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Modified Design of Water Metering System

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Abstract. The analog *flow meter* has been widely used in Regional Water Supply Company (PDAM) to measure the amount of water flow consumed by PDAM customer. This analog *flow meter* has an inadequacy in converting water consumed into *rupiah* billing system. In this research, a modified design of water metering system was proposed. A system involving *water flow sensor* to detect water flow velocity in the form of pulses as the inputs of microcontroller was analyzed. The output of the flow sensor will be converted as information of how much water consumed and how much money (in *Rupiah Currency*) should be paid to the water company. These outputs will be delivered through SMS using SIM 800L. The result of the experiments show that the proposed modified design of the water metering system could fulfill the standard of the metering system.

1. Introduction

In Indonesia, clean water consumed everyday is obtained from the Regional Water Supply Company (PDAM). This company has a responsibility to distribute clean water to customers in every region and distict throughout Indonesia. The PDAM intalls some pipes equipped with flow measuring devices in every customers site. The flow measuring devices has function to calculate the amount of distributed clean water. In general, that flow measuring devices is responsible to determine the cost that should be paid by the customers.

The flow meter which can count the water usage offers appropriate help for the PDAM officers to determine the amount of the water consumed. The rotation of the flow meter becomes the basic reference of the company to count the customer billing. However, the conventional system that was used for counting the water usage seems not suitable for nowadays application anymore. It shows inefficient and ineffective applications, such as: i) the conversion from water debit to rupiah needs a lot of processes; ii) officers should give extra effort to note the water consumpsion. They have to go to each customer's house to record the value of the analog flow metering system. These two reasons of course consumes a lot of time and more cost. Therefore, an instrumentation system that can provide customer and PDAM convenience is needed, i.e. by changing the analogue water consumption measurement system to a more modern digital consumption system.

Several methods have been carried out, such as using a water flow sensor as a tool to monitor the volume and cost of PDAM water consumption. This flow sensor is equipped with a microcontroller to make easy the officers in calculating the costs of water consumed, however, this method still make the officers have to record the customer's flow usage, as the same as using conventional analog flow meter. Thus, a more efficient solution is needed. The metering system is not only able to measure the water consumption, but also can provide a solution in reducing the number of losses of the PDAM.

In this research, to answer the problems stated above, the authors will redesign the water measuring device by utilizing the SIM 800 L and mobile phone. The proposed modified design uses Water Flow Sensor as sensor that detects the speed of water flow in the form of pulses. This pulses that will be forwarded as the input of the water metering system. Then, they will be processed by the microcontroller. The results of the process will be displayed by the LCD in the form of data that has been converted into rupiah. Besides being displayed in the LCD, the results will also be sent using SIM 800L automatically within a certain time to the PDAM officer. In this research, RTC circuit is applied to help in determining the time allocation for sending the message. Finally, at the end of the water meterig system process, the data received by the Officer will be directly stored in the officer computer. This communication of data using SIM 800 L will make PDAM officers feel more easy in collecting the water consumption data. The officers is not necessary to come to costumers' house to collect data. To mantain the robustness of water measuring system, in this research, the transmited and the received module system are equipped with mini UPS that can substitute the alternating current source when there is no electricity.

2. Water Flow Meter

Flow meter is a device to measure the amount or the flow rate of a fluid in a pipe or open section. This device consists of *primary device* as the main component and *secondary device*. The primary device produces a signal as a response to the fluid flow caused by the disturbed system. The main component in *Flow meter* is an Orifice with its purpose to interfere the *flow rate* and also correspond to create a lowering pressure effect. The secondary device receives the signal from *primary* device and performing several actions to the signal such as displaying, recording or transmitted into water flow measurement outcome.

The concept of the *Water flow meter* sensor is based on *hall effect.* The Hall effect was driven by Magnetic field as a connection with the moving particle. The output from this system is a square wave that can resulting a pulse frequency to determine the amount of water usage. The water flow system can be calculated with formula:

$$Q = \text{Pulse} / 4{,}5$$

Note:
Q = Water flow (Liter/Minute)
Pulse = Pulse Frequency (Hz)
4,5 = Constant

To get the value of water flow can be calculated with this formula:

$$Q = V / T$$

Note:
Q = Water flow (Liter/Minute)
V = Water Volume (Liter)
T = Time (Minute)

The author has investigated the flow sensor not only for water but also for gas, such as in [1]. For water flow sensor, in author's previous research [2], a water flow sensor is used as the input of fuzzy in the flood warning system. Some other reseachers in the world have also conducted the experiments in analyzing the water flow systems. Sejong Chun [3] proposed mathematical modelling for callibrating the water flow sensor. Nguyen [4] made modification in the metering system by offering smart metering technology, in which could calculate the water consumption using high resolution data. Mduduzi [5] proposed smart water metering system based wireless sensor networks (WSN). That system was used as water management system. Beal [6] made an investigation on the digital water age in Australia. D. Hoffman [7] has analyzed and developed a smart system that utilized the water to generate energy, called as energy harvesting. Nusrat [8] made an intelligent water metering system by using SMS that can be controlled and monitored from different place. Cho Zin Myint [9] tried to implemented the advance of IoT technology in the water flow meter in order to monitor the quality of the water. Gupta [10] made a review of the need of the smart water system in India. Chiara [11] analyzed the water leakage consumption. Jaco Marais in [12] made a review of the topologies that were used by the smart water flow meter system. Hug March [13] studied about the household smart water system in Spain, while Xiaowei [14] analyzed the prepaid smart water system in China.

3. Experimental Setup

3.1. Hardware Design

In this research, a modified design system for water metering system was proposed. The reading of the system was conducted using the connection as shown in **Figure 1**. The input of the system was the flow of water obtained from the water flow sensor YF-S201. The data of how much the water has passed trough the flow sensor was then sent to the microcontroller. At the same time, the IC *Real Time Clock* DS3231 was active and sent the time pulse to the microcontroller. The microcontrolller processed the data obtained from water flow sensor YF-S201 and pulse from IC real time clock into the cost and the volume that were then displayed by the LCD. At determined time and date, SIM 800 L communication module from the costumer device would send the data of the cost and the volume to the customer and PDAM officer using Short Message Service (SMS). The data was then sent to the computer by the Arduino Uno of the officer devices. The data sent to computer was automatically saved in the computer's memory in the form of a txt file format.

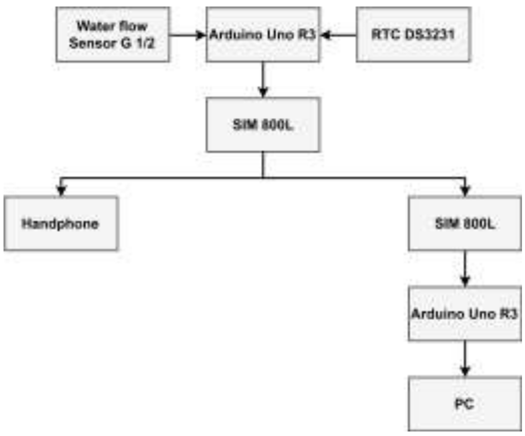
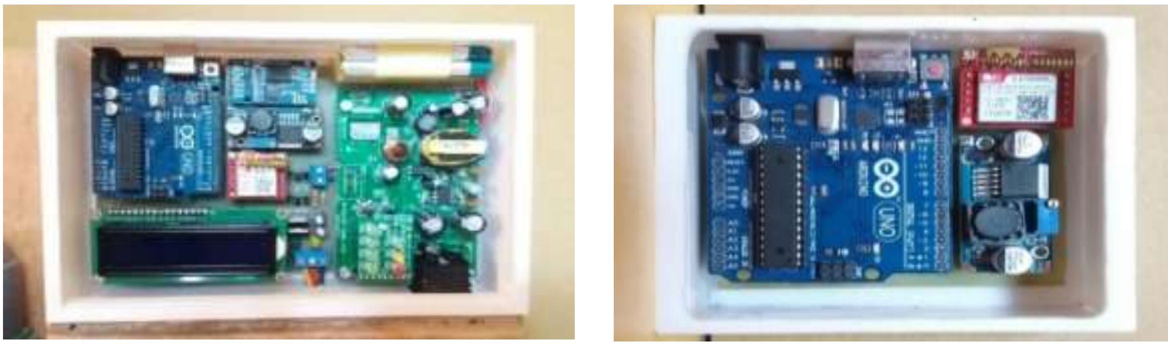


Figure 1. The modified design of the water meter reading system

Two devices module were set up in this modified design of the residential water meter reading. The first one was the module that was connected to the costumer metering. It was 18 x 12 x 6 cm in size, in which some components, namely a microcontroller, Liquid Crystal Display (LCD), Real Time Clock (RTC), communication module (SIM 800 L), and a mini UPS were inserted in that module. Mini UPS was useful for being a backup power supply whenever the electricity in the costumer was out. It can stand for more than 8 hours as the backup. The second module was the module for the operator. It was 9 x 8 x 4 cm in size. A microcontroller and a communication module (SIM 800 L) were placed in this module. The top part of each module was designed to be able to be closed and opened to make easy the operator to check the inside of the module. The physical form of the two modules can be seen in **Figure 2**.

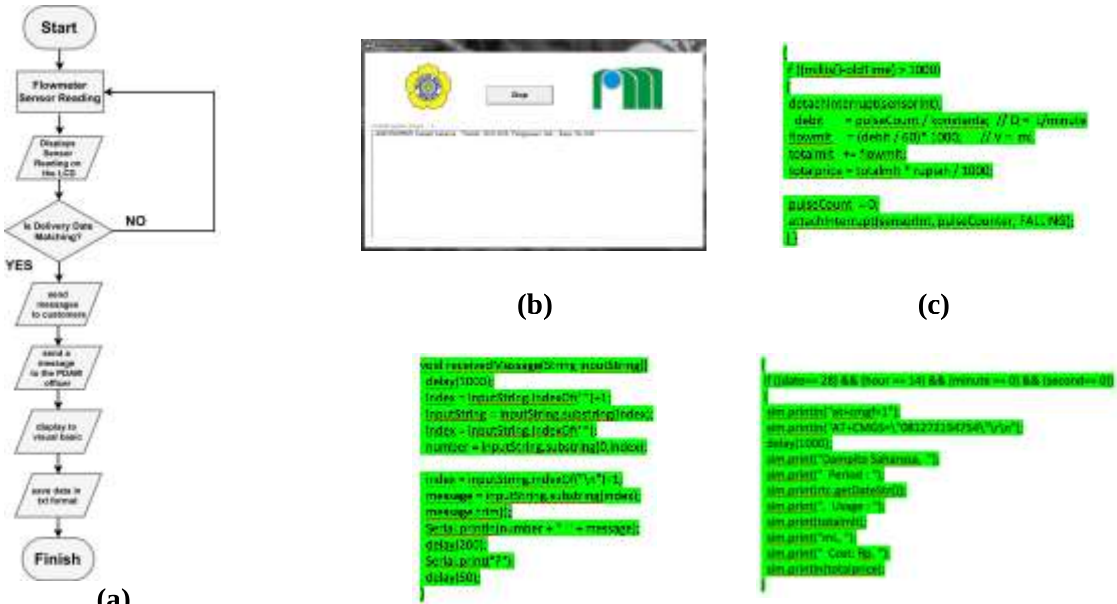


(a) **(b)**

Figure 2. Physical form of the modules **(a)** costumer **(b)** operator

3.2. Software Design

The software design for the customer and PDAM officer devices was based on the C language. This language was coded to the Arduino microcontroller that was used in the devices. To display the data of the customers (including name, phone number, time period, the quantity of the consumed water, and the cost), a C++ language was used to code the visual basic program. Figure 3 (a) Shows the flowchart of the system, while **Figure 3 (b)** shows the system display in the computer, **Figure 3 (c) – Figure 3 (e)** show the parts of the system coding.



(a) **(b)** **(c)** **(d)** **(e)**

Figure 3. The software of the system Design **(a)** Flowchart, (b) PDAM display, (c) Costumer system coding, (d) Received message coding, (e) Data sent coding

4. Result and Discussion

The calibration of the flow meter reading is needed to check weather the system could run well or not. In this research, the calibration of the system was done using measuring glass as the reference. The measuring glass was filled with the determined quantity of water which was then inputted to the devices. The flow meter helped the system to measure the quantity of the water that was passed trough it. The flow meter calibration data is shown in **Table 1**.

Table 1. Flow meter calibration

Water Measurement (mL)		Error (%)
Measuring Glass	LCD	
1500	1513	0.87
3000	3008	0.2
4500	4502	0.04

From **Table 1**, it can be seen that the modified system has good accuracy. The reading of the measuring glass and the LCD shows only a little error (not more than 1 %). The more water the flow meter detected, the more accurate the measuring data was.

In measuring the cost of the water use, a calibration of the volume and cost displayed in LCD were needed. Some tests were done to ensure that the system could run well. One of them was to pass the water trough the flow meter in various time. The volume and cost were then calculated using the equation (1):

$$Cost\ (Rp) = \frac{measured\ volume}{1000}\ x\ Rp.2.77 \tag{1}$$

The cost $Rp. 2.77$ was obtained as the reference for the calculation based on the data in **Table 2**. It was based on the price list of the PDAM. After inserting the reference data to the calculation and the program, the data of the volume and the cost of the water flow at various times were obtained (as shown in **Table 3**).

Table 2. The cost of drinking water use in 1 liter of various areas [15]

Category Area	Cost (1 liter)
RT 1 (0-36 m^2)	1,30
RT 2 (36-54 m^2)	1,63
RT 3 (54-100 m^2)	2,28
RT 4 (100-200 m^2)	2,77
RT 5 (200-300 m^2)	3,84
RT 6 (>300 m^2)	4,81
Embassy/Consulate	4,29
TNI	3,84

In **Table 3**, the calculation and LCD display shows the same values; it means that the system could work well. In the YF-S201 datasheet, the water discharge range is 1-30 L/min. From the data obtained in **Table 3**, the value of water flow can also be calculated as shown in **Table 5**:

Table 3. Volume and Cost Calibration

Time (s)	Volume (mL)	Cost (Rp.)	
		Calculation	LCD Display
15	1.861	5,15	5,15
30	3.623	10,04	10,04
45	5.518	15,28	15,28
60	7.413	20,53	20,53

Table 4. Calculation of Q

Time (s)	Calculation of Q	Result (l/min)
15	$Q = \frac{1,861}{0,25}$	7,4
30	$Q = \frac{3,623}{0,5}$	7,2
45	$Q = \frac{5,518}{0,75}$	7,4
60	$Q = \frac{7,413}{1}$	7,4

Table 5. Flow sensor measurement, based on the tap-water condition and the time

Tap water condition	Volume (mL)			
	15 Seconds	30 Seconds	45 Seconds	60 second
Fully opened	1.793	3.689	5.592	7.467
¾ opened	1.711	3.445	5.191	6.823
½ opened	1.249	2.448	3.643	4.761
¼ opened	204	381	540	694

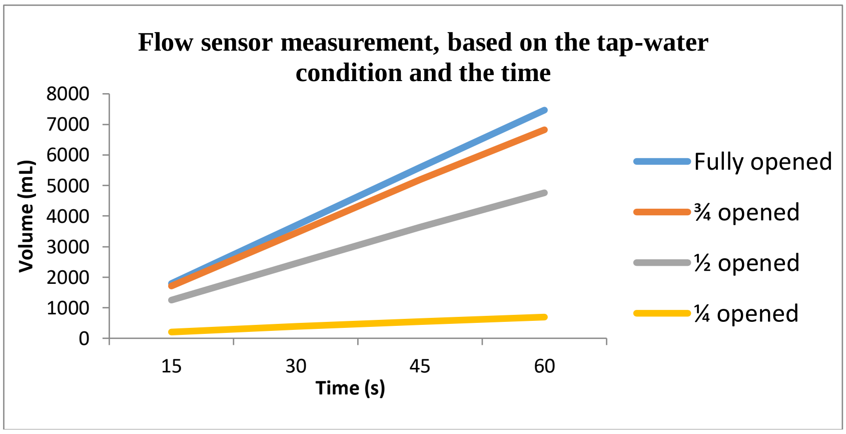


Figure 4. Flow sensor measurement, based on the tap-water condition and the time

From the debit (Q) calculation in **Table 4**, the obtained values are 7.2 L/min and 7.4 L/min. This debit value is still permitted in the flow range of the YF-S201 datasheet. Thus, it can be proven that the sensor worked in accordance with existing datasheets.
The datasheet uses the frequency formulation of F = 7Q (L/Min), it means that: 2 L/min = 16 Hz; 4L/min = 16 Hz; 6 L/min = 49.3 Hz; 8 L/min = 65.5 Hz; and 10 L/min = 82 Hz. Therefore, the frequency for 1 L/min = 8 Hz. In this study, the frequency formula F = 4,5 Q (L/min) was used because the pulse generated in each cycle was ± 4 pulses per cycle. Due to the limitations of measuring devices owned by State Polytechnic of Sriwijaya to determine the number of pulses obtained, the authors converted the value of 1 L/min = 8 Hz used for 7 pulses per cycle with the following calculation:

$$1\ \mathrm{l/min} = \frac{4{,}5}{7}\ x\ 8\ = 5{,}14\ \mathrm{Hz}$$

The 5,14 Hz value from the calculation was a frequency for 4,5 pulse per cycle. In this case, the resulted frequency matched with the measurement data, i.e: 7,4 l/min x 5,14 Hz = 38,036 Hz. This resulting frequency has matched with YF-S201 datasheet and this also proved that the measurements have been conducted correctly.

Table 6. Flow sensor measurement, based on the tap-water condition and the volume

Tap water condition	Time (s) 1.000 ml	2.000 ml	3.000 ml	4.000 ml
Fully opened	9	17	25	33
¾ opened	9	17	26	35
½ opened	13	26	39	52
¼ opened	95	195	298	400

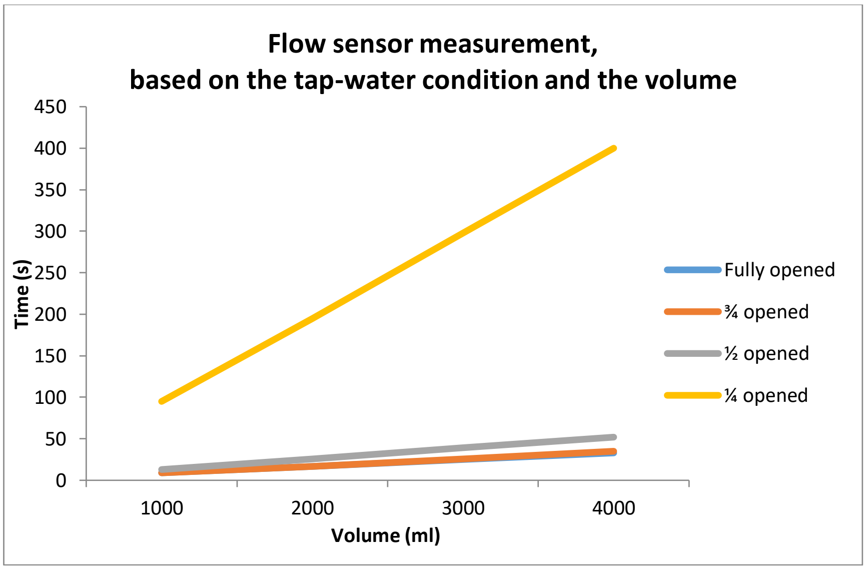


Figure 5. Flow sensor measurement, based on the tap-water condition and the volume

The flow measurements shown in **Table 5** and **Table 6** used different conditions of the tap, i.e. in fully opened, ¾ opened, ½ opened, and ¼ opened. Both measurements were carried out in order to determine the volume produced and the time required if the condition of the tap is open under different conditions. From the data obtained in both tables, the condition of the tap greatly influences the speed of the water flow. In **Table 5**, with the specified time, the smaller the condition of the open tap, the lesser water was obtained. In **Table 6**, with the predetermined volume, the smaller the condition of the open tap, the longer the time required to reach the predetermined volume. **Figure 4** and **Figure 5** show the graphs of the **Table 5** and **Table 6** respectively.

5. Conclusion

The research in this paper proposed the new design of water metering. From the experiment, it was obtained that the design has fulfilled the standard of the water metering. It has the same reading with the conventional metering reading. The modification of the metering proposed in this research utilized the communication module that can make easier the consumer and the water public service to know the consumed water in predetermined time. The customer can monitor the quantity of the consumed water trough their mobile phone.

References

[1] Bunyamin, N. L. Husni, H. Basri, and I. Yani, "Challenges in Turbine Flow Metering System: An Overview," *J. Phys. Conf. Ser.*, vol. 1198, no. 4, 2019.

[2] M. R. H. Evelina Ginting, Nyayu Latifah Husni, Tresna Dewi, Ade Silvia Handayani, "Application of Fuzzy Logic and Social Media on Flood Hazards," *J. Ilm. Pendidik. Tek. Elektro*, vol. 3, no. 1, pp. 42–48, 2018.

[3] S. Chun, B. Yoon, Y. Lee, and H. Choi, "Development of water flow standard system for calibrating water flow meters up to 2000 m 3 / h in KRISS," *FLOMEKO*, pp. 1–4, 2016.

[4] K. A. Nguyen, R. A. Stewart, H. Zhang, and C. Jones, "Intelligent autonomous system for residential water end use classification: Autoflow," *Appl. Soft Comput. J.*, vol. 31, pp. 118–131, 2015.

[5] M. J. Mudumbe and A. M. Abu-Mahfouz, "Smart water meter system for user-centric consumption measurement," *Proceeding - 2015 IEEE Int. Conf. Ind. Informatics, INDIN 2015*, pp. 993–998, 2015.

[6] C. D. Beal and J. Flynn, "Toward the digital water age: Survey and case studies of Australian water utility smart-metering programs," *Util. Policy*, vol. 32, pp. 29–37, 2015.

[7] D. Hoffmann, A. Willmann, R. Göpfert, P. Becker, B. Folkmer, and Y. Manoli, "Energy harvesting from fluid flow in water pipelines for smart metering applications," *J. Phys. Conf. Ser.*, vol. 476, no. 1, 2013.

[8] N. S. Islam and M. Wasi-ur-Rahman, "An intelligent SMS-based remote water metering system," *ICCIT 2009 - Proc. 2009 12th Int. Conf. Comput. Inf. Technol.*, no. Iccit, pp. 443–447, 2009.

[9] C. Z. Myint, L. Gopal, and Y. L. Aung, "WSN-based reconfigurable water quality monitoring system in IoT environment," *ECTI-CON 2017 - 2017 14th Int. Conf. Electr. Eng. Comput. Telecommun. Inf. Technol.*, pp. 741–744, 2017.

[10] A. Gupta, S. Mishra, N. Bokde, and K. Kulat, "Need of smart water systems in India," *Int. J. Appl. Eng. Res.*, vol. 11, no. 4, pp. 2216–2223, 2016.

[11] C. Luciani, F. Casellato, S. Alvisi, and M. Franchini, "From Water Consumption Smart Metering to Leakage Characterization at District and User Level: The GST4Water Project," *Proceedings*, vol. 2, no. 11, p. 675, 2018.

[12] J. M. Marais, R. Malekian, N. Ye, and R. Wang, "A Review of the Topologies Used in Smart Water Meter Networks: A Wireless Sensor Network Application," *J. Sensors*, vol. 2016, 2016.

[13] H. March, Á. F. Morote, A. M. Rico, and D. Saurí, "Household smart water metering in Spain: Insights from the experience of remote meter reading in alicante," *Sustain.*, vol. 9, no. 4, 2017.

[14] X. Wang, J. Shao, F. van Steenbergen, and Q. Zhang, “Implementing the prepaid smart meter system for irrigated groundwater production in Northern China: Status and problems,” *Water (Switzerland)*, vol. 9, no. 6, pp. 1–18, 2017.
[15] Hendrik Naipospos, “Tarif Air PDAM Naik, Ini Daftar Harga Terbarunya,” *Tribun News*, 2017.

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