A SURVEY ON SMART ENERGY METER WITH THEFT &BILLING

Rutuja Kajrolkar[1], Aastha Deshmukh[2], Poonam Nakti[3], Deepashree Datar[4], Mahalaxmi Palinje[5]

[1-4]BE Student, Electronics and Tele-Communication, Atharva College of Engineering, Mumbai, India
[5]Professor, Electronics and Tele-Communication, Atharva College of Engineering, Mumbai, India

---***---

Abstract – *In the Energy Management System, the fundamental limitations are exact metering, energy checking, controlling and execution of visual information for shopper load profile. The absence of validity of information procured through customary methods from an ordinary metering framework has decreased the viability of the Energy Management System. Concerning the heaps ordinarily utilized by private shoppers. Subsequently, the nonstop checking of the electrical apparatuses can be seen through the android application, besides, electricity bill of individual burden can likewise be observed. The client can likewise kill the gadget, which is devouring inordinate force. Hence, saving the energy utilization of the associated loads. Further, this work can be reached out for power utilization of entire structure and power bill can be resolved.*

Key Words: IOT, Energy Management System, Energy Observing and Controlling, Wifi module, Node MCU.

1. INTRODUCTION

Energy observing means to give clients data about their utilization designs and that is completed utilizing Energy Monitoring application that accumulates utilization information, examine it and afterward gives helpful data straightforwardly to the customer's gadget. This shows clients how much energy they are utilizing and how it is utilized whenever of the day. Energy Controlling plans to give clients to control their electric machines utilizing Energy controlling application which will ultimately assist the client with saving the energy utilization on a day to everyday schedule. In the Energy Management framework, the primary limitations are exact metering, energy checking, controlling and execution of visual information for customer load profile. This Project is expected in planning a framework at home which Monitors and control the energy utilization of every gadget. The investigation can be made for the exact use or energy utilization of every gadget to additionally lessen the use of the gadget which is drawing the greatest measure of energy. These observing reports can be gotten to and would assist customers with making the necessary move to extemporize the energy utilization. The constant energy checking is pictured utilizing a portable application. The application additionally fills in as a brilliant home regulator where the client is equipped for controlling the electrical apparatuses distantly or controlled dependent on occasions set by the client also, we are adding a PNR Sensor for Theft Detection System

to get a clear picture to our customer regarding their Energy System.

2. LITERATURE REVIEW

In[1](2021) A significant advantage of implementing advanced metering infrastructure (AMI) in smart grid (SG) is the feature to allow utilities to monitor and curb power theft and proliferation. with help of sm communication becomes bidirectional.AMI test rig, consisting of three consumers, a distribution station (DS) and an operation center is designed to select the load 3 single-phase Phoenix 2 SMs are used to track the power consumption of each consumer.

In [2] (2017)After switching power on the Arduino and the GSM modem, turn on the SSR and connects the energy meter to load via SSR. Read from EEPROM then display data. Arduino checks the readings from voltage and two current sensors .In order to prevent a power theft, detection program is present in the Arduino.

*Arduino and GSM based smart energy meter can be divided into several parts as IC, LCD, Arduino, GSM modem, Relay, Optocoupler, Lever switch, Display Unit, voltage &current sensor and Power Supply Unit etc.

In [3] (2019)They had presented internet connected energy monitoring and controlling system that increases awareness of energy consumption amongst devices and users. Energy awareness enables the user to control the power state of the devices as per there needs which minimizes the energy use. In the coming future, each individual device will have their own identity that can share and communicate the information over the IP network.

In[4] (2017) They had built a simple, compact and low-cost implementation of secure WiFi based power monitor sensor is proposed. It has been successfully implemented and tested at the premises of IITH. *The accuracy of power measurement is shown to be suitable for reliable use as power monitoring sensor. *Considering the small size, low-cost and simplicity, multiple sensors can be used to monitor power consumption of multiple electrical appliances simultaneously. This granular information about power consumption will help consumers in utilizing electricity in a efficient way.

In [5] (2017) They had done a study concerning the acquisition and identification of data provided by different loads and consumers has been presented. The identification of consumer load profiles was the main objective. The experimental tests furnish real data concerning the loads commonly used by residential consumers, which is made possible by applying the data analytics over the results obtained for the graphical visualization of each appliance usage. Usage of the smart metering technique allows for the accurate readings and un-tampered data for the proper calculation to monitor the energy consumption of each appliance. Drawing the signatures from the charts, data analytics provide the maximum and minimum usage of each appliance.

In [6] (2016) They proposed an energy consumption monitoring and controlling smart energy meter which would increase awareness of energy consumption amongst devices and users. Energy awareness at the domestic level enables the user to control the power state of the devices as per their needs which minimizes the energy use. Thus, using such smart energy meters in home management system is very important.

In [7] (2018) The smart meter has a ZigBee transmitter which sends energy consumption data periodically to the Gateway over ZigBee network. The gateway receives the data and uploads it to the utility provider's cloud/database using internet connection. The utility provider monitors the data and manages the customer's billing information.

The software called Digi XCTU is used to configure the ZigBee radios in different modes. An SD card module is also being used to store.

In [8] (2015) SOPC Design Methodology deals with developing a reconfigurable controller architecture which can replace the convention embedded controller/processor based design. The basic controller building blocks for such a system will be implemented as hardware-software co-design into a programmable system like FPGA. uses the idea of using the control block as hardware IPs (designed in HDL as custom IPs), which is comparatively faster and reusable compared to its equivalent software implementation. These IPs can either be used as a peripheral of soft/hard CPU core or as standalone.

In [9] (2018) They demonstrated an Iot Energy mangement system to make a more effective and reliable system compared with the conventional energy management system. Instead of collecting data from door to door, the key feature of the proposed system offers a more accessible way of collecting data from a server through internet, which is automatically updated after a short time interval via Wi-Fi. The NodeMCU used in this system has the dual functionality of a microcontroller and a Wi-Fi module, which eliminates the need for an additional microcontroller. Furthermore, remote control of domestic appliances has also been made possible through this system. The total hardware.

In [10] (2018) They proposed to overcome all the disadvantages in the already existing energy meter. The Arduino esp8266 micro controller is programmed to perform the objectives with the help of GSM module. All the details are sent to the consumer's mobile through the IoT and the GSM module and it is also displayed in the LCD. It is a time saving process and it helps to eliminate the human interference.

In [11] (2020) They used Linear Regression method for detecting power theft by continuously monitoring the consumer and distribution end smart meters data. Android applications are developed for monitoring consumption & billing information of consumers and alerting the authorities in the event of theft. The presented system is capable of detecting power theft due to meter bypass, meter tampering and direct line hooking. As an additional feature, direct control of smart meters from distribution authorities is implemented for providing access/denial of power supply for an individual consumer. A prototype circuit is developed using ATmega328P micro-controller with NodeMCU as a WiFi module, for validating the presented system.

In [12] (2013) They proposed a temperature dependent predictive model which uses smart meter data and data from distribution transformer to detect electricity theft in an area. The model was tested for varying amounts of power thefts and also for different types of circuit approximations. The results are encouraging and the model

3. DISCUSSION:-

A smart energy meter's main components are ATmega328P microcontroller and Node MCU for its controlling actions. Many researchers have done different variations in energy meters GSM and Wi-Fi module for consumption and online billing messages. And bill is also displayed on LCD display. For android access different apps are used. Also for theft detection some have used distribution transformer and some have used heat sensors. The PIR sensor attached detects any motion around the meter and send a warning to the customer.

4. FUTURE SCOPE

The project provides the entire energy readings at one's finger tips. The project can be further extended to detect the zone and probable consumers which are involved in power theft which can analyze the electricity theft going on in percent with area wise. And for power factor improvement purpose we can also develop two-way communications with the capacitor bank and smart energy meter with advance communication techniques. AI can be used so as to make a single sensor capable of measuring, alerting and notifying the user all together.

5. ACKNOWLEDGEMENT

6. CONCLUSIONS

In this paper, it has been proposed a smart meter which takes advantage of the GSM network that has virtually access to every household and area across different countries. GSM communication not only implements the idea of prepaid consumption of electricity but also facilitates the utilities to control energy theft using our smart energy meter. Therefore, utilities can take immediate legal action against the accused consumer and hence control electricity theft to a great extent. The PIR sensor attached detects any motion around the meter and send a warning to the customer.

7. REFERENCES

[1] https://www.electronicsforu.com/electronicsprojects

[2] https://github.com/EdjeElectronics

[3] Himanshu K. Patel, TanishMody, Anshul Goyal Institute of Technology, Nirma University,. Arduino Based Smart Energy Meter using GSM 978-1-7281-1253-4/19/$31.00 , 2019 IEEE

[4] Visalatchi S, Kamal Sandeep K, Smart Energy Metering and Power Theft Control using Arduino & GSM Automated Smart Metering, 978-1-5090-4307-1/17/$31.00 ,2017 IEEE

[5] Naziya Sulthana, Rashmi N, Prakyathi N Y, Bhavana S, K B Shiva Kumar, 28-08-2020 , IJERTCONV8IS14011

[6] Brinda.S , Vishal Kumar Sah, Jaladi Harish , Akshay.U, Vishal Deo Mahto, Swetha Umapathy, International Journal of Engineering Science and Computing, March 2018

[7] Rakhi.S,Rushali Poovamma PJ,Varshitha R,Sahana SB, Swathi P. (2020). Smart Energy Meter using LoRa. International Journal of Advanced Science and Technology, 29(10s), 4233-4242.

[8] Soumyadeep Mukherjee, Debjyoti Dey Disha Ghosh) & Sourav, IOT BASED PREPAID SMART METERING SYSTEM, Maulana Abul Kalam Azad University of Technology (MAKAUT) © 2020

[9] Elakshumi, S.; Ponraj, A., A Server Based Load Analysis Of Smart Meter Systems, 978-1-5090-5913-3/17/$31.00 ,2017 IEEE

[10] Maha Aboelmaged, Yasmeen Abdelghani, Mohamed A. Abd El Ghany , Wireless IoT based Metering System for Energy Efficient Smart Cites , 978-1-5386-4049-4/17/$31.00 ,2017 IEEE

[11] Hui Miao, Guo Chen, Member, IEEE, Zhiheng Zhao, and Fangfei Zhang, Evolutionary Aggregation Approach for Multi-hop Energy Metering in Smart Grid for Residential Energy Management, 1551-3203 (c) 2020 IEEE.

[12] Md Redwanul Islam , Supriya Sarker , Md Shahraduan Mazumder, Mehnaj Rahman Ranim, An IoT based Real-time Low Cost Smart Energy Meter Monitoring System using Android Application , ISSN: 2395-1303

[13] Apoorva, Ashwini, Nisarga and Dr.P K Kulkarni, Dr.SomashekharSwamy, IOT Based Smart Energy Meter for Automatic Billing, Power theft Detection and Disconnection , Volume XIII, Issue VII, JULY 2020

[14] Rishabh Jain, Sharvi Gupta, Chirag Mahajan, Ashish Chauhan, IOT based Smart Energy Meter Monitoring and Controlling System , IJRECE VOL. 7 ISSUE 2 APR.-JUNE 2019.