IoT Base Smart Home System Technologies

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Abstract- *In this paper, Energy monitoring and conservation holds prime importance in today's world because of the imbalance between power generation and demand. The current scenario says that the power generated, which is primarily contributed by fossil fuels may get exhausted within the next 20 years. Currently, there are very accurate electronic energy monitoring systems available in the market. Most of these monitor the power consumed in a domestic household, in case of residential applications. Many a times, consumers are dissatisfied with the power bill as it does not show the power consumed at the device level. Internet of Things (IoT) is an emerging field and IoT based devices have created a revolution in electronics and IT. This paper presents the design and implementation of an energy meter using Arduino microcontroller which can be used to measure the power consumed by any individual electrical appliance.*

Keywords- Energy monitoring system, Arduino Uno,ESP8266,Current sensor.

I. INTRODUCTION

Conservation of energy is one of the most important need of the day. The concept of energy efficient devices has come up in various areas such as lighting, air conditioning and so on. Energy monitoring is an important tool for determining the energy efficiency of various devices.

Energy bills are generated on monthly basis and the user has the option of analysing the consumption details every month. The energy meter installed in the residential buildings show the energy consumed by the household. Very often, devices which operate in standby mode consume a significant amount of power about which the end customer is unaware of. Many a times the domestic electricity bill shows excess amount which causes consumer dissatisfaction and complaints.

Internet of things (IoT) has opened up a plethora of applications in numerous fields such as medical and healthcare systems, smart home automation and environmental monitoring. IoT is expected to bring about large amount of change in the field of ubiquitous computing. IoT based energy management system can contribute a lot into conservation of energy.

This paper implements an energy monitoring system which displays the power consumed by individual or multiple devices. This can help a user to detect any errors in the electricity bill. A smart energy monitoring system can help a user to analyse the energy consumption data at device level and manage it rather than assuming it to be a fixed monthly expenditure. Also, it helps a user to replace the regular appliances by energy efficient ones.

II. PROPOSED WORK

This system consists of ARM LPC2148, GSM/GPRS, Current transformer, Power transformer, LCD Display, Relays Automatic meter reading system is divided in to five parts:-

A. Signal Sampling Unit (SSU)

B. Relay Control Unit (RCU)

C. ARM – Based Embedded System (AES)

D. Global System for Mobile Communication(GS M)

E. Utility Control Center (UCC)

A. Signal Sampling Unit (SSU)

It consists of

a.Current Transformer(CT)
b.Power Transformer(PT)

a. Current Transformer (CT):

A current transformer (CT) is utilized for measuring the alternating electric current. Current transformers contiguous with voltage transformers are recognize as instrument transformers. When current in a circuit is extra large to apply directly to measuring instruments, a current transformer generates a reduced current directly proportional to the current in the circuit, which can be kindly connected to measuring and recording instruments. A current transformer is separates the measuring instruments from what may be very high voltage in the monitored circuit. Applications of Current transformers are metering and protective relays in the electrical power industry

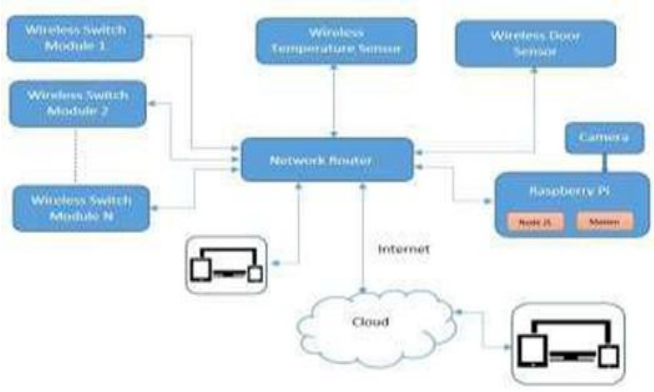


Fig 1. IoT Block Diagram

b. Power Transformer (PT):

Production of electrical power in low voltage level is highly cost effective. So electrical power is produced in low voltage level. But if the voltage level of a power is raised, the current of the power is reduced which causes reduction in ohmic losses in the system, Decrease in cross sectional area of the conductor that is decrease in main cost of the system and it also civilize the voltage regulation of the system. Because of these, low level power must be increased for efficient electrical power transmission. Step up transformer at the sending side of the power system network is used for efficient electrical power transmission. As this high voltage power may not be extended to the consumers directly, this must be decreased to the desired level at the receiving end with the help of step down transformer. These are the applications of electrical power transformer in the electrical power system.

B. Relay Control Unit (RCU):

It consists of relay and breaker. Relay Control Unit is used to disconnecting the electric power supply when the signal
from ARM embedded system because payable date is over. By using protective relay wired in series with breaker control circuit, electricity will resume automatically. This relay is controlled by ARM processor.

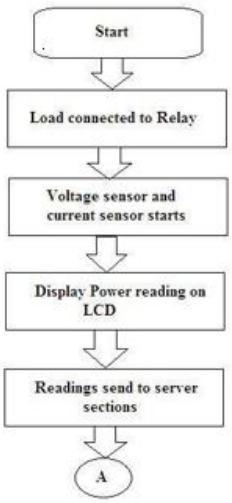
C. ARM based embedded system:

This system is used to calculate current, voltage and power. There are various microprocessor based digital power meters are available in market. These are bulky in size & havinglimited capabilities. ARM – based system occupies small space. It also supports most popular communication protocols. ARM based system is widely used in variety of network equipment such as mobile phone and PDA, and become popular and cheaper. It's also having on chip 10 bit ADC of successive approximation type. In this each analog input has a separate register to avoid interrupt handling & it is having global start command for both converter. D.

III. SYSTEM IMPLEMENTATION

The system is designed around an ARM LPC 2148 based board. The LPC 2148 have a on-chip timer, interrupt, UART and ports for interfacing energy meter. The code is written using standard C programming used for programming the ARM. The energy meter used provides output indicating the energy burnt. It provides readings in the form of voltage and current. These signals are given as input to the ARM based system which converts the signals into power. When power is calculated at ARM controller it sends to the server by using GPRS module. We used internet to sends data at server with power consumption and bill generation takes place at server. The user can be paid electricity bill by using android application.

A. Flowcharts:



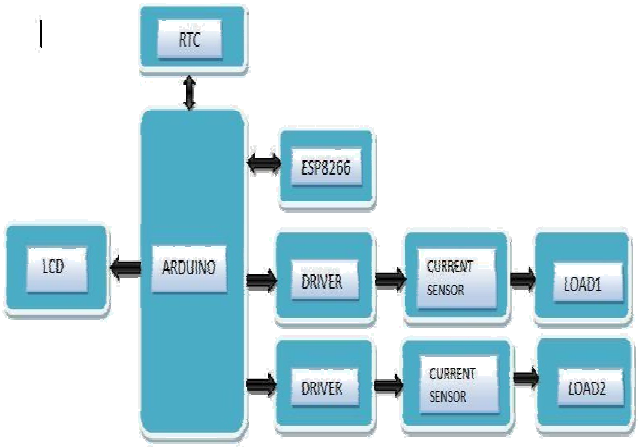


Fig 3. Energy monitoring system

B. Results:

Fig 2. Screenshot of home energy monitoring system
Fig. 4 Dashboard for controlling devices

C. App Results:

i. Remote control of household devices can also be done by the user. For controlling a device from webpage, ON/OFF interface was created as shown in Fig 3. Interface will indicate the status of device whether it is ON/OFF based upon the previous selection of the user i.e.,if previously user made the device ON by hitting "change status" tab,display shows 'ON'.

The power consumption details are sent to cloud with the help of WiFi module which will be then updated on the website.

Minimal power consumption is the main design aspect of any appliance. This paper presents the implementation of a portable energy meter which can monitor the power consumption at device level as well as for a residence. The energy device which is currently implemented assumes the voltage to be 230Vrms and subsequently computes the power consumed by means of current sensing only.

IV. CONCLUSION

The accretion of energy meter is done in a continuous manner as the technology grows. The usage of internet in this project makes preferable communication over existing one. The data is transmitted at standard internet speed. Thus any data can be transmitted at lowest cost, even the data may be a largest one which takes lot of time for transmission. The data can be transmitted frequently to the remote station as well, using GPRS. Since the transmission is done frequently the generation of bill is also done for each transmission of power data. This is also helps us to know the power requirements, meter failure and manage them. The unauthorized power consumption will be found out using this project. The human intervention is totally avoided. The bill generation can be checked at the moment of generation itself.

REFERENCES

[1] AH Shajahan, A Anand, "Data acquisition and control using Arduino- Android platform," Energy Efficient Technologies for Sustainability (ICEETS), pp. 241-244, April 2013.
[2] H.G.Rodney Tan, C.H.Lee, V.H.Mok, "Automatic Power Meter Reading System Using GSM Network," 2007 International Power
[3] https://www.arduino.cc/en/Main/Software
[4] https://www.eeweb.com/company-blog/allegro_microsystems/hall-effect-linear-current-sensor-ic
[5] http://esp8266.net/ [5]https://en.wikipedia.org/wiki/Real-time_clock