



PREPAID ENERGY METER AND ELECTRICITY THEFT DETECTION USING GSM

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ABSTRACT

PIC Microcontroller based Prepaid Electricity Meter is a system which makes the billing of electricity consumed by a user prepaid. The main aim of this project is to calculate the usage of energy depending on the number of pulses produced by the energy meter, and the following subtraction of money from the balance amount. This makes the consumer conscious of the use of electricity, but also it reduces person effort of direct billing, as the project would send well timed and proper messages to the registered consumer in the event of low balance in the system. The project is intended to make it interference proof and if any, external human intervention is found; it would report the Electricity Board and detach the power supply. A detection system for electricity theft has been implemented which allows to tackle threaten of electricity theft faced by electricity boards to make sure that no electricity theft takes place. Interference proofing of this system makes sure that there is no intentional interference of the electricity meter to change or stop the calculation of electricity consumption.

Keywords- PIC Microcontroller, Theft detection, prepaid electricity meter.

1. INTRODUCTION

In today's world electricity has become an indispensable a part of our daily life. It's a serious driving factor for advances in technology. During a developing country like India with such an oversized population who wants access to electricity, the metering of electricity usage at household level proves to be a manpower extensive task where a representative from the electricity company goes door to door and takes readings from meters installed at homes and provides bills to subscribers which is to be paid. Also, electricity theft is kind of common which further strains the already burdened electricity grid in our country. It's a menace in terms of revenue for the electricity boards/companies.

2. LITERATURE SURVEY

Electricity theft includes illegal tapping of electricity from feeder, by grounding neutral wire as it does not measures readings and avoid payment of bills. In early system there wasn't any device to detect theft over line so anyone can use electricity without purchasing it. The system stops the illegal usage of electricity. [1] The theft of the electricity is the major concern of the transmission and distribution losses in the supply of the electricity worldwide. Theft also may occur by rewiring circuits to avoid an electric meter, or by tapping into another customer's electrical lines. 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.

R.Sathish, et al., [2] states the idea of detection of power theft by using two current sensing parts one is Hall sensor and another one energy meter current measure current transducer. The proposed system will deliver continuous real-time monitoring of energy utilization, minimum energy loss and power theft detection. This system the service provider can get the immediate knowledge about the energy theft and passing to the concerned energy theft detecting squad.

Identification of electricity theft using plc application of plc in monitoring of electricity supply and demand, reporting through ip-sms and tracing the location Siddhartha sarma et al.,

3. PROPOSED METHODOLOGY

Prepaid energy meter concept the diagram representation of the project is shown in Figure 1. It describes the assorted blocks of the system and shows which components receive output from the PIC and which of them provide an input to the PIC. Some work as sensors and other as actuators the present sensors provide an input after sensing the flow of current and also to the PIC. The LCD module receives inputs from the PIC for displaying customary messages to the user and for sending SMS alerts just in case of electricity theft and system tampering. The GSM module interfaced to the PIC is liable for sending alerts. A relay is employed to trigger the most supply ON or OFF and automatic ON or OFF for prepaid energy meter concept.

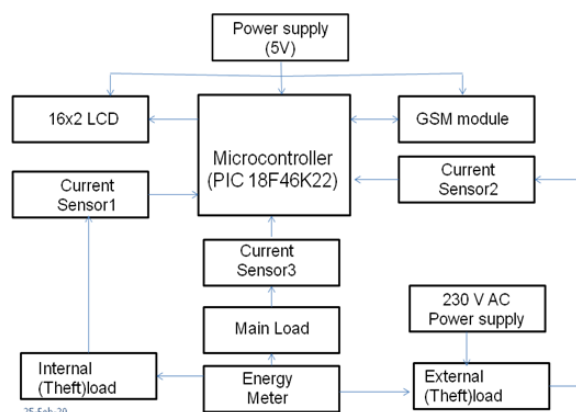


Figure1:-Block diagram of the proposed system

A brief description of each block of the project is as follows:-

3.1. PIC Microcontroller: This is the board used in the project and it is the heart of the project where microcontroller is PIC18F46K22. It is responsible for sending commands to the GSM module, for sending SMS alerts to the user and also to the 16x2 LCD module to display proper messages to the user. The input from the current sensor is taken to find the theft of electricity. It also drives a relay switch to switch ON and OFF the main supply.

3.2. GSM Module: It's to blame for sending SMS alerts to the consumer also to the electricity company and it allows the user to recharge the electricity meter by sending an easy SMS.

3.3. 16X2 LCD:The 16X2 Liquid Crystal Display is used to display proper messages on its screen .It is employed to print additional information like units remaining, welcome text for the user whenever the system is turned ON, theft detection message etc. It's used to form the system more users friendly.

3.4. Current Sensor: This sensor detects the flow of current through the load side of the electricity meter and generates an indication proportional to it of current. This sensor is employed to detect the theft of electricity by the consumer.

3.5. Relay: A relay is employed to change ON/OFF the most supply which is connected to the electricity meter just in case of Zero balance within the system. It's also triggered in case of tampering with the meter. It also gets triggered whenever theft of electricity is detected by the system.

ALGORITHM

Step1: Initialize balance=1, count=0, units=0

Step 2: Check if (tampering) == yes go to step 3 else go to step 4.

Step 3: Send "Tampering detected" text message to the electricity board. Trigger relay to show off load. Intimate subsequent message on LCD.

Step 4: Check if (balance>1), if yes go to step 5 else go to Step 9.

Step 5: Activate the system, intimate the consumer regarding the same.

Step 6: Compute the amount of units remaining and update the balance.

Step 7: Check (if balance but or adequate 5), if yes go to step 8.

Step 8: Send message to the subscriber regarding low System balance. Print "Low Balance" message on LCD.

Step 9: Check (theft), if yes, go to step 10 else go to step 11.

Step 10: Intimate the electricity board by sending message "Theft is detected".

Step 11: Open live terminal to receive message within the GSM module.

Step 12: Check for message, if message is received goto step 13 else goto step 11.

Step 13: Read message from memory and extract.

Step 14: Check, if (message received ==#).If yes, Update the system balance as balance =balance+10.

Step 15: Send message to user about recharge success and goto step 2.

4. IMPLEMENTATION OF PREPAID SYSTEM

4.1. Electricity Metering

The project presents a strong system which allows the buyer to use electricity by making payments during a prepaid manner, similar to the recharge of a mobile SIM is allotted. The user can recharge his/her system account by sending a straightforward SMS to the system. This SMS recharges the User's account. The system also sends alerts to the user just in case of low balance within the system to remind the user to recharge. The system detaches the power supply when the balance of the system falls to zero based upon calculation of the total amount of current being consumed by the load. The implementation is shown in Fig. 2.

4.2. External theft detection

If the power theft before the energy meter then CT1(Current Transformer 1) device can read the current and compare with the internal current ,if CT1 current is not equal with the internal current then it declared as external theft .PIC

microcontroller then it'll send the message(External theft detected) to station controller convenient through GSM equipment.

4.3. Internal theft detection

If the power theft internally found, then CT2 device can read the current and compare with the internal current ,if CT2 current isn't equal with the internal current then it declared as internal theft .PIC microcontroller then it'll send the message(Internal theft detected) to station controller convenient through GSM equipment.



Figure.2: Prepaid Electricity meter system

5. RESULTS AND DISCUSSION

The system switches the power supply 'ON', on condition that the balance in the system is greater than or adequate to 1 Rupees. The system calculates the amount of power consumed by the load connected and deducts the subsequently from the balance amount. The system sends alerts to the the system balance is Re. 1 to remind the consumer to recharge. 2. When balance falls to 0 informing that power is detached. 3. The system is recharged by the consumer.

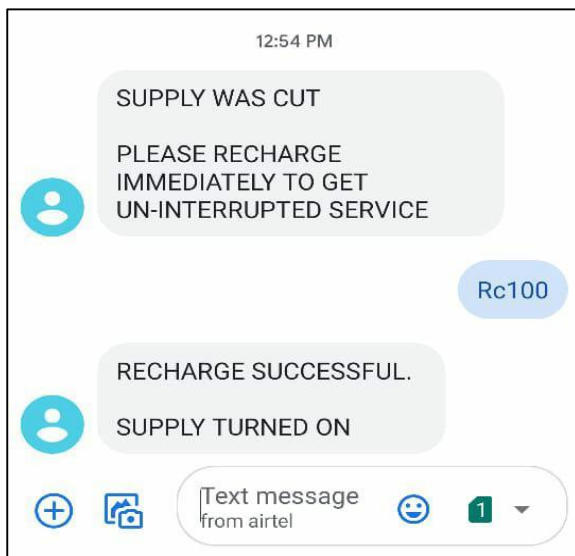


Figure 3: SMS alerts for recharge received

The user can recharge the system simply by sending a SMS to the system (#-recharges the system for rupees 10).The system receives the message through the GSM module. After the message is received it is decoded by the PIC Microcontroller based upon the code and recharges the system and sends alert to user that recharge of Rs 10 is done as shown in (considering # is sent by the user) and switches back the power ON by triggering the relay

The system informs the electricity board whenever the consumer tries to use electricity even after the balance in his/her account falls to zero by using a current sensor which senses the electricity owing through the load end of the meter even after the power supply is turned OFF after the balance has become zero. This keeps unauthorized usage of electricity in under control by detecting theft of electricity at the household level as shown in Fig.5

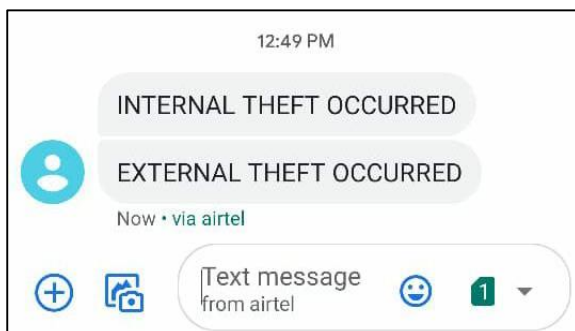


Figure 4: Alerts received when theft is detected.



Figure 5: Final output received in the prepaid energy meter

5. CONCLUSION

The project Prepaid electricity meter with theft detection has been implemented successfully and has applications in households especially in rural areas. This technique may be adopted widely due to its low cost and also it stops revenue leakage to the electricity boards. The most advantage of this project is its low cost solution for prepaid metering of electricity usage and also stops theft of electricity at household level. The facility of tamper detection stops any intrusions by the user into the electricity meter to change or stop the calculation of units being consumed.

REFERENCES

- [1]. YujunBao and Xiaoyan Jiang, Design of electric Energy Meter for long-distance data information transfers which based upon GPRS, ISA2009. International Workshop on Intelligent Systems and Applications, 2009. Volume 2, Issue 4, pp. 70- 73, 2010.
- [2]. Ashna.K and Sudhish N George, "GSM based automatic energy meter reading system "IEEE Wireless communications, 2013.pp-471-488
- [3]. Vivek Kumar Sehgal,Nitesh Panda, Nipun Rai Handa, Electronic Energy Meter with instant billing,UK Sim Fourth European Modeling Symposium on Computer Modelling and Simulation,2011.
- [4]. Hou-Tsan Lee, Wei-Chuan Lin, Ching-Hsiang Huang, Yu- Jih Huang, "Electricity Metering and Inroads to New Technologies", Proceedings of SICE Annual Conference

- (SICE), Volume-1, Issue-4 pp. 2164- 2169, 2011.
- [5]. Philip Garner, Ian Mullins, Reuben Edwards and Paul Coulton. "Mobile Terminated MS Billing - Exploits and Security Analysis" New Generation. Proceedings of the Third International Conference on information Technology: New Generations (ITNG'06) –Vol 200, 10- 12 April 2006, Las Vegas, Nevada, USA, pp. 294 - 299.
- [6]. H.Vijaya Laxmi and M.Narender; Communication between GSM enabled electricity meters and ; International Journal of Engineering Research and Applications Vol. 1, Issue 4, pp. 48-52, 2010.
- [7]. Win Adiyansyah Indra, Fatimah Bt Morad, Norfadzlia Binti Mohd Yusof and Siti Asma Che Aziz, "GSM-Based Smart Energy Meter with Arduino Uno", International Journal of Applied Engineering Research, Vol. 13, No. 6, pp. 3948-3953, 2018.
- [8]. IOT based Power Theft Detection. R Giridhar Balakrishna, P Yogananda Reddy, M L N Vital.. International Journal of Innovations in Engineering and Technology (IJET) ISSN: 2319-105, Volume 8, Issue 3, June 2017
- [9]. A Survey Of IOT For Power Theft Detection, Fault Identification And Location Tracking. Anshu Singhal, Anupriya Tomar, Neha Kumari, S Hena Kauser, Mrs. Savitha. S.C. International Journal of Science, Engineering and Technology Research (IJSETR) Volume 5, Issue 5, May 2016 I.S.
- [10]. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.
- [11]. IOT Based Power Theft Detection and Monitoring System. N Kunan, Poornima BK. IJIREICE. Vol. 5, Issue 5, June, 2017.
- [12]. Chandler, T. 2005. "The technology development of automatic metering and monitoring systems". Power Engineering Conference, 2005. IPEC 2005. The 7th International, Vol., No., pp.1-147.
- [13]. Ali Zaidi.S.K., "Design and implementation of low cost electronic prepaid energy meter", Multitopic Conference, 2008. INMIC 2008.IEEE International 2008.
- [14]. Syed Khizar Ali Zaidi I, HuraMasroor I, Syed Rehan Ashraf I and Ahmed Hassan, "Design and Implementation of Low Cost Electronic Prepaid Energy Meter", NED University of Engineering and Technology, Karachi, Pakistan, 2010.
- [15]. HuraMasroor I, Syed Rehan Ashraf I and Ahmed Hassan, "Design and Implementation of low cost Electronic Prepaid Energy Meter", NED University of Engineering and technology, Karachi, Pakistan, 2010.
- [16]. Jain and Bagree , "A prepaid meter using mobile communication" , International Journal of Engineering, Science and 164 Technology, Vol. 3, No. 3, 2011, pp. 160-166.