

# ADVANCED ENERGY METER WITH THEFT DETECTION

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**Abstract:** India uses electromechanical electricity meters but considering their disadvantages such as power theft, incorrect meter reading, billing, and reluctance of consumers towards paying electricity bills on time. Therefore, such systems are replaced by more sophisticated and accurate digital and electronic meters. This paper proposes a new methodology to implement a controller based global system for mobile communication [GSM] network to incorporate the facility of prepaid metering system and remote load control. That features a smart card secure solution for a novel prepaid electricity system. It aims to reduce the power bill defaulter using smart card technology. LCD display is used to display the amount of energy consumed. The user can recharge the meter as per his requirements by sending an SMS to the server. The user needs to make an initial recharge to deal with the issues of unpaid bills and human error in billing which eventually ensures justified revenue collection.

**Index Terms** - Smart meter, GSM, Safety control, SMS, AMR, PC, Theft Control, etc.

## Introduction

In recent decades, global energy crises are increasing at very rapid rate. Hence a lot of new technology has been introduced to satisfy the user demands. Apart from generation the demand can be fulfilled by automation in the energy distribution is also necessary to enhance people's life standard. The traditional method of electricity billing system involves complexity. There are many issues related to this method so there is a need to make advancement and automation in this system. The automatic meter reading (AMR) reduces the complexities. In which Energy Meter sends the recorded power consumption reading by using GSM technology through SMS services. As the technology increases, the power theft is also increases which will affect the economic stabilization factor of our country. Therefore the meter will not count the actual energy consumption due to power theft updates the energy consumption details in the reading and billing system. By using GSM, the bill is delivered to the consumer via SMS and disconnects the load automatically when the user fails to pay the bill. Thus not only the energy theft but also energy meter bypassing can be monitored by this meter. Hence it helps to maintain the accuracy and power theft can be stopped.

## II. PROBLEM IDENTIFICATION

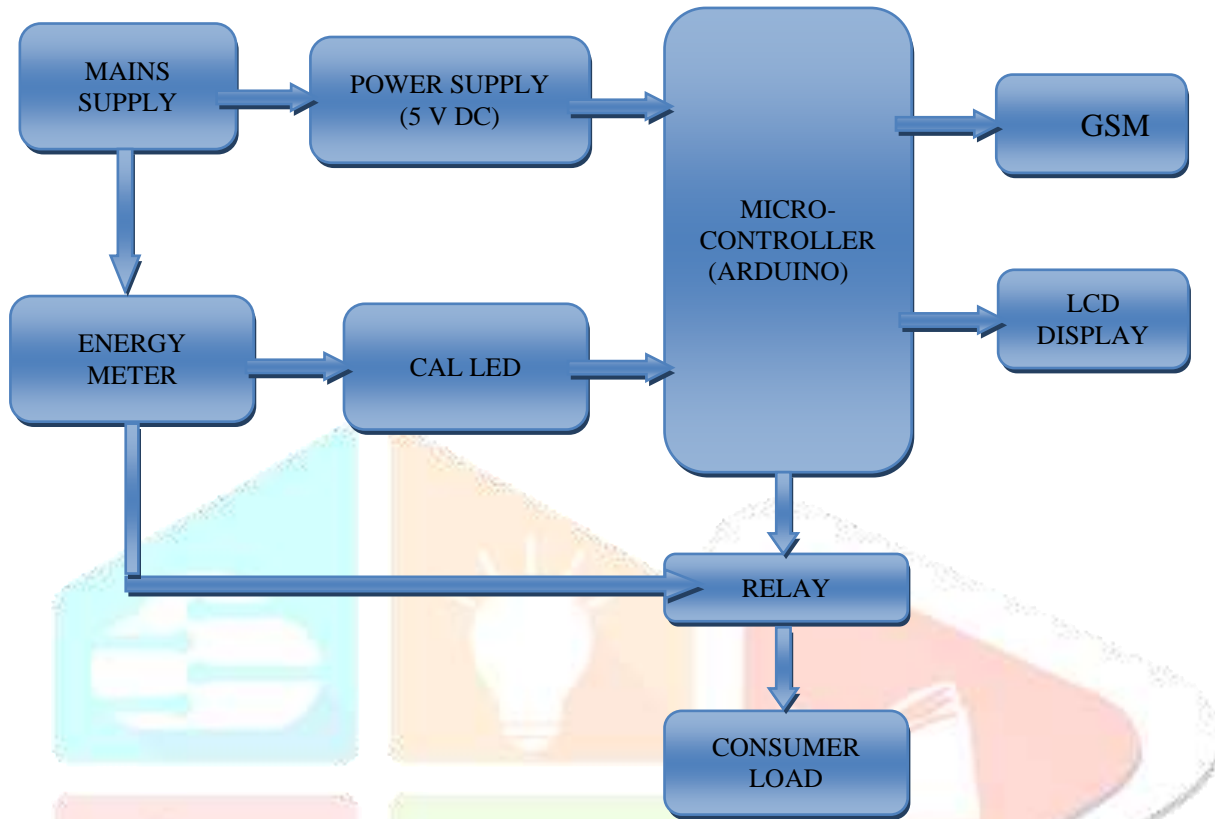
1. Existing system is unable to adopt the external conditions.
2. Accuracy of identification is less.
3. Complex classification techniques employed.
4. Time consuming.
5. Unable to detect power theft.

## III. OBJECTIVES

- This system would provide a simple way to detect an electrical power theft without any human interface.
- It will indicate exact zone and distribution line on which unauthorized tapping is done in real time.
- It will determine transmission line faults.
- To maximize revenue generation by the power utility companies.
- Its cost is less as compare to other present system.

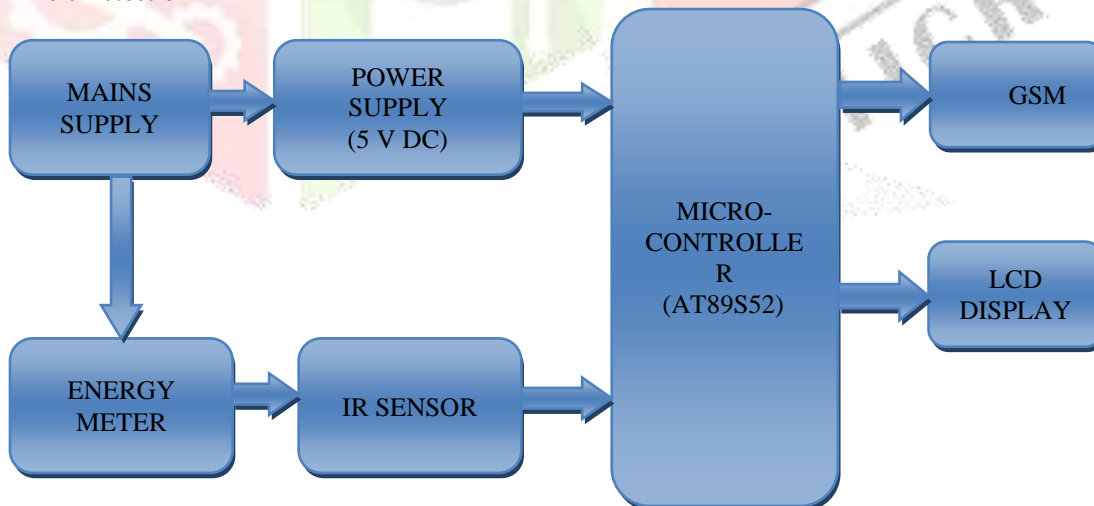
**IV. BLOCK DIAGRAM**

**A) Prepaid Metering system**



**Figure 1. Block diagram of prepaid energy meter**

**B) For Theft Detection**



**Figure 2. Block diagram of Theft Detection**

**V. BLOCK DIAGRAM DESCRIPTION**

**Power supply**

The main function of power supply is to convert single phase supply into constant DC source by using a voltage rectifier circuit. The microcontroller and associated circuitry requires 5V supply while the relay requires a 12 V supply. A single 12V adapter connected to

the mains produce DC 12V output usable for the relay and this voltage is further passed through a positive fixed voltage regulator IC 7805 resulting in a 5V DC output usable for the microcontroller and other logic circuitry.

### LCD

LCD is connected with microcontroller so as to show the current status of GSM modem. The main function of the LCD in our project is to display the energy meter readings. Also it performs another function that it is used to show the load ON/OFF condition.

### Connected loads

Lamp is connected at the output of project circuit which is domestic load provided to the consumer.

### Energy Meter

The energy meter records the amount of power consumption. It does so by an electromechanical system. The system is provided with such a mechanism that an increment in amount of current flow through circuit causes the disc to rotate faster, means that the rotational speed of disc is directly proportional to the amount of current flowing through circuit. The pulses from this LED are fed to microcontroller for the count operation i.e. these pulses are countered by is microcontroller and readings are stored into external memory. External memory used here EEPROM.

### GSM Modem

GSM modem is the means to communicate over wireless systems. GSM modem is connected with microcontroller via MAX 232 IC. Whenever a command is sent to the GSM modem, it decodes the commands and works accordingly. The GSM network offers most coverage in most developed and developing countries. This method is also effective in rural areas, which are not densely populated, and in which, most people do not have access to a fixed telephone network. So in a country like India we need to focus more on this method as it can be implemented very easily and effectively.

### Microcontroller IC

The pulses from the energy meter LED are fed to microcontroller for count operation i.e. these pulses are fed to microcontroller and readings are stored into the external memory. Here external memory used is EPROM. Microcontroller provides signal or message to LCD display activities of the project work.

### Relay

A **relay** is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations.

## VI. Hardware Implementation

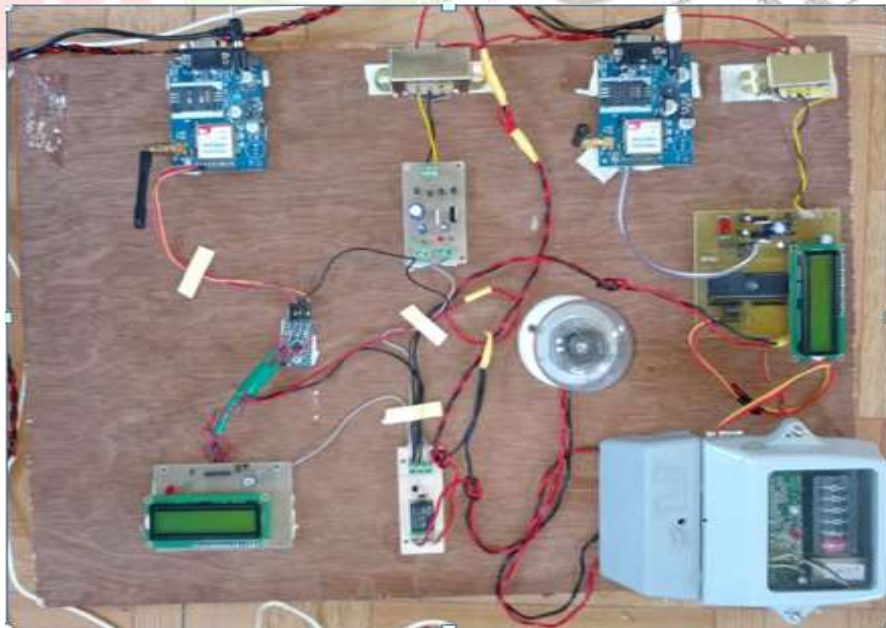


Photo 1. Hardware Implementation Model

In this project we have focused on the most common practice of stealing power which is bypassing or tampering the meter. We are going to design a system which can detect the theft of electric power and inform the nearest substation with the meter ID in which theft has occurred. Here we have used IR sensor for detecting the theft.

When energy meter is bypassed then IR sensor will detect the theft and gives high alert status signal to the GSM. As per the flow chart when status signal IR=1, theft is detected and when status signal IR=0 No theft is occurred. Further through the GSM, MSEB will receive SMS of theft detection with the meter ID. Also when AURDINO gives signal to the relay, it will disconnect the load automatically.

#### PCB Design Circuit

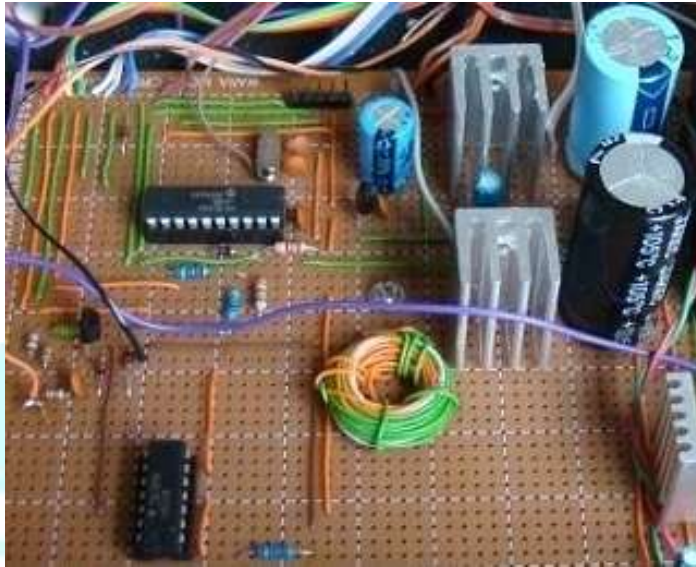


Photo 2. PCB Circuit Design

The PCB layout editor allows back annotation to the schematic and auto-routing to automatically connect traces based on the connections defined in the schematic.

#### CASE (1): WHEN NO THEFT HAS OCCURRED



Photo 3. Circuit View when No Theft Detected

#### CASE (2): WHEN THEFT HAS OCCURRED



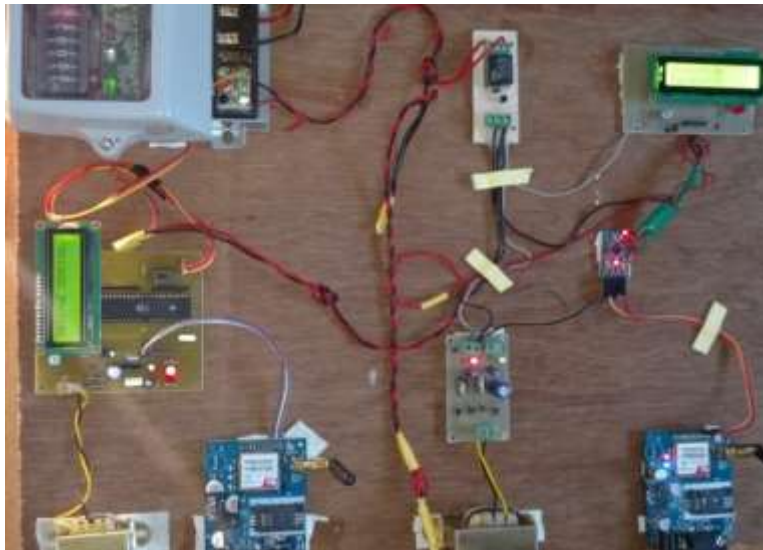


Photo 4. Circuit View when Theft Detected

### VII. APPLICATIONS

- Home Appliances
- Electricity Board
- Industries and Factories
- Commercial use

### VIII. ADVANTAGES

- High Accuracy over a wide current dynamic range
- Reliability and Robustness
- Automatic Meter Reading (AMR)
- More easily enables new facilities
- Tamper Proofing
- Power out range detection
- Power Factor Detection
- Easily Reconfiguration, Upgrade
- Do not use gears that wear out or magnets that saturate with DC current
- Do not require precision mechanics or have large tolerance variations over temperature

### IX. CONCLUSION

In the present work wireless meter reading system is designed to continuously monitor the meter reading and it avoids the human intervention, provides efficient meter reading, avoid the billing error and reduce the maintenance cost, to reduce issues like unpaid bills, billing irregularities, inaccurate meter readings and illicit payment from customer because of bribed service man. This system can be a powerful tool for having efficient use of electricity. From all the proposed methodology it can be concluded that this advanced energy metering system can be really proved as a benefit for the consumers and electricity board.

### REFERENCES

- [1] Sagar Patil, Gopal Pawaskar, Kirtikumar Patil, April 2013. Electrical Power Theft Detection and Wireless Meter Reading International Journal of Innovative Research in Science, Engineering and Technology Vol 2, Issue 4.
- [2]Virendra Pandey, Simrat Singh Gill, Amit Sharma, March 2013. Wireless Electricity Theft Detection System Using Zigbee Technology International Journal on Recent and Innovation Trends in Computing and Communication Vol.1, Issue 4.
- [3] G. L. Prashanthi, K. V. Prasad, Nov - Dec. 2014. Wireless power meter monitoring with power theft detection and intimation system using GSM and ZigBee networks IOSR Journal of Electronics and Communication Engineering (IOSR-JECE) Vol. 9, Issue 6, Ver. I PP 04-08.
- [4] Soma Shekara Sreenadh Reddy Depuru, Lingfeng Wang, Vijay Devabhaktuni, February 2011. Electricity theft: Overview, issues, prevention and a smart meter based approach to control theft Energy policy, Volume 39, Issue 2, and Publisher: science direct Pages 1007-1009.
- [5] Thomas B Smith, December 2004. Electricity theft: A Comparative Analysis Energy policy, Volume 32, Issue 18,, Publisher: science direct Pages 2067-2076