Machine Learning Approach Based Smart Energy Meter for Home Application

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ABSTRACT: A pic16f877 micro controller is used to blueprint and run an IOT - enabled energy monitor system. The advanced system design put an end to need for manual electrical maintenance. The buyer is responsible for the cost of the electricity consumed. If the buyer does not pay on schedule, a remote server may cut off the electricity. By going to a website and entering their device IP address, users can see how much energy their device expends. The attached theft detection unit sends a signal to the corporate side via a GSM modem and they can cut off the power. On a corporate terminal, this signal will be displayed. The Wi-Fi module is used to connect energy meter readings to a public web-sites. This hardware interface circuit includes a pic161877a micro controller, an LCD display, relay driver and an esp8266 Wi-Fi module. The Wi-Fi module is used to transfer energy meter readings via an IP network.

Keywords: IOT, Node MCU, PIC Microcontroller, GSM.

I.INTRODUCTION

This paper proposes a flexible, all-encompassing power monitoring system that monitors the voltage and current in a remote system. It is influenced by corporate enterprises, everyday objects and open-source technologies.

This explores an GSM based smart energy metering system that replaces manual meter reading with do not necessitate visits to each house. To monitor and monitor power consumption, a Microcontroller based system with the sensor is used. The information is displayed on a lcd monitor. The meter's readings are immediately uploaded to the internet of things cloud. This paper emphasizes the importance of financial responsibility by encouraging us to pay our bills on schedule. This method has the main drawback that one has go to each house to check the meter and distribute the bills

Even after all bills have been paid in full, the electric board is infamous for eliciting remainders and alerts. This study has found a way to solve this problem by eliminating the intermediary and putting the client and service provider in direct contact. In the context of this study, the idea of a IOT - enabled smart energy meter has been presented. Given the fact that the microcontrollers consume little power, this procedure has been carried out. the primary objective of this study used to eliminate manual meter reading, accelerate electric system monitoring, extract real-time data that can be used to balance electric loads and reduce the power outages (blackouts), enable dynamic pricing (rising the electricity prices based on demand), and make more efficient use of power sources. With the support of the initiative, all of these goals can be achieved.

As these technologies progress a wide variety of intelligent device can now sense, recognize and communicate. The "Internet of Things" is the intelligent network created by these connected objects when they automatically connect to the internet. Developing fully automated energy meters can be remotely monitored and controlled. The energy meter is continuously monitored by an automatic meter reading technology. It sends the gathered information to the service provider via short message service when requested. As a result, people will be to do much less work. The scheme, which uses the existing system as a starting point, proposes a novel way to reduce the high costs associated with its design and maintenance. If the customer fails to pay the bill, the system is programmed to cut off the electricity to the remote server.

This will happen if the client falls behind on payments. This system's programming language is a modified version of C. The primary purpose is to identify areas where electricity is being stolen. This improves public health and keeps consumer prices from rising. If you give the thief a monthly a meter reading and rate, he will be caught as an added internet of things feature, this system provides consumers with an overview of the global connectivity landscape as well as the ability to check the meter reading from anywhere. When electricity is stolen consumers pay huge amount of money are exposed to danger.

The old metering system manual reading had many flaws, including inaccuracy, difficulties in obtaining measurements, external factors influencing readings, sluggish work, and a lack of knowledge of where consumers lived. Automatic meter reading devices were developed to measure meters inefficiently because manual meter reading methods were ineffective.

II.LITERATURE SURVEY:

[1] Proposed smart energy meter surveillance using IoT, internet of things as an emerging field and IOT based devices have created a revolution in electronics and IT. The foremost objective of this project is to create awareness about energy consumption and efficient uses of home appliances of energy savings. Due to manual work, existing electricity billing system has major drawbacks. This system will give information on meter reading, power cut when power consumption exceeds beyond the specified limit using IOT. The esp8266 micro controller is programmed toper form the objectives with the help of GSM module. It is proposed to overcome all the disadvantage in the already existing energy meter. All the details are sent to the consumer mobile through the IoT and the GSM module and it is also displayed in the LCD. It is a time savings and it helps to eliminate the human interference using IoT.

[2] Smart power monitoring using IOT that energy consumption is the very important and challenging issues. Automatic Electrical Energy meter is used in large electric energy distribution system. The integration of the Wi-fi and SMS provides the system as smart power monitoring system. Smart energy meter provides data for optimization and less the power consumption. This system also includes a motion sensor such that if there is no human in house it will automatically turn off the power supply.

[3] Presented a paper titled design and implementation of smart meter using IoT describing the growth of IOT and digital technology. The future energy grid needs to be implemented in a distributed topology that can dynamically absorb different energy sources. IoT can be utilized for various applications of the smart grid consisting power demand side management and various area of energy production. In this paper, the smart energy metering is explained as main purpose of SEM is necessary for collecting information on energy consumption of household appliance and monitor the environmental parameters and provide the required services to home users.

[4] Demonstrated based smart energy meter that removes human intervention in meter readings and bill generation thereby reducing the error that usually causes in India. The system consist of the provision of sending SMS to user for update on energy consumption along with the final bill generation along with the freedom of reload via SMS.

PROPOSED SYSTEM:

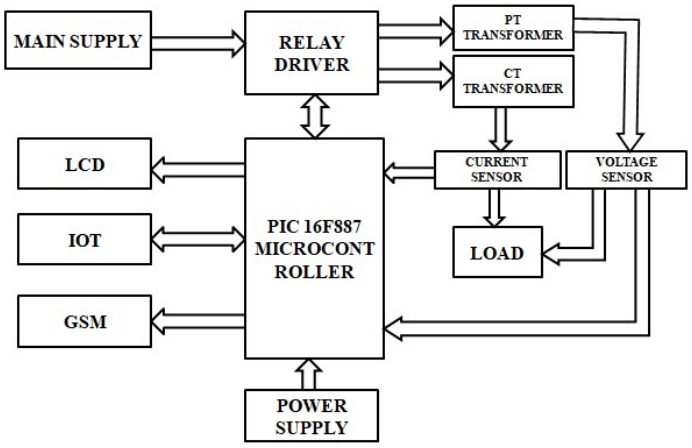

FIGURE 1. BLOCK DIAGRAM OF PROPOSED SYSTEM

This paper proposes smart, integrated power consumption monitoring system has been implemented with the use of open standard technology, commercial project & household items which actively monitors the voltage & current ratio in remote system. Here a GSM based smart energy metering system using IOT which will replace traditional meter reading method. They can monitor the meter reading regularly without the person visiting each house. Microcontroller base power consumption monitoring system that senses parameters and shows on a LCD display. If the power theft presents in the consumer side, alerts through the sms and the power will cut off, by using

the relay driver which is operated as switch. The meter readings are automatically sent on cloud generated using IOT.

According to that reading we have to pay the bills. The main drawback of the existing system is that person has to go area by area and he has to read the meter of every house and handover the bills. Many times errors like extra bill amount or notification from electricity board even though the bills to be paid are common errors. To overcome this draw back we have come up with an idea which will eliminate the third party between the consumer and service provider even the errors will be overcome.

HARDWARE SPECIFICATIONS:

1.PIC microcontroller:

PIC stands for "Peripheral Interface Controller". This system uses the "PIC 16F887A" microcontroller, an integrated chip consisting of RAM, ROM, CPU, timers, Counter, ADC, and DAC. It is an 8-bit microcontroller that was developed by "Microchip technology." PIC designed based on "Harvard Architecture" and "Reduced instruction Set Computer (RISC)" architecture.

It consists of 40 pins with 256 bytes of EEPROM memory. A PIC is a self-programming controller, and it requires a minimum operating voltage of 2V and a maximum operating voltage of 5.5V. It contains comparators and ADC channels. The memory capacity of RAM is 368 bytes. Compared to other microcontrollers like the 8051, this controller consumes less power, as a larger programming memory, and it is easier to program. It easily allows users to interface with other external devices. "PIC 16F887A" supports "inter-integrated circuit (12C) communication". This controller also supports controller area network (CAN), serial peripheral interface (SPI), and Universal Asynchronous Receiver Transmitter (UART) protocols.

2.GSM module:

GSM (Global System for Mobile Communications) is a standard developed by the European Telecommunication Standards Institute (ETSI) to describe the protocols for second generation (2G) digital cellular data used by mobile devices such as mobile phones and tablets. It was first deployed in Finland in December 1991. As of 2014, it has become the global standard for mobile communications with over 90% market share, operating in over 193 countries and territories.

The letters GSM originally stood for words Group Special Mobile, but as it became clear this cellular technology was being used world-wide meaning of GSM was changed to Global System for Mobile Communications. Since this cellular technology was first deployed in 1991, the use of GSM has grown steadily, and it is now the most widely cellphone systems in the world. GSM reached the billion subscriber point in February 2004, and it is now well over the 3 million subscriber mark and still steadily increasing.

3.NODE MCU:

NODE MCU is an open source IOT platform. Which includes firmware which rums on the ESP8266 Wi-fi module from express if the systems, and hardware which is based on the ESP module. The term "NODE MCU" by default refers to the firmware rather that the device kits. NODE MCU firmware was developed so that at commands can be replaced with LUA scripting making the life of developers easier.so it would be redundant to use at commands again in NODE MCU.

4.RELAY DRIVER:

A relay driver circuit is a circuit which can drive or operate, so that it can function appropriately in a circuit. The driven relay can then operate as a switch in the circuit which can open or close, according to the needs of the circuit and its operations. In this project, we will build a relay driver for both AC and DC relays. since Ac and DC operate differently, to build a relay-drivers for them requires slightly different setup. We will also go over a generic relay driver which can operate from either AC or DC voltage and operate both AC and DC relays. All the circuits are relatively simple to understand.

5.LCD:

An LCD stands for "Liquid Crystal Display". It is combo of both solid and liquid phases. These displays have two layers, which consist of polarized filters and electrodes. here are two types of pixel grids used in LCDs namely "Active-matrix grid" and "Passive matrix grid". Every LCDs has pixels and sub-Pixels. The working principle of LCD is the "Liquid crystal color emission principle". This device is an electronically modulated optical device. Twisted Nematic Display, in-plane switching display, vertical alignment panel, advanced fringe field switching (AFFS), passive and active-matrix display are the different types of LCD.

6.POTENTIAL TRANSFORMER:

Potential transformers are also known as voltage transformers, and then they are basically stepdown transformers with a very precise turn-rate. Potential transformers reduce the voltage of a high magnitude to a lower

level that can be measured with a standard measuring device. These transformers have a large number of primary turns and a smaller number of secondary voltage range.

7.CURRENT TRANSFORMER:

The current transformer is mounted

in parallel with the line on which the current is to be measured. They are used for lower the current is to be measured. There are used to lower the current such level that it can be easily measured with an ammeter. They are generally expressed as a primary, a secondary current ratio. The most common use of current transformer on the market is as a "clamp meter.

If the secondary of current transformer is open. it means that there will be no current flowing on the secondary side and therefore no mmf, while the primary side will be flowing and there will be mmf produced. There will be no secondary mm f to counter the primary. In the future, a significant amount of mmf will be present.

RESULT AND DISCUSSION:

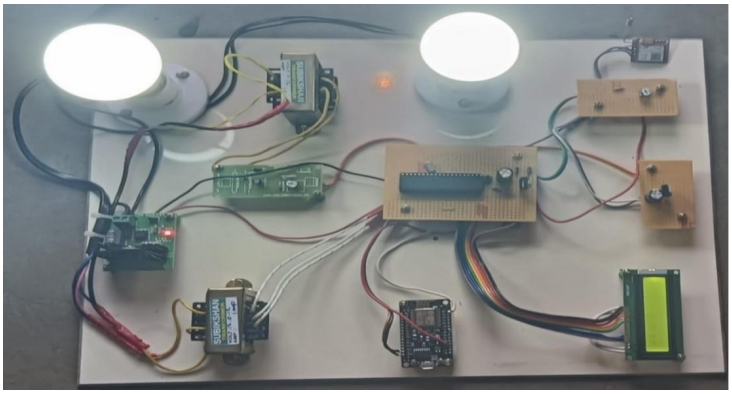

FIGURE 2. MACHINE LEARNING APPROACH BASED SMART ENERGY METER FOR HOME APPLICATIONS

This paper gives explanation of energy meters, which can control how much electricity the user uses and help cut of waste energy. Energy meter are innovative and cost effective approach to stop people from steeling electricity. User just have to pay when they use the service. A consumer is more inclined to trust and use an energy meter that has already been paid for used electricity. Using this energy meter is a tremendous assistance to electrical business. It manages how much electricity resistance uses so that as little power as possible is wasted theft of electricity and the honest buyers are held accountable. This will boost the economy and brings in more tax for everyone. But they have to obey a few regulations when they pay a head of time.

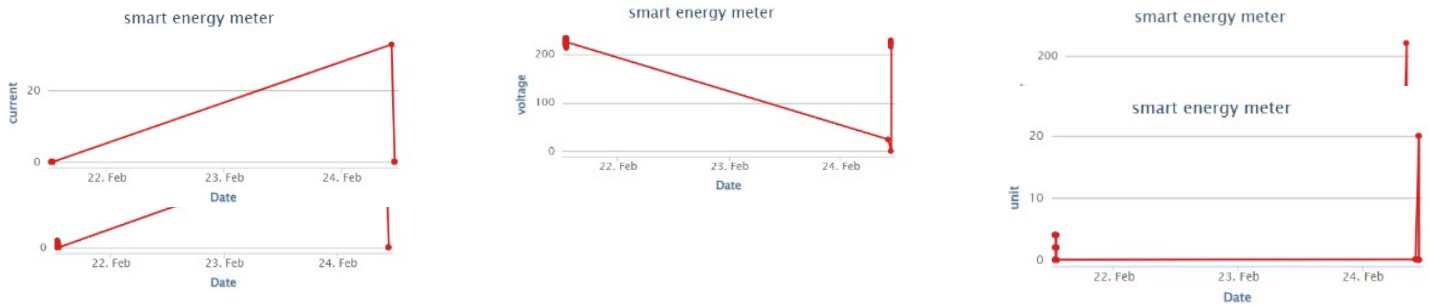

FIGURE 3. OUTPUT ON THINKSPEAK (IOT)

This article describes the operation of the "Internet of Things" web service and API Thing speak (IOT). Even though the definition of this term is changing, we use it here to refer to the ability to recognize and communicate not only with our various electronic devices, but also with one another. This is a fascinating development. The Think speak API will be used to connect a device to the internet of things. The interface provides. Sensor data can also be used to develop applications with Think speak. Data from customer can be collected, analyzed, and displayed in a real time. The user's data is organized into "channels" that provide access to various

functions. Each channel can hold 255 alphanumeric characters as well as eight data fields. Location data is also stored in the description, attitude, longitude, and elevation fields. When data arrives, it is given a unique identifier as well as a time and date stamp.

To access data in a channel designed to keep it private, a “read key” is required (the default setting). The data and instruction can then be sent to the device in question by the cloud (such as commands or choices made). A better understanding of how everything works, especially on the server side. It is necessary to control the data flow from the device to the application and ensure its security. The absence of technical documentation for the diagram’s components in Think speak is problematic. However, if you have been enough time and knowledge, you should be able to find the solution by examining the (open source) code base.

The EB will use this IOT to cut off a consumer’s main lines if they haven’t paid there bills in a timely manner (here we use blynk application as IOT platform). There are no human errors, no intervention from out siders and the technique is economical and simple to use this technique is also less time consuming, automated and realistic and effective solution to side step the issue of the power department sending staffs to read meters once in a month.

III. CONCLUSION:

The proposed smart metering system will monitor various aspects of electricity such as voltage, power factor, current, energy consumption in kw hand therefore the consumer will take appropriate precaution to protect the electrical appliances. The buyer becomes a part of energy managements, which is why it is so vital. During peak hours, the consumer can also monitor the load. If the load is moved to normal hours there by the time of day, the peak demand will decrease, and thus power generation during peak hours is often reduced, lowering the production price. Since the consumer are benefited by limiting their consumption during peak hours, they are becoming more vigilant in limiting their electricity consumption. The proposed smart metering scheme is therefore beneficial to both the utility provider and the consumer. The system can be programmed and integrated with an intelligent circuit that detects theft and generates a syncing pulse upon detection of theft. The proposed smart meter system will include an appropriate tariff system as well as theft detection circuitry.

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