

# A Smart Prepaid Energy Metering System to Control Electricity Theft

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## Abstract:

*In this Smart Prepaid Energy Metering System to Control Electricity Theft, a meter is installed in every consumer unit and a server is maintained at the service provider side. Both the meter and the server are equipped with GSM module which facilitates bidirectional communication between the two ends using the existing GSM infrastructure. Consumers can easily recharge their energy meter by sending a PIN number hidden in a scratch card to the server using SMS. The bidirectional GSM communication using SMS ensures the effectiveness of these measures.*

*Electricity theft has emerged as a serious problem in power sectors especially in the developing countries. A huge amount of revenue is lost due to electricity theft. In some countries this is so severe that governments are incurring losses instead of revenue. In some cases government has to provide subsidies to the power sector to maintain a reasonable price of electricity. The financial loss results in shortage of funds for investments to expand the existing power capacity and as a result governments are failing to satisfy the ever increasing demand of electricity.*

*Stealing electricity bypassing a meter, billing irregularities and unpaid bills. Billing irregularities comprise inaccurate meter reading taken by bribed service man and intentional fixing of the bill by office staffs in exchange of illicit payments from the consumer. Different non-technical and technical methods were proposed in the past to detect electricity pilfering. Some of the technical ways to detect pilferage are use of central observer meter at secondary terminals of distribution transformer, harmonic generator, genetic support vector machines, extreme learning machine, and power line impedance technique.*

*In the proposed system the power utility maintains a server and each consumer are provided an energy meter. The energy meter consists of a Microcontroller (ARM7), GSM module, current transformers, potential transformers, LCD display and a relay. The Microcontroller calculates the*

*energy consumption by counting the output of current and potential transformers on an interrupt basis. The household meter then receives the corresponding unit and is activated. As the user consumes energy, the corresponding units are deducted from the total balance and the remaining units are displayed.*

## Keywords

*Smart, prepaid, energy metering system, electricity theft, GSM.*

## 1. Introduction

Automatic Power Meter Reading and Distribution Control Using GSM Networks, mainly focused on measurement of power from the consumer side that has been consumed by them. It is an integration of single phase class T, IEC61036 Standard Compliance Digital KWh Power Meter, Power to Communication (P2C) interface board and a GSM modem which utilize the GSM network to send the power usage reading back to energy provider wirelessly.

The system mainly focuses on taking to an account of power consumed by the user. The digital power meter is used to measure the power consumption drawn from the energy provider substation to the consumer in KWh unit. A single phase digital Watt Hour Meter ATEC12 and ATEC was chosen for GSM Power meter implement the system consists of opt coupler instead of Electromagnetic Relay which may require a step down transformer to transfer the amount of power consume and will also, result in complexity in circuit.

The Power to Communication (P2C) is used to interface the impulse and synchronization count from the power meter opt coupler circuit and to store the power meter reading into the internal on EEPROM memory at single impulse count interval. In the case of power failure the last meter reading will be stored in EEPROM. During the time of power restoration the microcontroller circuitry used here retrieves back last meter reading and to continuous synchronous with the digital power meter. At the time of normal operation the Power to Communication interface board used to retrieve the last meter reading from the EEPROM memory.

Here the GSM Power Meter and SMS Gateway uses normal SIM card phone number. The billing notification to customer send by SMS, E-mail and hardcopy printing for postal. The complete demonstration of GPMDC from meter reading, notification, payment, distribution control of power cut-off and power restoration are being done.

Mr. Nazir Bin Abdullah [1], developed an automatic meter reading system (Automation of Residential Electricity Cut off Using Embedded Controller). In 2012 for domestic user. In this project he used GSM modem for transmitting and receiving information, both sides means user side and energy provider side.

Mr. Hung Cheng Chen [2] proposed a wireless automatic meter reading system in 2012. In this project he used ZigBee module on both sides. This technology is chip and low cost.

Mr. Alauddin Al -Omary[3] develop an automatic meter reading system using GPRS technology.

In 2011 MR.LI Quan Xi [4] design an automatic meter system based on ZigBee and GPRS system.

In 2010. Mr. H.G.Rodney Tan [5] develop an automatic power meter reading system using GSM network. In 2007. In this system GSM digital power meter installed in every consumer unit and electricity billing system at the energy provider side.

Mr. Mejbau Haque [6] develop a microcontroller based single phase digital prepaid energy meter for improved meter and billing system.

Amit Jain [7], proposed a prepaid meter using mobile communication in 2011. In this system he used controller unit, prepaid card and communication module.

Fawzi Al-Naina and Bahaa Jalil[8], Built a prototyping prepaid electricity meter system based on RFID. This system is divided into two part such as client and server. The client consist of a digital meter based on a microcontroller and an RFID reader and the server consist of a PC with MySQL database server. The client installed in each house and the server installed in local substation.

GSM technology is used so that the consumer would receive messages about the consumption of power (in watts) and if it reaches the minimum amount, it would automatically alert the consumer to recharge. This technology holds good for all electricity distribution companies, private communities.

The GSM infrastructure, which has national wide coverage can be used to request and retrieve power consumption notification over individual houses and flats. Apart from making readings using GSM communication, billing system is needed to be made prepaid to avoid unnecessary usage of power. It replaces traditional meter reading methods and enables remote

access of existing energy meter by the energy provider. Also they can monitor the meter readings regularly without the person visiting each house.

## 2. Project Design

In this Smart Prepaid Energy Metering System to Control Electricity Theft, a meter is installed in every consumer unit and a server is maintained at the service provider side. Both the meter and the server are equipped with GSM module which facilitates bidirectional communication between the two ends using the existing GSM infrastructure. Consumers can easily recharge their energy meter by sending a PIN number hidden in a scratch card to the server using SMS. The bidirectional GSM communication using SMS ensures the effectiveness of these measures. In the proposed system the power utility maintains a server and each consumer are provided an energy meter.

The energy meter consists of a Microcontroller (ARDUINO UNO), GSM module, current transformers, potential transformers, LCD display and a relay. The Microcontroller calculates the energy consumption by counting the output of current and potential transformers on an interrupt basis. The household meter then receives the corresponding unit and is activated. As the user consumes energy, the corresponding units are deducted from the total balance and the remaining units are displayed using LCD. After the consumption of the allocated energy, the meter automatically disconnects the load from the main power line using the relay until the user recharges again. Thus the system avoids the irregularities associated with traditional billing system and ensures revenue collection.

In this chapter the block diagram of the project and design aspect of independent modules are considered. Block diagram is shown in the below:

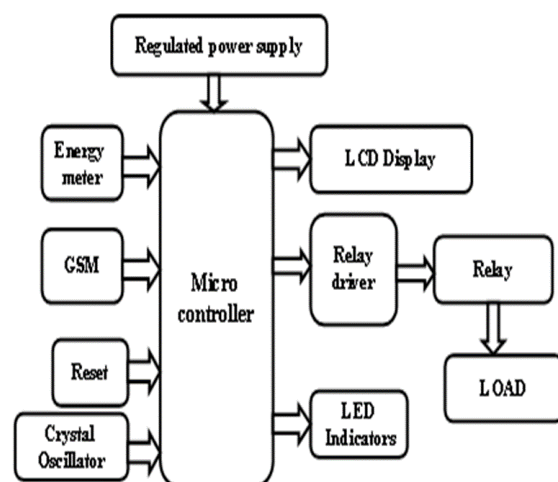


Fig1: Block diagram of Hardware

### 3. Results and Discussions

The project “A SMART PREPAID ENERGY METERING SYSTEM TO CONTROL ELECTRICITY THEFT” where Consumers can easily recharge their energy meter by sending a PIN number hidden in a scratch card to the server using SMS.

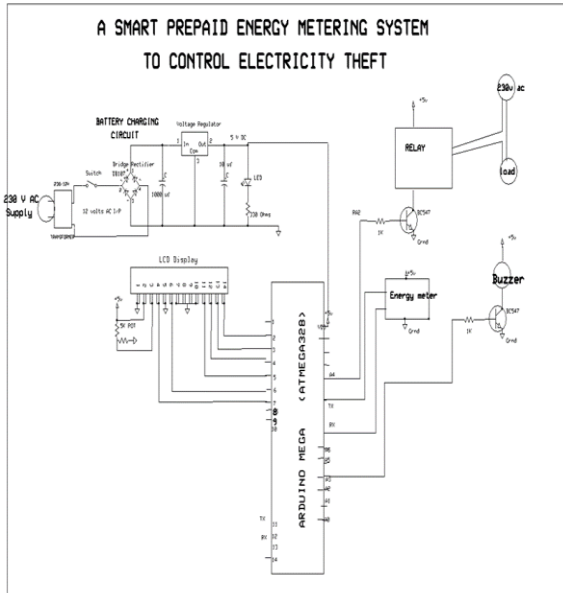


Fig 2: Schematic Diagram of Proposed Design

### 4. Conclusion

Integrating features of all the hardware components used have been developed in it. Presence of every module has been reasoned out and placed carefully, thus contributing to the best working of the unit. Secondly, using highly advanced IC's with the help of growing technology, the project has been successfully implemented. Thus the project has been successfully designed and tested.

### 5. Future Scope

Our project “A SMART PREPAID ENERGY METERING SYSTEM TO CONTROL ELECTRICITY THEFT” where Consumers can easily recharge their energy meter by sending a PIN number hidden in a scratch card to the server using SMS.

The controlling device for the automation in the project is a Microcontroller. The data sent from Android phone over Ethernet will be received by Ethernet module connected to Microcontroller. Microcontroller reads the data and decides the switching action of electrical devices connected to it through Relay switches. Also, the live temperature from the system is continuously sent to android phone and can be monitored on android phone screen The Microcontroller is programmed used embedded ‘C’ language.

By connecting temperature, gas, sensors to the system we can get the temperature of dangerous zones in personal computer itself instead of sending human to there and facing problems at field. The project can be extended by using robot to there and sensor will detect the temperature and it gives information to the micro controller and micro controller gives the information to the transceiver from that we can get the data at pc side.

### 6. References

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