

IOT Based Energy Meter System to Identify Power Theft

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Abstract

This paper is described to measure energy consumption in the house. This can help in reducing energy consumption in house as the owner is continuously being notified about the number of units that are consumed. Consumers are not satisfied with the services of power companies. Thus we are trying to present an idea towards the minimization of technical errors and to reduce human dependency at the same time. Theft of electricity increases the costs paid by customers and can have serious safety consequences. A proposed method provides the communication between the Electricity Board section and the consumer section using Internet of things (IOT) for transmitting the customer's electricity consumption and bill information that is calculated using ATmega328 microcontroller. The power and billing information is continuously transmitted by the use of Internet of Things and monitored by the Electricity Board section. WIFI performs the IOT operation where and through which the information is sent to the Web server. This data is then transmitted to the server unit at MSEB. The power consumption can be checked by the owner anywhere globally also. The snap of energy meter is sent on email. Also power theft can be detected if any tampering happens it will send the information to the server and alert SMS to the owner as well as it will cut the electricity automatically. The internet is connected to meter and it counts the pulses from it and displays it over the LCD display. The meter reading can be obtained at zero cost. This system not only reduces the labour cost but also increase meter reading accuracy and save hugs amount of time. In this way we can reduce human efforts needed to record the meter readings which are till now recorded by visiting every home individually.

Keywords: Internet of things, microcontroller, Energy meter and GSM, LCD Display, WIFIESP8266 module, Theft Control

I. INTRODUCTION

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. In India, bill is issued only once in a month or two months. So the consumers will be in dark during this period of time about their energy usage. In this era of complete digitalization, no one will take the pain to go and check their electricity meter reading and compare it with the previous reading so as to get an idea about their consumption. 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 24x7 online, it will be really a boon if they can monitor their energy consumption online from anywhere on the globe. As the generation is increases the consumer's requirements also increasing so in accordance with it the technology improvement is needed. So we developed the system with faster and improved technology i.e. IOT. The electricity also contains some issues like power theft. Power theft is a measure crime and it also directly affects the economy of our country. Transmission, generation and distribution of electricity include the loss of electricity. To avoid the losses we need to monitor the power consumption and losses, so that we can efficiently utilize the generated power. To resolve these issues we developed system on the base of IOT energy meter reading.

II. EXISTING METER

The present system only provides feedback to the customer at the end of the month that how much power is consumed in the form of bill. The consumer has no way to track their energy usage on a more immediate basis. The consumers are growing exponentially fast and load on power providing divisions is rapidly rising. In the existing system meter tampering can be done easily and it's one of the major drawbacks for an energy crisis.

III. PROPOSED SYSTEM

In this system we are connecting energy meters to the internet i.e. IoT concept. In the proposed system, consumer can do power management by knowing energy usage time to time.

The block diagram of the system is shown in Fig-1.

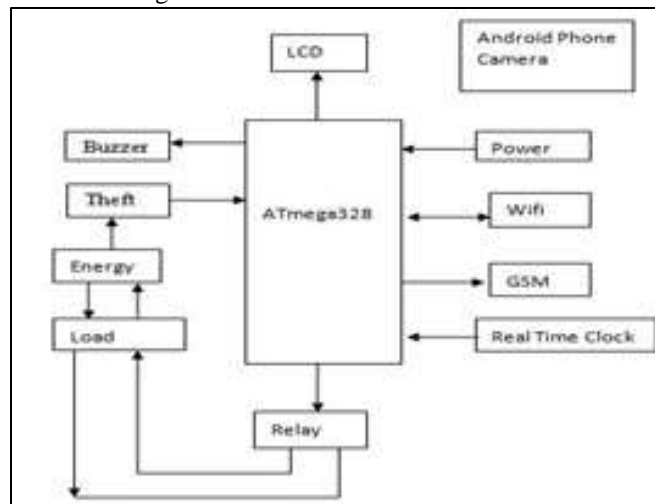


Fig. 1: IOT based energy meter block diagram

IOT based energy meter reading consists of four parts: ATmega328 microcontroller, Theft detection, GSM module and WIFI part. Controller part plays a major role in the system. Where all the information can send through this controller to the other part of the system and it also stores the information in it. WIFI part and GSM module performs IOT operation. Meter readings are passed to the server through the GSM module connected to the energy meter. The energy meter connected with theft detection part if any temper happens it will send the information to the company and consumer by sending SMS as well as it will take automatic action by making power off. Daily consumption reports are generated which can be monitored through Android application and/or web portal. The live readings from the energy meters are collected by the microcontroller. This can be viewed through an LCD display which is connected to the micro controller. The LCD display shows the readings of the energy meters and the theft status. Then the relay will operate and this can be used for disconnecting the load.

A. System Implementation

Microcontroller is the core component of the project that connects input and outputs of the devices. LCD, Relay, Buzzer, these are other components present in the system. The load and relays in this circuit represent the devices that need energy or electricity to operate and are used at homes. If in case any theft occur automatically buzzer will beep by making load OFF. Also the information is sent to the web server through wifi which is attached to Arduino controller. We can set the period in the microcontroller for every meter reading daily, weekly, monthly and sends to the central server of the energy Provider Company Alternatively we can also send through by email.

1) ESP8266 WI-FI Module

ESP8266 WI-FI module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions for another application processor. ESP8266 module is extremely cost effective board with a huge, and ever growing, community.

2) LCD Display

LCD is used in the project to visualize the output of the application. We have used 16x2 LCD.

3) Microcontroller unit

In the micro controller unit we are going to use ATmega328 microcontroller which is used to sense the values from the sensors and will transfer to the monitoring section regarding the situation. In the sensing part Analog to Digital conversion is done internally in the controller.

4) Real Time Clock

A real-time clock (RTC) is a computer clock. It is most often in the form of an integrated circuit that keeps track of the current time. RTCs are present in almost any electronic device which needs to keep accurate time.

5) Relay Section

Relay circuits are interfaced with the energy meter and microcontroller. Relays allow one circuit to switch a second circuit which can be completely separate from the first. Relay circuit are used for switching the consumer's main consumption line between cut-off and power supply mode.

6) Temper Detection Unit

A tempering unit used for stop of this energy theft that sent the alert to energy Provider Company when tempering occurs.

7) GSM Modem

GSM modem is connected to a microcontroller which would transmit data from a meter to cell phone. AT commands set which stands for attention terminal are used by energy meter to communicate with the GSM Modem.

B. Advantages

The users can be aware of their electricity consumption. Theft of electricity can be avoided by tamper proof energy meters. the proposed system eliminates the human involvement in electricity maintenance. The users can also monitor their energy meter reading online from anywhere.

C. Applications

Industrial control, Medical systems, Access control, MSEB and general purpose applications.

IV. EXPERIMENTAL RESULTS

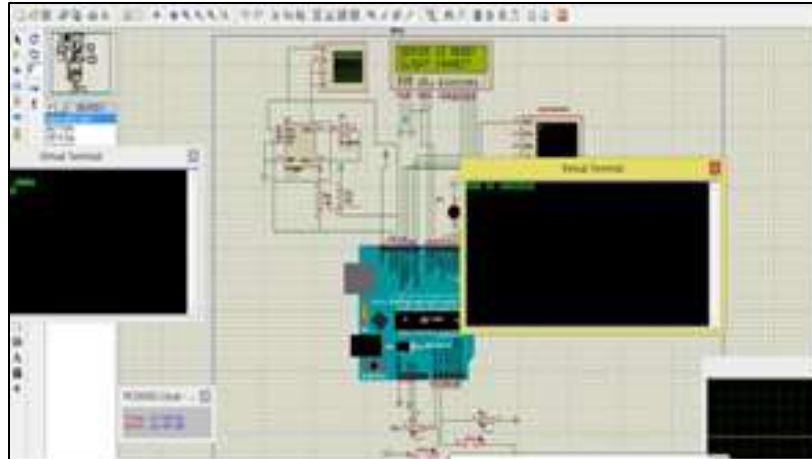


Fig. 2: Overall Simulation Design

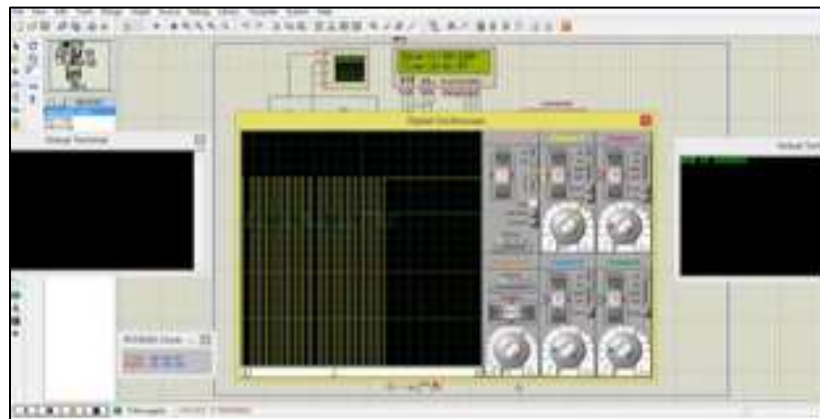


Fig. 3: Pulse based Amount Estimations

The results of the project are shown below step by step in the form of picture representation. The figure 4 shows the representation of consumers end implementation IOT board consists of ATmega328 microcontroller, GSM module, theft detection and WIFI ESP8266.



Fig. 4: Implementation on board



Fig. 5: LCD display of energy meter power blinking rate



Fig. 6: Snap of energy meter on email.



Fig. 7: Power blinking rate and theft detected part displays on consumer mobile as SMS.

V. CONCLUSION

The Project is mainly concentrated on IOT network. When we discussed about the project there are certain points to notify first we are converting conventional energy meter into a digital meter .We are doing automatic reading and also connection and disconnection of meters using WIFI module. It is designed to continuously monitor the meter reading and transfer the data to a central server. The service provider can disconnect the power supply when a theft is identified. This system eliminates the human involvement in energy management. Finally concluding our project that we are successfully monitored the tampering i.e. seal tampering and we have read the energy consumption of meter using IOT concept.

VI. FUTURE

The project mainly aims at providing overall infrastructure of the energy meter presently used for the smart city concept. The main improvement for the future is going to make some wifi hotspots in each area through which all the energy meters are get connected

IoT energy meter consumption is accessed using Wi-Fi and it will help consumers to avoid unwanted use of electricity. So, in future following objectives can be achieved to save power and avoid thefts: • we can make an IoT system where a user can monitor energy consumption and pay the bill Online. • We can make a system where a user can receive SMS, when he/she crosses threshold of electricity usage slab.

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