

A Review on Overload and Theft Detection for Power Distribution System

Rajbir*, Rohit Grewal, Tushar Sharma, Karamjit Kaur

Department of Electrical and Electronics Engineering, Amity University Haryana, Haryana, India

Abstract— Energy theft is a major threat that affects economy of our country and there necessitates to fulfil the energy demand as per the requirement of power consumption. GSM based energy meter is used to avoid the user to pay for excess power theft bill irrespective of the electricity usage. Practice of prepaid recharge system is an inexpensive way of giving power supply, reducing the problems of billing. Electricity theft detection solves the problem of human inspection as the system requires no manpower. Illegal electricity usages will be reduced. Internet of things and GSM are used for reporting of energy overload and power theft to the supplier. The overload and theft detection techniques that have been written in the paper are reviewed.

Keywords— *Overload, energy theft, prepaid recharge system, GSM, internet of things, microcontroller.*

I. INTRODUCTION

Usage of electricity is necessary in today's world. With the increase in usage, the energy demand is also increasing. Sometimes, the supply does not meet the demand. There are various reasons for this such as energy theft, leakages, power losses etc. But energy theft is a major issue among the problems and needs to be sorted. This, also has a bad impact on the economy of our country. Electricity theft can be happened by tampering the meter or by tapping on the distribution lines outside the energy meter. There are various ways in which electricity power theft takes place and succeed with the support of utility staff members or higher officials. The concept of IOT can monitor the power consumption calculated by the microcontroller continuously.

II. RELATED WORK

Several techniques are proposed and developed for detecting power theft. [1] represents the theft detection based on load profile analysis of customer. The profile is presented the SVM where classifiers are need to detect the suspicious energy consumption. The classifiers are designed using data base of historical data comparison of load using with and without theft. [2] discusses about advanced metering infrastructure. AMI is used to address the electricity theft challenge. There are various attacks on AMI the current power theft detection techniques which are classified into three categories as classification-based, state estimation based and game theory-based. The comparison is done between these categories. There are various challenges arise in the power theft. [3] brings into the notice about the types of electricity theft and power theft control methods. A simple way of electricity theft is by direct hooking the distribution lines before the energy meter. Slowing down the LED in the energy meter with the help of magnets. Wrongly injecting of energy meter readings or resetting the readings in order to get reduced electricity bill. Usage of neural networks/SVM in detecting power theft. Installation of current transformer for measuring the flow of current. The concept of smart meters and AMI is introduced. In [4], effective data fusion techniques that are developed for improving occupancy monitoring accuracy are proposed using a multitude of sources for the occupancy collection of data. IR sensors are used for the detection of existence of the persons and it will count the people in the buildings entering. IOT comes into picture with the involvement of smart phones, and Wi-Fi APs. [5] uses a GSM based concept to generate bill that is available as SMS at the time of generation itself and hard copies are available to the consumer as postal mail. A soft copy can be send to the consumers' e-mail if consumers are registered with their e-mail address. [6] represents consumption-based power theft detector. The distribution transformer meters are used to identify the high-power loss areas and in these areas by using patterns, the suspected fraud customers are listed their approach which will overcome the problem which is present in classification-based systems. The multiclass support vector machine is used and support vector machine is trained using historical data and developed attack's dataset. Three experiments are performed using variants of support vector machine and compare detection rate and false positive rate between these experiments. [7] tells about a system that disables the theft of electricity through bypassing the energy meter. The electricity theft detection system is used to detect an unauthorized tapping on distribution lines. A wireless technology Zig Bee module is used to check the theft of electricity and to send a message to the consumer but it is incapable of detecting the overload and exact power theft location. [8] shows dogma of a system that would reduce the power loss due to illegal energy thefts and other illegal activities. A GSM technology is used, through which the consumer would receive SMS about the power consumption (in watts) and on reaching to the low amount, it would automatically alert the consumer to recharge and if the prepaid card is out of balance, the consumer load would be disconnected from the supply by the relay. [9] presents a framework to identify power loss activities. Feature extraction methods are used for customer profile with ELM, OS-ELM and SVM to identify customer who does fraud. The consumption patterns can be extracted using data mining and statistical techniques. ELM, OS-ELM and SVM classifies profiles for fraud detection. The outlier detection is used to find fraud customer profiles. The customer's consumption analysis and its correlation with other factors are also presented. [10] talks about a system in which service provider can collect the bill any time with a single message. The data collection and manipulation task become fast and easier and any modification can be made to the code in less time changes in rate or unit calculation can be done very effectively. Manual manipulation work is reduced. Here, GSM usage provides the numerous advantages of wireless network systems. The metering IC ensures the accurate and reliable measurement of power consumed. [11] discuss about the electricity theft control in energy meters by the government to save money and also more beneficial for customer side and the government side. This ensures low cost meter when compared to other energy meters which are incapable to get automatic meter reading and theft control. [12] gave

the ideology of a system with GSM modules which will help the company to monitor the amount of usage by this specified customer and generate bill periodically and send it to customer via SMS. Thus, it saves a lot of labor work, time and cost of reading the proposed found to be little bit complex as far as distribution network is concerned but it's an automated system of theft detection. It helps to maximize profit margin for utility company working in electrical distribution network. [13] represents a design of an electrical energy meter for long distance data information which is based upon GPRS. The PLC's are used for high performance installation protection system. It can be obtained only at the cost of highly complex relay scheme. [14] tells about the internet of things (IOT) which has become a popular term for describing scenarios. The internet connectivity and computing capability extend to a variety of objects, devices, sensors, and everyday items. [15] denotes energy theft incidents where users do electricity theft to lower their bills by meter tampering. The physical attack can be extended to a network attack by means of false data injection (FDI). A hybrid detection framework is developed to detect anomalous and malicious activities so that the network observability and detection accuracy can be improved by means of grid-placed sensor deployment. The limitations of the proposed method are limited to a one-player attack. [16] approaches towards the non-technical loss (NTL) detection in power utilities using artificial intelligence-based technique and pattern classification technique in order to detect and identify load consumption patterns of fraud customers. It shows customer committing fraud activities.

III. CONCLUSION

It aimed at reducing the heavy power and revenue losses that occur due to power theft by the customers. It can be concluded that power theft can be limited by its detection and reporting it to the authorities. IOT sends notification to the server about the energy theft. A GSM is used for billing purposes and monitor the meter readings. The system will help in detection of overload and theft without any manpower. The need of inspecting the energy theft physically by going to the site will now be prevented. It saves time as well as help to maximize the profit margin for utility company working in electrical distribution network. It reduces the heavy power and revenue losses that occur due to power theft by consumers. Utility company can also keep a constant eye on its customer. The issues of overload and power thefts are discovered. There are various techniques of power theft which are reviewed here. Optimum results are obtained for different theft detection methods. The system is effective but there are shortcomings that are to be addressed in the nearby future.

REFERENCES

- [1] Soma Shekara Sreenadh Reddy Depuru, Lingfeng Wang, and Vijay Devabhaktuni, "Support Vector Machine Based Data Classification for Detection of Electricity Theft", IEEE, Power Systems Conference and Exposition (PSCE), 2011.
- [2] Rong Jiang, Rongxing Lu, Ye Wang, Jun Luo, Changxiang Shen, and Xuemin (Sherman) Shen, "Energy-Theft Detection Issues for Advanced Metering Infrastructure in Smart Grid", Tsinghua Science and Technology, vol.19, issue.2, 2014.
- [3] B. Saikiran, R. Hariharan, "Review of Methods of Power Theft in Power System", IJSER, vol.5, issue.11, 2014.
- [4] L. Deepika, B. Divya, P. Jeevitha, P. Ramkumar, T. Boobalan, "IOT Based Prepaid Electricity", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), vol.2, issue.2, 2016.
- [5] Paria Jokar, Nasim Arianpoo and Victor C. M. Leung, "Electricity Theft Detection in AMI Using Customers' Consumption Patterns", IEEE Transactions on Smart Grid, vol.7, issue.1, 2016.
- [6] Virendra Pandey, Simrat Singh Gill, Amit Sharma, "Wireless Electricity Theft Detection System Using Zigbee Technology", IJRITCC, vol.1, issue.4, 2013.
- [7] Kumarsagar M.Dange, Sachin S. Patil, Sanjay P. Patil, "Prepaid Energy Meter using GSM Module", IJESI, vol.6, issue.2, 2017.
- [8] D. Dangar, S. K. Joshi, "Electricity Theft Detection Techniques for Distribution System in GUVNL", IJEDR, 2014.
- [9] Kalaivani, R. Gowthami, M. Savitha, S. Mohanvel, S., "GSM Based Electricity Theft Identification in Distribution System", International Journal of Engineering Trends and Technology (IJETT), vol.8, issue.10, 2014.
- [10] S. Anusha, M. Madhavi, R. Hemalatha, "Detection of Power Theft using GSM", International Journal of Advanced Research Trends in Engineering and Technology (IJARTET), vol.1, issue.3, 2014.
- [11] G. L. Prashanthi, K. V. Prasad, "Wireless Power Meter Monitoring with Power Theft Detection and Intimation system using GSM and Zigbee Networks", IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), vol.9, issue.6, 2014.
- [12] Sirisha, Bachu Sowjanya, "IOT Frame-work for Energy Efficient Smart Building", vol.3, issue.10, 2016.
- [13] K. Ashna, Sudhish N George, "GSM Based Automatic Energy Meter Reading System with Instant Billing", IEEE, Automation, Computing, Communication, Control and Compressed Sensing (iMac4s), 2013.
- [14] Shivaji G. Shinde, Bhagyashri G. Jaind, "IOT framework for energy efficient smart building", International Journal of Application or Innovation in Engineering & Management (IJAIEM), vol.5, issue.4, 2016.
- [15] Yujun Bao and Xiaoyan Jiang, "Design of electric Energy Meter for long-distance data information transfers which based upon GPRS", IEEE, International Workshop on Intelligent Systems and Applications, 2009.
- [16] M. V. N. R. P. Kumar, Ashutosh Kumar, A.V. Athalekar, P.G. Desai, M.P. Nanaware, "Electrical Power Line Theft Detection", International Journal of Research in Advent Technology (IJRAT), vol.3, issue.5, 2015.

AUTHORS PROFILE

Mr Rohit Grewal and Mr Tushar Sharma, B. Tech., Electrical and Electronics Engineering from Amity University Haryana, Haryana, India. Dr Karamjit Kaur and Mr Rajbir, Assistant Professor, Department of Electrical and Electronics Engineering, Amity School of Engineering and Technology, Amity University Haryana, Haryana, India.