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STRENGTHENING ELECTRICITY CONTROL IN THE TIME OF COVID 19 BASED ON MICROCONTROLLER

Eki Putra[1], Solly Aryza[2], Adi Sastra P Tarigan[3]
Program Study Electrical Engineering
Faculty Sceince and Technology
Universitas Pembangunan Panca Budi, Medan
North Sumatera Indonesia

ABSTRACT

This research was conducted during the Covid 19 pandemic season where PT. PLN (Persero) provides prepaid and postpaid electricity program services, but when the development of technology in postpaid electricity programs often encounters human errors when officers read the kwh meter, sometimes PLN officers do not go down to residents' homes to record consumer usage because people are afraid of covid-19. In this study, an electrical energy monitoring tool was built using SMS (short massage service) based on the ATMEGA 2560 microcontroller which can measure and monitor electrical energy consumption in real time using a voltage sensor and a current sensor SCT013-030.

Keywords: Energy Monitoring, Covid-19 Energy Analysis, Energy Control.

1. INTRODUCTION

In essence PT. PLN (Persero) is a State-Owned Enterprise that is engaged in electricity, both from starting to operate power plants, namely from generators to consumers by transmitting to all parts of Indonesia, consumers of PT. PLN Persero has received prepaid and postpaid electricity program services, but in postpaid electricity programs, human errors often occur when the officer reads the kwh meter, on digital or prepaid kwh meters we can see the amount of power per meter that we have filled, but often power outages occur or not measured how much power we spend per day when using electrical appliances at home(Wijaya, 2019).

In this research, an electrical energy monitoring device is designed that can be used using SMS (short message service) based on the ATmega2560 microcontroller which has a larger data capacity and quite a lot of input pins that function to add sensors if needed.(Aryza et al., 2018). Record and read the use of electrical energy in real time and periodically. In addition, there is also an RTC DS3231 which functions for more accurate time measurements in other words a real time clock, because the RTC 3231 IC has a crystal component in it which makes the data more accurate. For sending data via SMS using an 800L sim which has the advantage of using lower power. For data retrieval, ADS 1115 is used which serves to retrieve data to be more accurate and precise(Solly & Lubis, 2019).

2. THEORY BASIS.

2.1. Electrical Energy Monitor.

In this research, a tool is designed that is able to read and monitor electrical energy using SMS which can measure and monitor the use of electrical energy in real time, using the direct measurement method. Where the readings of the current sensor and voltage sensor are forwarded to the ATMEGA 328 microcontroller to be converted into the amount of electrical energy and the amount of payment in accordance with the tariff determined by PLN(Hamdani et al., 2018).

The first research design for monitoring electrical energy using an Arduino-based ATMEGA 2560 sms was designed by Raden Ajeng Gusti Ramadhianti, Ir Cok Gede Indra Sensha Partha, and I Gusti Agung Pt Raka Agung in June 2018. The research was conducted at the Electrical Engineering Basic Laboratory, Electrical Workshop & Installation Laboratory, Electrical Engineering Study Program.

(Yulistiana et al.,(2016) The second study was conducted by Diah Rizqiwati, Ahmad Ghzali Rizal and Zamah Sari on August 1, 2016, the researcher proposed to make a control device using Arduino Uno, so that the owner could control electricity usage in real time. Arduino Board functions as a data retrieval control system, before the data is processed on the server. There is a sensor system that functions to collect Ampere data, namely the AC712-20A sensor and the relay module as an electrical switch that functions to cut off electrical power when the pulse is insufficient. From the results of the tests that have been carried out, the average error for measuring the ACS712-20A sensor with a multitester is 26%, while for the measurement of prepaid electricity bills there is an error of 6%.(Gregor et al., 2015);

2.2.Current Sensor STC013-030

A current sensor is a sensor that measures current and detects AC (alternating current) or DC (direct current) electric current in a cable, producing a comparable signal in the form of an analog or digital signal to be processed.(Aryza, 2017). In this study, the current sensor used is a current sensor type STC013-30

The current sensor technology is almost the same as the voltage sensor technology, namely by using a current transformer known as the Current Transformer (CT) and by using the hall effect technology. This sensor is classified as a component that has a good level of stability.

Figure 1. Current sensor STC013-030

2.3. Voltage sensor.

In this design the voltage sensor functions as a sensor that measures the voltage provided by PLN, in this study used a voltage sensor that has an output voltage of 5 volts using a 500 mA ct transformer which functions to reduce the AC voltage (altenating current) from 220 volts to 5 volts, then the voltage is aligned and converted into a DC voltage with a rectifier diode, the voltage sensor is used to take voltage data

to the terminal connected to the load(Adityawarman, Dimas Zebua & Hakim, 20116).

Figure 2.voltage sensor

2.4.Arduino Microcontroller

Arduino Atmega is an electronic prototyping platform which is an open source hardware based hardware and software which is flexible and easy to use. Arduino is intended for artists, designers, and anyone interested in creating interactive objects or environments. According to Sulaiman (2012).

Arduino is a platform consisting of software and hardware. Arduino hardware is the same as microcontrollers in general, but Arduino adds a naming pin to make it easier to remember. Arduino software is open source software so it can be downloaded freely. This software is made to enter programs on Arduino. Arduino programming is not as much as conventional microcontroller stages because Arduino has been designed to be easy to learn, so beginners can start learning microcontrollers with Arduino.

Based on the description above, it can be concluded that Arduino is an electronic prototyping platform consisting of hardware and software. According to Feri Djuandi (2011: 8), the main component on the Arduino board is the Atmega 8 bit brand made by Atmel Corporation. Different arduino boards use different types of Atmega depending on the specifications, for example the arduino uno uses the Atmega328 while the arduino Atmega2560.

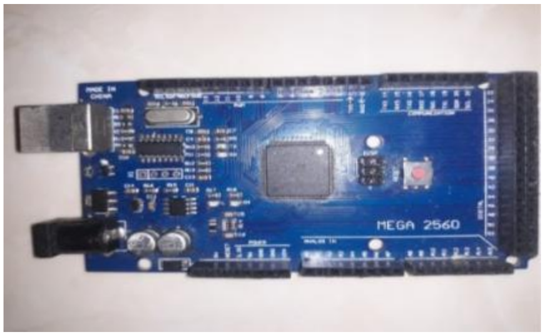

Figure 3. Atmega 2560 . Microcontroller

following new features:

1.0 pin out: added an SDA pin and an SCL pin near the AREF pin and another two new pins placed near the reset pin, IOREF allows the shield to adapt to the available voltage on the board. In the future, this shield will be compatible with both boards that use AVR that operate with a voltage of 5 volts and with Arduino which operates with a voltage of 3.3 volts. And there are two unconnected pins, which are reserved for future use.

RESET circuit.

The Atmega 16U2 chip replaces the Atmega8U2 chip.

2.5. Electrical voltage

Voltage is a potential difference (voltage) is the effort made to move a charge (equal to one coulomb) on an element or component from one terminal or pole to another terminal or pole, or at both terminals or poles there will be a potential difference if we transfer or transfer a charge of one coulomb from one terminal to another. The relationship between the work done is actually the energy released, so the above understanding can be simplified that voltage is energy per unit charge. (Irwan Dinata, 2015)

Mathematically:

At direct voltage (DC) (1)

$V = I/R$ (volts)

At alternating voltage (AC). (2)

$V = p / I.\cos \phi$

3. RESEARCH METHODOLOGY

3.1.Hardware Design

In electrical energy monitoring research using an Atmega 2560 microcontroller based SMS, using software, namely Diptrace software for PCB schematics and layouts. The block diagram of an electrical energy monitoring system using an ATmega328 microcontroller-based SMS is shown in the figure below.

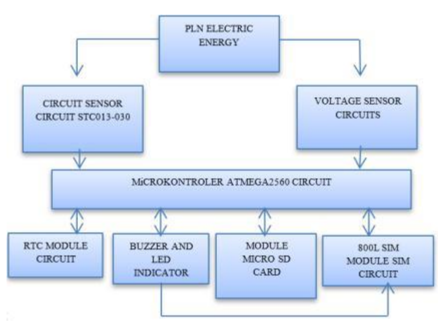

Figure 4. Hardware Design

In general, the implementation of the electrical energy monitoring system design uses an Atmega2560 microcontroller based SMS, using a current sensor SCT013-030 and a voltage sensor based on an Atmega2560 microcontroller, with input from electrical energy (PLN). Electrical energy (PLN) will go through the current sensor SCT013-030 and pass through the voltage sensor, the output of the current sensor and voltage sensor is electrical energy, which is then forwarded to the microcontroller. The amount of incoming electrical energy will be converted to the amount of payment that has been determined by PLN. The reading and price conversion results will be displayed on the LCD.

The schematic of the electrical energy monitoring design circuit using SMS based on the Atmega2560 Microcontroller is as follows

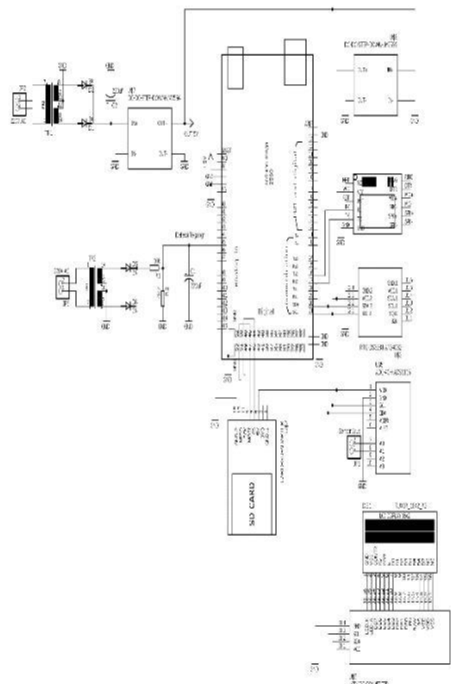

Figure 5. Schematic Drawing: a series of studies

The current used by consumers will be detected by the current sensor STC 013-030 and the voltage will be detected by a voltage sensor using a 500 mA transformer and rectifier diode which will be input to Electrical Energy Monitoring during the Covid-19 Pandemic Using SMS on the Microcontroller (Fitra) ATmega2560 microcontroller.

Hardware design consists of:

Atmega2560 microcontroller circuit.

Current sensor circuit SCT013-030.

Voltage sensor circuit.

LCD circuit.

Micro SD Card module series.

Real Time Clock module series.

GSM SIM800L GPRS Module Series as SMS sender.

A series of Buzzer modules and LED indicators.

DC to DC converter step down module.

i2c to LCD Converter Module.

4. ANALYSIS AND RESULTS.

Testing the tool by comparing the current, voltage, electric power data on the measuring instrument. The test data taken are as follows:

4.1. Experiment with comparison of current and load between experimental and measuring instruments.

In this experiment, the experiment will compare the value of the electric current in the load with a measuring instrument, where at the load there are incandescent lamps, blenders, irons, TVs, and fans. Experimental table of comparison of current with load between experimental and measuring instruments.

In this experiment, the experiment will compare the value of electric power at the load with a measuring instrument, where the load contains incandescent lamps, blenders, irons, TVs, and fans.

Table 2. Experiment comparing power load between test equipment and measuring instrument

Electric load	**Voltage**	**Test tool**
	measuring	**voltage**
Incandescent	**device**	209
	210	
lamp	209	208
blender		
an iron	209	208
TV	213	210
Fan	215	214

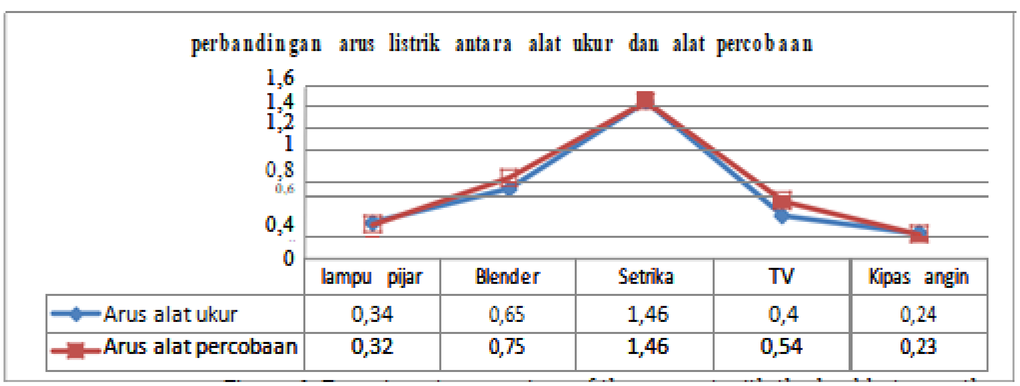

Figure 6. Current-to-load comparison experiment between experimental equipment and measuring instruments

In this experiment, the experiment will compare the value of electric power at the load with a measuring instrument, where the load contains incandescent lamps, blenders, irons, TVs, and fans.

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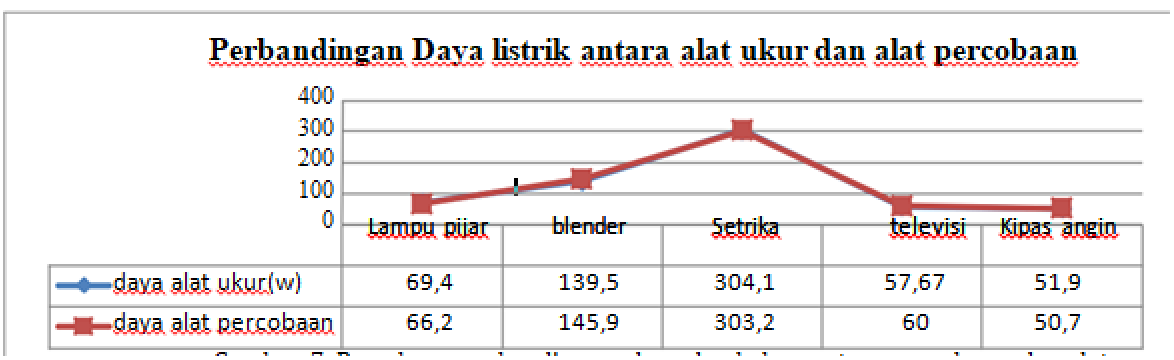

Figure 7. Experimental comparison of power and load between experiments and measuring instruments.

The reply text contains information on the date and time, the amount of power that has been used, the amount of electricity consumption (KWh) in real time and the amount to be paid (Rupiah). Power (Watts) is obtained from the following calculations:.

= VI cos phi

229. 1.73. 0.9

356 watts

Energy (kWh) is obtained from the following calculations:

Energy = VI Cos phi / 3600 s

356 w / 3600 sec

0.098 kWh

Cost (Rupiah) is obtained from the following calculation:

Cost = ((kwh) x Price / kwh x 1.05)

0.098 x 1,428 x 1.05

0.146 Rupiah

In this study, the data logger monitoring electrical energy aims to determine whether the data logger on the system is running according to measurements. Data collection was carried out for 24 hours, starting on August 26, 2019 at 22:33 WIB until August 27, 2019 at 22:44 WIB.

Table 3. Data logger measurement results table.

Date	Time	Currently	Volt	Watt	Kwh	Rp
27/08/2019	22:33	1,431	204	292.52	0868	1174
27/08/2019	23:34	1,442	205	295.97	1.148	1552
28-08/2019	0:34	1.389	207	288.19	1.457	1970
28-08/2019	1:35	1.393	210	292.54	1,745	2360
28-08/2019	2:35	1,439	212	304.56	2,029	2743
28-08/2019	3:35	1,271	213	270.54	2.310	3123
28-08/2019	4:36	1,214	213	258.26	2,591	3503
28-08/2019	5:36	1,460	207	302.80	2,874	3885
28-08/2019	6:37	1,245	207	257.73	3.195	4319
28-08/2019	7:37	1,208	212	256.60	3,464	4683
28-08/2019	8:38	1.013	209	212.11	3,699	5001
28-08/2019	9:38	2.207	208	458.69	4034	5454
28-08/2019	10:39	1.022	206	210.85	4.293	5805
28-08/2019	11:39	0.983	208	204.13	4,507	6094
28-08/2019	12:40	0.989	209	206.34	4.734	6400

CONCLUSION

The conclusions that can be drawn based on the results of the tests and discussions carried out are as follows:

1. After doing research on the design and monitoring of electrical energy using the ATmega 2560 microcontroller based on consumer SMS PT. PLN (Persero) can find out the power that has been used and the price of electricity that has been used every day

2. In this study, it can be seen the working principle of electrical energy monitoring design using an SMS based micromeal controller atmega 2560, namely the current used by consumers will be detected by a current sensor STC 013-030 and the voltage will be detected by a voltage sensor using a 500 mA transformer and a rectifier diode that will be input to the Atmega 2560 microcontroller, then the resulting data is processed using the ADS 1115 module and will then be displayed on the LCD so that the sensor data produced is more precise in calculations, to display the date and time on the LCD screen using the RTC ds 3231 module which functions to calculate the time continuously starting from the date, day, month, year, hour, minute and second.For sending data that has been used, the SIM 800 L module is used which serves to send data that has been used to consumers via SMS, for data storage using a micro sd card module with 32 GB of external memory to store data loggers every day.

3. In this experiment, it can be seen that the components used in the design of electrical energy monitoring using an SMS-based Atmega 2560 microcontroller are the current sensor STC013-030 for the current sensor, the voltage transformer ct 500mA for the voltage sensor, LCD 20x4 for data display, RTC module DS3231 to calculate the time, date, month and year continuously, Sim 800L module for sending data via SMS, stepdown dc to dc module for microcontroller power supply, micro sd card module for data storage, ads 1115 module for current sensors and sensor trade calculations more precision calculation, i2c module to lcd for LCD pin input.

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