

Smart Energy Meter

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Abstract: India uses electromechanical electricity meters, but considers the drawbacks of electricity theft, meter reading errors, billing, and consumers hesitating to pay utility bills on time. Therefore, such systems are being replaced by more sophisticated and accurate digital and electronic gauges. This paper proposes a new methodology for implementing a control-based global system for mobile communication networks (GSMs) to integrate prepaid metering system setup and remote load control. This provides a secure smart card solution for new types of prepaid power systems. It aims to reduce the number of utility bill obstacles using smart card technology. The LCD display is used to show the amount of energy consumed. Users can replenish the counter as needed by sending an SMS to the server. Users must make the first replenishment to address the issue of unpaid invoices and human error in invoices. This ultimately guarantees a legitimate return.

Keywords: Smart meter, GSM, Safety control, SMS, AMR, PC, Theft Control, etc

I. INTRODUCTION

In recent decades, the global energy crisis has increased very rapidly. As a result, many new technologies are being introduced to meet the needs of our users. In addition to power generation, demand can also be met by automating energy distribution to improve people's living standards. The traditional method of electricity billing system is complicated. There are many problems with this method, and the system needs to be further developed and automated. Automatic meter reading (AMR) reduces complexity. The energy meter sends readings of power consumption recorded using GSM technology via SMS service.

As technology advances, theft of electricity also increases, which affects Japan's economic stability factors. Therefore, due to the theft of electricity, the meter does not count the actual energy consumption and updates the energy consumption details of the meter and billing system. When using GSM, the invoice is sent to the consumer by. Send an SMS and automatically unload if the user does not pay the invoice. Therefore, not only energy theft, but also energy meter bypass can be monitored with this meter. Therefore, you can maintain accuracy and prevent electricity theft.

II. PROBLEM IDENTIFICATION

1. Existing systems cannot adapt to external conditions.
2. The accuracy of identification will be low.
3. Applied a complicated classification method.
4. Takes time.
5. Electricity theft cannot be detected.

III. OBJECTIVES

- This system will provide a simple means of detecting electricity theft without any human interface.
- It will show the exact area and distribution line where the illegal mining is done in real time.
- It will identify transmission errors.
- Maximize revenue generation with utilities.
- Its cost is lower than other current systems.

IV. SCHEMATICS AND CIRCUIT DIAGRAMS



Figure 1: Schematics of Smart Energy Meter

V. COMPONENTS

1. Arduino Nano
2. GSM Sim800L Module
3. 16×2 LCD Display
4. Analogue Electricity Energy Meter
5. Opt coupler PC817
6. 100R Resistor
7. 4.7k Resistor
8. 1k Resistor
9. 10k Resistor
10. Buzzer
11. 1-Channel 5v Relay Module
12. Male to Male Jumper Wires
13. Male to Female Jumper Wires
14. Bulb Holder
15. 220v LED Bulb
16. 5v 2Amp Power Adapter

VI. BLOCK DIAGRAM

6.1 Power Supply

The main function of a power supply is to convert a single-phase power supply into a continuous DC power supply using a voltage rectifying circuit. The microcontroller and related circuits require a 5V supply and the relays require a 12V supply. One 12V adapter connected to mains produces a 12V DC output that can be used by the relay and this voltage is passed through a positive regulator. The DC voltage of the IC 7805 produces a 5V DC output used in microcontrollers and other logic circuits.

6.2 LCD

The LCD display is associated with the microcontroller to display the current state of the GSM modem. The main function of LCD in our project is to display the reading of the energy meter. It also performs other functions used to display the term load ON/OFF condition.

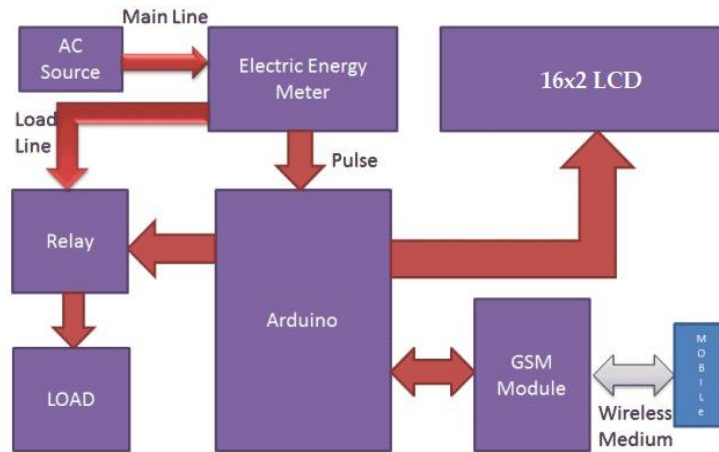


Figure 2: Block diagram

6.3 Connected Loads

The lamp is connected to the output of the design circuit, which is a household load supplied to the consumer.

6.4 Energy Meter

Energy meter records energy consumption. It does this by means of an electromechanical system. This system has a mechanism such that an increased amount of current flows through the circuit causing the disc to rotate faster, meaning that the speed of rotation of the disc is directly proportional to the amount of current flowing through the circuit. The pulses of this LED are transmitted to the microcontroller to perform the counting operation, i.e. these pulses are reflected back by its microcontroller and the readings are stored in external memory. External memory is used here EEPROM.

6.5 GSM Module

GSM modems are a means of communication over wireless systems. The GSM modem is connected to the microcontroller via the MAX232IC. Each time a command is sent to a GSM modem, the command is decoded and acts accordingly. The GSM network provides the widest coverage in most developed and developing countries. This method is also effective in rural areas where the population density is low and most people do not have access to landlines. Therefore, in a country like India, it is very easy and effective to implement, so we need to focus more on this method.

6.6 Microcontroller IC

Pulses from the electricity meter LED are fed to the microcontroller for calculation. These pulses are fed to the microcontroller and the readings are stored in external memory. Use external EPROM memory. The microcontroller provides signals or messages to the LCD display about project work.

6.7 Relay

A relay is an electrically operated switch. Many relays use electromagnets to mechanically actuate the switch, but other operating principles are also used, such as solid state relays. Relays are used when it is necessary to control a circuit by a separate low-power signal or when multiple circuits need to be controlled by a single signal. Relays were first used in long-distance telegraph circuits as amplifiers: they repeated a signal coming from one circuit and retransmitted it on another. Relays were widely used in early telephone exchanges and computers to perform logical operations.

VII. HARDWARE IMPLEMENTATION

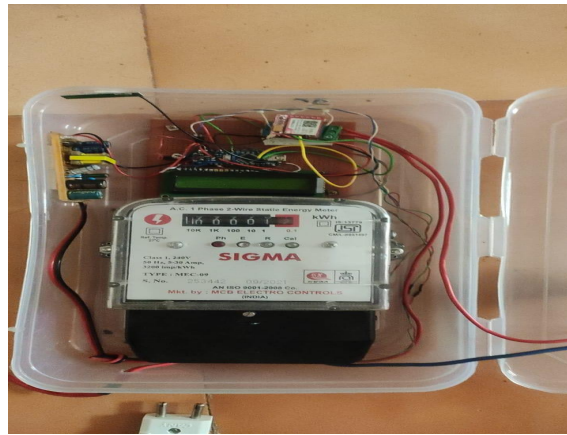


Figure 3: Project implementation

A. When no theft has occurred



Figure 4: Working smart energy meter when no theft has occurred

B. When theft is occurred

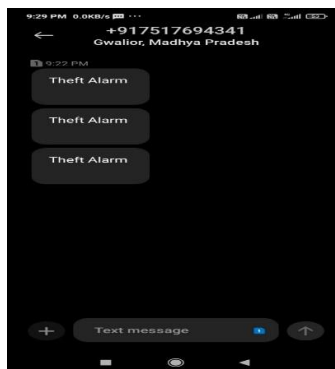


Figure 5: Message displaying on user mobile when theft is occurred

VIII. APPLICATIONS

- Domestic home appliances
- Electricity power plant
- Industry and Factories
- Commercial use

IX. ADVANTAGES

- High accuracy over wide dynamic current range
- Reliability and durability
- Automatic Meter Reading (AMR)
- Easier embedding of new objects
- Protection from unauthorized access
- Power off range detection
- Determination of power factor
- Easy reconfiguration, upgrade
- Do not use worn gears or magnets that are saturated with direct current.
- No precise mechanics required and no large temperature tolerances.

X. CONCLUSION

In the current work, the wireless meter reading system continuously monitors the meter reading, avoids human intervention, enables efficient meter reading, avoids billing errors, reduces maintenance costs, and unpaid invoices. Designed to reduce problems such as billing irregularities and inaccurate meter readings. Unauthorized payment to a customer by a service representative who received a bribe. This system will be a powerful tool for efficient use of electricity. From the whole proposed methodology, we can conclude that this advanced energy measurement system can actually be demonstrated in the interests of consumers and power supply.

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