Prepaid Energy Meter by Using GSM

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ABSTRACT:

Electricity theft is one of the reasons that cause huge financial loss to the government. Few customers are resorting to electricity theft to enjoy free electricity services without paying the bills. This paper proposes a solution to prevent some of the kinds of electricity theft using ARM7 (Advanced RISC Machines) microprocessor and GSM (Global System for Mobile Communications) module. An energy meter is designed using ARM7 to detect the amount of current being used. GSM module is used for the communication between the consumer meters and the energy meter. It is a bidirectional communication process. A consumer can easily recharge his/her energy meter by sending an authenticated pin to the power station. We use SIM in the GSM module for the communication purpose through SMS. This paper also proposes few measures to prevent electricity pilferages like tampering, meter bypassing, removal of meter.

So the proposed system not only helps in prepaid recharge system but also to reduce the different kinds of electricity pilferages. The aim of this project is to detect the power theft and intimation to electricity board about meter information through SMS and disconnect the power to loads when power theft is detected. Electricity theft is at the center of focus all over the world but electricity theft in India has a significant effect on the Indian economy, as this figure is considerably high. Ineffective and inefficient present methods of detecting and preventing Power theft cause a revenue loss along with damage to personal and public property. Large amount of power shortage is caused due to power theft. One of the challenges in stopping power theft is the difficulty in detecting power theft. In particular it is difficult to find the exact location where power theft is occurring.

Measurement of parameters like power line current and power line voltage has not been available in a satisfactory way to optimize power network management.

Keywords:
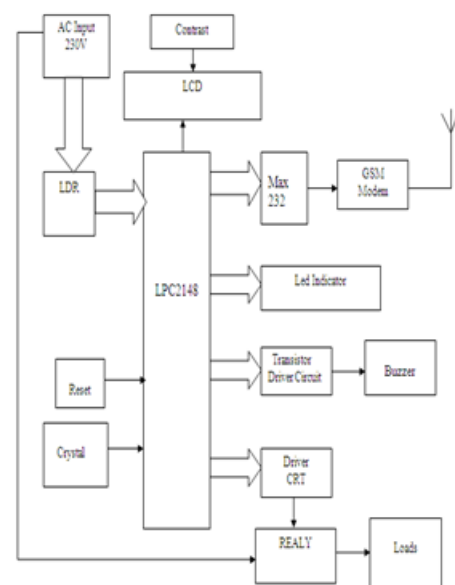
GSM, Energy meter, ARM7.

INTRODUCTION:

Power theft is the biggest problem in recent days which causes lot of loss to electricity boards. In countries like India, these situations are more often, if we can prevent these thefts we can save lot of power. Electrical power theft detection system is used to detect an unauthorized tapping on distribution lines. Implementation part of this system is a distribution network of electrical power supply system. Many developing countries confront widespread theft of electricity from government owned power utilities. In India electricity theft leads to annual losses estimated at US$4.5 billion, about 1.5 percent of GDP. Who are the losers? Honest consumers, poor people, and those without connections, who bear the burden of high tariffs, system inefficiencies, and inadequate and unreliable power supply. Line faults may be caused due to over current or earth fault. If there happens to be a connection between two phase lines then over current fault occurs. Earth fault occurs due to the earthing of phase line through cross arm or any other way. Now in India, there is not any technique to detect the specific location of the fault immediately. Power theft is another major problem faced by Indian electrical system. The aim of this project is to detect the power theft and prepaid energy meter using GSM. Electricity theft is at the center of focus all over the world but electricity theft in India has a significant effect on the Indian economy, as this figure is

considerably high. 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. 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.

BLOCK DIAGRAM:

In our system, a micro controller is interfaced with an energy metering circuit, GSM modem and a contactor to make or break power line. GSM modem is connected to microcontroller through MAX232 [4].It is used to send message to the saved number if balance is low or zero. We can recharge our energy meter by our mobile so that late bill or bill pending matters will not occur. User have to recharge energy meter as per their requirement so that balance get reduce as per electricity use. When balance get low or zero system will send message to user mobile regarding balance. This system also helps in theft detection. Inside energy meter there is LDR connected with controller. Whenever anyone tampers with energy meter it will give signal to controller. Because if anyone wants to stolen electricity, he has to tamper or open the meter and as soon as energy meter get opened LDR get activated and will send signal to system then buzzer will on.In this way we can minimize theft also. Whenever power theft is detected, then micro controller will send message on authorized mobile. And this controller also disconnects power to the loads to avoid power theft[1].

This project uses regulated 5V, 750mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Bridge type full wave rectifier is used to rectify the ac output of secondary of 230/18V step down transformer [7]. The aim of this project is to reduce billing, manpower, time of electricity board & detect the power theft. Electricity theft is at the center of focus all over the world but electricity theft in India has a significant effect on the Indian economy, as this figure is considerably high. Ineffective and inefficient present methods of detecting and preventing Power theft cause a revenue loss along with damage to personal and public property. Large amount of power shortage is caused due to power theft. One of the challenges in stopping power theft is the difficulty in detecting power theft. In particular it is difficult to find the exact location where power theft is occurring. Measurement of parameters like power line current and power line voltage has not been available in a satisfactory way to optimize power network management. But due to advancement in present technologies we can give better solution to detect the power theft.

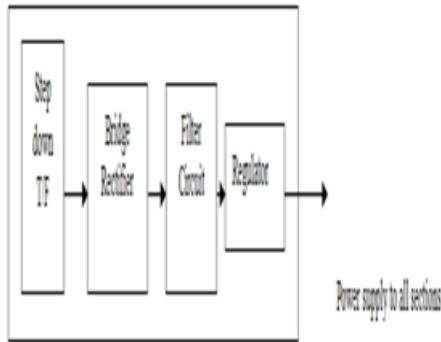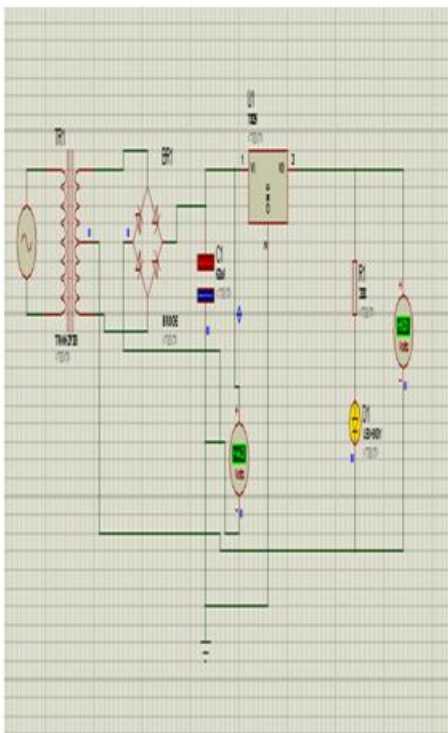**Fig.1-Interfacing of Energy meter by using GSM**

Fig.2 Power Supply

Fig.3 Simulation in PROTEUS Software

PREPAYMENT METERING:

Yet another advantage of the electronic meter is the possibility of introducing Prepaid metering system. Prepaid metering system is the one in which the consumer pays money in advance to the utility and then feeds this information into his meter. The meter then updates the credit available to the consumer and starts deducting his consumption from available credit.

Once the credit reaches a minimum specified value, meter raises an alarm. If the credit is completely exhausted, the meter switches off the loads of the consumer. Main advantage of this system is that the utility can eliminate meter readers. Another benefit is that they get paid in advance. The consumer benefits due to elimination of penalty for late payment. Also it enables him to plan his electricity bill expenses in a better manner. Due to the intelligence built in into the electronic meters, introduction of prepaid metering becomes much easier than in the case of electromechanical meters.

FOLLOWING HARDWARE REQUIREMENTS:

1. METER
2. LCD
3. ARM 7 MAX 232
4. GSM
5. RELAY
6. ENERGY
7. BUZZER

FOLLOWING SOFTWARE REQUIREMENTS:

1. KEIL
2. PROTEUS
3. PROLOAD/ FLASHMAGIC

SAMPLE CASE STUDY:

1. Smart bills can be a cost-efficient and effective way to engage an entire customer base, promote energy efficiency and foster conservation behavior. In the case studies reviewed as part of this report, smart bills were responsible for reducing household electricity consumption by between 1.1% and 2.7% and gas consumption by between 2.2% and 2.8% while at the same time proving cost-effective compared to other feedback and energy efficiency programs;

2. A few simple features have been shown to greatly improve traditional bills and provide useful actionable insight to household consumers;

3. Smart metering will not necessarily result in smart billing or any other feedback programs unless supported by adequate regulation as shown in the case of Sweden;

4. Although quality and insight are greatly improved by the data granularity enabled by advanced metering infrastructure systems, enhanced bills can also be implemented with traditional meter data as shown by the case studies in Chile, Abu Dhabi (UAE); South Africa and Hong Kong (China);

5. Smart bills and other feedback programs increase customer acceptance of other energy efficiency programs such as ToU tariffs or smart meter roll out since feedback programs enable them to benefit. The case of Victoria (Australia) is a good counter example;

6. Smart bills are most effective when they are part of a comprehensive education and feedback package. Pre-offering education in order to engage consumers at an early stage, mixed feedback channels to reach all members of the household as well as people with different cultures or interests and appealing and intuitive feedback devices have all shown to lead to greater acceptance and impact of feedback programs;

7. The most advanced and arguably the best cases of smart bills are to be found in countries with both enhancing technology and supporting regulation. California and Ireland are inspiring examples.
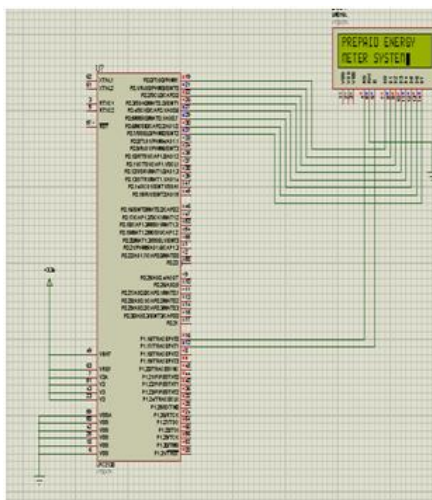
SIMULATION OF LCD CODE:

Fig.4

APPLICATIONS:

- Power monitoring at homes, apartments
- Industrial power monitoring
- It is very useful for domestic power monitoring
- We can use this as Modern Energy Meter
- This is more applicable in rural areas.

ADVANTAGES:

- Real-time power monitoring.
- Sensing the power theft at the exact location.
- Less time
- Less maintenance
- Reduces billing
- Reduces manpower
- Highly secured and easy to install

FUTURE SCOPE OF PROJECT:

In future, this project can be implemented and validated in remote areas. Future enhancements can be incorporated to suit the system for three phase electric distribution system in India. Along with all this new architectural components can be incorporated, so that the system can be completely used for optimizing the energy consumption. This method will reduce the energy wastage and save a lot of energy for future use Measurement of parameters like power line current and power line voltage has not been available in a satisfactory way to optimize power network management. But due to advancement in present technologies we can give better solution to detect the power theft.

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. This paper is aimed at reducing the heavy power and revenue losses that occur due to power theft by the customers.

By this design it can be concluded that power theft can be effectively curbed by detecting where the power theft occurs and informing the authorities. Also an automatic circuit breaker may be integrated to the unit so as to remotely cut off the power supply to the house or consumer who tries to indulge in power theft Encourage consumers to opt for prepaid meters on a voluntary basis and offering tariff or non-tariff incentives to those consumers who prepaid their power changes would help the utilities to implement this system.

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] Muhammad Ali Mazidi; Janice Gillispie Mazidi; Rolin D.Mckinlay; edition 2007, "The 8051 Microcontroller And Embedded System"

[3] K. J. Ayala, "The 8051 Microcontroller"

[4] B.P. Singh & Renu Singh;"Advanced Microprocessors and Microcontrollers".

[5] Irfan Quaziet 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.

[6] Md. MejbaulHaquelet 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.

[7] 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.

[8] Liang Zhao," Development of an energy monitoring system for large public buildings" Elsevier journal, Energy and Buildings 66 (2013) 41–48.

[9] M. Trejo-Perea"A real time energy monitoring platform user-friendly for buildings" Elsevier journal Procedia Technology 7 (2013) 238 – 247.

[10] Amit Sachan "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.

[11] Abhinandan Jain "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.

[12]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.