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Smart Power Monitoring System and Theft Detector

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ABSTRACT: This paper describes AT89S52 Microcontroller based design and implementation of energy meter using IoT concept. The proposed system design eliminates the human involvement in Electricity maintenance. The Buyer needs to pay for the usage of electricity beforehand (a prepaid system), in case that he couldn't pay, the electricity transmission will automatically turned off from the distant server. The user can monitor the energy consumption in units from an android app. Theft detection unit connected to energy meter will notify the user when theft occurs in energy and it will send theft detect information through the server to the user's Android mobile. The server performs the IoT operation by sending energy meter data to android app. The Hardware interface circuit consists of AT89S52 Microcontroller, a computer as server, theft detection unit. The server performs IoT operation by sending energy meter data to web page which can be accessed through the android app.

KEYWORDS: AT89S52 controller, WIFI module, IOT Technology, Current Transformer, ADC.

I. INTRODUCTION

In the Internet of Things (IoT) model, of the living and nonliving things that encompass us will be on the internet in one form or another. Nowadays many electronic devices such as radio, Bluetooth speakers, embedded sensors etc. have came into limelight, IoT has moved out from its beginning stage and it is actuallymon the edge of changing the present fixed internet into are well featured upcoming Internet. Currently there almost nine billion internet - connected gadgets and it is estimated to touch almost fifty billion gadgets by 2020.

Today the world is facing such an environment that offers challenges. Energy crisis is the major problem seen in today's world. A relevant system to control and monitor the power usage is one of the solutions for this problem. One approach through which today's energy crisis can be addressed is through the reduction of power usage in households. The consumers are increasing rapidly and also burden on electricity offering divisions is sharply increasing. The consumers must be facilitated by giving them an ideal solution:-i.e. the concept of IoT (Internet of Things) meters and on the other hand service provider end can also be informed about electricity thefts using theft detection unit and PLC modem. By keeping above factors, the concept of IoT meters thrived consisting of 3 units: Microcontroller unit, Theft detection unit, and server. The paper describes AT89S52 Microcontroller based design and implementation of energy meter using IoT.

The user can monitor the energy consumption in units from an android app by logging in into the app. Theft detection unit connected to energy meter will notify user when theft occurs in energy and it will send theft detect information through server and theft detected will be displayed on the app.

II. METHODOLOGY

The system here consists of microcontroller interfaced with ESP8266 wifi module which is connected wirelessly with the user's android mobile where our consumption by a particular device is shown. The device's wattage

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consumption is controlled by the current transformer and the subordinate circuits. The rate is calculated by the microcontroller which inputs all the required parameter for calculation.

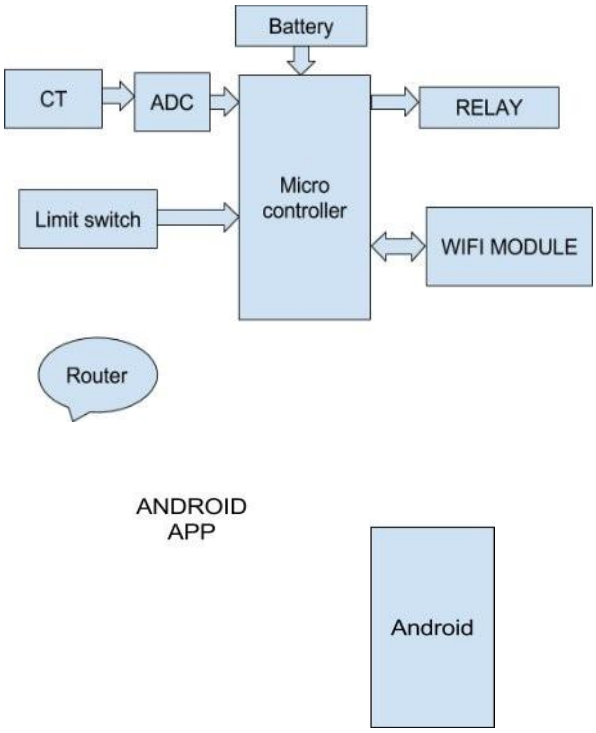

Fig 1: Block Diagram

ESP8266 wifi module sends all the data from microcontroller to the user's android mobile (App).If the thief tries to open the meter, the limit switch goes high and user is notified through the app. User is notified about the exhaustion of meter usage on android app.

We have made an electric meter to measure the amount of consumption of electric power. Here the measurement is made by simple power circuit i.e. by using a current transformer. The current transformer is used to measure the amount of current drawn by the load. At the output of current transformer we have connected shunt resistor so as to convert the current into equivalent voltage. This voltage is then given to the ADC 0804. The ADC will perform analog to digital conversion so as to interface the current information to the microcontroller. The microcontroller will receive the data information from adc and will then will give it to the PC where the PC will log the data details into PC. On the other side of PC is connected to GSM modem which continuously tracks the received message.

The PC will keep the data of the current consumption of the loads and previous consumption and then will transmit the data to other GSM modem when requested i.e. when the message is received from the other gsm modem, it will forward the details of the consumption to the requested number.

To power up the circuit we have used the power supply PCB which consists of rectifier to convert the 12 V AC from transformer secondary into pulsating DC. This pulsating DC is then given to the Filter capacitor of 2200uf value so as to filter out the pulsating DC into pure DC voltage. This filtered output is then given to the input of 7809 regulator which will provide +9V regulated output to the circuit.

The +9V regulated output is then given to the microcontroller PCB which has a 7805 regulator to provide +5V regulated power supply and we are driving all the integrated chips through this +5V.

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III. HARWARE SYSTEM

Microcontroller:
It is interfaced with the wifi module to send the information regarding the data usage and power theft. It also counts the power unit which is provided by the current transformer and ADC. The limit of the power consumption is set in the controller. The AT89S52 used here is a low-power and a high-performance 8-bit microcontroller.It has 8K bytes of in-system programmable Flash memory.The features include: 128x8 bit internal RAM, 32 programmable I/O lines, 2 16 bit timers/counters,etc.

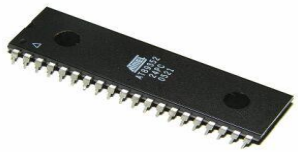

Fig 2: AT89S52 microtroller

WIFI Module:
Microcontroller gathers the data of ADC and then the data is send over the WIFI. The WIFI module is connected to the mobile phone having the required app through the router.In this case the WIFI module is being used as a server as well as a host.It will generate an IP address or a website designed by the electricity supplier.The WIFI module used is ESP8266.To interface the WIFI module with the microcontroller we require certain AT commands.

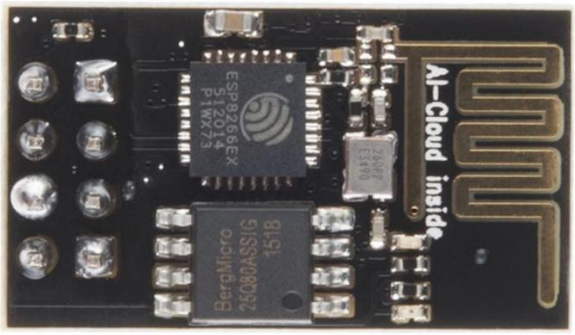

Fig 3.ESP8266

Current Transformer:
The current transformer converts the high power current to a lower value which can be easily measured in the microcontroller. Since our microcontroller has a low power rating therefore the transformer is used in this circuit.

ADC:
Since the microcontroller requires digital input on its serial data line, the ADC converts the analog current signals to digital value which is then fed in to the controller for the further process.The ADC gets the input from the rectifying circuit which rectifies the signal received from the current transformer.The ADC used is 0804.Thhe ADC is set/reset by the microcontroller.

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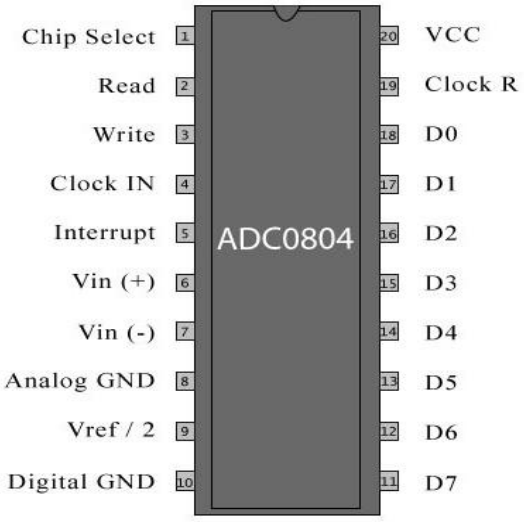

Fig 4. ADC 0804

Relay:

The relay is an important component in this system.The process of prepaid billing is mainly dependent on the functioning of the relay.There are three pins of the relay:VCC,Data and GND.The Data pin of the relay is connected to the microcontroller.As soon as the usage of electricity reaches a predecided limit value the microcontroller triggers the data pin of the re;ay and the relay in turn trips off the electricity supply.Therefore,the relay here acts as a switch.

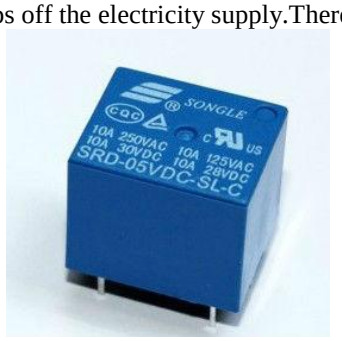

Fig 5 : Sugar cube relay

IV. RESULTS

The figure 6. shows the display of the app/website which has been created using wifi module.

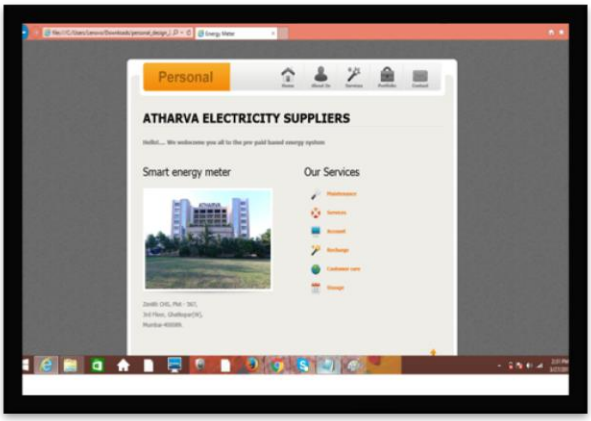

Fig 6. Display of app

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The Fig 7. and 8. Shows the graph the weekly and monthly energy usage.

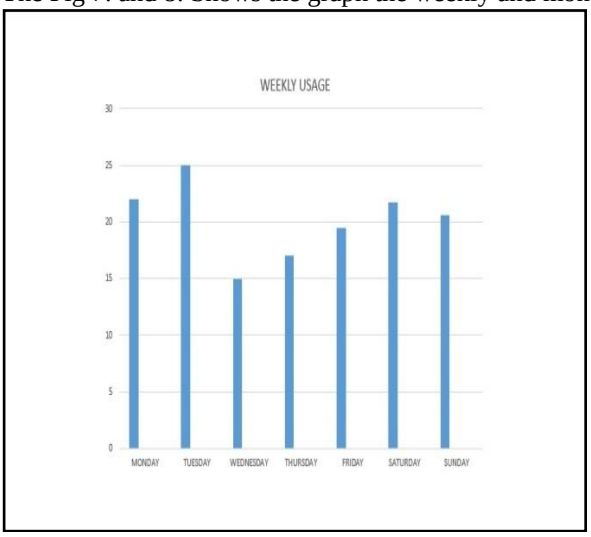

Fig 7. Weekly usage

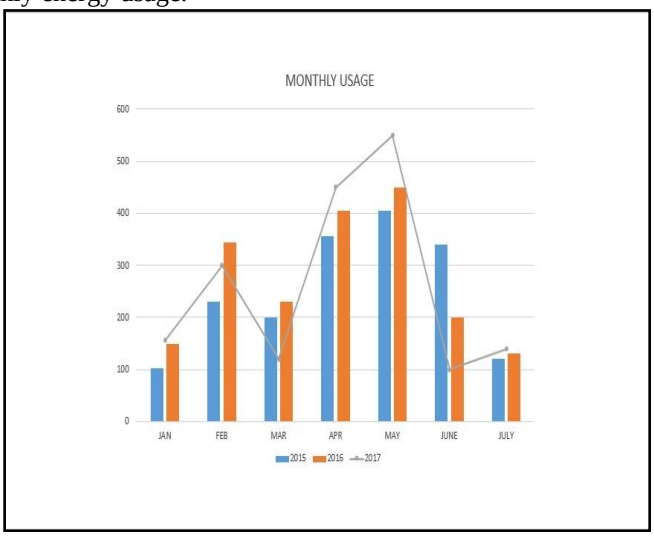

Fig 8. Monthly Usage

V. CONCLUSION

The successful development of the automatic meter reading system described in this paper is based on the high performance, extremely low power consumption, high level of integration, and low price technology.The technology has strong market competitiveness. Meter reading system uses short-range wireless communication and computer network technologies to read and process metering data automatically. Automatic meter reading technology can not only save human resources, but also improve the accuracy and instantaneity of the meter reading. It enables management sector to timely and accurately access power consumption messages. Moreover, no cabling is required with relatively economical investment. For the proposed automatic meter reading system, wireless communication links can be quickly built, engineering period significantly shortened, and it has better scalability compared to a wired system. In the present work Automatic Power Meter (APM) unit is designed to continuously monitor the meter reading. It avoids the human intervention, provides efficient meter reading and reduces the maintenance cost.

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