

Anti-Theft Automatic Metering Interface

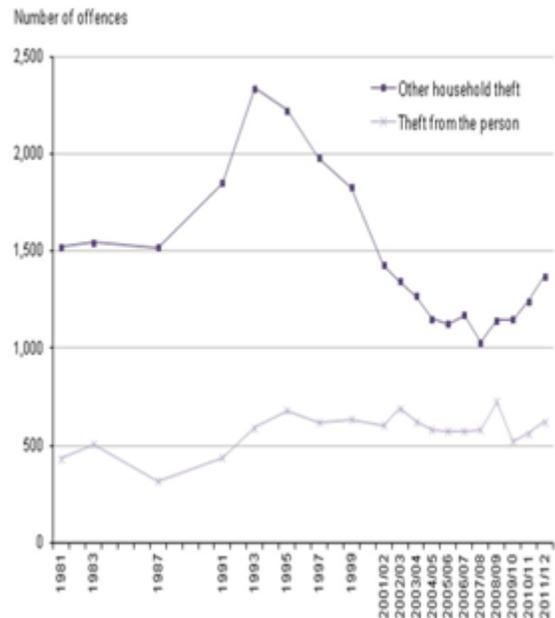
Abhijeet Das, Hiroklyotikalita, Partha Pratim Talukdar

Abstract: Electricity is now more than a necessity and its need is increasing day by day resulting in power theft and power scarcity. The purpose of this project is to provide automatic control and monitoring of the Domestic Energy Meter enabling the Electricity Department to read meter readings without anyone visiting each house and also prevent electricity theft. This can be achieved by the use of a Microcontroller Unit that continuously monitors and records the Energy Meter readings in its permanent memory location. This system also makes use of a GSM module for remote monitoring and control of Energy Meter with the help of an interfacing circuitry. The Microcontroller based system continuously records the readings and the live meter reading can be sent to the Electricity department after a count period or on request. This system also can be used to disconnect the power supply to the house in case of non-payment of electricity bills. The Substation will be the receiving end. The data received is fed to a microcontroller at the Substation which will automatically calculate the bill based on tariff provider and display it.

Keywords: GSM module, Arduino Uno, 32 Bit Microcontrollers, PWM

1) INTRODUCTION

Energy is an essential ingredient for economic development of a country. It is indispensable for uplifting quality of lifestyle of the general people as well as industrial and agricultural development as such the power grid has become a necessity in the modern society. Without a stable and reliable power grid, tens of millions of people's daily life will be degraded. Per capita electricity consumption of a country is often considered as a useful indicator of its socio-economic condition. The per capita electricity consumption in India is still very much lower than that of the developed countries. For instance, though the installed capacity of the country is over 160,000 GW which is the 3rd largest producer of electricity in the world but the per capital consumption is around 704 to 712 units per month. India's network technical losses was 23.65% in 2013, compared to world average of less than 15%. In 2012, electricity losses in India during transmission and distribution were about 24%, while losses because of consumer theft or billing deficiencies added another 12–15% costing India Rupees 45k Crore in 2011-12. In this paper, we are trying to reduce the losses due to consumer theft and billing deficiencies by developing an Advanced Metering Interface [3] which will have built in anti-theft features. It will also considerably reduce human work as well a large portion of losses due to human error. With the development of information system and communication technology many countries have been modernizing ageing power system into smart grid, which is featured with two way transmission, high reliability, real time demand, response.



Within Smart Grid, Advance Metering Infrastructure (AMI)[3] plays a vital role and modernizes the electricity metering system by replacing old mechanical meters with smart meters which provide two way communication between utility companies and energy customers.

2) PROBLEMS

In India, the electricity meter readings are noted down by the people from electricity board and is a cumbersome process. This can lead to differences in actual readings and the billed readings due to human error, corruption, thefts etc. Our project is directed towards reducing these human errors and differences in the reading by using an automated metering system.

3) ELECTRICITY THEFT AND ITS DIFFERENT ASPECTS

3.1) TYPES OF THEFT

Electrical power distribution network suffers typically two types of losses:

i) **Technical loss** ii) **Non-technical loss**

Technical loss is mainly due to structure and characteristics of the network. Transmission and distribution losses fall into

- Abhijeet Das, Department of Software Engineering, School of Computing, SRM University, India, PH-9789910847 E-mail: abhijeet.das4u@gmail.com
- HiroklyotiKalita Department of Electrical and Electronics Engineering, SRM University, India, PH-01123456789. E-mail: hiru01@gmail.com
- ParthaPratimTalukdar, Department of Telecommunication Engineering, SRM University, India, PH-9962313693. E-mail: parthatalukdar92@gmail.com

this category. Non-technical losses mainly occur due to electricity theft. There are about \$25 billion of losses annually in the world. Losses can actually be computed by finding the energy supplied, subtracting the amount of energy billed/paid. If we want to calculate non-technical losses (NTL), simply one way of calculating it is to calculate technical losses. We can evaluate it as follows:

$$\text{Total Energy Losses} = \text{Energy Supplied} - \text{Bills paid} \quad (1)$$

$$\text{Total Energy Losses} = \text{NTL} + \text{TL} \quad (2)$$

Combining equation 1 and 2, we get

$$\text{NTL} = \text{Energy Supplied} - \text{Bills Paid} - \text{TL} \quad (3)$$

Percentage losses are calculated as:

$$\text{Percentage Loss} =$$

$$\left\{ \frac{(\text{Received Value} - \text{Sold Value})}{(\text{Received Value})} \right\} * 100$$

There are certain methods of stealing electricity. The core reason of stealing is lack of awareness amongst the peoples, due to which this unpleasant act is being performed in different areas of the world. Meter tampering[1] can be done in electromechanical meters and smart meters as well. Electricity theft comprises of fraudulent activities by the consumer, stealing electricity illegally, irregular billing and unpaid bill.

A. FRAUDULENT ACTIONS

Fraudulent actions from the consumers refer to illegally manipulating or tampering[1] the meter by himself or with the help of a professional. By tampering[1] the meter, the reading is usually shown in the meter lower than what it is supposed to be.

B. STEALING ELECTRICITY

Electricity stealing is mainly done by rigging a line from the source of supply. This practice is more common in South-East Asian nations due to the poor economic condition of the general people.

C. IRREGULAR BILL PAYING

Consumers often bribe the meter readers or the concerned officials to reduce their original bill. It is quite a common practice in economically backward countries to underpay the bill with help of the concerned official.

D. UNPAID BILLS

It is sometimes observed that electricity bills are unpaid due to various reasons. Sometimes an organization may go bankrupt and thus get exemption from paying the due bill.

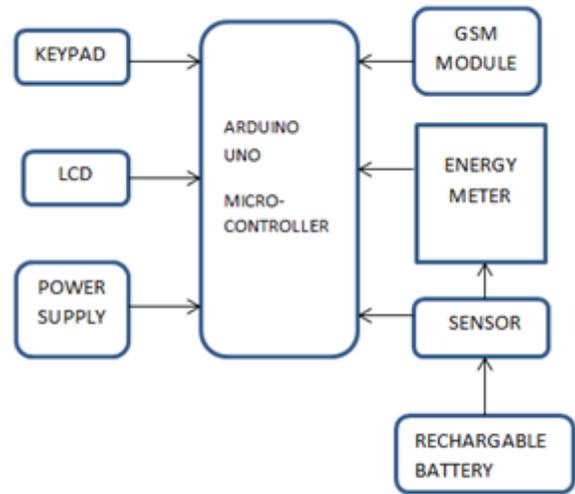
4) PROPOSED SYSTEM

To overcome the problems of energy theft, human error and load regulation, we are introducing an Anti-theft Automatic Metering Interface[2]. This will contain a Microcontroller Unit that will continuously monitor and record the Energy Meter readings [3] in its permanent memory location. This system also makes use of a GSM module[4] for remote monitoring and control of Energy Meter with the help of an interfacing circuitry which is capable of counting pulses with respect to the power consumed by the user. The microcontroller counts these pulses and derive equivalent average, minimum and maximum load for that duration. At the end of the count of 30 days or on request by the substation the value is sent to the substation i.e. the receiving with the help of a Transmitter in the GSM Module[4]. The data received is

fed to a microcontroller at the Substation which will automatically calculate the bill based on tariff provider and display it.

4.1) ARDUINO UNO

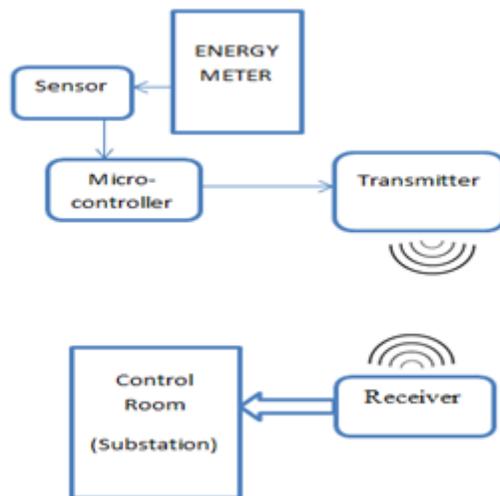
The Arduino Uno[6] is a 32 bit microcontroller based on the ATmega328. It has an operating voltage of 5V with a clock Speed of 16 MHz It has 14 Digital I/O Pins (of which 6 provide PWM) and 6 analog I/O Pins. DC current per I/O pin is 40 mA and that per 3.3V pin is 50mA. It has a USB connection, a power jack, an ICSP header, and a reset button. It can be powered by simply connecting it to a computer with an



USB cable or with a AC to DC adapter or battery. It can be programmed with the Arduino Software – Arduino IDE[6].

5) ANTI THEFT FEATURE

In this proposed system, we use a tactile sensor to detect if any tampering[1] is being done with the meter. Tactile sensor usually refers to a transducer that is sensitive to touch, force, pressure. Tactile sensors are employed whenever a signal or stimulus having to do with force between a contact surface and the environment are to be measured and registered i.e. the detection and measurement of a contact force at a defined point. A touch sensor can also be restricted to binary information, namely touch and no touch. To detect bypassing current we use comparator, if a supply comes it first passes through meter and is fed to the domestic households, in bypassing the current is tapped after it passes the meter. In case of detection the comparator is set parallel to the meter, we feed two input to the comparator one before the supply passes through the meter and other after it passes the meter. So, when tapping is done there will be no input through the second port and large current passes through the comparator this value is then fed to the microcontroller.



CONCLUSION:

This system would make the data collection and manipulation task faster and easier as well as power theft. Changes in rate or unit calculation can be done very easily and effectively, substantially reducing human work as well as human error. Future improvement can be done by introducing a dynamic pricing system which charges different amount depending on the time-of-day when the service is provided. This will help in regulating the load during peak hours and also help us in tackling power crisis.

REFERENCES:

- [1] Mohit Arora, Freescale Semiconductor "Prevent tampering in energy meters" EE Times-India.eeindia .com
- [2] Amin S. Mehmood, T. Choudhry, M.A. Hanif, "A Reviewing the Technical Issues for the Effective Construction of Automatic MeterReading System" in International Conference on Microelectronics,2005 IEEE.
- [3] Abdollahi, A. Dehghani, M. amanzadeh, "SMS-based Reconfigurable Automatic Meter Reading System" in Control Applications, 2007.
- [4] AmeyKelkar. "Implementation of unmanned vehicle using GSM Network with Arduino". In ijarcse, vol 4, issue 4, April'14.
- [5] HE Xiao-rong, DONG Ch UN, LIU Shu-xi. The new Technology and application of singlephase electric Energymeter defenseelectricity stealing. Power Supply, 2007, Vol.24, No.2: pp.70-71, 74.
- [6] arduino.cc/en/uploads/Main.