Design Tools of Electric Applications Kwh Printing by Short Message Service

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Abstract. The prepaid electric meter is an electrical measuring and recording device used by customers with a prepaid system or so-called prepaid. A system that is able to recharge electric vouchers automatically using SMS and notification to the customer that the balance of electricity will be exhausted. This system is built using SMS gateway method by using GSM sim900 modem. When the power balance is below 10 KWH then the alarm will sound, at the same time the microcontroller will send SMS and miscall to customer's mobile number.

1. Introduction

In Indonesia itself, a government company that serves the provision of electrical energy is the State Electricity Company or commonly referred to as PLN. With the development of technology, PLN issued a new innovation in the form of Prepaid Electric Meter KWh. This innovation is intended to facilitate the public in controlling and controlling the use of electricity in their homes. But the use of electricity prepaid is considered less efficient by the community. People still feel less comfortable in using it. One of the obstacles is that the kWh meter of prepaid electricity should be monitored as often as possible because otherwise the amount of kWh on the meter can be depleted at any time at an undesirable time such as midnight or home while there is an event. If the number of kWh is exhausted, the electricity will instantly die. But it is still considered not efficient enough because the alarm indicator has a limited voice. Manually charging tokens is also a constraint because it takes a long time.

some of the problems encountered in designing the remaining prepaid kWh reminder tool via SMS is how to make the programming language to be able to send SMS to Prepaid Electric Meter.

Limitation Issue:

1. Discuss the working mechanism of the residual notification system via SMS and microcontroller programming.
2. Not discussing the specific pre-paid electricity meter working system.

The purpose of this study are:

1. To be able to create a system that will help customers in supervising the prepaid electricity meter.
2. To help give notice to the customer that the electricity will die soon.
3. Facilitate customers in knowing the remaining balance of prepaid electricity.

2. System Designation

2.1. Block Diagram of the Circuit

The common circuit diagram block according to their respective working systems can be seen in the following figure:
Figure 2.1 Block Diagram For Work System Reminder The Number of KWh Will Be Out

The Function of each block:
1. HP User functions to send the number of electrical tokens through SMS.
2. BTS serves as a transmission medium between HP and Modem.
3. Modem serves as an SMS recipient into input for a microcontroller.
4. Microcontroller serves as a Controller of all system work processes.
5. Prepaid Electric Meter serves as an input on the process of remaining balance notice and into the output on the process of refilling electric vouchers.
6. KeyPad Relay function as the interface between Microcontroller with Prepaid electric meter.
7. Max 232 serves as the interface between Modem SIM-900 with Microcontroller.

SMS serves as a message sent or received by a microcontroller that becomes input or output on MLPB

2.2 Flowcharts Balance Reminders Will Run Out and Check Out Remaining Balance

Figure 2.2 Flow Chart System balancing behavior
The microcontroller ensures whether the alarm is on or off otherwise wait until the alarm is on. If yes then the microcontroller will process it. The microcontroller will send SMS using instructions send SMS on a modem.

From the modem check if there is an SMS, otherwise wait until there is an incoming message. If yes then the microcontroller does the data retrieved on the LCD display after that the microcontroller will send SMS via modem in accordance with the data taken on the LCD display pre-paid electricity meter.

2.3 Design of Arduino Uno Microcontroller Circuit
This arduino uno microcontroller is the entire control center of the system built from the source required for the sensor source and also all analog and digital signal inputs as well as analog and digital outputs as in Figure 2.4 below.
In microcontroller either type of MCS or AVR Pin-Pin (Port) to do serial communication that is Rx (Receive) and Tx (Transmitte). Rx is used to transmit data serially while Tx is used to receive serial data as well. Serial communication on this microcontroller still uses TTL signal level (Transistor Transistor Logic) is a signal that has a wave of data level between 0 and 5 volts. With facilities Rx and Tx this microcontroller can either serial communication between devices or with a computer connected with series of serial communication made.

If you want to use a microcontroller to communicate with computers or other devices then Rx and Tx cannot be directly connected to the device because the signal level used varies. For example, serial communication for computers using RS232 signal is a signal whose signal level wave is between +25V to -25V. Therefore, if you want to expect communication between the microcontroller and the computer required a buffer that can change the signal level TTL from the microcontroller into RS232 level signal. The circuit in Figure 2.5 describes how the port of the modem is connected to the arduino microcontroller through the serial communication circuit.

The required software should be able to integrate all the supporting equipment systems used in the design of a prepaid rechargeable voucher charging system by using a microcontroller based SMS so that it can become a complete system. The microcontroller must be able to manage the input data as well as the output data in the controlled equipment.

The software shall be made in accordance with the desired system in order to achieve the purpose of design, in order to control the keypad of the prepaid electricity meter automatically starting from receiving SMS and inputting the number to the meter automatically.
2.5.1 Arduino Uno Software
In making the system using arduino microcontroller to design the desired system. Figure 2.6 is the view when the software wants to run.

![Figure 2.6 Starting Arduino Programming](image)

2.5.2. Getting Started Writing Programs
To write the program we have to open the place of writing sketch, the way is to select File-new menu. Then will appear box like picture 2.7, and the program can be written.

![Figure 2.7 Sketch Place Writing Program](image)

Before writing the program it is better to specify the com port of the address used for communication like Figure 2.8

![Figure 2.8 Port Selection Used](image)

2.5.3 Programming With Arduino uno
The program used uses the function of language c. The following is Figure 2.9 is a program display that has been written.
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Figure 2.9 Appearance of Programs Already In Write

Next, do the data storage by selecting the file menu-then select Save as to the stored data is not deleted or lost, and save it in the program folder.

2.5.4 Uploading the Program to Arduino Uno Microcontroller

Before uploading the program first do by clicking the check mark verification program like image display 2.10 below:

Next is the process of moving the program that has been made to arduino uno atmega328 microcontroller, by connecting the data cable to the computer or laptop and then connected the end of the cable to the microcontroller. How to upload it is to press the arrow to the right to make the upload. Figure 3.16 shows the process of uploading the program.

Figure 2.10 Program View in Verification
After completion of the upload process then the tool will work in accordance with the system in the wake.

2.5.5 List of Allocations
The allocation list is a determination of input equipment and output equipment (input / output) of the microcontroller. These input and output devices shall be assigned an address according to their respective functions in order for the system to operate as expected. List of allocations from the system can be seen in the table below:

| Input / Output | Port | Keterangan |
|----------------|------|------------|
| Modem          | RX 0 | Digital input |
| Relay 1        | D11  | Digital input |
| Relay 2        | D12  | Digital input |
| Relay 3        | D13  | Digital input |
| Relay 4        | D8   | Digital input |
| Relay 5        | D9   | Digital input |
| Relay 6        | D10  | Digital input |
| Relay 7        | D5   | Digital input |
| Relay 8        | D6   | Digital input |
| Relay 9        | D7   | Digital input |
| Relay 10       | D2   | Digital input |
| Relay 11       | D3   | Digital input |
| Relay 12       | D4   | Digital input |

2.6 Working Principles of the System
In the design that is made, there is one Prepaid electric meter, Sim900 SMS Modem and Microcontroller in the sequence in such a way as to become a system that is expected. At the time of the alarm on the meter start active then the microcontroller will process and then send SMS to mobile via modem sim900. Then Prepaid electricity meter will receive token number sent by SMS when there is
SMS sent to modem then will be processed by microcontroller for the input to automatic meter of prepay automatically, between micro controller with electricity meter prepaid there is one series of keypad driver in the form of relay which executes the keypad when there is a command from the microcontroller.

3. Result and Discussion

3.1 Objectives Testing and Analysis System
To analyze whether the system has been made to function in accordance with the desired then the need to be tested. This test aims to obtain data - data on each block series of Design of Notebooks and Checking Removable Time KWH Prepaid Electricity And Refilling Through SMS, test data obtained will be analyzed to be used as a reference in drawing conclusions. 4.2 Device Testing 4.2.1 Communicating MLPB with Microcontroller The communications of pre-paid electricity meter with the microcontroller is done through the 7-bit keypad on the pre-paid power meter, where 12 microcontroller output is ordered to enable relays. As is known if the relay is a substitute to the manual keypad to be electrically, the following Figure 3.1 is a picture of communication between pre-paid electricity meter with a microcontroller

![Figure 3.1 MLPB Communications with Microcontroller](image)

3.2 Communicating the SIM900 Modem with Microcontroller
Communication between Modem sim900 with the microcontroller is done through the RS22 Max circuit where the modem has TTL signal which then will be converted to RS 232 which will be transferred as input for the microcontroller, here is Figure 3.2 is communication between Modem sim900 with microcontroller

![Figure 3.2 Communicating sim900 modem with Microcontroller.](image)

3.3 System Testing Notice of Balance Will Be Out
This test is done to find out that the system of balance notice is exhausted can work in accordance with its function. This test is done by setting the alarm sound to be above 5.00 kWh. This is because the balance on the meter is only 5.00 kWh to make the alarm sound it must be set above 5.00 kWh. At the time the alarm sounds and also the LED indicator changes color from green to red.
Here is the test result image

![Figure 3.3 Display LCD alarm in settings to 07 kWh](image)
Based on the above test results, it can be analyzed that to activate the alarm then the alarm must be set above the minimum balance on the meter. At the time of active alarm then LED indicator also become change color and microcontroller catch the change. Then the microcontroller will perform sending "peringatan" via SMS which contains information that the balance of electricity on the meter runs out immediately and also miscall to the customer's mobile phone to ensure if the customer does not read the SMS message.

Program language

```c
void sms_pemberitahuan()
{
    Serial.print("AT+CMGS=");
    Serial.print("\n");
    Serial.print("082367803355"); //---ini adalah no HP yg dituju
    Serial.print("\n");
    Serial.write(13);
    delay(1000);
    Serial.print("Saldo KWH Anda Sudah Habis");
    delay(1000);
    Serial.write(0x1A);
}
```

The above program is a program to send SMS from the electricity meter to the customer's mobile phone. This is indicated by the AT + CMGS Instruction which is the instruction to send SMS. The SMS is delivered with a delay of 1000 ms or equal to 1 second. If the program is AT + CMGR instruction means the instruction is to read the incoming SMS to the microcontroller.
4. Conclusions
From the results of measurements and observations made in Chapter IV, the results for tool work is to move the keypad buttons on the meter automatically requires the relay driver circuit. In this design use sim900 modem for SMS recipient when filling voucher of electricity and send SMS when the balance of electricity will run out.

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