Modeling And Simulation Of Electrical Prevenion System Using Arduino Uno,Gsm Modem, And Acs712 Current Sensor

1Ummul Khair, 2Abdul Jabbar Lubis, 3Indra Agustha, 4Dharmawati, 5M. Zulfin

1,2Program Studi Teknik Informatika Sekolah Tinggi Teknik Harapan Medan
Jl. HM Jhoni No. 70 Medan, Indonesia

4 University Of North Sumatera

1ummul.kh@gmail.com

Abstract. The current electricity needs is very primary, all objects including electronics require power, it encourages people not to be able to save electricity so the theft of electric power would be done. The use of ACS712 current sensor as the sensor with arduino uno would find out the power consumption continuously and prevent the theft of electricity because of the use of electricity which has been determined by PLN and the people felt that it is not enough for every house, so the author made a tool for prevention of theft of electric power by using the arduino uno, buzzer, ACS712 current sensor, lcd, and relay then the power usage can be controlled according to the use to prevent the occurrence of theft of electricity so the use can be seen directly on the lcd 16x2and GSM modem to give information to employees of PLN so that it can reduce electrical theft by the public.

Keywords : Electric theft prevention tools, ACS712 current sensor, Arduino uno.

1. INTRODUCTION
The development era increasingly, the current electrical needs are very primary. All electronic tools require electric power. Without realizing, the people make electricity as primary needs, so that we are very difficult to control and economize the use of electricity. The economies of people in Indonesia who are still low, the electricity fare is more expensive and it is difficult to control and save electricity usage, so there is a fraud done by the society to meet all the needs by making the theft of electric power without thinking big risks. So it losses the PLN (State Electricity Company) and it can dangerous to the crime of electricity theft such as fire because of short circuit.

The previous research related to the topic of discussion on electrical controller, which is done Temy Nusa, Sherwin R.U.A ST, MT. Dr.Eng Meita Rumbayan, ST, MT from UNSRAT Manado (2015). Using this tool we can save electrical energy on devices that are considered quite wasteful by utilizing microelectronics designed to monitor the consumption of electrical energy that utilizes a step-down transformer to measure power from PLN and At mega 328 microcontroller which function to process data from parameters needed to obtain the value of electrical energy consumption.

It is the same with the research was done by Mukhlas Arihutomo, Muhammad Rivai, Suwito from Institut Teknologi Sepuluh Nopember (2012). Using this tool, we can know the use electric current distribution at home, so if it is the excessive use of nets electric current, it is possible the electric current use electrical...
theories, that is if the use of the greater load while the voltage constant, the current consumption will also be greater. The current usage data on a line will be sent to the monitoring center through the media trasmisi nets.

Based on problem above, So the writer made a research about a device that can prevent electrical theft by containing a series of microelectronics such as Arduino uno, Buzzer, Modem GSM, ACS712 current sensor, Power Supply, LCD, socket and plug. This electrical theft prevention system uses arduino uno as a microelectronics that processes all data from other electronic components such as data from ACS712 sensors that connect directly to electric current and arduino uno. The system has 2 ways of working namely:

1. This tool measures the electrical current in the program by creating a maximum electric current limit that will be passed by the ACS712 current then LCD always displays the passing current from the ACS712 sensor when the electric current meets or exceeds the maximal current load so Buzzer rings in second as a reminder to prevent the occurrence of electricity theft so the people can reduce excessive electricity consumption and power back under maximal.

2. This tool measures the electric current programmed by making the limitation of maximal electric current or the continuation of the first workings when buzzer sounds and the person is not responding the buzzer ringing up to a few minutes then the electricity theft prevention system directly give a short message (SMS) that utilizes GSM modem communications installed on this tool to the nearest PLN with the requirement of PLN phone number is listed on the program of electricity theft prevention system so PLN can know where the theft of electricity and give warning to the user of electricity can be given sanctions from PLN.

2. RESEARCH METHOD

This method used an experimental method. Experiments were carried out on the design of circuit blocks to produce a tool. By conducting experiments on the design and manufacture of this tool, is expected to be obtained series and programs in accordance with the function and purpose of designing this tool. Block diagram can be seen in Figure:

![System Block Diagram](image)

**Figure 1 System Block Diagram**

Explanation and function of each block in system block diagram above is as follows:
1. ACS 712 Current Sensor serves as a tool for measuring the electric current on this tool sensor. [2]
2. The socket has a function as the final terminal of the electrical installation
3. Power Supply has function as a charger on arduino uno. [1]
4. LCD (Liquid Crystal Display) has a function as an electrical current data. [3]
5. Buzzer is the sound signal when it exceeds a predetermined load [3]
6. GSM modem has a function as a modem to receive instruction smartphone android. [4]

2.1 Data Flow Diagram

The data flow diagram is a graphical representation that shows the flow of data from its source in the object through a process that transforms to another destination. Data flow diagram is a tool used to describe the flow of data through the system and the work or processing performed by the system, which exists on other objects.

1. Data Flow Diagram
2. Arduino Uno Installation
In this research he writer used Arduino uno as a controller. Arduino uno is a board micro controller on the basis Atmega328 and a reset button. Arduino uno has a function as processing input and output data other components, While the series reset button has a function as a repeater of the arduino process if it does not work well when it runs. The Arduino uno series can be viewed in the image below:

3. LCD Display Installation
In this research the writer used LCD to perform information to electrical customers which use overload the electrical capacity that has been determined by arduino. The process of sending sms command if the usage of electricity exceeds that has been determined, and the process will run as before. The LCD circuit can be seen in the figure below:
4. I2C Installation Circuit (Inter Integrated Circuit)

In designing models and simulations for the theft of electricity, the writer used Inter Integrated Circuit or often called I2C, it is a standard two-way serial communication using two channels designed specifically to send and receive data. I2C system consists of SCL (Serial Clock) and SDA (Serial Data) channel that brings data information I2C and Arduino. The purpose of I2C LCD is to reduce the number of pins that use on connection on arduino and character LCD.

5. GSM SIM900A Installation

This research was used SIM900A. SIM900A modul is a part that has function to communicate between a prototype electrical prevention tool and handphone. To give information when electrical is overload that has been determined and send from SIM900A ordered by arduino. AT Command is a command that can be given GSM / CDMA modem to send and receive data from SMS.

6. ACS 712 Current Sensor Installation

The use of ACS712 current sensor in designing prototype electrical prevention to measure the amount of electrical usage repeatedly has an output to the LCD as data read by ACS712 current sensor, principle of current sensor from ACS712 is Hall Effect to measure electric current. This sensor can measure Direct Current (DC) and alternating (AC). It can be used analog signal with low noise and lower error is 1,5% to TA = 25 °C, and 4% to –40 °C until 85 °C.
7. Socket Installation
Socket is an electrical installation material that has a function as a connecting between electrical current and electrical equipment. These sockets can not be used to turn on and off household appliances with power more than 2,000 watts or 16A.

8. Buzzer Installation
A Buzzer is an audio device, the use of buzzer here as a warning from a Buzzer tool that uses the Piezoelectric effect to produce sound. The electric voltage applied to the Piezoelectric material, it will cause mechanical movement, the movement is converted into sounds that can be heard by the human ear by using the diaphragm and resonator.

9. Designing Relay
Relay is one of the electronic components consisting of a metal plate as a switch and a coil that has a function to produce a magnetic field. Relay used in this circuit is 250 VAC, it means that positive relay (coil 1) connected to voltage source 250 VAC and negative relay (coil 2) connected to ground, so the coil will produce magnetic field, it will pull the coil and make the switch (coil 3) connected to coil 4. Therefore, we can use coil 3 and 4 on relay as a switch to connect to positive or negative voltage source.
10. Designing Overall Hardware
Designing hardware such as Arduino Uno, LCD (Liquid Crystal Display), GSM sim900a module, I2C (Inter Intergrated), ACS712 current sensor, Relay and Buzzer which is connected to a unity with Arduino Uno through ports which have been determined. At this stage, the hardware is transformed into a prototype so that it can be simulated directly.

3. RESULT AND DISCUSSION
After doing test from the tool, the result are:

3.1 The Tool works
How the tool works are:
1. Active ACS712 current sensor to Arduino
Firstly all tools that have been built must be ready, then activate the arduino uno and wait a while to activate some other tools, after waiting for minutes the buzzer will be active and the sound. It means that tool is active then connect the socket to source of electrical current to ACS712 current sensor to give information like current data, then to check sensor, user must Connect some electronic devices to the socket, ACS712 current sensors will inform arduino, and arduino commands the LCD to display data that has been given from the ACS712 current sensor repeatedly without adding any previous data.

2. Active Buzzer as a warning
To active Buzzer, the User must provide an overload current that has been determined and remembered, it is only a simulation and checking, then if the current is overload, Buzzer is active to warn the user that electrical is overload than if Users respond it, the user will reduce the use of electricity and if the electricity consumption has decreased, the buzzer is not active and returns as before and it will appear on the LCD.

3. Active GSM 900A Modem and Relay
To activate the GSM 900A modem, the user must provide a predetermined overload current and it should be remembered, it is only a simulation and checking, then if the current is overload, Buzzer is active for 10 times respectively, if the user does not respond to the warning then arduino automatically give the command to send a short message (SMS) via GSM 900A modem to the registration number that has been determined such as user and it is displayed on LCD, then if the user does not reduce it, the relay disconnect the power automatically to prevent the theft of electricity during the process.

3.2 Testing Tool
The Test tool is done to test and know how the tool works according to previous planning.
1. Testing Arduino Uno Circuit with LCD

This test is done to determine whether the Arduino is running well or not in accordance with planning. To find out if this Arduino is running well then we must run the program Arduino IDE using visual language C. What must be done before running program is uploading the program on Arduino.

![Figure 12 Listing Program to display Arduino Text on LCD](image)

Program for arduino testing with LCD to display text as shown in Figure 4.4. In program lcd.setCursor (0,0); shows that first character “SELAMAT DATANG” is located on cursor x=0 dan y=0, it means that in the first column and raw. Then in program lcd.setCursor (0,1); shows that cursor x=0 and y=1 that is “WAKTU UJI COBA”. Started from first column and second raw.

![Figure 13 LCD Display](image)

2. Testing Arduino with ACS 712 Current Sensor

Testing ACS712 current sensor circuit is done to find out the advantages and disadvantages of this current sensor in checking the electric current, and whether the sensor circuit is working well or not. The sensor circuit testing is done by installing ACS 712 current sensor in the circuit and contacted at socket. Similarly, in testing the arduino uno with the LCD, testing on the current sensor is also by using arduino IDE program. The measurements are made to measure current on electricity consumption, up and down data will appear on the LCD. After the program is uploaded to the tool set, This tool automatically runs according to the program, it can be seen in figure 15 with current sensor display.

![Figure 14 Display of ACS712 Current Sensor Value](image)

3. Testing Arduino Uno Circuit with GSM SIM900A Modem

This test is done to find out whether SMS system runs well or not. To know it, we must run Arduino IDE program.
4. CONCLUSION

The conclusion about modeling and simulation of electrical prevention system using arduino uno, GSM modem, and ACS712 current sensor are:

a. Using buzzer user get information such as little warning that is buzzer is active in seconds and it is not with different times to inform an excessive load on electricity.

b. Using GSM 900 automatically, it sends message like a warning to inform overload.

c. Using relay, the electricity will be disconnected automatically when SMS sends for the certain time in order electricity theft.

5. References

[1] Arduino. 2016. Tersedia Online – www.arduino.cc. Di akses Mei 2016.

[2] Hilman, HR. Jufri. 2016. Rancang Bangun Alat Ukur Daya Arus Bolak – Balik Berbasis Mikrokontroler Atmega 8535. Jurnal Tugas Akhir. Jurusan Fisika Fakultas MIPA Universitas Sumatera Utara. Medan.

[3] Permadi, Muhammad Teddy. 2015 Rancang Bangun Smart Home Berbasis SMS Gateway Menggunakan ATMEGA16 (Fokus Hardware). Tugas Akhir. Teknik Informatika STT-Harapan Medan.

[4] Wiharto, Yudi. 2011. Sistem Informasi Akademik Berbasis SMS Gateway. Jurnal Palembang : Politeknik PalComTech Palembang.