IOT based Electricity Theft Detection

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Abstract

We can't imagine today's life without electricity, almost all the things, equipments and appliances we are using in day to day life are using electric power to run smoothly. Solar energy is the alternative but is has some limitations like environmental changes, high initial cost etc. 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. So the solution can be -A smart energy meter. Basically energy meter is a device that calculates the cost of electricity consumed by homes, business, or an electrical device. Using IOT based Electricity Theft Detection a system one can find the fraudulent user by showing the status of energy meter at the back end of electricity office.

IndexTerms –IOT, Electric Energy, Energy Meter, Arduino.

INTRODUCTION

"Transmission Losses" due to illegal connections or tampering consume up to 42% of total electricity production in our country. (Source: BBC) Electricity theft is basically an illegal way of getting the energy for different uses, resulting in loss for utility companies. Losses consist of technical and non technical losses. Annually there are about $25 billion of losses in the world [4]. Losses can actually be computed by finding the energy supplied, subtracting the amount of energy billed/paid. The energy usage in an electricity reticulation system can consist of the energy used by consumers, technical losses and non-technical losses. The energy consumed by the users is measured by the electricity distributor at a consumer measuring point, such as a conventional or a prepaid meter. The utility is responsible for delivering quality power up to that measuring point within strict specifications. The technical losses consist of transmission and transformer inefficiencies in the transmission system to the consumers in the transmission system. Non-technical losses are best defined as poor management or human failing related reasons such as supplies that haven't been metered, meters that measure inaccurately or don't work properly, meters that are tampered with, bad or fraudulent accounting by vendors, illegal connections to the distribution system and other similar circumstances. Electricity theft is then defined as the non-technical losses, encompassing both criminal activity and non-criminal actions and circumstances, in a reticulation system [2].

Power or energy theft is a serious crime, it may creates short fall, increases load, decreases the frequency, which is not acceptable and causing load shedding, increases tariff on the legal customers. The main reasons behind electricity theft are low literacy rate and lack of awareness. Power Theft is a non ignorable crime and at the same time it directly affected the economy of a nation. To utilize generated power in a most efficient manner it is needed to closely monitor power consumption and losses. The system prevents the illegal usage of electricity. The problem of illegal usage of electricity can be solved electronically without any human control. The basic idea is to use Smart Meters, using Smart meters you can shut off the services of households and commercial establishments which don't pay their bills.

- **Ways of Power Theft:**

- Power Tapping: Often power theft is done during transmission by illegal tapping of the power lines to divert the power to the required destinations.
- Fraud in Meter: The person is often bribed to give false readings in many areas where manual reading of the meter is done, and thus the amount paid is for lesser amount of power compared to the power actually consumed. Here meters are tampered by obstructing the motion of the disk (usually electro mechanical consists of slowly spinning disks to record the power consumed).

LITERATURE SURVEY

1. Minimizing Electricity Theft by Internet of Things
Here a smart meter has been utilized to limit the power theft. Basically energy meter is a device that computes the cost of power consumed or used by homes, business, or an electrical device. It diminishes the theft of power by locating the dishonest client by demonstrating the status of energy meter at the back end of power office. Here energy meter communicate with raspberry pi through GPIO pins. GPIO pins get the effective information from energy meter and it send compelling information to the raspberry pi and interface raspberry pi with the web. At the backend, government individual can see the status of energy meter as graph [3].

75 | ICRTET0016   www.ijream.org

2. IoT Based Electricity Energy Meter Reading, Theft Detection and Disconnection using PLC modem and Power optimization

PIC18F46k22 Microcontroller based design and execution of energy meter utilizing IoT is used here. The framework configuration disposes of the human contribution in Electricity support. The Buyer needs to pay for the utilization of power on plan, on the off chance that he couldn't pay, the power transmission can be turned off from the distant server. The buyer can screen the energy utilization in units from a web page by giving device IP address. Theft detection unit which is associated with energy meter will tell organization that when meter tampering happens in energy meter? and it will send theft detection data through PLC modem and theft identified will be shown on the terminal window of the organization side. Wi-Fi unit is used to send energy meter information to web page which can be accessed through IP address.

3. ARM-Based Energy Management System usingSmart Meter and Web Server.

ARM - based energy administration framework is proposed here. It is considered as a feature of a circulated framework that measures the principle control framework amounts and give the likelihood to deal with the entire power plant. An integrated Web Server permit to gather the insights of energy utilizations, control quality and can interface device for stack removal. The device is described by simple access to the data and the blend of an energy meter and information correspondence ability permit nearby and remote access. Along these lines it is conceivable to deal with the power utilization of the power framework prompting a general diminishment in utilization and expenses.

PROPOSED SYSTEM

A smart way to manage power and energy meter without human effort and involvement is proposed here. It reduces the burden over Electricity Board to manage the consumers. It helps consumer to manage his/her power usage in house. The Arduino is programmed using embedded C, such that if any theft is found then power will automatically goes off due to relay connected between load and power supply. The data i.e., the number of units used and total amount is loaded on to cloud using GSM module. The on- off buttons on web page are operated on Arduino commands transferred through GSM module. As per the US government research, if the usage goes beyond 9 units then the consumer need to pay extra money than the normal payment [4]. In this system, the circuit is designed such that the power goes automatically after the usage of 9 units, so that the theft can be detected. If the consumer doesn't pay the bill in time, the EB person can cut the power through On- Off button provided on the Web page which gives command to Arduino.

Implementation and Working Details

In this project, Arduino, SIM 800, Relay, IR Emitter and Detector, Electromechanical induction type energy meter are used. The project mainly focuses on Theft Detection and power distribution to consumers. The following block diagram shows the outline of project implementation.
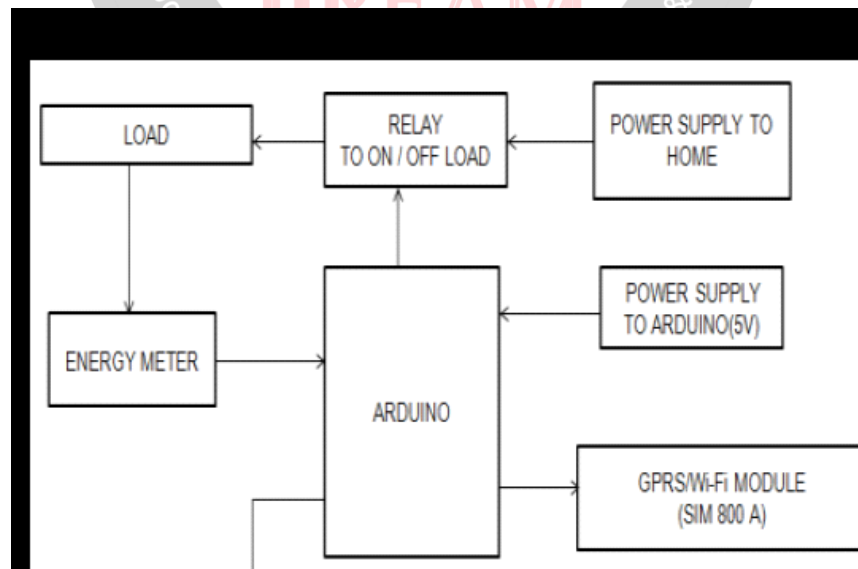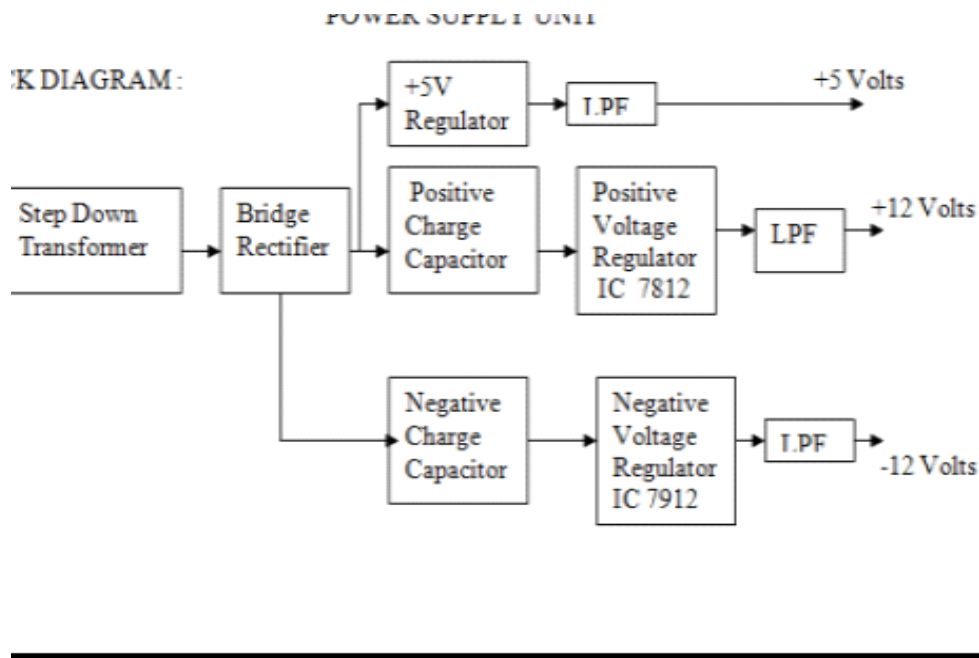

Fig 1: Block Diagram

POWER SUPPLY UNIT

Fig 2. Power supply circuit

In power supply unit, a step-down transformer (Secondary12volt,1A) is used to covert 230V to 12V from main supply. Usage of bridge rectifier helps to convert Alternating current to direct current. The capacitor is used to smoothen dc and to remove any sort of ripples. Usage of heat sink to ICLM7812 and LM7805 for safeguarding devices from overheating. Power supply unit distributes power to all the components. The arduino module takes the data from the energy meter and performs the necessary control operations and sends the required information like number of units through GSM / GPRS module. LCD module is used to get visual information like no. of units used and total amount user needs to pay.

The Power supply circuit is connected to the arduino. The Arduino is programmed in embedded C such that when we press buttons on webpage then the required operation is carried out. Arduino takes the data from energy meter depending on rotations. If the number of units consumed crosses certain limit then the power supply is switched off automatically as the theft is found. Here for experimental purpose we have used 200W bulb to detect the theft. If the usage of electricity crosses certain limit then the consumer need to pay extra amount to the EB, otherwise it comes under theft. As per US government, how smart the home is, it uses only 9 units per day. Here using 200W bulb instead of 100W increases the number units consumed, so depending on arduino commands the relay connected to load goes off automatically. The Webpage consists of four buttons A,B,C,D and two other button refresh and clear_details. Button A is to clear the previous data or command, button C is to off the power supply to home and button D is to distribute power to home. Refresh button is used to refresh the webpage and clear_details button is used to clear the details like number of units and total amount. GSM module SIM 800 pushes the data like number of units used and the total amount onto the cloud

Energy meter reading is loaded on webpage and buttons are used to control the power supply to home by giving commands to arduino. If the customer doesn't pay the bill then power distribution can be off from the distant server by pressing button 'C' on the webpage. The program written for button C in arduino will off the relay connected to the load. If the customer has paid the bill then power is distributed to his house by pressing button 'D' on the webpage. The program written for button D in arduino will on the relay connected to the load. For the experimental purpose the allowable power we decided is 100W, so when the bulb of 200W is used in the project then it shows as theft detected and the circuit goes off automatically. The arduino is programmed such that relay connected to the load will be off when power theft is found.

CONCLUSION

IoT and arduino -based meter reading system is designed to monitor the meter reading and service provider can disconnect the power if customer does not pay the monthly bill also it eliminates the human involvement in Energy meter management.

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