



Unmanned Power Theft Detection and Automatic Power Breaking by Wireless Control System

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ABSTRACT: In this paper, by means of wireless technology, prevent the power from unauthorized persons. This paper of ours is aimed at reducing the heavy power and revenue losses that occur due to power theft by the customers. We by this design would like to conclude that the power theft can be effectively curbed by detecting where the power theft 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. The ability of our system to inform or send data digitally to be mote station using wireless radio link adds a large amount of possibilities to the way the power supply is controlled by the electricity board.

We have come up with is fool proof when it comes to detecting and preventing the power theft as, we have taken into consideration a large number of possibilities in which the power theft may occur and have designed accordingly to prevent it. Thus by the above mentioned design we can successfully and effectively address the problems related to power theft by the consumers, in a completely automated, wire-free, cost effective and most importantly a reliable way.

KEYWORDS: Wireless, Power, Automation, Theft Detection

I. INTRODUCTION

Generation, transmission and distribution of electrical energy involve many operational losses. Whereas, losses implicated in generation can be technically defined, but T&D losses cannot be precisely quantified with the sending end information. This illustrates the involvement of nontechnical parameters in T&D of electricity. Overall technical losses occur naturally and are caused because of power dissipation in transmission lines, transformers, and other power system components. Technical losses in Transmission & Distribution (T&D) are computed with the information about total load and the total energy billed [1]. Net Transmission Losses (NTL) cannot be precisely computed, but can be estimated from the difference between the total energy supplied to the customers and the total energy billed.

NTL are caused by the factors external to the power system. In many developing countries, NTL are a serious concern for utility companies as they account to about 10 to 40% of their total generation capacity. Data regarding NTL is uncertain and it is very difficult to analyse theft in terms of actions that cause these losses. Electricity theft forms a major chunk of the NTL. Electricity theft includes bypassing, tampering with the energy meter and other physical methods to evade payment [2]. Illegal tapping of electricity from the feeder and tampering with the meter are the most identified and accounted ways of theft. Electricity theft can also be defined as, using electricity from the utility company without a contract or valid obligation to alter its measurement is called electricity theft [3].

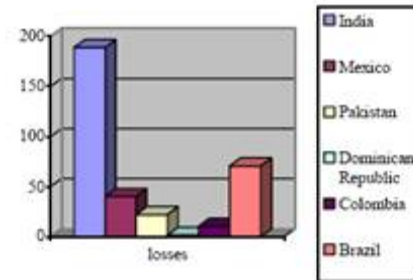


Fig 1: Over all T&D

II. FACTORS THAT INFLUENCE ILLEGAL CONSUMERS

There are many factors that encourage people to steal electricity. Of which socio-economic factors influences people to a great extent in stealing electricity. A common notion in many people is that, it is dishonest to steal something from their neighbour but not from the state or public owned utility company. In addition, other factors that influence illegal consumers are:

- Higher energy prices deject consumers from buying electricity.
- Growing unemployment rate show severe effect on the customer's economic situation.
- Lower illiteracy rate in under developed communities has greater impact on illegal consumers, as they might not be aware of the issues, laws and offenses related to the theft.
- Weak economic situation in many countries has implied its effect directly on common man.
- In view of socio economic conditions of the customer, electricity theft is proportional to the tariff of electricity utilization.
- Countries with weak enforcement of law against electricity theft have recorded high proportion of theft.
- Corrupt political leaders and employees of the utility company are responsible for billing irregularities.

III. EFFECTS OF ELECTRICITY THEFT

Negative effects of electricity theft are severe and dangerous. Primarily, electricity theft affects the utility company and then its customers. In addition, electricity theft overloads the generation unit. In energy market, utility companies expect their money back from the customers for the electricity supplied, most of which is lost by them due to the NTL (Nontechnical losses). Electricity theft is a serious concern for utility companies as they are under threat of survival because of these incurring economic losses. It is evident that some utility companies in developing countries are losing about 10 to 30 percent of their total revenue, which shows that they could not invest on measures to reduce the electricity theft. These economic losses affect the utility company's interest in development of the devices in view of improving the quality of supply or for electrification process.

IV. METHODS OF THEFT

Methods used to commit theft fall into the Following broad categories:

A. Connection of supply without a meter

Connection of supply without a meter following disconnection for non payment or by "squatters" occupying empty properties.

B. Bypassing the meter with a cable

It converted into the supply side of the metering installation (i.e. the meter terminals, the metering cables, the cut-out or the service cable).

C. Interfering with the meter to slow or stop

The disc, including use of electrical devices which stop the meter or cause it to reverse (so-called "black boxes").



- D. Interfering with the timing control
Equipment used for two rate tariffs to obtain a cheaper rate.

V. IDENTIFICATION OF THEFT

A. Financial Rewards

Utility companies encourage consumers to report electricity theft, sometimes offering big rewards for information leading to conviction of anyone stealing electricity.

Unfortunately, most cases are never identified in the apartment industry due to lack of timely information.

B. Periodic Checks

Electricity theft frequently takes place after service has been disconnected. Some utility companies periodically check disconnected meters if the customer has not contacted them to reconnect service. This labour intensive, manual process has little chance of success given that the apartment industry averages 70% turnover of tenants annually.

C. Meter Readers

Utility meter readers typically suspect that electricity theft is taking place when they find a broken meter tag or other signs of tampering. But as more utility companies outsource the meter reading function to third parties, training meter readers to detect theft is becoming more difficult and less efficient. In addition, third party meter readers do not read disconnected meters.

VI. ANALYSIS OF LOSSES IN POWER SYSTEMS

Losses incurred in electrical power systems have two components:

- Technical losses and
- Non-technical losses (Commercial losses)

Where P source (t) is the instantaneous power that the source injects into the transmission line and P load (t) is the instantaneous power consumed by the Load at the other end of the Non-Technical Losses (Commercial Losses)-Losses incurred by equipment breakdown are quite rare. These include losses from equipment struck by lightning, equipment damaged by time and neglect. Most power companies do not allow equipment to breakdown in such away and virtually all companies maintain some form of maintenance policies. Other probable causes of commercial losses are:

- Non-payment of bills by customers
- Errors in technical losses computation
- Errors in accounting and record keeping that distort technical information.
- Inaccurate or missing inventories of data on customers.

VII. PREVIOUS POWER THEFT DETECTION DORK

Utilization of a central observer meter at secondary terminals of distribution transformer. Vigilant energy metering system (VEMS) is an advanced energy metering system that can fight against electricity theft

Nagi J. et al. proposed a novel approach of using

Genetic algorithm- support vector machines (GA-SVM) in detecting electricity theft.

A. Modern detecting tools

There are many modern tools that assist in power theft identification. Some of them are:-

- Tamper proof seals and labels.
- Meter leaders.
- Tamper resistant screws / locks. AC Check meter and remote meter readers.
- Tamper alarms and sensors.

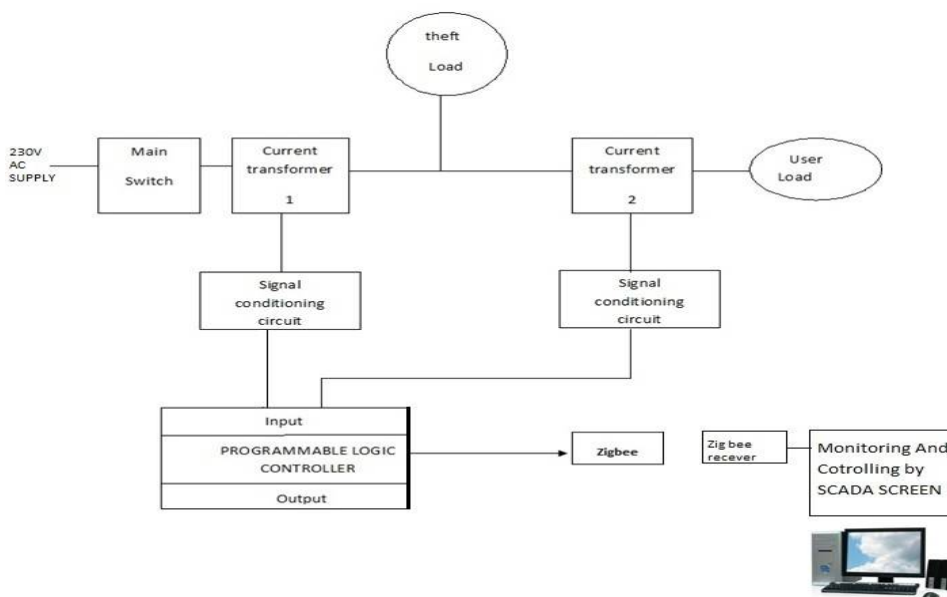
This paper undertakes the Check meter and remote meter readers for power theft identification. In our case, the consumption recurred by the check meter is compared with the revenue meters consumption. If there is a difference then it indicates either there is a theft or revenue meter malfunction. The check meter can also be used to monitor the energy used on the secondary of a distribution transformer serving several customers and compared to the sum of all

the meter usage. Besides spotting out the line where power theft is suspected to occur, it also detects the amount of energy stolen. Compact size, lightweight for Quick and high accuracy make the system more effective. Power theft identification, in this paper, is done by converting the disc revolutions of each consumer's energy meter and distribution transformer into pulses. These pulses are frequency division multiplexed and transmitted through power line. These signals are individually picked and counted at the receiver end. If the difference of the sum of the consumer's readings and that of distribution transformer exceeds the preset value, which is set by considering transmission loss, the power theft is said to occur. B. Detection and estimation of theft Researchers have proposed and developed several techniques for detection and estimation of electricity theft. Of which, a few methods are illustrated in this section. Total phase currents at all the distribution transformers and feeder lines over a period of time are collected. These two values of the current are compared to estimate the total electricity being lost by the utility company in the form of theft. Bandim C.J. et al. proposed utilization of a central observer meter at secondary terminals of distribution transformer. Value of energy read by the central observer meter is compared with the sum of energy consumption values read by all energy meters in range. These two values of the current are compared to estimate the total electricity that is being consumed illegally. Vigilant energy metering system (VEMS) is an advanced energy metering system that can fight against electricity theft. It has the ability to collect, transfer and process data between other energy meters, local station and base station. It also identifies probable locations of theft and helps the utility companies to control theft. A remote billing system can also be developed modifying this model. Illegal consumption of electricity can be detected using a remote check meter based on the amount of losses and the time stamp of the check meter. This method is implemented before inspecting the illegal consumers personally by the vigilance officials, based on the data at proper frequency of the consumer measurements.

VIII. IMPLEMENTATION OF SYSTEM

We can detect power theft wirelessly. Illegal usage of electricity can be solved electronically without any human control, using Radio frequency (RF) Technology. Electric Power is transforming from transmitter to the receiver at that time if load is apply in between transmission of power and if difference is find between the transforming and receiving power then there is stealing of power from unauthorized person. i.e. Whenever energy is passing from supplier to the receiver at that time if the total amount of power is not received by the receiver then there is possibility of energy theft

IX. BLOCK DIAGRAM





WORKING:

The hardware mainly consists of PLC, SCADA, CT and ZIGBEE module. It uses 230v supply. Here two CT's are connected, one at the distribution transformer side and the other at the user side. These two CT's are used to compare the currents at two sides. The voltage is varies continuously in a transmission line whereas current remain the same and also very small.

All the time two CT's compare currents at both ends and monitored in the SCADA screen. If any theft or fault current to be detected in between these CT's a current mismatch occurs. The information from two CT's are passed to the PLC through a signal conditioning circuit and to the zigbee transmitter. The zigbee receiver receives the signal and displays on SCADA screen. Monitoring and controlling is possible in the SCADA screen. The section where the power theft occurs is identified. Here 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.

X. ADVANTAGES AND LIMITATIONS

The advantages are:

- The proposed system provides the solution for some of the main problems faced by the existing Indian grid system, such as wastage of energy, power theft, manual billing system, and transmission line fault.
- This method will reduce the energy wastage and save a lot of energy for future use.
- We can detect the location from where the power is being stolen which was not possible before.
- Optimized use of energy.
- Real time theft monitoring
- Currently used energy meters can be modified into this sensor, so no need to replace currently used energy meters.

The limitations are:

- One major disadvantage of this project is that it is not capable of detecting the exact location from where the power is being stolen.
- Cannot determine who is stealing, but no any other existing system is capable.
- If implemented on a large scale it may take a lot of time and manual input.

XI. RECENT TRENDS AND DEVELOPMENTS

The National Electricity Policy aims at laying guidelines for accelerated development of the power sector, providing supply of electricity to all areas and protecting interests of consumers and other stakeholders keeping in view availability of energy resources, technology available to exploit these resources, economics of generation using different resources, and energy security issues.

The National Electricity Policy aims at achieving the following objectives:

- Access to Electricity – Available for all households in next five years
- Availability of Power – Demand to be fully met by 2012. Energy and peaking shortages to be overcome and adequate spinning reserve to be available.
- Supply of Reliable and Quality Power of specified standards in an efficient manner and at reasonable rates.
- Per capita availability of electricity to be increased to over 1000 units by 2012.
- Minimum lifeline consumption of 1 unit/household/day as a merit good by year 2012.
- Financial Turnaround and Commercial Viability of Electricity Sector.
- Protection of consumers' interests

Stiff penalties for the offence under section 135 of EA2003 are provisioned The Act describes electricity theft as -
“Whoever, dishonestly,-

a) taps, makes or causes to be made any connection with overhead, underground or under water lines or cables, or service wires, or service facilities of a licensee;



b) tampers a meter, installs or uses a tampered meter, current reversing transformer, loop connection or any other device or method which interferes with accurate or proper registration, calibration or metering of electric current or otherwise results in a manner whereby electricity is stolen or wasted.

c) damages or destroys an electric meter, apparatus, equipment, or wire or causes or allows any of them to be so damaged or destroyed as to interfere with the proper or accurate metering of electricity, so as to abstract or consume or use electricity shall be punishable with imprisonment for a term which may extend to three years or with fine or with both”.

XII. FUTURE SCOPE

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. GSM module can also be used in place of Zigbee module.

XIII. SOFTWARES USED

WPL 2.12 Soft

- Programming software.
- Communicates with all windows xp,7 and vista.

SCADA

- User defined software
- Controlling and monitoring all the equipment.

XIV. COMPARISON

EXISTING SYSTEM LIMITATION:

- Large amount of power shortage.
- Power theft causes a revenue loss along with damage to personal and public property.
- Cable Installation for Long distance required.

Proposed system:

- Here 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.
- The monitoring and controlling cable between field area is too high. By means of this type it can be reduced as much as possible.

XV. CONCLUSION

This paper defines electricity theft in social, economical, regional, political, infrastructural, literacy, criminal and corruption points of view. This paper illustrates various cases, issues and setbacks in the design, development, deployment, operation, and maintenance of electricity theft controlling devices. In addition, various factors that influence people to steal electricity are discussed. This paper illustrates the effect of NTL on quality of supply, burden on the generating station and tariff imposed on genuine customer.



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REFERENCES

- [1] M.A. Oliveira and C.C. Barioni, “*Technical loss calculation by distribution system segment with corrections from measurements,*” Proc.20th international Conference and Exhibition on Electricity Distribution, Prague, Czech Republic, June 2009
- [2] T. B. Smith, “*Electricity theft- comparative analysis,*” Energy Policy, vol. 32, pp. 2067–2076, Aug. 2003.
- [3] “*Overview of power distribution,*” Ministry of Power, Govt. of India.
- [4] A. Pyasi and V. Verma, “*Improvement in electricity distribution efficiency to mitigate pollution IEEE ISEE,*” Proc. IEEE International Symposium on Electronics and the Environment, San Francisco, California, May 2008, pp. 1–1.
- [5] “*India struggles with power theft,*” Business News, BBC, [Online].