Designing web-based and android application to monitoring and estimating price of the use of water discharge

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Abstract. Water discharge is a measure of the amount of water volume that can flow or be disposed in a place in one unit of time. The research goal is to calculate the amount of water discharge and the bill for every use of water that has been used by the customer. Monitoring the use of water discharge will use the IoT (Internet of Things), with a microcontroller as a processor or input and output processing of the sensor used. The sensor used in this plan is the water flow sensor using ESP8266 module through the Internet as a data communication between tool and software. The data transmitted is water discharge in each use of 10 litters. This research will use prototyping method to know about the use of water and the price that must be paid each month from customer’s phone. The form of application is web that is created for the admin (Server) and Android application for the customer. On the next process, this design can be directly applied for the use of calculation of discharge and the bill for local government.

1. Introduction
Sometimes, people forget to control the consumption of paid water and shockingly find that their water bill is beyond their expectation. Therefore, they need an automatic water consumption monitoring system to help them control and calculate their monthly water bills and at the same time provides them with information delivered through the Internet network [1].

In this study, the water consumption monitoring system uses Arduino UNO microcontroller as a data processor. A microcontroller is a control device which makes the system becomes flexible, reduces the cost and size of the entire system [2]. Data transmission process from Arduino UNO to web- and Android-based applications is performed using the Internet of Things (IoT). IoT has been a major development theme recently. The paradigm of the IoT capitalizes on gaining identity of objects and environments belonging to our daily life, by means of the Internet, them being characterized by functionalities of self-awareness, interaction with surrounding space and data elaboration locally performed [3]. IoT is a concept that has become increasingly disputed in the past decade and half [4]. It is the extension of the internet to the physical world where all objects collect information and interact with their environments with no or little human intervention [5].

Previously, there have been many studies with regard to water consumption such as water quality monitoring system [6], consumption monitoring system [7], and water meter system [8]. Furthering these studies, the present study seeks to design a system to help people measure their paid water consumption and calculate the bills. Using this system, the administrator can monitor water consumption through a web-based application. The customer also could do the same using an Android-based
application. Using this system, the customer can monitor using the water, and the customer can prepare the money for pay the bill of water. So the administrator and the customer can know the using of water and the bill transparently.

2. Method
This study was conducted using a prototyping method through a procedure consisting of planning, specification, design, and results [9]. The prototype-based model is specially characterized by one idea; the object is the only abstraction provided to the programmer [10].

![Figure 1. Block diagram of input, output, and process.](image)

Figure 1 present the diagram of system input, process and output. The amount of water discharge is processed by Arduino UNO to be displayed on LCD. At the same time, Android UNO will also send data using the Internet network to the administrator through a web-based application and to the customer through an Android-based application.

3. Results and discussion

![Figure 2. Installation of circulating water pump.](image)

Figure 2 shows the circulating water pump installation. This installation is equipped with water flow sensor to provide the information about the amount of water discharge. When the water pump has installed, we can know the water flow of the water. The water flow from water pump can displayed on serial monitor in Arduino IDE.
Table 1. Water discharge as read by the water flow sensor.

| Second | Litter/minute | Second | Litter/minute |
|--------|--------------|--------|--------------|
| 1      | 3            | 31     | 3            |
| 2      | 4            | 32     | 4            |
| 3      | 3            | 33     | 3            |
| 4      | 3            | 34     | 4            |
| 5      | 4            | 35     | 3            |
| 6      | 3            | 36     | 3            |
| 7      | 3            | 37     | 4            |
| 8      | 4            | 38     | 3            |
| 9      | 3            | 39     | 3            |
| 10     | 3            | 40     | 4            |
| 11     | 4            | 41     | 3            |
| 12     | 3            | 42     | 3            |
| 13     | 3            | 43     | 4            |
| 14     | 4            | 44     | 3            |
| 15     | 3            | 45     | 3            |
| 16     | 4            | 46     | 3            |
| 17     | 3            | 47     | 4            |
| 18     | 3            | 48     | 3            |
| 19     | 3            | 49     | 3            |
| 20     | 4            | 50     | 4            |
| 21     | 3            | 51     | 3            |
| 22     | 3            | 52     | 3            |
| 23     | 4            | 53     | 3            |
| 24     | 3            | 54     | 4            |
| 25     | 3            | 55     | 3            |
| 26     | 4            | 56     | 4            |
| 27     | 3            | 57     | 3            |
| 28     | 3            | 58     | 3            |
| 29     | 4            | 59     | 4            |
| 30     | 3            | 60     | 3            |

| Average | 3.4 litters/minute |
|---------|---------------------|

Table 1 shows the amount of water discharge per minute. Every water consumption of 1,000 litters is charged IDR 2,100. Since the average water flow 3.4 litters/minute, it takes about 294 minutes to generate 1,000 litters. Since the prototype uses a 1,000:10 scale, it would only take 3 minutes to generate 10 litters of water.

Figure 3. LCD.

Figure 3 shows the LCD that displays changes in price as the water discharge changes.
Figure 4. Admin display.

Figure 4 is how the website looks to the administrator. It displays customer code, water discharge, and price.

Figure 5. Customer billing.

Figure 5 shows the Android-based application, from which the customers can check their water consumption and how much money they have to pay for it. This can be used by the customer to control the consumption. The prototype display water discharge in litter, but in reality, the volume of water is measured in cubic meter (m$^3$). The use of Wi-Fi module keeps the tool connected to the Internet. If it is mass produced, every tool will have its own IP address.

Discussion in this research is how to make water flow in m$^3$ not in liter and what the instrument can be used to measure the water in m$^3$. Another discussion is how can try this prototype to water pipe from government. Another discussion is using IoT, the customer should have the internet connection in every home, but using internet for the small data is redundant.

4. Conclusion
A lot of research has been done about water, such as research about water quality monitoring system, consumption monitoring system, and water meter system. But in this research, the administrator will send them data about water consumption and price after every consumption of 10-litter water.
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