

# GSM BASED AUTOMATIC TRIP CONTROL SYSTEM FOR ENERGY MANAGEMENT

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**Abstract:** This paper presents the development of Automatic Trip Control System for Energy Management using GSM. The proposed system monitors the usage level of electricity of every consumer at all the time. During excess of electrical energy used by consumer, the system will give the alerts through an alarm circuit. After the alarm circuit, the consumer has to take an alternative solution to cut-off excess supply from the Electricity Board (EB) to stop alarming. Otherwise, the circuit breaker will come into OFF position and the supply will be tripping-off coming from EB. The information about the particular consumer will be sent to EB through GSM (Global System for Mobile Communication Network). Then, the consumer has to give the requisition to EB for making the circuit breaker coming into normal with the help of PIC microcontroller, which is programmed to monitor the parameters of electrical energy. This system helps for illegal usage of electricity, monitoring the energy, maintaining data on tariff etc. The implementation and demonstration of the system were made.

**Keywords:** Embedded Microcontroller, GSM module, Power sensor, and Circuit breaker.

## I. INTRODUCTION

Electricity plays a vital role in growth of our country. Even though power production corporations focusing highly on generation, transmission and distribution, they are meeting power loss due to illegal consumption of electrical power from the transmission lines by the consumers. Power theft has become a great challenge to the electricity board. The dailies report says that Electricity Board suffers a total loss of 8 % in revenue due to power theft every year, which has to be controlled. This research paper identifies the power theft and indicates it to the Electricity board through GSM network. It also deals about the remote monitoring of an energy meter in the proposed system.

In the field of electrical or electronics current and energy consumption, which may effect on stabilization of the components, are playing an important role. In case of Industries, the industrialists have to monitor and control the usage of electrical energy level. The main objective is to prevent energy usage beyond the maximum allotted energy by the power supplier, by preventing from over load usage. Energy consumption is audited by using current transformer connected series to the load. Then the current is measured by implementing Analog to Digital Conversion (ADC) techniques of the PIC (Peripheral Interface Controller) microcontroller, if any invariance is found tripping device takes the charge there by removing the excess load and invariance. Microcontroller is giving control signals to tripping various equipment provides controlling feature. Output can then be displayed in the LCD (Liquid Crystal Display). The difference with other existing system is that even transmission line theft can also be detected apart from the meter bypassing. The additional feature of this system is that there is no need of manual interface as the entire system is fully

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automated and also meter reading also accurately calculated in this system, which overcomes the traditional manual meter reading.

Now a days the traditional manual meter reading was not suitable for longer duration operating purposes as it spends much human and material resource. It brings additional problems in calculation of readings and billing manually. The number of electricity consumers increasing in great extent. It becomes a hard task in handling and maintaining the power as per the growing requirements. Presently maintenance of the power is also an important task as the human operator goes to the consumer's house and produces the bill as per the meter reading. If the consumer is not available, the billing process will be pending and operator again needs to revisit. It seems to each house and every consumer's house and generating the bill is a laborious task and requires lot of time. It becomes very difficult in rainy season. If any consumer did not pay the bill, the operator needs to go to their houses to disconnect the power supply. These processes are time consuming and difficult to handle. Moreover, the manual operator cannot find the unauthorized connections or malpractices carried out by the consumer to reduce or stop the meter reading/power supply. The human error can open an opportunity for corruption done by the human meter reader. So the problem which arises in the billing system can become inaccurate and inefficient.

## Energy Conservation and its need

Energy conservation is crucial for the economical way of power generation. Energy conservation does not mean curtailment in energy use at the expense of industrial and economic growth; rather it means effective utilization of energy resources ensuring the same level of economic and industrial activity with lesser inputs of energy. Despite the fact there has been a phenomenal increase in energy production in the past four decades, energy shortage continued to exist. This is mainly because of increasing demand, limited resources, rapid depletion and increasing cost of harnessing the resources. Hence it becomes imperative to attribute a special status to energy conservation in the world.

## II. LITERATURE SURVEY

A. Vijayarajet *al* [1] the paper titled as, "Automated EB Billing system using Ad-Hoc wireless routing". In this system the central EB office has immediate access to all consumer homes in a locality with the help of the RF system. The EB meter present in each house is connected by wireless network with the EB office which periodically gets updated from the meter. The EB officer using a backend database calculates the amount to be paid according to the number of units consumed and sends it back to the meter for display and also to the users mobile phone.

IrfanQuaziet *al* [2] the paper titled as, "Prepaid Energy meter based on AVR Microcontroller" In this paper, the idea of pre-paid energy meter using AVR controller has been introduced and energy meters have not been replaced which is already installed at our houses. But a small modification can be done on the already installed meters. The use of GSM module provides a feature of pre-paid through SMS.

Liang Zhao[5]The paper titled as "Development of an energy monitoring system for large public buildings". The author said that building energy conservation is one vital method for increasing the efficiency. In order to locate the status of energy consumption for large buildings such as super market, government office buildings and hospitals, an internet based energy monitoring was developed.

M. Trejo-Perea [6] "A real time energy monitoring platform user-friendly for buildings ". This study work introduces the development of user friendly quite effective energy monitoring system installed in the building. The metering and control software that process and analyse digitized signals has been developed in Integrated Development Environment (IDE) and linux embedded server operating system with real time kernel. This system allows the measurement of electric energy parameters of within a building. The consumption of electric energy parameters are displayed by means of graphic interface which can be consulted via internet.

AbhinandanJain[8] "Smart and Intelligent GSM based Automatic Meter Reading System". Entirely automated energy meter which can be remotely monitoring and controlling, is developed. It continuously monitors the energy

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meter and sends the data on request of the service provider through SMS. The data received from an energy meter has been stored in data base server which was located at electricity board station by SMS gateway. Energy provider sends electricity bills either by email, SMS, or post. This system allows the customer to pay bill online either by credit card, debit card or by net banking.

S.H. Shete [10] "GSM Enabled Embedded System for Energy Measurement and Billing". This paper revealed that development of measuring instrument that enhances the measurement of electrical parameters as well as sending these parameters to service providers by using GSM technology. The energy meter system can be incorporated with embedded microcontroller with GSM port to transmit the data. This data fed and integrated into energy management systems located at power company.

## Methods of illegal electricity usage:

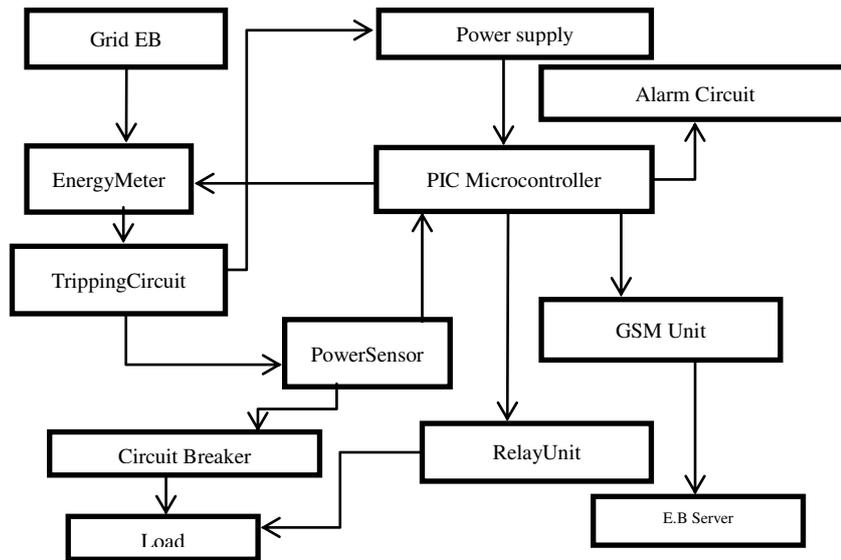
The followings are the illegal way of using electrical energy.

- 1) *Using the mechanical objects:* A subscriber may use some mechanical objects to prevent the revolution of a meter, so that disk speed is reduced and the recorded energy is also reduced.
- 2) *Using a fixed magnet:* A subscriber may use a fixed magnet to change the electromagnetic field of the current coils. As is well known, the recorded energy is proportional to electromagnetic field.
- 3) *Using the external phase before meter terminals:* This method gives subscribers free energy without any record.
- 4) *Switching the energy cables at the meter connector box:* In this way, the current does not pass through the current coil of the meter, so the meter does not record the energy consumption.

## Problem Identification in Existing System

- 1) Frequent power failures, Illegal usage of electricity, over usage of electricity, low voltage problems and also the manual intervention between the consumer and Electricity board.
- 2) Due to over usage of electricity many peoples are suffering lot by lack of power supply.
- 3) Many imports and exports are stopped due to power cuts, which result in down of trade market.
- 4) Generating the bill - The Electricity board Employee is going to each and every house and takes the reading and generating the bills. It will take lot of time and laborious task.
- 5) Disconnect the power supply- If the consumer did not pay the bill means again one of the Electricity board employees should go to consumer place and disconnect the supply.
- 6) Corruption on meters - If there is an interconnection between consumer and electricity board department, then the person is giving the wrong reading to the consumer and he / she gets some money from the corresponding consumers. So, it gives the huge loss.
- 7) Manual operator cannot find the un-authorized connections or malpractices carried out by the consumer to reduce or stop the meter reading/power supply.
- 8) The human error can open an opportunity for corruption done by the human meter reader. So the problem which arises in the billing system can become inaccurate and inefficient.

**Hardware Description – Automatic Trip Control System**



**Fig.1 Block diagram for proposed system**

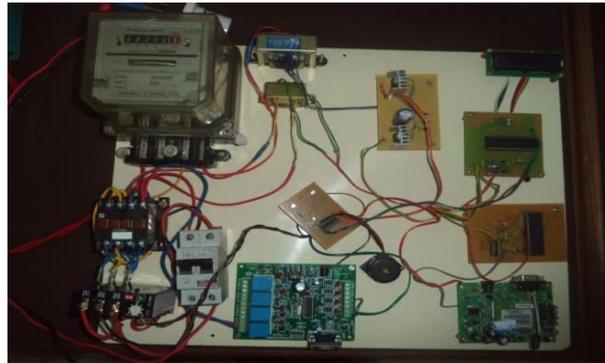
Fig.1 shows the overall block diagram of the energy monitoring and trip control of power supply while over loading. In the proposed system PIC 16F877 microcontroller is used in maximum demand controller. Energy consumption is audited by using current transformer connected series to the load. Then the current is measured by implementing ADC techniques of the PIC microcontroller and then Energy consumption is audited by using voltage transformer connected parallel to the load results indicating LCD Display, if any invariance is found tripping device takes the charge there by removing the excess load and invariance. If any one of them over use the electricity, then alarm circuit gets ON and within the mean time if the consumer reduces the load or makes some other alternatives like using generator, then automatically alarm circuit turned OFF and then normal supply is supplied. If not, then the circuit breaker trip OFF and the entire supply is cut off immediately and sends the information to EB server via GSM. Even if consumer switched on the circuit breaker it won't works. It works only after the consumer intimating the message to the EB. If they accept the consumer's request then they send the message to the consumer's GSM and then this message will be sent to the PIC micro controller. This will be indicated in the PIC micro controller circuit and then only by switch on the circuit breaker consumer can get the normal power supply. If there is any misuse of programmed PIC microcontroller takes place automatically that information also send to the EB server via GSM network and also by this system we can measure the accurate amount of electricity consumed by the consumer, which sends automatically to the EB server via GSM network at monthly once. Fig.2 shows the model of the proposed system.

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## IMPLEMENTATION MODEL OF PROPOSED SYSTEM



**Fig.2. Model of proposed system**

### III. CONCLUSION

This research paper demonstrates the concept and implementation of automatic trip control system for energy management using Embedded controller and GSM. It mainly focused on industrial purpose. The similar idea can be implemented for domestic areas for avoiding the illegal usage of electricity. It facilitates for vigilance squad to control theft quickly and easily. With its usage, the crime of stealing power may be brought to an end and thereby a new bloom may be expected. This proposed work will help us in conserving energy so that our nation will be improved. This research work can make a great change in assessment of electricity bill and can give the benefits to the government by reducing the man power and time consumption.

### REFERENCES

- [1] A.Vijayarajet *al* "Automated EB Billing system using Ad-Hoc wireless routing" published at International Journal of Engineering and Technology Vol.2 (5), 2010, 343-347
- [2] IrfanQuaziet *al* "Prepaid Energy meter based on AVR Microcontroller" published at International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622, Vol.1, Issue 4,pp.1879-1884.
- [3] Md. MejbauHaquelet *al*" Microcontroller Based Single Phase Digital Prepaid Energy meter for Improved Metering and Billing system" Published at International Journal of Power Electronics and Drive System (IJPEDS) Vol.1, No.2, December 2011,pp.139-147 ISSN: 2088-8694.
- [4] I. H. Cavdar, "Performance analysis of FSK power line communications systems over the time-varying channels: Measurements and modeling," *IEEE Trans. Power Delivery*, vol. 19, pp. 111-117, Jan. 2004.
- [5] Liang Zhao,"Development of an energy monitoring system for large public buildings" Elsevier journal, *Energy and Buildings* 66 (2013) 41-48.
- [6] M. Trejo-Perea"A real time energy monitoring platform user-friendly for buildings" Elsevier journal*Procedia Technology* 7 (2013) 238 - 247
- [7] AmitSachan"GSM based SCADA monitoring and control system substation equipment" International Journal of Engineering Research & Technology (IJERT)Vol. 1 Issue 5, July - 2012  
ISSN: 2278-0181.
- [8] AbhinandanJain"Smart and Intelligent GSM based Automatic Meter Reading System" International Journal of Engineering Research & Technology (IJERT)Vol. 1 Issue 3, May - 2012  
ISSN: 2278-0181
- [9] Abhinandan Jain " Design and Development of GSM based Energy Meter" International Journal of Computer Applications (0975 - 888) Volume 47- No.12, June 2012.
- [10] S.H. Shete "GSM Enabled Embedded System for Energy Measurement & Billing" International Journal of Scientific & Engineering Research Volume 4, Issue 1, January-2013 1 ISSN 2229-5518.

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