

Energy Meter with Automatic Electricity Bill Generation and Monitoring System

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Abstract—The electricity is the essential need of human beings. The electricity is commonly used in Agricultural, domestic and industrial applications. Emerge advancement in energy meter has gone through rapid technology and there is a need for efficient and reliable energy meter with automatic electricity bill generation and monitoring system. The system deals with the design of a simple budget friendly energy meter, for automatic electricity billing and monitoring. The electronic energy meter integrated with GSM communication module of each entity to detail remote access of the used electricity. The proposed system replaces reading method used by traditional energy meters and enables remote access of existing energy meter. Also they can regularly monitor the meter readings without visiting the person house of the consumer. It will also continuously monitor the power factor and indicates when the power factor lag or lead exist the time limit for an industrial organization. By using GSM & IOT the consumer can obtain their electricity consuming information through their mobile phone.

Keywords—*Energy meter; GSM; IOT; Consumption; Power factor.*

I. INTRODUCTION

Electricity is now essential to human progress and survival. Automation in energy distribution is also required to raise the standard of living for people in addition to attempts to fulfil the growing demand. In order to satisfy the needs of future residential growth, traditional metre reading by human operator is inefficient. As a result, there is a rise in the need for energy meters with automatic electricity bill generation and monitoring systems that electronically collect metre readings, and their use in industrial, commercial, and utility environments is rising.

The automation of utility metering is made possible by the use of electronic meters. Numerous new features on automated utility meters help to lower the price of utilities for

consumers and the price of providing utilities to the utility provider. The beginning of rural electrification offers chances for the use of new and more effective metering systems. Traditional electro-mechanical meters, which are still in use globally today, are susceptible to temperature and time drift.

Due to the mechanical and analogue character of the parts of these meters. Because a meter reader must physically be present to take the readings, collecting meter readings is also inefficient. When readings must be gathered from broad, often dispersed rural areas, this method of obtaining meter readings becomes more difficult and expensive. Due to reluctance to visit to these locations, meter readers frequently report erroneous estimates of the quantity of electricity used. Traditional meter reading is incredibly inefficient for homes at the top of tall buildings and on exclusive property. There is a chance for unpaid invoices, consumer absence, etc. Despite the fact that more effective electronic meters have taken the place of these traditional ones, and the energy meters only shows the power factor value.

The primary goal of this paper is to develop an energy meter that can track energy consumption and transmit that data to a mobile via GSM & IOT module. The information can be obtained about energy usage based on necessary consumption. Among the problems with the current systems are every time, unable to manually calculate the energy use and verify the meter. If they consume more energy than the threshold limit, there are no alerting features. There is no disclosure of the unit charge during billing. Digital meters simply show the current quantity of energy used; historical energy consumption history and the value of power factor are not shown. Remote monitoring of electricity use is possible in this system.

II. LITERATURE SURVEY AND RELATED WORKS

In this article, existing meter reading practices in India are examined, and a thorough investigation of the various energy measuring tools now in use is done. To measure usage in the current system, either an electronic energy meter or an electro-mechanical meter is put in the building. The only unit of measurement available to the meters in use right now is the kWh. Meter readers must still record the monthly usage of kWh units on foot. A corporation that reads meters must process the recorded data. In order to process the meter reading, the corporation must first associate each record of power usage with a specific account holder before calculating the amount owed using the applicable rate.

III. PROPOSED METHODOLOGY

To replace old traditional energy meters into Advanced Energy meters which is capable of electricity monitoring and auto bill generation and establishing a transparency between

Electricity bill generation and people which in turn reduce the clashes between people and electricity board on electricity bill taxes and extra cost for households, in this type of energy meters with generation of electricity bill and monitoring system consumers can monitor their energy consumption and amount should be paid according to regular basis.

To provide an alarming system if there is a heavy load acting on the meter and also if energy consumption crosses the basic limit and establish a connection between energy meter and mobile phone of the consumer through GSM to send and receive data in the form of SMS.

To avoid human interruption in the billing process, there is a need to monitor and intimate the power factor to maintain the power factor near to unity, by using GSM & IOT the consumer can obtain information through their phone, in this new generation, an advanced meter system came into use.

By using PIC controller the problems such as lack of multitasking, not optimized for performance, limited support for programming languages can be avoided. The FIG.1 shows the over view of proposed system.

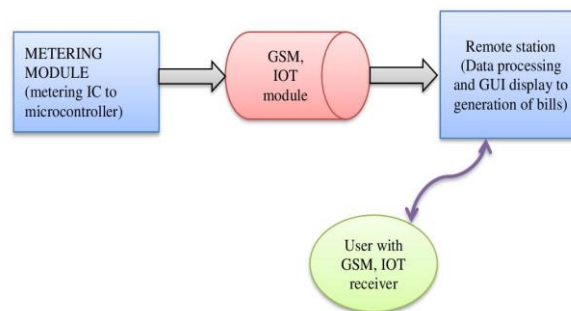


FIG. 1.Overview of Proposed Methodology

A. Problem Statement

Despite the fact that there are numerous issues with the manual procedure, the Electricity Board has become accustomed to it and continues to utilise it. When a user receives a defective bill as a result of human error, it is their responsibility to request a correction from the energy supply board. The customer will then need to go to the office, wait in queue and get it fixed. The issue only exists as a result of human action. In this new generation, an energy meter with automatic electricity bill generation and monitoring system was included to reduce the need for human interaction during the billing process and there is a need to monitor & alarm the Power factor in industry utilization.

B. Block Diagram

This project consists of PIC microcontroller, GSM Module, IOT module, Power Supply, Relay, 16X2 LCD Display and Load which together used for electricity monitoring and auto bill generation. The load can be monitored by sending an SMS from mobile phone to GSM Module with the help of energy meter which is embedded in the system and we can obtain the electricity bill through GSM Module to directly to our mobile phones showing how many units has been consumed. Firstly turn on the power supply for the kit and initialize it by dumping PIC Microcontroller code to PIC16F887 board, the software code can be coded in PIC and wait for the LCD to operate and then send a message from mobile phone to ON bulb. GSM receives the SMS and executes the instructions. So, By the way we can switch ON/OFF the load (bulbs).Energy meter present in the system gives out the reading i.e how many units has been consumed and also which provides the electricity bill via GSM module to mobile phone displaying the number of units consumed along with the amount to be paid and also the system monitor the Power factor. FIG.2 shows the block diagram of the system.

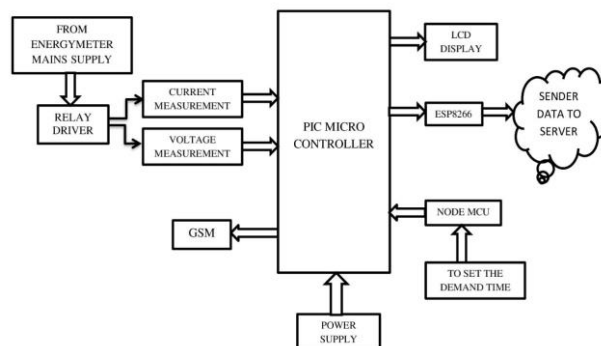


FIG 2.Block Diagram.

C. Working of The System

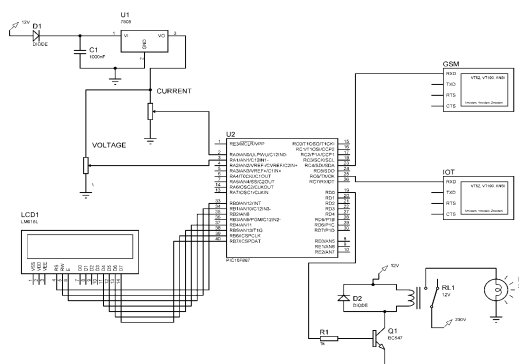


FIG.3.Circuit Diagram.

The FIG.3 shows the circuit diagram of the energy meter with automatic bill generation and monitoring system. The circuit diagram consists of PIC16F887 controller, LM016L LCD, IOT & GSM module, current & voltage measuring circuit and power supply. The current & voltage measuring circuit measures the respected voltage & current. The measured voltage & current values given as input to the PIC. The PIC is used as a controller and it calculates the power and bill amount for consumed power. The value of consumed power, bill amount, voltage, current and power factor are displayed in the LCD display. The GSM module is used to convey the details to the consumer through mobile phone. The IOT module is used to store the data in cloud.

D. Experimental Result of The System

The software tools used in this project are thing speak, Blynk IoT, and embedded c used for the working of energy meter with automatic electricity bill generation and monitoring system.

The FIG.4 shows the prototype of energy meter with automatic electricity bill generation and monitoring system.

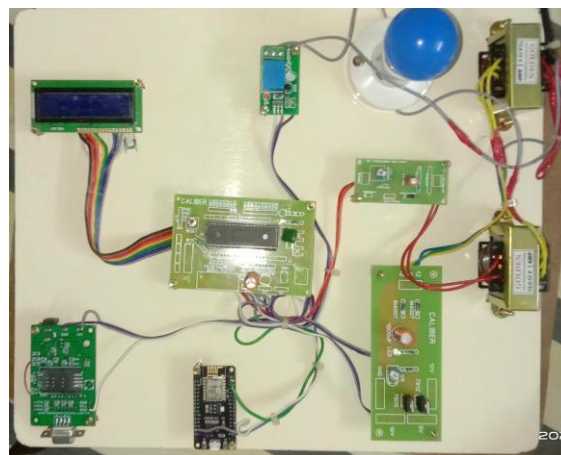


FIG.4. shows the Prototype of the energy meter with automatic electricity bill generation and monitoring system.

The following are the results of energy meter with automatic electricity bill generation and monitoring system. FIG.5. shows the SMS alerts are received in the following way when project test.

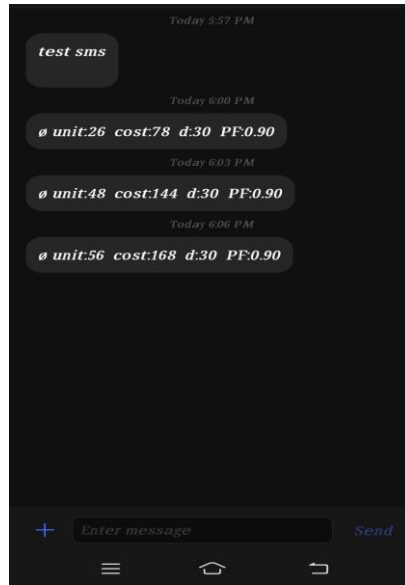


FIG.5. shows how an SMS is received to the consumer and local operator (in theft case) from the base station.



FIG.6. shows the output through LCD

The FIG.6 shows the measured Current, Voltage, Power, Power Factor value.



FIG.7. shows the information that stored in cloud.

The FIG.7 shows the Data stored in Cloud by using IOT for record purpose.

IV. CONCLUSION

The technological development of the electrical distribution network is a continuous process. The energy meter with automatic bill generation and monitoring system used in this work is built to remotely monitor the energy consumed by the consumer while also continuously monitoring the meter reading. It eliminates the need for human involvement, provides accurate metre reading, prevents billing error, and lowers maintenance costs. For user notification, the corresponding information like power factor, current, voltage, power is displayed on the LCD, GSM module is used to convey the consumption and bill details to

consumer and IOT helps to store the data in cloud. Energy meter with automatic bill generation and monitoring system provides the following benefits: it involves less staff, eliminates the need for collection efforts, sends bills to customers with due dates, and can reduce household power use.

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