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ENERGY METER MONITORING OVER IOT

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Abstract - *We can see a person standing in front of our house from electricity board, whose duty is to read the energy meter and handover the bills to the owner of that house every month. This is nothing but meter reading. According to that reading we have to pay the bills. The main drawback of this 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 electric board even though the bills are paid are common errors. To overcome this drawback 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. In this paper the idea of smart energy meter using IOT and embedded system have been introduced. In this method we are using PIC16f886microcontroller because it is energy efficient i.e. it consume less power, it is fastest and has two UARTS. In this paper, energy meters which are already installed at our houses are not replaced, but a small modification on the already installed meters can change the existing meters into smart meters. The use of GSM module provides a feature of notification through SMS. One can easily access the meter working through web page that we designed. Current reading with cost can be seen on web page. Automatic ON & OFF of meter is possible. Threshold value setting and sending of notification is the additional task that we are performing).*

Key Words: **IOT (Internet of things), Current Sensor, Automatic Meter Reading, LCD Display, PIC Microcontroller, GSM/Wifi Module.**

1. INTRODUCTION

In the present billing system the distribution companies are unable to keep track of the changing maximum demand of consumers. The consumer is facing problems like receiving due bills for bills that have already been paid as well as poor reliability of electricity supply and quality even if bills are paid regularly. The remedy for all these problems is to keep track of the consumers load on timely basis, which will held to assure accurate billing, track maximum demand and to detect threshold value. These are all the features to be taken into account for designing an efficient energy billing system. The present project "IOT Based Smart Energy Meter" addresses the problems faced by both the consumers and the distribution companies. The paper mainly deals with smart energy meter, which utilizes the features of embedded systems i.e. combination of hardware and software in order to implement desired functionality. The paper discusses the concept of IOT and the application of GSM and Wi-Fi modems to introduce 'Smart' concept. With the use of GSM modem the consumer as well as service provider will get the used energy reading with the respective amount, Consumers will even get notification in the form text through GSM when they are about to reach their threshold value, that they have set. Also with the help of Wi-Fi modem the consumer can monitor his consumed reading and can set the threshold value through webpage. This system enables the electricity department to read the meter readings monthly without a person visiting each house. This can be achieved by the use of microcontroller unit that continuously monitor and records the energy meter reading in its permanent (non-volatile) memory location. This system continuously records the reading and the live meter reading can be displayed on webpage to the consumer on request. This system also can be used to disconnect the power supply of the house when needed.

1.2. LITERATURE REVIEW

Anitha et al., [1] proposed Smart energy meter surveillance using IoT about 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 use of home appliances for energy savings. Due to manual work, existing electricity billing system has major drawbacks. This system will give the information on meter reading, power cut when power consumption exceeds beyond the specified limit usingIoT. The Arduino esp8266 micro controller is programmed toper form the objectives with the help of GSM module. It is proposed to overcome all the disadvantages in the already existing energy meter. All the details are sent to the consumers 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.

Devadhanishini et al., [2] Smart Power Monitoring Using IoT that energy Consumption is the very important and challenging issue. Automatic Electrical Energy meter is used in large electric energy distribution system. The integration of the Arduino WIFI 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 or house it will automatically turn off the power supply.

Mohammed Hosseiu et al., [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 consumption, smart meter, electric power demand side management and various area of energy production. In this paper, the Smart Energy Metering(SEM) is explained as the main purpose of SEM is necessary for collecting information on energy consumption of household appliances and monitor the environmental parameters and provide the required services to home users.

Himanshu K Patel et al., [4] demonstrated Arduino 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 consists the provision of sending an SMS to user for update on energy consumption along with final bill generation along with the freedom of reload via SMS.

2. PROPOSED SYSTEM

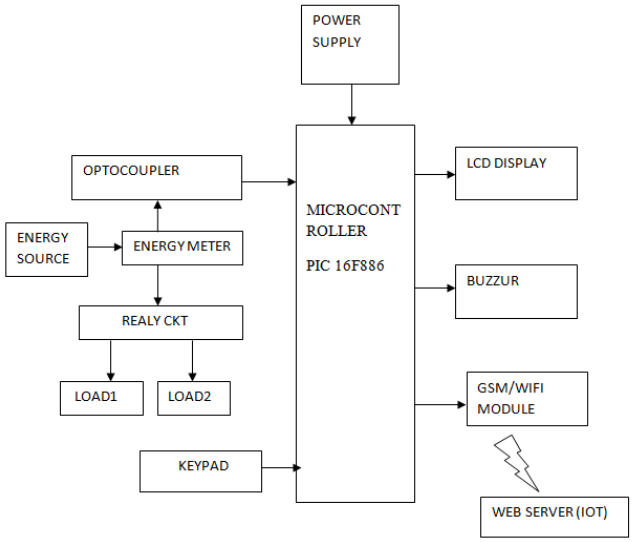

Fig 1: **Block Diagram of System**

This system principally monitors electrical parameters of appliances and subsequently calculates the units consumed. As WSN's are having many advantages, here we have designed smart meters predicting the usage of power consumption. However it is low-cost, flexible, and robust system to continuously monitor and control based on consumer requirements, wifi technology for networking and communication, because it has low-power characteristics, which enable it to be widely used in home and building environments.

The proposed system uses PIC 16F886 Processor that can process the instructions according to our requirements such as power delivered to appliances and status of devices i.e on state or off state. The energy meter that is connected to PIC 16F886 through opto coupler will regularly calculates the number of units consumed and the billing amount. The same will be displayed on LCD along with the same information will send to web server about number of units consumed in terms of graph. We could able to reduce the consumption of power by switching off through web links that are defined while programming the web server and ARM.

A. PIC 16F886 microcontroller:

This powerful yet easy-to-program (only 35 single word instructions) CMOS FLASH-based 8-bit microcontroller packs Microchip's powerful PIC® architecture into a 28 pin package. The PIC16F886 features 256 bytes of EEPROM data memory, self-programming, an ICD, 2 Comparators, 11 channels of 10-bit Analog-to-Digital (A/D) converter, 1 capture/compare/PWM and 1 Enhanced capture/compare/PWM functions, a synchronous serial port that can be configured as either 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I^2C™) bus and an Enhanced Universal Asynchronous Receiver Transmitter (EUSART). All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances or consumer applications.

Fig -2: **PIC16F886**

B. CURRENT SENSOR:

The device consists of a precise, low-offset, linear Hall circuit with a copper conduction path located near the surface of the die. Applied current flowing through this copper conduction path generates a magnetic field which the Hall IC converts into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper-stabilized BiCMOS Hall IC, which is programmed for accuracy after packaging. The output of the device has a positive slope (>VIOUT(Q))when an increasing current flows through the primary copper conduction path (from pins 1 and 2, to pins 3 and 4), which is the path used for current sampling. The internal resistance of this conductive path is 1.2 mΩ typical, providing low power losses.

Fig -3: Current sensor

C. GSM MODULE:

This GSM modem has a **SIM800A chip and RS232** interface while enables easy connection with the computer or laptop using the USB to Serial connector or to the microcontroller using the RS232 to TTL converter. Once you connect the SIM800 modem using the USB to RS232 connector, you need to find the correct COM port from the Device Manger of the USB to Serial Adapter. Then you can open Putty or any other terminal software and open a connection to that COM port at 9600 baud rate, which is the default baud rate of this modem. Once a serial connection is open through the computer or your microcontroller you can start sending the AT commands. SIM800 is a complete **Quad-band GSM/GPRS** solution in a LGA type which can be embedded in the customer applications. SIM800H support Quad-band 850/900/1800/1900MHz, it can transmit Voice, SMS and data information with low power consumption. With tiny size of 15.8*17.8*2.4 mm, it can fit into slim and compact demands of customer design.

Fig -4: GSM SIM800A

D. THINGSPEAK BASICS:

ThingSpeak is an application platform for the Internet of Things. ThingSpeak allows you to build an application around data collected by sensors. Features of ThingSpeak include real-time data collection, data processing, visualizations, apps, and plugins. At the heart of ThingSpeak is a ThingSpeak Channel. A channel is where you send your data to be stored. Each channel includes 8 fields for any type of data, 3 location fields, and 1 status field. Once you have a ThingSpeak Channel you can publish data to the channel, have ThingSpeak process the data, and then have your application retrieve the data.

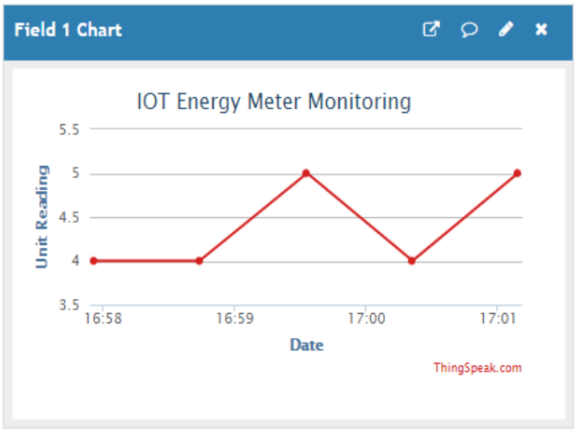

Fig -5: Online Data Visualization of unit reading On Thingspeak

E. LCD display:

A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.

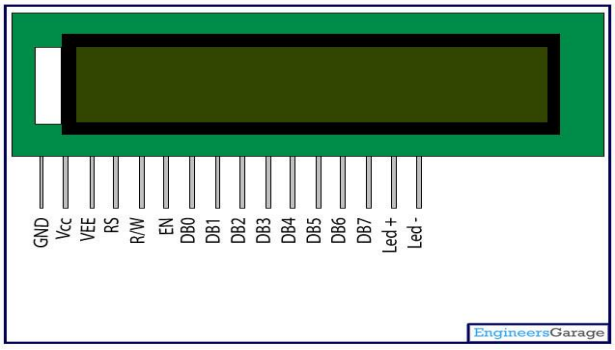

Fig -6 LCD display

3. FUTURE SCOPE:

Energy crisis is one of the major problems that the world faces today. The best remedy for this is not the increase in energy production, but the effective use of available energy. By properly monitoring our energy consumption and avoiding energy wastage, energy crisis can be reduced to a certain extent. But energy monitoring cannot be done efficiently mainly because consumers are not aware of their

energy consumption. They will get an idea about their consumption only when the electricity bills are issued. This whole procedure has to be repeated several times in a month to efficiently control the energy usage. If consumers can check their energy consumption using their mobile phone or laptop instead of checking energy meter, it will be a great leap in the area of energy management. Since most of the people are today 24*7 online, it will be really a boon if they can monitor their energy consumption online from anywhere on the globe. In this paper, we are describing a method of electricity energy meter reading using IoT concept

4. CONCLUSIONS:

We are doing automatic reading and also connection and disconnection of meters. Then meter reading has come faster. It is publically available for the customers as well as for the MSEB. The designed energy monitoring system has proven to successfully acquire accurate measurements for energy meter. A very systematic approach has been used for the overall design of the project, in which power consumption factors were to be controlled. Both the peoples will be using the information as per their requirements and they will be having freedom to check the bill, tampering, when the meter has been connected and disconnected before the due date. This system will bring transparency between provider & consumer. The IOT based energy meter for calculating consumed power & displayed in LCD has been achieved. The consumed power is send through serial communication to the virtual terminal constructed in PROTEUS. This project can therefore enlighten management about wasted time & unnecessary trips, book keeping & billing because it gives an accurate accounting of units driven because of the prevention of malpractice

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