ISSN No:-2456-2165

Electrical Energy Monitoring and Home Automation Using IoT

A.Veerraju,Abdul Adil,Dr.Srinu Naik
Department of EE,Andhra University, Visakhapatnam,

Abstract:- This project deals with Energy measurement and monitoring based on internet of things (IOT). In IOT, we can connect the physical world to the internet. Physical world means,like machines and home appliances which are being used in our day to day life.These tools can be changed into smart things by giving it unique identity in the world. These appliances can be shareing data and communicate with oneanother through web. the appliances can be analyzed and controlledby it anytime and anywhere from the world.

The main objective in this project is to measure and control the electric power using IOT, Design and implementation of project is mainly based on NODEMCU using IOT concept. where power is sensed through the pzem module. The signal from this module is processed in nodemcu and communicated to the user's smart phone through Nodemcu.

I. INTRODUCTION

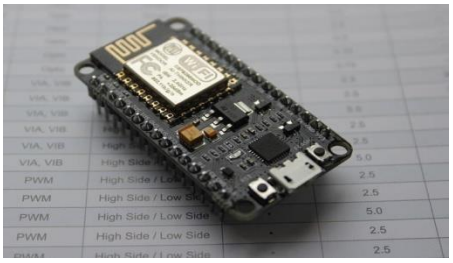
"Internet of Things" (IOT) was used first by Britisher Kevin Ashton in 1999 for describing a system in which the objects in the physical world can be controlled from the Internet by asing sensors. Ashton used the IoT to illustrate the power of connecting Radio-Frequency Identification(RFID) tags to the Internet in order to counting and tracking goods without the help of human involvement. Now a days,the Internet of Things is used a popular term for explaining scenarios in which Internet connectivity and computing capability is applicable to a variety of object, devices, sensors, and everyday items.Meanwhile the term "Internet of Things" is relatively new, the idea of linking computers and networks to monitor and controlling devices has been around for decades. By the late 1970s, for example, systems for monitoring meters on a electrical grid through telephone lines were already in commercial use. In the 1990s,advancement in wireless technology allowed "machine–to–machine" (M2M) enterprises and industrial solutions for equipment monitoring and operation for becoming widespread. However, outof these early M2M solutions many were based on closed purpose–built in networks and proprietary or industry–specific standards, rather than based on Internet Protocol (IP)–based networks and Internet standards. Using IP addresses to connect devices other than computers to the Internet was not a new idea**.** The first Internet "device"—an IP–enabled toaster that can be switched on and off through the Internet—was presentedin a Internet conference in1990.Over the next several years many ,other"things"wereIP–enabled,including a soda machine. From these beginnings, a robust field of research and development into "smart object networking" helped in creating the foundation for today's Internet of Things.

In this paper we monitor the electrical energy and control the home appliences ,by using nodemcu and pzem004t module where the pzem004t is used for measuring the voltage, current ,power, frequency ,power factor ,energy,and nodemcu is used for connecting this module to the firebase console over the wifi.

II. DISCRIPTION OF HARDWARE COMPONENTS

1.NODEMCU :

NodeMcu (ESP8266) is an open source firmware whichgives the flexibility for building the IoT based applications. NodeMcu has been obtaining its popularity because of its low cost and features enabled thhrough Wi-Fi. Apart from this it also provides the Nodejs, which require less time for computation for performing the task and using Lua script. Thus makes the device to operate much faster and also makes it as a one of the first choices for IoT applications.

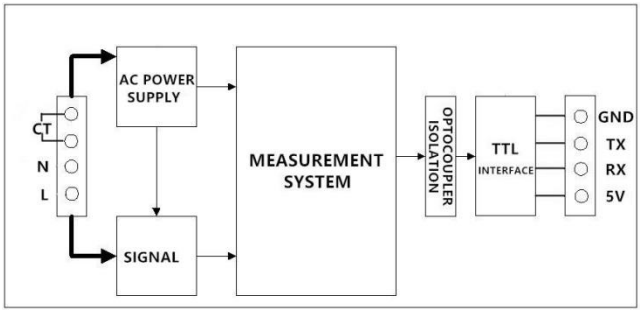


Nodemcu

2.PZEM-004T :

PZEM-004T is a energy meter of low-cost, it has a sensor for non invasive current transformer, a SD3004 energy measurement chip and microcontroller to measure the voltage, current, , power factor, active power and energy. It has a precision AC current transformer coil as a sensing part which has the output of 100A/100mA, The figure below shows the PZEM-004T module block diagram.

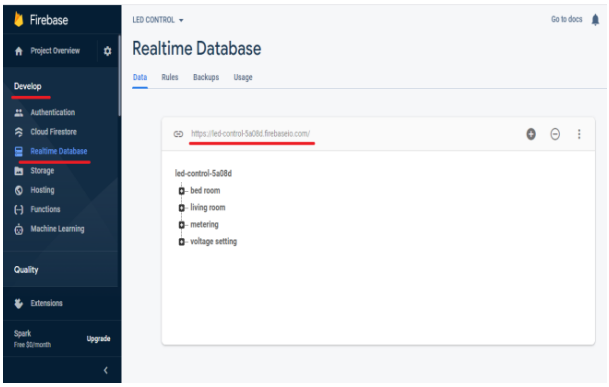
ISSN No:-2456-2165



Pzem_004t module block diagram

3.FIREBASE CONSOLE :

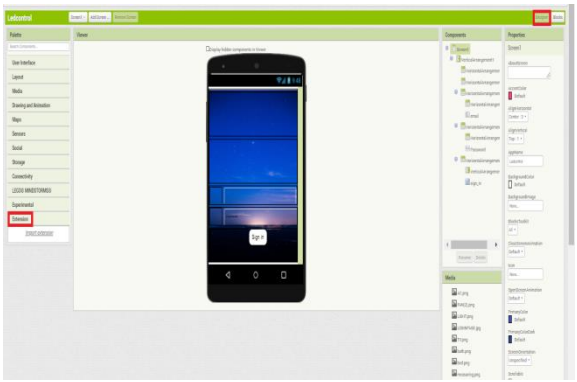
Firebase is a web and mobile based app developing platform which provides many services such as Realtime database, , Hosting,Storage and Authentication. Firebase Realtime database is a cloud-hosted SQL database whichallows users to store and synchroniseamong applications in real-time. In this system, Firebase Realtime database is utilised as a storage mechanism to store users' meter information like electricity usage. The figure below shows the firebase console interface.



Firebase console

4.MIT APP INVENTOR:

MIT App Inventor is also an open-source for app-building platformswhichlets users to drag-and-drop visual objects for creating an application which can run on the Android device as a mean for democratizing mobile app development. Application behavior will be provided by piecing blocks together in a visual blocksbased programming language and its interface is shown below.



MIT App Inventor Interface

III. DISCRIPTION OF SOFTWARE COMPONENTS

1.Embeded C:

The processor used in ESP8266 is used in association with embedded software, so embedded C programming is being used for implementing the outputs. Embedded C Programming language plays a important role in performing a specific task utilising a processor. In the energy monitoring circuit to calculate the energy used by the load embedded C programming code is used.

2. Arduino IDE:

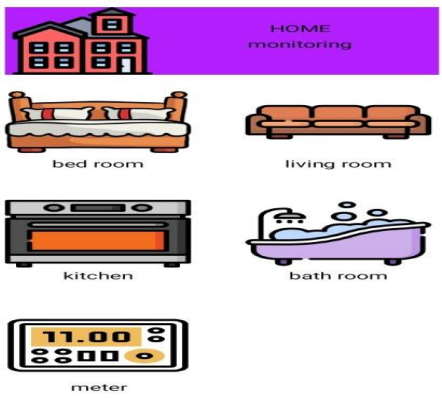
Arduino IDE is open source software .It is used to write and upload programs into the Arduino Compatible devices like ESP8266. The Arduino environment supports both C and C++ languages.

IV. WORKING

Single Phase AC 230V,50HZ supply rectified to 9V DC, which is act as inputs to relays and driver IC ULN8203.Driver ICULN8203 controls the load with the help of relays. Relays acts as switch, it will operates according to the signals received from Nodemcu. With the user interface command from mobile. The single phase supply is connected to the PZEM module, the output of the PZEM module is connected to the nodemcu using serial communication that is pin D5,D6,the maximum rating of the module is 100A,MIT app inventor is a third party application which acts as user interface between mobile and control equipment.

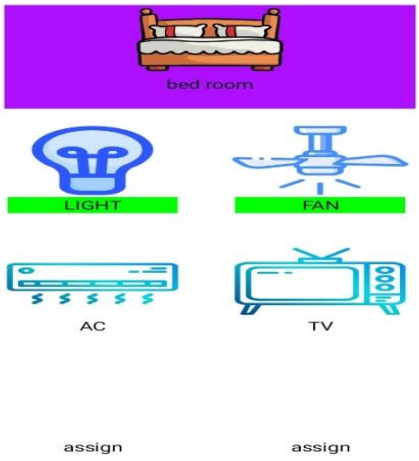
All the sensed and calculated values are send to application through Wi-Fi module i.e. Nodemcu.by using the mobile application we can monitor the energy, frequency, power factor, current, voltage and also we can set the limits to the voltage that is under voltage and over voltage, if the voltage is exceeds the over voltage or voltage below the under voltage then the supply is disconnected. we can also set the power alarm when the power is above the set value then there is a buzzer indication, we can control the appliances in home from anywhere in the world.

V. EXPERIMENTAL RESULTS

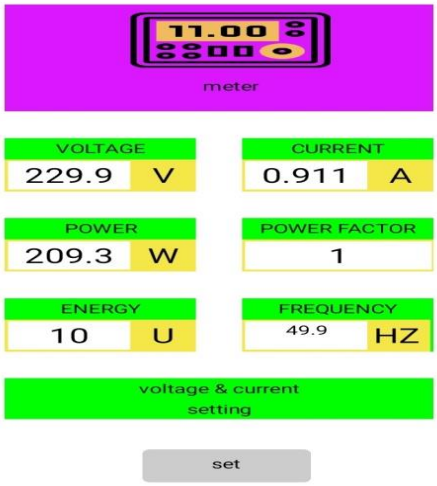


Home screen in app

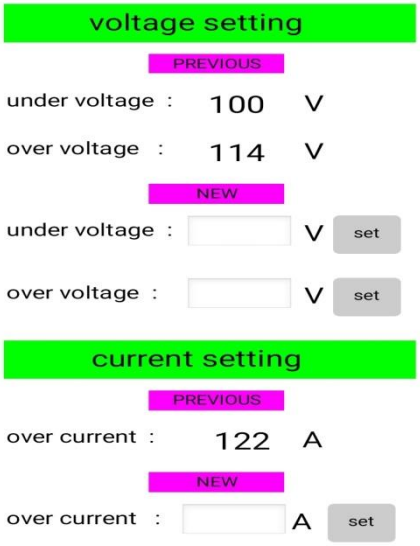
ISSN No:-2456-2165



Controlling the appliance



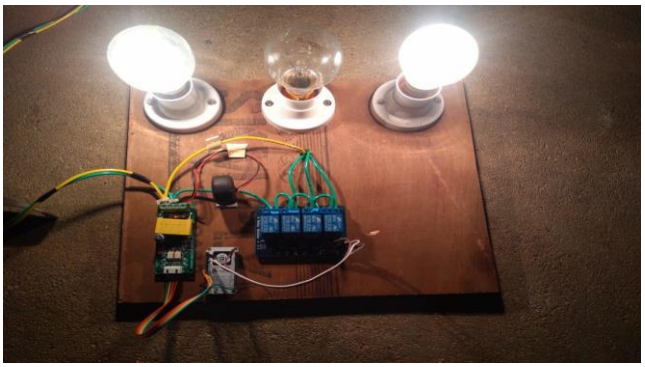
Meter readings



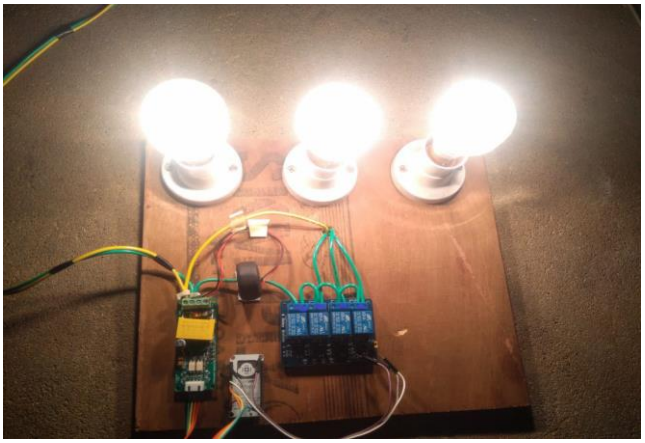
Setting voltage and current

VI. CONTROLLING LOADS

When Single Load is Acting



output when two loads are active



output when three loads are active

VII. CONCLUSION

This study is significant in outlining general information about IOT, such as definition, and status of IOT, which has become a hot IT topic nowadays, and in presenting applicable IoT models for building a smart energy meter as part of the future vision of power billing reflecting the new information paradigm of IOT. In this work we presented a Energy monitoring system which is abled to be monitore all over the world by using Internet. The model could be implemented by sensing the voltage and current with respect to the time of consumption. Finally, the implemented model proved that it is abled to control the appliances through the mobile.It will be Easy for

monitoringthe Voltage, , Power ,Current and Energy. It also provides continuous time monitoring. Because of continuous monitoring we are able reduce the wastage of energy. It can also be used widely in home appliances control, office and Industrial lighting loadcontrol.

REFERENCES

[1]. Design ofan IoT Energy Monitoring SystemKomkrit Chooruang; Kraison Meekul2018 16th International Conference on ICT and Knowledge Engineering (ICT&KE).
[2]. Energy Monitoring using IOT , Bandi Narasimha Rao;Reddy Sudheer2020 International Conference on Inventive Computation Technologies (ICICT).
[3]. Smart Energy Efficient Home Automation System Using IoT Satyendra K. Vishwakarma;PrashantUpadhyaya;BabitaKumari;Arun Kumar Mishra2019 4th International Conference on Internet of Things:smart Innovation and Usages(ioT-SIU).
[4]. Home Automation and Security System with Node MCU using Internet of Things K. Lova Raju;V. Chandrani;SK. Shahina Begum;M. Pravallika Devi2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN).
[5]. IoT Application Development Using MIT App Invento r to Collect and Analyze Sensor DataThilanka Munasinghe;Evan W. Patton;Oshani Seneviratne2019 IEEE International Conference on Big Data (Big Data)
[6]. Electricity Billing System using Ethereum and Firebas eKyawt May Hlaing;Dim En Nyaung2019 International Conference on Advanced Information Technologies (ICAIT)
[7]. JustIoT Internet of Things based on the Firebase real-time databaseWu-Jeng Li;Chiaming Yen;You-Sheng Lin;Shu-Chu Tung;ShihMiao Huang2018 IEEE International Conference on Smart Manufacturing, Industrial & Logistics Engineering (SMILE)
[8]. Anushri Aware , SonaliVaidya, PriyankaAshture, VarshaGaiwal , “Home automation using Android App and Cloud Network” International journal of Engineering Research and General Science volume 3,Issue3,May-June,2015.