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Design And Build A Home-Based PLN KWH Meter Reading System As An IoT-Based Home Electricity Consumption Report

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Abstract. Electricity is one of the primary human needs in the era of technological and communication advancement. KWH Meter is an electrical energy counting device that works using the magnetic field induction method. With the process of manual calculation with the officer in the sense of time consuming. To facilitate the recording process, Design a Home Pln Kwh Meter Reading System as a Report on The Use of IoT-Based Home Electricity (kWh Meter IoT) is needed. Research Procedure uses Analisis, design, testing and implementation. The kWh IoT meter design uses NodeMCU8266 as a controller, PZEM004Tv3 as an energy sensor and a 2x16 LCD as a display. This IoT kWh meter tool can record the use of home electricity in accordance with the recording of PLN kWh meter installed in the customer's home with an average difference of 0.021 kWh energy recording within 15 days, data can be monitored in real time through the Android Fullscreen Browser Application and or Desktop Web Browser.

1. Introduction

Electricity is one of the primary human needs in the era of technological and communication advancement. Almost all aspects of human life use electrically driven devices. With the diminishing natural resources of power plants, humans are expected to make savings on electricity use. The use of listri can be measured using the KWH Meter. KWH Meter is an electrical energy counting device that works using the magnetic field induction method, where the magnetic field is moving a disk made of aluminum. Watt or Kwatt gauges, commonly called Watt-meters/Kwatt meters are arranged in such a way that the voltage coils can rotate freely, thus electric power can be measured, either in WH (Watt Hour) or in KWH (KiloWatt Hour)[1]. In some uses of electricity, for example in housing, information is needed about the amount of electrical power used at a certain time to find out the increase in electricity usage. Monitoring of the use of electrical energy is necessary to reduce excessive and unprostitable use of electrical energy [2].

With officers noting one by one the use of electricity in housing, this process is felt to be time consuming and less efficient. Therefore, to facilitate the process will be made Designing and Building Home-Based PLN KWH Meter Reading System as an IoT-Based Home Electricity Consumption Report.

2. Methods

2.1 Research Procedure

This type of research is in the form of experimental research, with the stages of research as described in the following image:

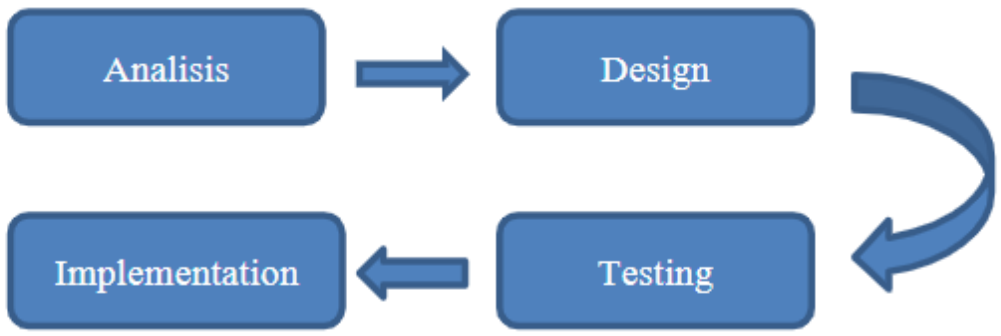

Figure 1 Research Procedure

2.2 Materials

This research requires materials in accordance with the results of observations and surveys in PLN customers one of the residents of Graha Bahari Housing No.A18-19 Jl. Dewi Sartika Rt.01 Rw.01 Pesurungan Kidul Tegal Barat Tegal City with PLN Customer ID 522511131099.

2.3 Tools

2.3.1 Software

a. Arduino IDE is used for microcontroller programming fromtools used for research.
b. PHP is used as a website programming.
c. MySql is used as a database.
d. Android Fullscreen Browser app.

2.3.2 Hardware

a. ESP8266
b. PZEM004Tv3
c. Coil Ampere
d. LCD 2x16
e. Power Supply Switching 12 volt 5 ampere
f. Access Point

2.4 IoT kWh Meter System Concept

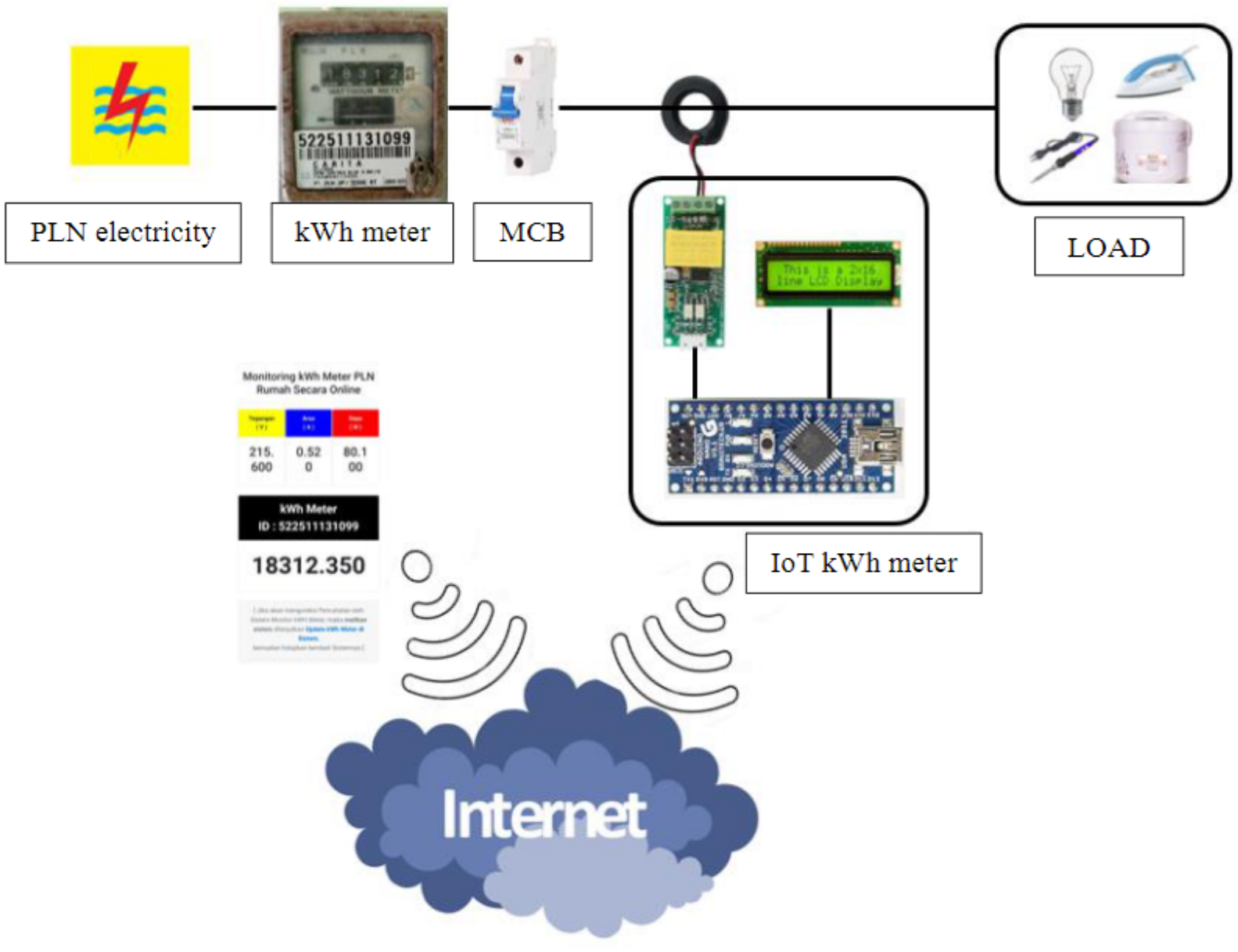

Figure 2 Concept of IoT Meter kWh System

2.5 Program Flow

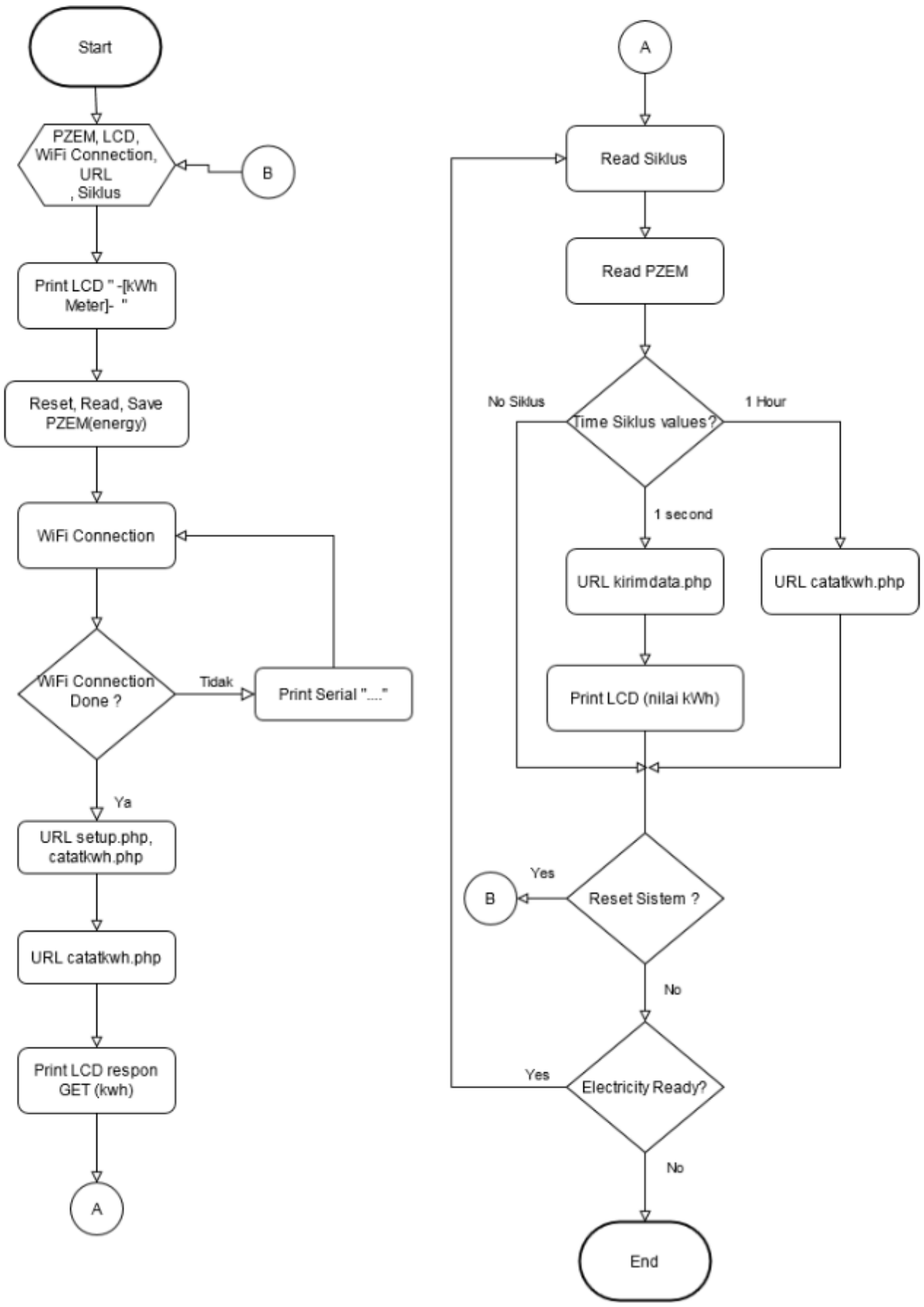

Figure 3 Flowchart System Design

3. Results and Discussion

3.1 Result

Hardware to make kWh IoT meters need a clear picture so that in the assembly of all the hardware can be done correctly then the assembly design is made in such a way that the device after assembled can work in accordance with expectations, the picture of the floor is described in Figure 4 below.

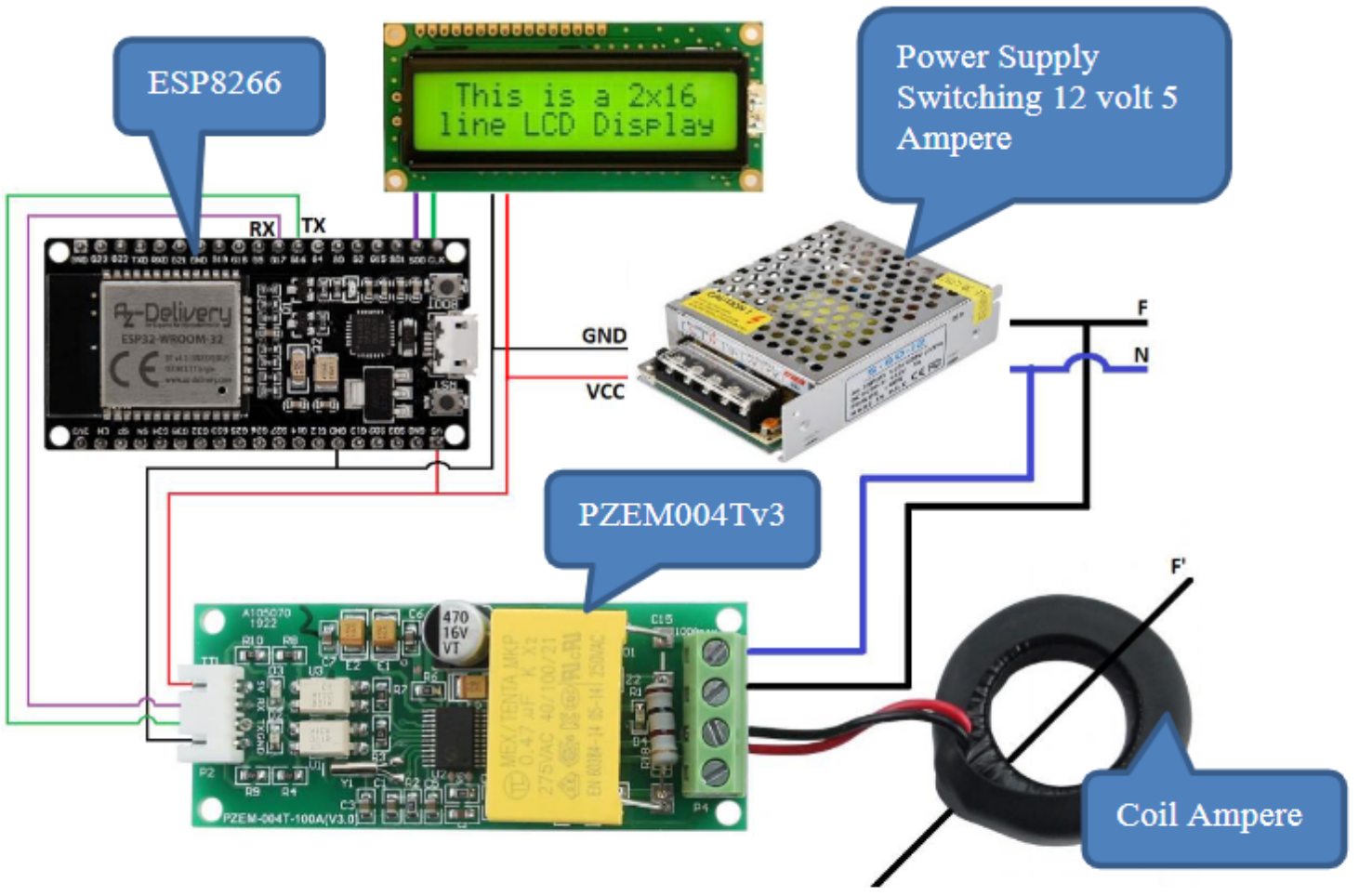

Figure 4 IoT Meter kWh Meter Hardware

Keterangan :

1. PZEM004Tv3 data pins are installed on pins 12 and 14 (TX,RX) to send energy data
2. 2x16 character LCD used for kWh display value
3. Ampere Sensor Coil is installed on the F (Phase) line of output from PLN kWh Meter before the load of the house
4. Wifi on ESP8266 connects to the customer's home Access Point.

Software is implemented in the form of PHP-based website applications by utilizing bootstrap as its style and MySql as a database to store kWh data. There are 10 php files used to process data transmitted through ESP8266 and 1 database containing 3 tables to store data that will be used for php file needs.

Figure 5 File php kWh Meter IoT

#	Nama	Jenis	Penyortiran	Atribut
1	id	int(11)		
2	idpelanggan	varchar(15)	latin1_swedish_ci	
3	tanggal	timestamp		
4	tegangan	float(8,3)		
5	arus	float(8,3)		
6	daya	float(8,3)		
7	energi	float(10,3)		
8	balance	float(10,3)		
9	kwh	float(10,3)		

#	Nama	Jenis	Penyortiran	Atribut
1	id	int(11)		
2	idpelanggan	int(15)		
3	tanggal	timestamp		
4	kwh	float(10,3)		
5	status	int(1)		

#	Nama	Jenis	Penyortiran
1	id	int(11)	
2	idpelanggan	varchar(15)	latin1_swedish_ci
3	tanggal	timestamp	
4	kwh	float(10,3)	
5	status	int(1)	

Figure 6 MySql database table

Figure 7 Interface Monitoring kWh Meter IoT file index.php

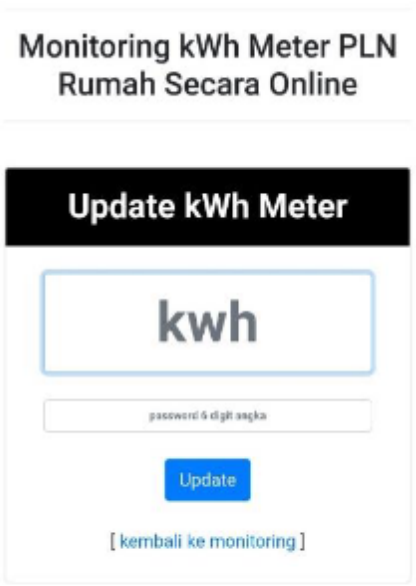

Figure 8 Interface Update kWh Meter IoT file updatekwh.php

The kWh data during this study can be seen in terms of Figure 9.10 and the following 1.2 tables:

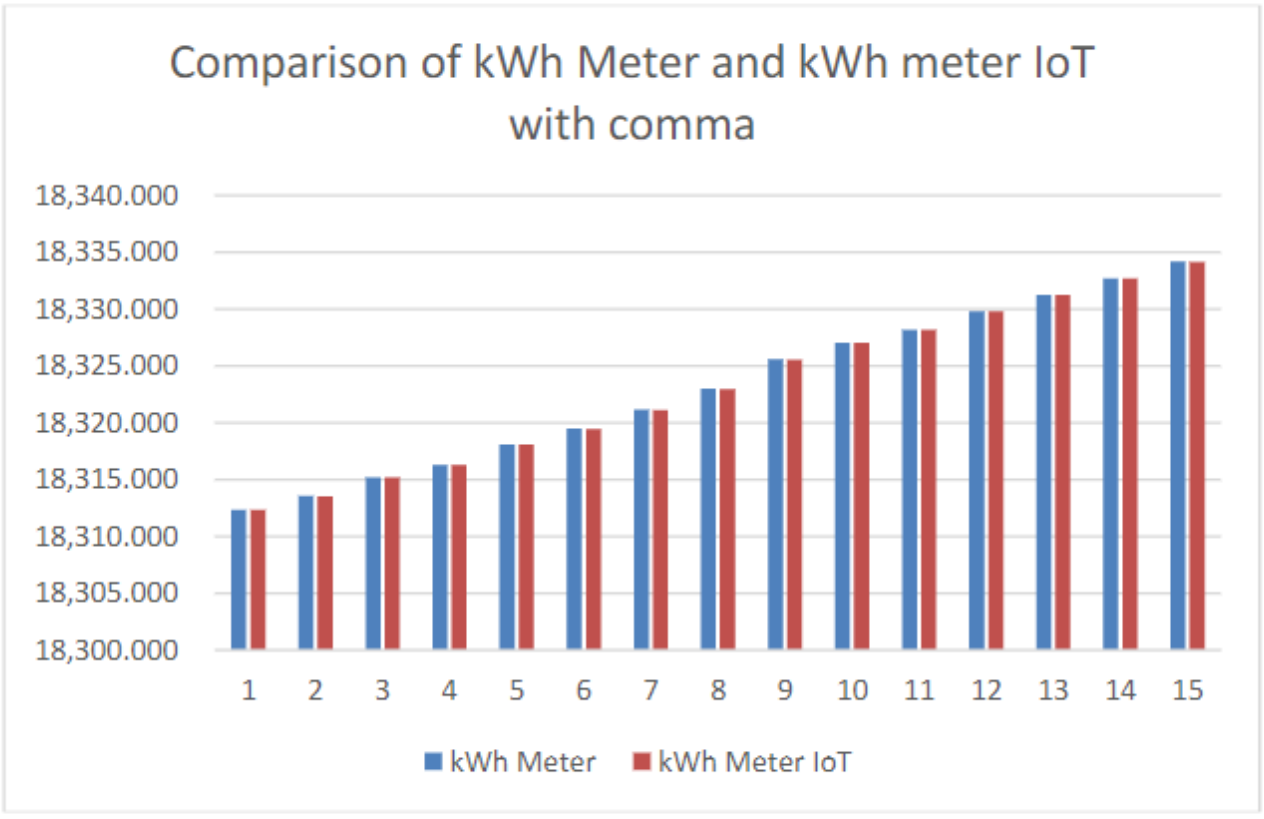

Figure 9 Comparison graph between kWh Meter and kWh IoT Meter with data accompanied by comma value

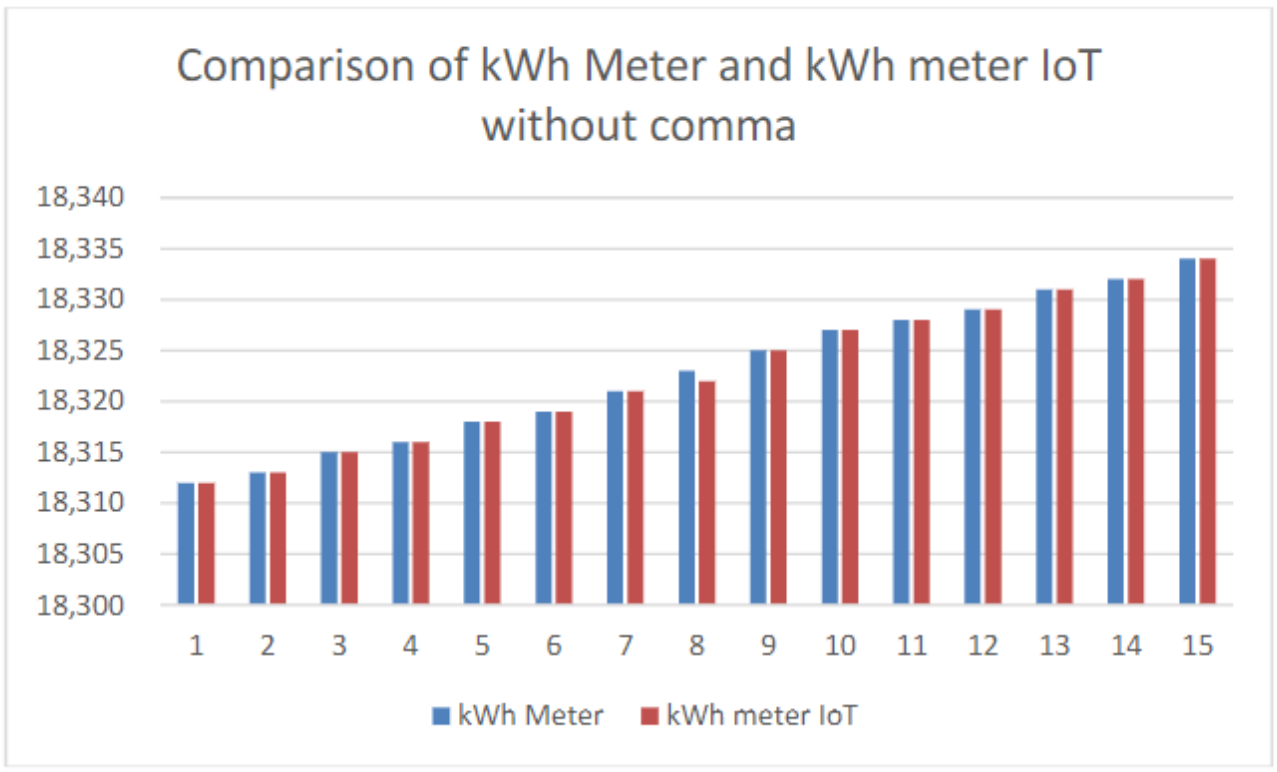

Figure 10 Comparison graph between kWh Meter and kWh IoT Meter with data without comma value

Table 1 Reading of kWh meter and kWh IoT meter data with data accompanied by comma value

No	Date_hour	kWh Meter	kWh Meter IoT	Difference
1	20211128_103156	18.312,360	18.312,350	0,010
2	20211129_040332	18.313,575	18.313,541	0,034
3	20211130_055355	18.315,210	18.315,211	(0,001)
4	20211201_060225	18.316,290	18.316,289	0,001
5	20211202_092418	18.318,098	18.318,078	0,020
6	20211203_070946	18.319,485	18.319,461	0,024
7	20211204_093551	18.321,160	18.321,125	0,035
8	20211205_093917	18.323,000	18.322,949	0,051
9	20211207_080920	18.325,605	18.325,541	0,064
10	20211208_070631	18.327,050	18.327,037	0,013
11	20211209_055514	18.328,205	18.328,189	0,016
12	20211210_075412	18.329,800	18.329,801	(0,001)
13	20211211_082623	18.331,255	18.331,246	0,009
14	20211212_133530	18.332,700	18.332,688	0,012
15	20211213_082233	18.334,175	18.334,154	0,021
			Min	(0,001)
			Max	0,064
			Average	0,021

Table 2 Reading of kWh meter data and kWh IoT meter with data without comma value

No	Date_hour	kWh Meter	kWh meter IoT	Information
1	20211128_103156	18.312	18.312	Appropriate
2	20211129_040332	18.313	18.313	Appropriate
3	20211130_055355	18.315	18.315	Appropriate
4	20211201_060225	18.316	18.316	Appropriate
5	20211202_092418	18.318	18.318	Appropriate
6	20211203_070946	18.319	18.319	Appropriate
7	20211204_093551	18.321	18.321	Appropriate
8	20211205_093917	18.323	18.322	Not Appropriate
9	20211207_080920	18.325	18.325	Appropriate
10	20211208_070631	18.327	18.327	Appropriate
11	20211209_055514	18.328	18.328	Appropriate
12	20211210_075412	18.329	18.329	Appropriate
13	20211211_082623	18.331	18.331	Appropriate
14	20211212_133530	18.332	18.332	Appropriate
15	20211213_082233	18.334	18.334	Appropriate

3.2 Discussion

Figure 7 is an interface of the index file.php useful for monitoring kWh IoT meters in real time and Figure 8 is an update interface.php useful for updating the value of kWh IoT meter at the beginning of kWh IoT meter will be used.

Figure 9 and Table 1 are kWh Meter and kWh IoT data that show kWh data in the form of scented values, there is a difference in readings between kWh Meter and kWh IoT Meter with an average of 0.021 kWh within 15 days of data retrieval.

Figure 10 and Table 2 are kWh Meter and kWh Meter IoT data that shows data in the form of kWh in the form of values without commas, there is 1 that does not match the reading between kWh Meter and kWh IoT meter within 15 days of data retrieval, namely on day 8, this is because kWh Meter uses the appearance of mechanical data where the number shows in the last digit before the comma in the form of the number 3 but on kWh IoT meter is still It's still the number 2.

Figure 7 and Figure 8 are interfaces used by Registrars or customers through Gadgets or PCs / Laptops using a Browser.

4. Conclusion

The conclusions in this study so that the tools implemented are as follows:

1. The tool made is kWh Meter ioT can report the use of electrical energy by customers to pln kWh meter registrar or PLN customer.
2. IoT kWh Meter tool design uses ESP8266 as controller and PZEM004Tv3 as energy reading sensor.
3. There is a difference in readings of kWh Meter and kWh IoT meter with an average of 0.021 kWh during the data retrieval period
4. Reading of kWh Meter and kWh IoT data with data without comma there is a difference that is when the value of comma data shows a value above 0.750 where on kWh Meter that visually uses mechanical display has shown rounding numbers.
5. The difference at point 3 can be rounded on the display in kWh IoT meter so that the value between kWh Meter and kWh IoT meter looks the same because PLN officers only record data without commas.
6. Data can be monitored in real time through the Android Fullscreen Browser App and/or The Desktop Web Browser.

Acknowledgments

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