

Real Time Power Consumption Monitoring and Control using IoT

Ms. P. Bhuvaneswari¹, Ms. M. Brundhadevi², Ms. S. Gayathiredevi³, Mr. P. Gopitha⁴, Mr. R. Gopalan⁵

Final Year ECE Students^{1,2,3,4},

Assistant Professor ECE⁵

Velalar College of Engineering and Technology, Erode, India.

Abstract—In present days energy theft and power demand is very common problem in many countries due to increase in consumers each and every day. Current energy billing in India cause errors and also time and labour consuming. There is no way to know the proper and detail information about the energy meter. So, problems and errors in existing system is overcome by proposed system using PIC microcontroller, NodeMCU, RFID tag, GSM module. In the proposed system at regular interval measure the amount of current and power consumed by the customer and the electric bill will be generated based on the their amount of power usage every month. Also eliminates the manual meter reading and providing real time data, useful for balancing electric loads and reducing power cuts. This system detect and control the energy meter from the power theft, if unauthorized activities detected an alert message will be sent through GSM module and power will cut from the server directly using relay. To pay the electric bill on time prepaid system is introduced. Objective of the system is making it possible to use power resources more efficiently.

Keywords—PIC microcontroller, NodeMCU, GSM module, RFID tag.

I. INTRODUCTION

Electricity is one of the important invention that scientist has given to mankind. Due to growing population, the power needs and demand become increasing. In existing system, for taking electricity reading worker has to come for note down the readings and the electric bill will be generated based on the usage. This cause error while take down the readings and also error occur while generating the electric bill. In many place unauthorized activities are happening and users consume extra amount of power without any prior information given to EB board this leads to power cut, load and substation damage.

If the customer is not paid the bill on due time, a worker has to come and cut the power in person. To avoid this, an alert message is sent and disconnect the service directly from the server, so that electric system is monitored and can be controlled from the EB board. Power theft also avoided in this system.

II. PROPOSED SYSTEM

The below Figure 1 shows the flow diagram of the proposed system

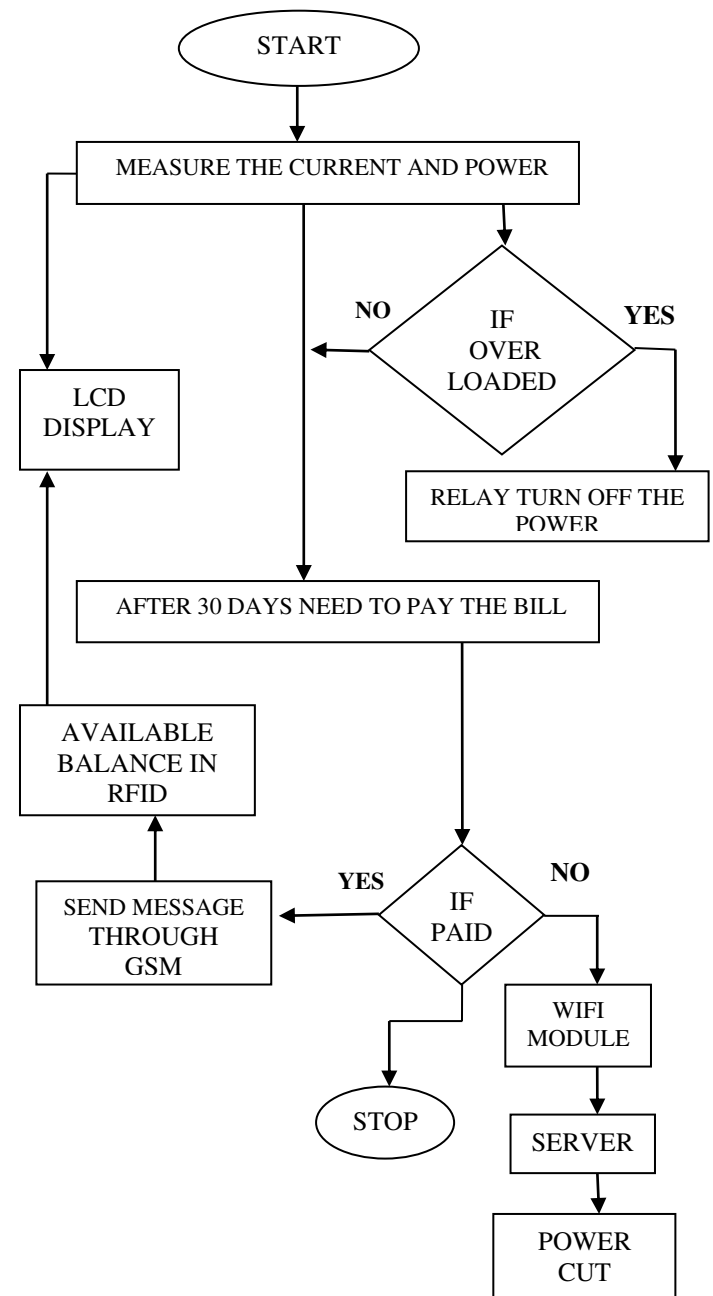


Fig 1 Flow Diagram of Proposed System

The above Figure 1 shows the flow diagram of proposed system. In our proposed system, from the energy meter main supply, PIC microcontroller measure the amount of current and power consumed using CT and PT and display

the cost for wattage consumed on LCD display. If it overloaded or any power theft occur relay turn off the power from the server. After 30 days electric bill is generated and due date information message is send through the GSM module. By using RFID tag prepaid system is available to pay the electric bill on time without any delay and need not to remember for paying electric bill. If the bill is not paid on due time, alert message will be sent and power will cut from the server directly using NodeMCU. This eliminates manually disconnecting the service also unauthorizedly using the electricity.

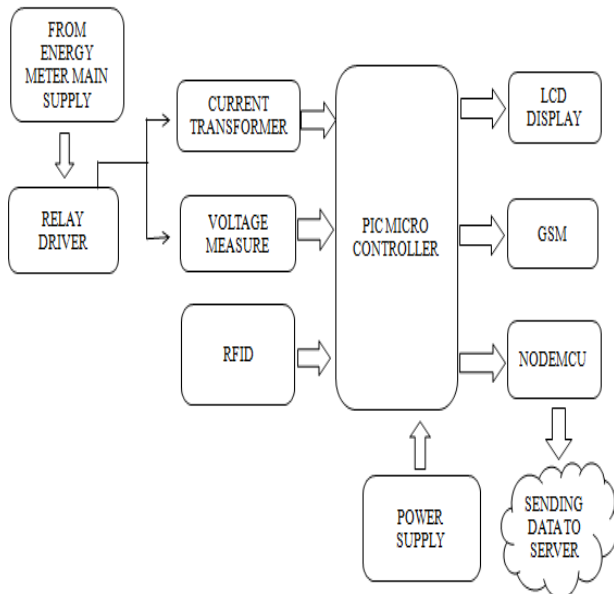


Fig 2 Block Diagram of Proposed System

The above Figure 2 shows the block diagram of proposed system. It consists of PIC microcontroller, RFID reader, RFID tag, LCD display, current transformer, GSM module, relay, NodeMCU.

A. PIC MICROCONTROLLER:

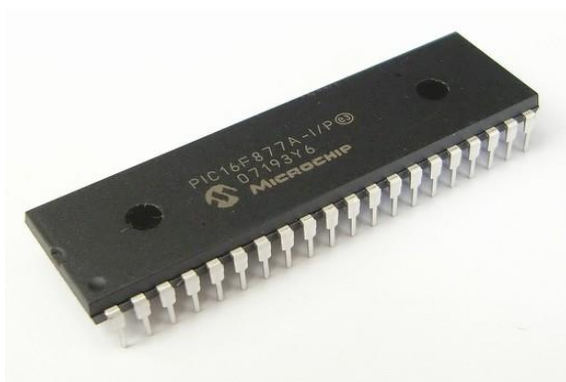


Fig 3 Image of 16F877A PIC microcontroller

The above Figure 2 shows the Image of. 16F877A PIC microcontroller. PIC(Peripheral Interface Controller) microcontroller has 40 pins in which there are 33 I/O pins. It

is very convenient to use and easily programmable. It has 5 ports namely port A, B, C, D and E. PIC is a RISC architecture so it is very fast. Compare to other microcontroller power consumption is very less. PIC16F877A has huge application in digital electronic circuits and used in number of devices.

B.LCD DISPLAY:



Fig 4 Image of Arduino UNO

The above Figure 3 shows the Image of LCD Display. LCD (Liquid Crystal Display) is a display of information on screen. For displaying it uses liquid crystal that become visible when electricity is passed through them. When compared to LED, LCD display consume very less power. This is used to display the reading and amount of wattage consumed.

C.RFID TAG:



Fig 5 Image of RFID tag

The above Figure 4 shows the Image of RFID tag. The RFID (Radio Frequency Identifier) is used for identification process like smart barcode. RFID tag contain small amount of data that be read or write into it. This is used to prepaid the energy system by reading the data from RFID tag by the RFID reader. It contain radio transponder, radio transmitter and receiver. Likewise barcode it doesn't need the line of sight.

D.RFID READER:



Fig 6 Image of RFID reader

The above Figure 5 shows the Image of EM-18 reader. RFID reader is used to read the RFID tag which transmits RF signal. It uses radio frequency waves to wirelessly transfer the data between RFID tag and itself. On reading the signal ,reader gets the data of available amount on RFID tag on displayed on LCD. RFID is very easy technology.

F.GSM MODULE:



Fig 7 Image of GSM module sim800

The above Figure 6 shows the image of GSM module sim800. GSM(Global System for Mobile) is mobile communication modem is used to make a communication between computer and other processor over a network . purpose of using GSM module is if there any power theft occurs alert message sent to customer , also send message about wattage consumed and electric bill cost.

G.RELAY:



Fig 8 Image of relay

The above Figure 7 shows the Image of relay. Relay is an electrically operated switch. Relay works as it makes or breaks contacts or combination between the connection. If the customer electric bill is not paid or power theft occur by using the relay power will cut down from the server.

RESULTS AND DISCUSSION



Fig 9 Image of measuring current and power value everyday

The above Figure 8 shows the image measuring current and power value every day.

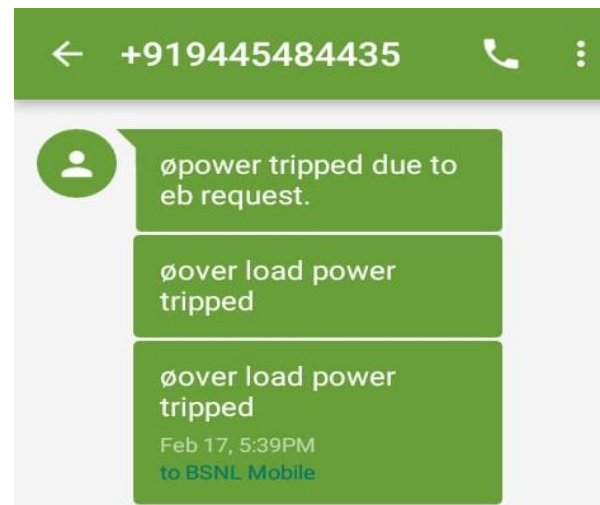


Fig 10 Image of overloaded message sent through GSM.

The above Figure 9 shows the image of overloaded message sent through GSM.



Fig 11 Image of need to pay bill after a month

The above Figure 10 shows the image of need to pay bill after a month.



Fig 12 Image of after payment of electric bill amount

The above Figure 11 shows the image of after payment of electric bill amount.



Fig 13 Image of available balance in RFID tag

The above Figure 12 shows the image of available balance in RFID tag.



Fig 14 Image of power tripped when electric bill is not paid.

The above Figure 13 shows the image of power tripped when electric bill is not paid.

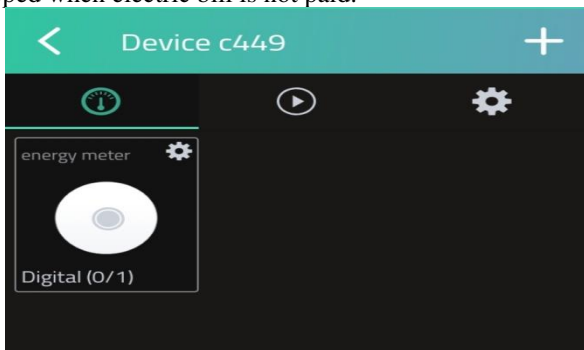


Fig 15 Image of cayenne web page

The above Figure 14 shows the image of cayenne web page.

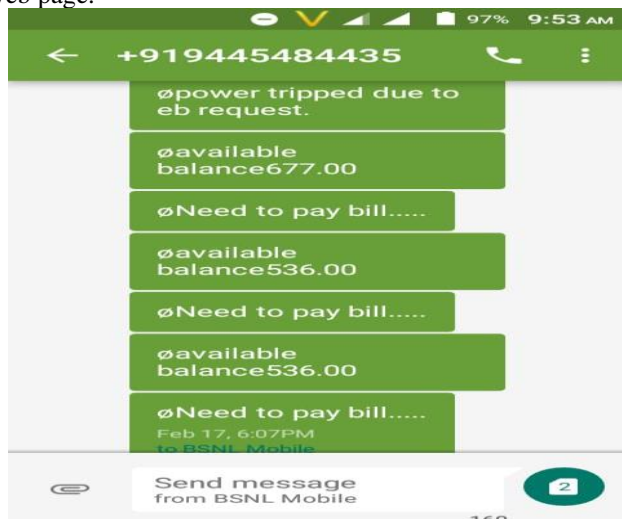


Fig 16 Image of message received by customer.

The above Figure 15 shows the image of message received by customer.

Thus, the amount of current and power is calculated and display on LCD, a message is send through the GSM module about power theft, electric bill amount and wattage consumption. Prepaid system is present to pay the electric bill on time, if bill is not paid or any illegal activities happened power will be directly cut from the server.

IV.CONCLUSION

In this paper monitoring and controlling the energy meter is successfully done. Power theft is identified and alert message send through GSM module. Prepaid system reduce the power consumption and to avoid paying of fine amount when delay or forget to pay. Here automation is achieved in this system by using NodeMCU and RFID tag. This system help to save the electricity and also reduced power cuts.

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