International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249 – 8958 (Online), Volume-9 Issue-5, June 2020

IOT Power Theft Identification and Monitoring

Abhijeet Kumar, Divya Gupta, Akshat Jadon, Anubhav Kumar, Jay Singh

Abstract: ***Now a days we can't imagine today's life without electricity, almost all the things, equipment and appliances we are using in day to day life are using ELECTRIC power to run smoothly. Ever since the advent of electricity it has become an integral part of our life. Solar energy is the alternative but is has some limitations like environmental changes, high initial cost etc. In todays present world every little appliance works on electricity from the electric toothbrush to huge motors. So from rural to urban and from domestic to industrial areas the use of electricity is increased but with the power theft hand in hand. Using IOT based power theft identification and monitoring a system can find the dishonest user by identifying the status of energy meter at the back end of power office.***

Keywords**: *About four key words or phrases in alphabetical order, separated by commas.***

I. INTRODUCTION

"Transmission Losses" due to unlicensed connections or tampering consume up to 42% of total electricity production in our country and also can be explained as 23% through total transmission and distribution losses and some states losses exceed 50% . (Source: BBC) Power theft is basically a non-illegal way of getting the energy for different uses like transmission and distribution resulting in loss for utility companies also the loss consists of technical and non-technical losses. Annually there are about $25 billion of losses in the world [1]. Misfortunes can really make sense by finding the vitality provided, reducing the measure of vitality charged/paid. The vitality use in a power reticulation framework can comprise of the vitality utilized by buyers, specialized misfortunes and non-specialized misfortunes. The vitality devoured by the clients is estimated by the power wholesaler at a shopper estimating point, for example, a customary or a prepaid meter. The utility is liable for conveying quality catalyst to that estimating point inside severe specifications. The specialized misfortunes comprise of transmission and transformer wasteful aspects in the transmission framework to the customers in the transmission framework. Non-specialized misfortunes are best characterized as poor administration or human bombing related reasons, for example, supplies that haven't been calibrated, meters that measure erroneously or did not work appropriately or meters that are messed with awful or false bookkeeping by merchants, illicit associations with the conveyance framework and other comparable conditions. Force robbery is then characterized as the non-specialized misfortunes, including both crime and non-criminal activities and conditions in a reticulation framework [2]. The introduced limit of the power part in India is 1330 billion Giga Watts as of year 2019-2020, which incorporates sustainable and non-inexhaustible sources. The per capita power utilization in India in 2018-2019 was 1249.337 BU [3]. The IOT has as of late become all-inclusive to feature the vision of a worldwide structure of interconnected physical items. As increasingly number of power expending items coming into day by day lives, for example, electrical vehicles (EVs) and propelled warming, ventilation, and cooling frameworks, load request builds drastically and power required at high amount[4].

Revised Manuscript Received on June 15, 2020.
* Correspondence Author
Abhijeet Kumar*, Electrical & Electronics department, GL Bajaj Institute of Technology & Management, Gr. Noida, India. E-mail: abhijeetkr742@gmail.com
Divya Gupta, Electrical & Electronics department, GL Bajaj Institute of Technology & Management, Gr. Noida, India E-mail: divyag887@gmail.com
Akshat Jadon, Electrical & Electronics department, GL Bajaj Institute of Technology & Management, Gr. Noida, India E-mail: akshatzidan@gmail.com
Anubhav Kumar, Electrical & Electronics department, GL Bajaj Institute of Technology & Management, Gr. Noida, India E-mail: anubhavtiwary54@gmail.com
Jay Singh, Electrical & Electronics department, GL Bajaj Institute of Technology & Management, Gr. Noida, India E-mail: jaysinghism@gmail.com

II. PRESENT SYSTEM

2.1 Literature review

In the framework proposed by R Giridhar Balakrishna, P Yogananda Reddy, M L N Vital [5] the technology based on IOT is used to detect the theft of electricity. The power transferred and the power consumed is measured and the difference is used to detect the theft of power.

In the framework proposed by Anshu Singhal, Anupriya Tomar, Neha Kumari, S Hena Kauser, Mrs. Savitha. S.C. [6] the theft of power and location is also determined in this system. This system basically have two important components that are energy meter use for unit reading of power and LCD is use to show the detection happening. In the system proposed by N Kunan, Poornima BK [7] real time power transfer data is stored in an online database which can be viewed by logging in the website. The detection of power theft is by finding the difference of power transferred and power consumed.

2.2 Problem in the present system

[1] In this system power theft detection is not real time and also the location of theft is not determined.

[2] In this system the use of IR sensor causes improper detection as any heat signal can trip the IR sensor causing the camera to take pictures.

Also this system is not feasible as it is not possible to install a camera in every electric pole.
[3] In this system the location of the theft is not determined

III. PROPOSED SYSTEM

3.1 Description of System

Our proposed system claims to detect power theft in real time, along with location of
theft. The system will have an online database which store all the data related to the distribution system along with the time and date. This data include power dispatched, voltage consumed at a pole and the serial no of the electric pole. The voltage value will be plotted against time. The pole number gives us with the location of the theft of power.

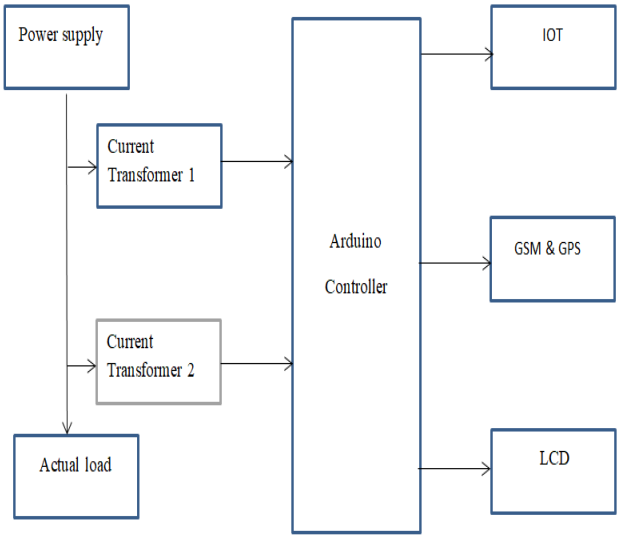

Figure: Block Diagram of IOT based power theft detection
The system will tabulate and form a statistical data for monitoring voltage levels in area where theft is taking place for a period of time the authorities can closely monitor the area and conduct a survey to find out where power theft occurs. We will compare the sending end and receiving end voltage levels, see demand of load if the difference is more than permitted value then a close check must be scheduled to look into abrupt rise of power demand. The authorities can use this to find the regions where there is really rise in power consumption and where power theft is occurring.

3.2 Working

The circuit consists of Arduino UNO, LCD, GSM, ESP8266 module, Energy meter, 2 transformer and loads. Energy meter is used to measure the input power supplied by the source. Two transformers are used to measure the voltage consumed in two different areas. The heart of this project is Arduino Uno controller. It is use to receive voltage signal from two transformers that are transformer-1 and transformer-2 by means of bridge rectifier. Than it compares the voltage magnitude with the voltage drop anointed for that locality .If there is no theft, than the voltage drop will be very low so there is no theft in the system. If theft occurs then the voltage drop will be high. Bridge rectifier is basically used to convert the AC to pulsating DC then the capacitor based filter circuit smoothen the DC power. Potentiometer and resistors are provided to reduce the voltage level and set it to 5volt.

The voltage given by the transformer is multiplied by a value to represent the real voltage value being supplied. If the voltage shown by the transformers drops below a particular value mentioned, it means the load in the area has increased and so there is theft occurring and with the use of GSM it will alert the function through SMS and email.
An online database is created by making use of THINGSPEAK server where the data of voltages of different areas are stored and updated automatically. In it the analysis of data can be done by MATLAB and the location of monitoring can also be done. It gives us a graphical view of the change in voltage in an area.
LCD is used to display the load voltages of different areas.
The ESP8266 Wi-Fi module allows the Arduino Uno board to connect the internet so that monitoring authority can get the information through the internet. The exact location of the power theft is determined by placing multiple transformers in load line at a specified distance by which monitoring authorities will be in a state to take legal action against the culprit.

3.3 Components:-

- Arduino UNO
- ESP8266
- GSM SIM800
- LCD (16x2)
- Transformers
- Bridge Rectifier
- Energy Meter
- Load
- Resistor
- Capacitor [5] [6][7]

IV. ADVANTAGES, APPLICATIONS AND RESULT

4.1 Advantages:-

- Safety is automatic in this system.
- The alert can be generated through GSM even in the case of failure of internet through sending text SMS.
- It will not affect the power transfer capability of line.
- IOT based power theft identification and monitoring will eliminates the need of human power by making it automatically.
- It will inform the supplier side about any theft that is happening in the distribution side or consumer side.
- A user can be aware of their electricity consumption.
- Theft of electricity can be avoided by tamper proof energy meters.
- The proposed framework eliminates the human involvement in electricity maintenance.
- A user can also monitor their energy meter reading online from anywhere.

4.2 Applications:-

- Its use in distributed system.
- It is use in AMR.
- A system can be incorporated for almost all type of users.

- The concept is well suited especially for the villages and interior areas.
- The power stealing can be effectively control by detecting where the tapping occurs through the IOT based device.

4.3 Result:-

- Due to the use of IOT based power theft detection, the losses from tapping can be reduced.
- The time which is consumed by regular checking of transmission lines will be reduced.
- The requirement of manpower will be reduced.
- The cost will also be reduced.
- This will also increase the economic growth in upcoming time.

We used the IOT based system for the purpose to implement and minimize electricity theft because electric energy is a necessary resource in everyday life. This can be designed by installing OS on raspberry pi and energy meter communicate with raspberry pi through GPIO pins. After this, raspberry pi connect with the internet. At the back end, government person see the status of energy meter in the form of graphs. This paper supports two energy meters. The results obtained after execution are shown below.
In below figures, level 0 shows that meter condition is ok and nobody tries to theft the electricity. But at level 10, it shows that someone theft the electricity.

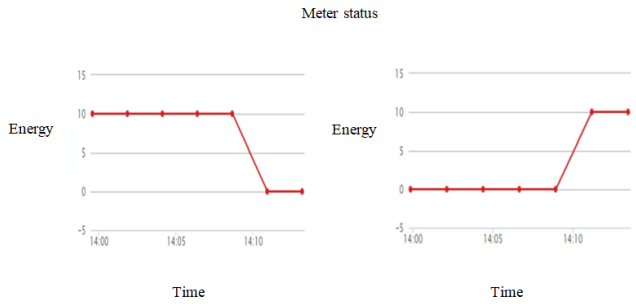

Fig:1-When no theft of electricity occur Fig:2-When theft of electricity occur

V. CONCLUSIONS

Using IOT, power theft identification and detection kit has been implemented and it is also done using GSM for the purpose of backup protection through sending e-mail. In case of internet failure the alert will be made through text message via SMS. By using above GSM and IOT techniques the crime of stealing power may be brought to an end by sending SMS and e-mail, thereby a new florescence may be expected in the economy of our motherland and also there will be less scarcity for power utilization.

REFERENCE

1. M. Anas, N. Javaid, A. Mahmood, S. M. Raza, U. Qasim, Z. A. Khan 2012.
2. Minimizing Electricity Theft using Smart Meters in AMI, arXiv:1208.2321v1[CS.
3. ni]
4. RIAAN (W.A.) DOORDUIN 2004. Electricity Theft Detection on a Low Voltage
5. Reticulation Environment- Thesis presented for the degree of Master of Science in
6. Electrical and Electronic Engineering at the University of Stellenbosch.
7. 3. Government in India, Ministry of power, 2017, Executive Summary Power Sector.
8. 4. Jawad Nagi, Keem Sigh Yap, Sieh Kiong Tiong, Syed Khaleel Ahmed and Malik
9. Mohamad, 2010, Nontechnical Loss Detection for Metered Customers in Power
10. Utility Using Support Vector Machines, IEEE Transactions on power delivery,
11. VOL. 25, NO. 2, Print ISSN: 0885-8977, Electronic ISSN: 1937-4208.
12. 5. IOT based Power Theft Detection. R Giridhar Balakrishna, P Yogananda Reddy, M
13. L N Vital International Journal of Innovations in Engineering and Technology
14. (IJIET) ISSN: 2319-105, Volume 8, Issue 3, June 2017.
15. 6. A Survey of IOT for Power Theft Detection, Faul Identification and Location
16. Tracking. Anshu Singhal, Anupriya Tomar, Neha Kumari, S Hena Kauser, Mrs.
17. Savitha. S.C. International Journal of Science, Engineering and Technology
18. Research (IJSETR) Volume 5, Issue 5, May 2016 I.S. Jacobs and C.P. Bean, “Fine
19. particles, thin films and exchange anisotropy,” in Magnetism, vol. III, G.T. Rado
20. and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.
21. 7. IOT Based Power Theft Detection and Monitoring System. N Kunan, Poornima
22. BK. IJIREEICE. Vol. 5, Issue 5, May 2017.
23. 8. C. J. Bandim, E. R. Alves, A. V. Pinto, F. C. Souza, M. R. B. Loureiro, C. A.
24. Magalhges and F. Galvez-Durand, “Identification of Energy Theft and Tampered
25. Meters Using a Central Observer Meter: A Mathematical Approach”, Transmission
26. and distribution conference and exposition, 2003 IEEE PES, vol. 1, pp. 163-168, 2003.

AUTHORS PROFILE

Abhijeet Kumar is doing his final year B.tech (EN) from GL Bajaj Institute of Technology and Management Greater Noida, UP, India. His final year project is “IoT Power Theft Identification and Monitoring”

Divya Gupta is doing her final year B.tech (EN) from GL Bajaj Institute of Technology and Management Greater Noida, UP, India. Her final year project is “IoT Power Theft Identification and Monitoring”

Akshat Jadon is doing his final year B.tech (EN) from GL Bajaj Institute of Technology and Management Greater Noida, UP, India. His final year project is “IoT Power Theft Identification and Monitoring”

Anubhav Kumar is doing his final year B.tech (EN) from GL Bajaj Institute of Technology and Management Greater Noida, UP, India. His final year project is “IoT Power Theft Identification and Monitoring”

Dr. Jay Singh received his Ph.D., M.Tech and B.Tech degrees, all in Electrical Engineering, where he received his Ph.D. degree (in year 2015) from Indian Institute of Technology (ISM) Dhanbad, M. Tech. (in year 2010) from Maharshi Dayanand University Rohtak, India and B.Tech (in year 2005) degree from Madan Mohan Malviya Engineering College Gorakhpur

(Currently known as Madan Mohan Malviya University of Technology) India. Dr. Singh has been awarded as best faculty from several institutions. Also he has received the best paper award from 1st IEEE Uttar Pradesh Conference in year 2015. He has published 46 research papers in reputed international journals / conferences. Dr. Singh is the reviewer & editor of several reputed International Journals. Currently he is supervising 5 Research Scholars of IITs and state Gov. Universities. His research areas are Load frequency controllers, Two degree of freedom internal model control, Model Order Reduction,etc. He has organized 4 IEEE International conferences, 1 International Seminar, 1 National seminar, 4 FDPs sponsored by government funding agencies. He has completed several tasks given by All India Council for Technical Education New Delhi. Currently he is working as Associate Professor in the department of Electrical & Electronics Engineering, GL Bajaj Institute of Technology and Management Greater Noida, U.P. India, where he is the officer In-charge of ISTE Chapter New Delhi, IEEE student branch Chapter, NBA and NAAC activity. Also he was the executive committee member of IEEE Uttar Pradesh Section India in year 2017. Dr. Singh encourages to his colleagues, students, neighborhood friends to make pollution free environment by using Cycle for office and local visit purposes. He has also established Cycling Club in his institute to make more awareness towards green environment.

Apart from holding several academic and administrative responsibilities, he is also senior member of numerous national & international professional bodies.

1. Guest Editor, Signal Processing and Communication, Inderscience Enterprise Ltd.
2. Senior Member - IEEE, Power and Energy Society
3. Life Time Member - Indian Society for Technical Education, New Delhi
4. Editor - World Academy of Science, Engineering & Technology, USA
5. Senior Member - International Association of Engineers, Hong Kong
6. Senior Member - International Society for development and sustainability, Japan
7. Editor - American Journal of Electrical Power and Energy Systems.