



A Review of Microcontroller Based Power Theft Detection

Shubham M. Pakhale¹, Rupali R. Burele¹, Pooja V. Tonpe¹, Mohd.Shahejad¹

UG Student, Dept. of EEE, Prof Ram Meghe College of Engineering & Management, Badnera(Amravati),
Maharashtra, India¹

ABSTRACT: Electrical energy is very essential for everyday life and is spine for the industry. Electricity is indiscipline to our daily life with the increasing need of electricity the power theft is also increasing. This paper deals with the power theft detection system, used to detect unauthorized tapping on transmission line and also able to identify the exact consumer where the theft is occurred. Data is transferred using RF network. This will provide an additional facility of wireless meter reading with the similar technique and in same cost using GSM. The implementation of this system will minimize the losses, and thereby electricity will be available for more consumers than earlier, in highly populated country such as INDIA.

KEYWORDS:Current Transformers, GSM Modem, RF Transmission, PIC, Pulse monitoring circuit, Energy Meter.

I.INTRODUCTION

Now days with emerging developments in all sectors and growing demands, electricity has become priority for each individual and also for organizations. The basic steps for power supply include power generation, power transmission and power distribution to the consumer. Naturally considering few technical faults, losses may occur due to power dissipation by some devices. These losses can be minimized using the modern technologies, but what about the other types of losses? These are the losses caused wilfully by human beings for the illegal access to the power distribution, is nothing but the power theft [6].

In developing countries like India, power theft is one of the most serious issues which not only cause economic losses but also irregular supply of electricity. It affects functioning of industries and factories, due to shortage of power delivered to them. It causes shortage of power supply to domestic consumers. It leads to loss of revenues by Government as individual enterprises may choose to install their own power generators, increases corruption in form of bribes and many more.

Many individuals who cannot afford paying the electricity bills often run wires directly to distribution lines, tamper with meters or steal meters from vacant houses [1].

POWER THEFT:

Theft of electricity is the illegal practice of thieving electrical power. It is a crime and is punishable by fines and/or imprisonment.

According to the annual Emerging Markets Smart Grid Outlook 2015, study by the Northeast Group, LLC, the world loses US\$89.3 billion annually to electricity theft. The highest losses were in India (\$16.2 billion), followed by Brazil(\$10.5 billion) and Russia (\$5.1 billion). The state of Maharashtra which includes Mumbai alone loses \$2.8 billion per year, more than all but eight countries in the world. Nationally, total transmission and distribution losses approach 23% and some state's losses exceed 50%.

TYPES OF THEFT:

There are more ways to snaffle power. Some techniques are very simple, but effective, while others are sophisticated and difficult to detect including tapping a line or bypassing the energy meter. According to a study, 80% of worldwide theft occurs in domestic consumers and 20% on commercial and industrial premises. The various types of electrical power thefts are as follows;



International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 9, September 2016

A) Direct hooking from line

Hooking is the most used method. 80% of world's power theft is by direct tapping from the line. The thief taps into a power line from a point ahead of the energy meter. This energy consumption is immeasurable and procured with or without switches.

B) Bypassing the energy meter

In this method, the input and output terminals of the energy meter is short-circuited, preventing the energy from recording into the energy meter.

C) Injecting foreign element into the energy meter

Meters are controlled via remote by installing a circuit inside the meter, so that the meter can be slowed down at any time. This type of changes can evade external inspection attempts because the meter is always shows correct reading, unless the remote is turned on.

D) Physical obstruction

This type of theft is done to electromechanical meters with a rotating element. Foreign material is placed inside the meter to disturb the free movement of the disc. A slower rotating disk signals less energy consumption.

E) Many people who cannot afford paying the electricity bills frequently run wires directly to circuit breakers, tamper the meters or steal meters from vacant houses.

F) Many cases of power theft using a remote controlled device have come to light of late, but to use the remote controlled device you have to install a sensor in the electricity meter by tampering with it. The earlier electro-mechanical meters could be manipulated even with a magnet, but with electronic meters you cannot do so. The device used for theft generates an electrostatic discharge. It was the size of a compass box used by students. The user could keep it anywhere and only when he wanted to theft power he have to fit a wire loop and place the device and the loop near the meter.

The device contains electronic circuit and a coil, which gets activated on pressing a small button of remote. The device produces high voltage and high frequency discharge, which generates a small spark in the meter. The meter gets 'hanged' and does not record any electricity consumption. When the user wants the meter to run normally, he reactivates it using the same method.

II.METHODS TO MONITOR OR PREVENT POWER THEFT

- Energy Meter Tampering can be detected by using a simple arrangement of an IR LED and a Photodiode. It is used in cases where electro-mechanical energy meters are used. A photodiode is placed on the shaft of the rotating disk of the meter and is illuminated with the IR LED. In normal operation, the output of the photodiode gives a logic low signal to the Microcontroller. However when the meter is tampered, i.e. the disk rotation is disturbed or the meter cover is removed, a barrier is created between the LED and the photodiode, results to a logic high signal to the Microcontroller. The Microcontroller detects this disturbance in the logic signal and based on this, sends a message to the GSM modem. The GSM modem then sends the message about tampering at the particular consumer's house, to the power distribution authority and appropriate action is taken by them.
- Either the power supply is cut off or energy meter is replaced in case of any damage.
- Power line tapping can be detected by comparing the power distributed to the line and the power actually consumed by the load. This is done by installing an electronic energy meter at the load side and the consumed power readings are send wirelessly to the distribution unit. This reading is received by the wireless receiver at power distribution authority and is compared with the actual power given to the load. The difference in readings indicate the theft and this signal is given to a controller which in turn controls the secondary voltage of the transformer, thus causing the transformer to stop the supply of power. Thus power theft by tapping is detected and it is prevented by stopping the power to the line totally.

III.OBJECTIVES

- This system is beneficial for government and also for consumers.
- This system provides easiest way to identify illegal power uses.
- It decreases power demand and increases the profit of government authority.
- It would identify particular theft consumer with meter number and pole number.

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 9, September 2016

- It saves human efforts and minimizes time for meter reading and billing.

IV.SYSTEM TO BE USED

In this proposed system, RF transmission is used to transmit the meter(M1) reading to PIC microcontroller and second reading from pole side meter(M2) directly taken for comparison. If PIC result is negative then theft is occur. This then send consumer meter number with pole number through a message to authority by using GSM technology[8].

V.METHODOLOGY

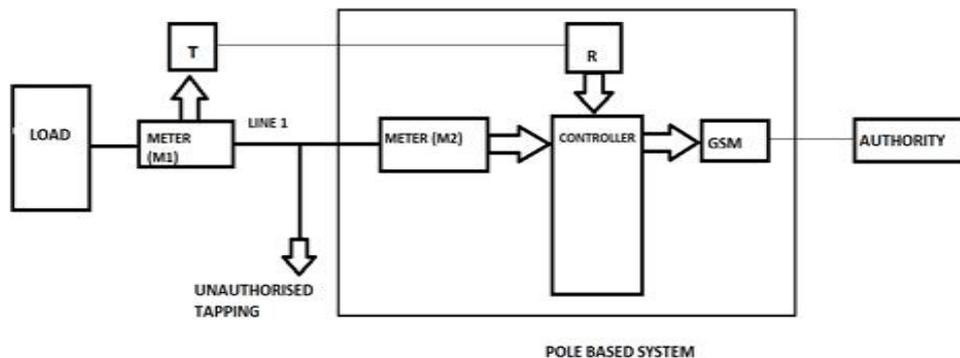


Fig (1). Block diagram of power theft detection.

In this system, two energy meters are use. Here one meter (M1) is placed at consumer side and second meter(M2) is placed at distribution pole. Power consumed by the load is recorded into energy meter (M1) and same power is measure by meter (M2) at the pole. There is analog to digital converter is used to convert analog data from both meters into digital. It will transmit the data from transmitter to receiver with the help of wireless digital data transmitter (RF).

The energy meter (M2) reading is directly provided to the controller and other reading is taken out from RF receiver. Then controller compares both the readings, if compared result has more negative value than considered tolerance value, then this particular line is detected as theft point.

This system is also used to detect the exact theft consumer by using pulse monitoring circuit and or vibration sensor. Then microcontroller sends a signal to GSM modem and GSM modem transmit the message including consumer meter number and pole number to the authority (control unit of electricity board) [5][8].

VI.WIRELESS METER READING

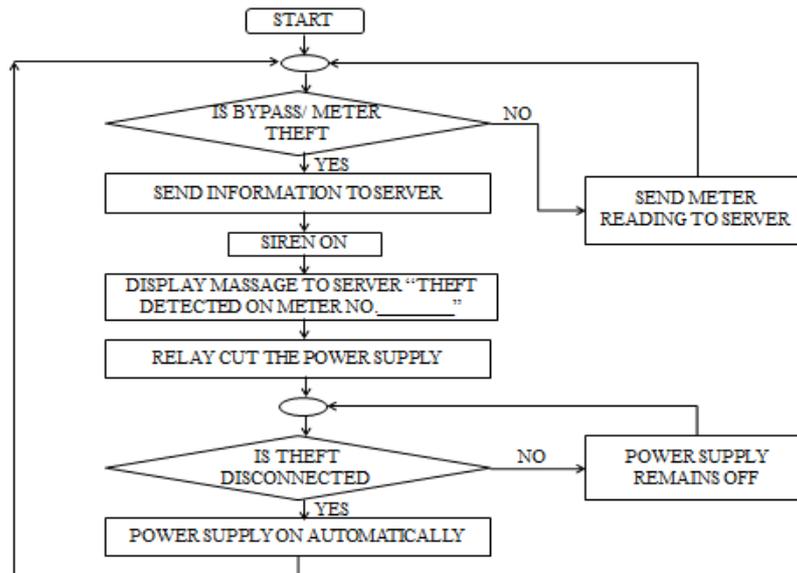
Now a day, electricity company personnel taking more efforts for meter reading by specially going into every house for billing purpose. They would face problems with consumer for taking reading. In this system, we also provided the wireless meter reading to the authority in same cost via GSM [5].

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 9, September 2016

VII.FLOWCHART



Above flowchart is used to detect power theft at pole as well as at consumer meter in following way;

If power sent on line is more than power consumed by that load over a given time considering tolerance (say 5min.) the power theft is occurring on that line. Also if there is meter tampering/theft is occurred it will identified by the vibration sensor and meter pulse monitoring circuit. This sends the signal of power theft with the line number/meter number and its area to utility company. For this RF transmission is used. If power theft is not occurring then again take the data after say 5min. It's an endless program.

VIII.MATHEMATICAL MODEL

Mathematically we can say that,

1. Total power delivered = consumed power + Transmission losses.....No theft
2. Total power delivered \neq consumed power + Transmission losses.....Theft occurs[8]

IX.CONCLUSION

In this way we design a microcontroller based power theft detector circuit. The purpose of designing such system will ultimately reduce the illegal use of electricity, because power theft is non-ignorable crime which has to be minimized. This system will be beneficial to consumer as well as for government. It requires only one time installation cost and can be used further. The big advantage of this system is that it will increase the revenue.

REFERENCES

- [1] H. Cavdar, "A Solution to Remote Detection of Illegal Electricity Usage via Power Line Communications", IEEE Transactions on power delivery, June 2007 Vol. 19.
- [2] Bharath P, Ananth N, Vijetha S, JyothiPrakash K. V. , "Wireless automated digital Energy Meter", ICSET 2008.
- [3] H. M. ZahidIqbal, M. Waseem and TahirMahmood "Automatic Energy Meter Reading using Smart Energy Meter" Department of Electrical Engineering, University of Engineering & Technology Taxila, Pakistan, 2013.
- [4] Md. MejbaulHaque, Md. Kamal Hossain, Md. Mortuza Ali and Md. Rafiqul Islam Sheikh "Microcontroller Based Single Phase Digital Prepaid Energy Meter for Improved Metering and Billing System", International Journal of Power Electronics and Drive System (IJPEDS), Vol. 1, No.2, December 2011
- [5] D.T. Zhang, "The anti-theft alarm system of power cable based on the power line carrier and GSM communications," Journal of Northeast Dianli University Natural Science Edition, vol. 02, pp. 84–88, 2008.
- [6] V.K.Mehta and Rohit Mehta, "Principles of Power System", 4th edition, S. Chand publication, 2008.



ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 9, September 2016

- [7] Ashfaq Husain, “Electrical Power System”, 5thedition, CBS Publishers and Distributors Pvt. Ltd., 2007.
[8] SagarPatil, KirtikumarPatil, GopalPawaskar, “Electrical Power Theft Detection And Wireless Meter Reading”, IJRSET, Vol 2, issue 4, april2013.

BIOGRAPHY



Shubham Marotirao Pakhale, student of 7th semester in Department of Electrical and Electronics Engineering, Prof Ram Meghe College of Engineering & Management, Badnera(Amravati). He is working on project of Microcontroller Based Power Theft Detection.



Rupali Ramesh Burele, student of 7th semester in Department of Electrical and Electronics Engineering, Prof Ram Meghe College of Engineering & Management, Badnera(Amravati). She is working on project of Microcontroller Based Power Theft Detection.



Pooja Vijay Tonpe, student of 7th semester in Department of Electrical and Electronics Engineering, Prof Ram Meghe College of Engineering & Management, Badnera(Amravati). She is working on project of Microcontroller Based Power Theft Detection.



Mohd. Shahejad Mahedavi, student of 7th semester in Department of Electrical and Electronics Engineering, Prof Ram Meghe College of Engineering & Management, Badnera(Amravati). He is working on project of Microcontroller Based Power Theft Detection.