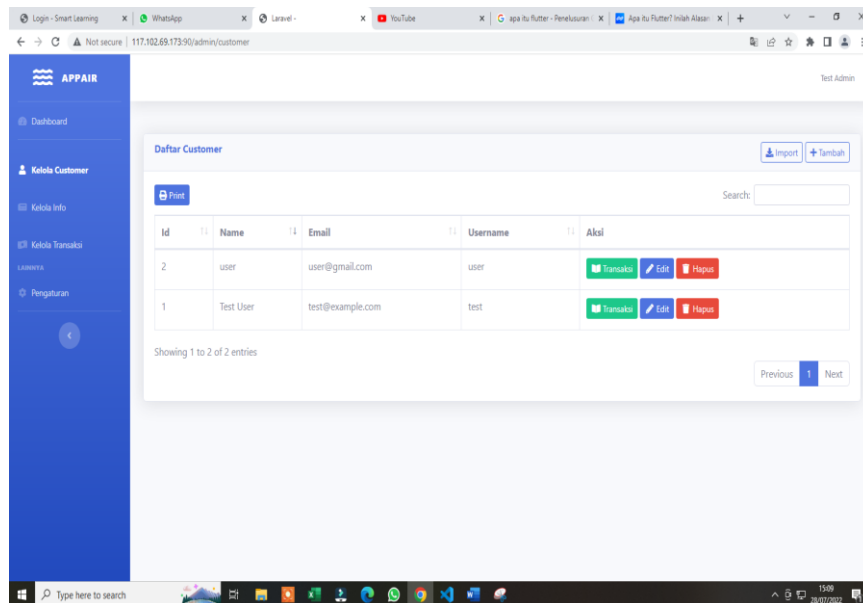

Figure 10. Managing Customers

Manage Information

On this menu, administrator can give information that later will show up on customers' application. This information can be in the form of agendas that will be held, or other notices related to the application.
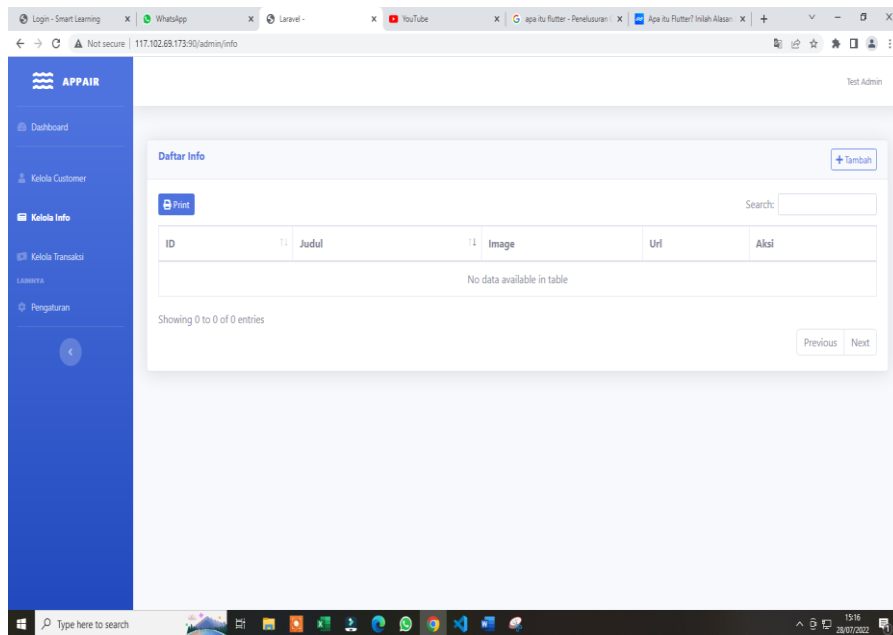
Figure 11. Managing Information

Manage transaction

On this menu, there is a recapitulation of customers' transactions such as one that has not been paid on that period, submissions from customers who pay through the application by uploading the proof of payment (on "received" menu), customers whose transactions are "rejected" because the data is not valid, customers who receives bonus by not having to pay on "passed" menu, and recapitulations of customers whose bills have been "paid off" or those who have paid.
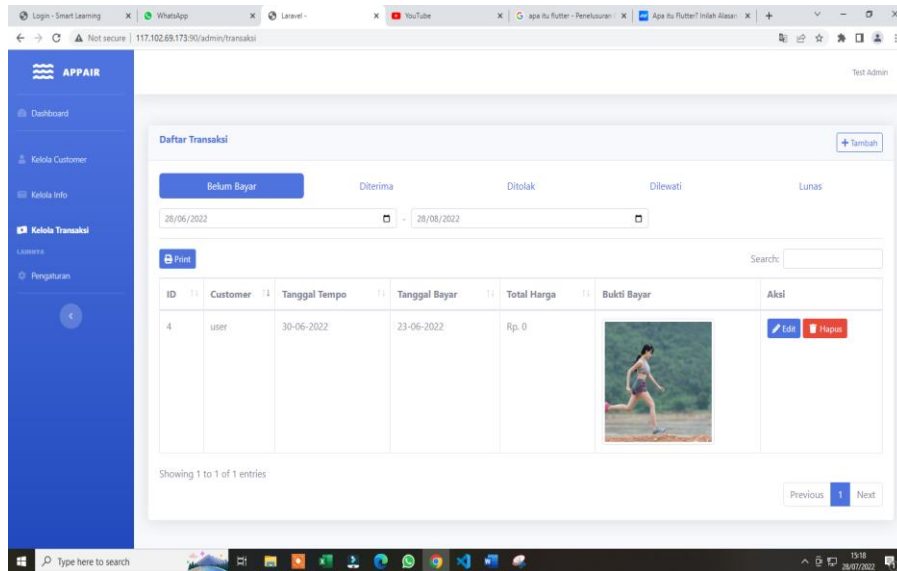

Figure 12. Manage Transactions

Setting

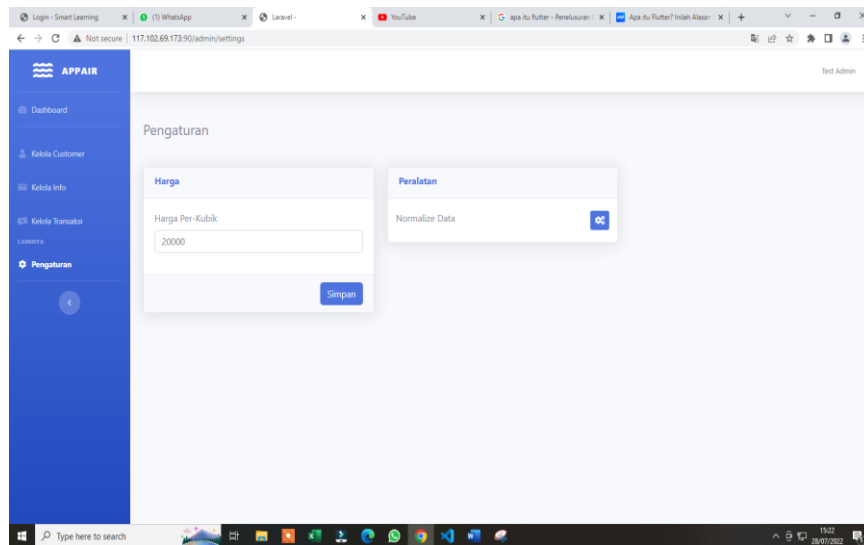This menu display the setting of water usage price per cubic meter.

Figure 12. Managing Setting

CONCLUSION

The application generated in this research has been able to apply Volley library of android device to access information on web server. However, since this research only focuses on how to apply Volley library, the application features that are displayed are only in the form of imain data reading information. The easy access to data through the application makes the note-taking job of water usage meter can be done faster without having to work twice by taking note manually and then recapitulating manually as well. Nevertheless, users can still feel weaknesses of the application. Accordingly, on further development: a) Interface display and function need to be fixed so it can dinamically adjusted to the screen size of the android device, b) Supporting features need to be added to accomodate the entire needs of water usage management whether on the web server or the application on android device, c) In addition to these basic features, hopefully the use of camera on android device can be integrated to process the reading of numbers on water meter, so that the recording process becomes easier. Theoretical collaboration with image processing system is certainly needed. Even though the Volley library is managed to be applied, there are still algorithms that need to be perfected such as the algorithm to count the cost of water usage. It is because the type of data kept in the database is relational. So, only the main field is kept. Meanwhile, the process of counting mst be done through the application. Consequently, errors often happen at program compilation time. saat kompilasi program. So that the application can run, for the meantime, the amount of bill data is added to the data that is kept on our web server, with the result that the counting is done manually through the web server. A complete system with specific interface to manage web server is also needed to be developed, so that it will not have any troubles in database management without having to access the application of web server provider.

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