SMART HOME ENERGY MANAGEMENT SYSTEM USING IOT

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Abstract
Smart home energy management systems (SHEMS) helps to manage electricity demand to optimize energy consumption and distributed renewable energy generation without compromising consumer's comfort. SHEMSs operate according to multiple criteria, including energy cost, weather conditions, load profiles, and consumer comfort. They play an increasingly ubiquitous role in energy efficiency through the reduction of electricity consumption within residential and commercial smart grids. This project presents a review of the SHEMS literature with reference to main concepts, configurations, [11]and enabling technologies. In doing so, it also provides a summary of SHEMS computing trends and popular communication technologies for demand response applications. The ensuring survey offers the reader with an overall overview of current and future trends in SHEMS solutions and technologies.
Keywords---Blynk App, Node MCU, real time monitoring and controlling.

1. Introduction

IOT is a term, which was first suggested by kelvin Ashton in 1990. IOT is a communication network where the objects are connected to each other or two larger systems. Smart home is a term that is widely used in order to define a living space with lighting, heating, air-conditioner, television, Computer, entertainment, audio-visual systems, and security and camera system that can communicate with each other. Our main objective is to reduce energy consumption with a proper operation planning by monitoring energy consumption of a house. The operating conditions of the electrical house can be monitored in real time via the android-based user interface. Sensors attached to embedded devices along with the low power wireless connectivity can facilitate to remotely monitor and control the devices. IOT also helps in transferring of data from sensors through wireless network, achieving recognition and informational exchanging open computing network. The operating parameters (current, voltage, power etc.,) of the electrical appliances used are continuously recorded in the closed system, in this way additional measures can be taken to reduce energy cost. The wi-fi is chosen the mode of communication in the prototype and the devices are controlled through Blynk app implemented using ESP8266.

A load controlled by computer systems has many advantages compared with manual controlled loads. Nowadays there are many programs and applications help to control things better using codes or python algorithms in artificial intelligence projects. In order to save energy and make loads monitored easily, this research suggests smart home project based on IoT technology. This smart home is an Internet of Things (IoT) project that controls load with internet connection via Wireless Fidelity WIFI connection. A smart phone connected to internet with Blynk application as a control panel, and Node MCU microcontroller kit in other side as a controller that receives control commands via WIFI signal. Node MCU kit is built with ESP8266 WIFI receiver that able to process and analyze WIFI signal to input the microcontroller. The WIFI receiver and microcontroller are built in one kit to be used as IoT Project. It's called Node MCU. To connect the system to the Internet, needs a Wi-Fi receiver. In my case I used ESP8266 that is connected as built-in in the Node MCU board that contains a firmware runs with the ESP8266. The firmware is a low-level control computer software. The Node MCU is coded via Arduino Integrated Development Environment (IDE) with the Universal Serial Bus port (USB) to tell the Node MCU what to do, I want to make the Node MCU controls four-channel relay kit by Blynk hand phone application.

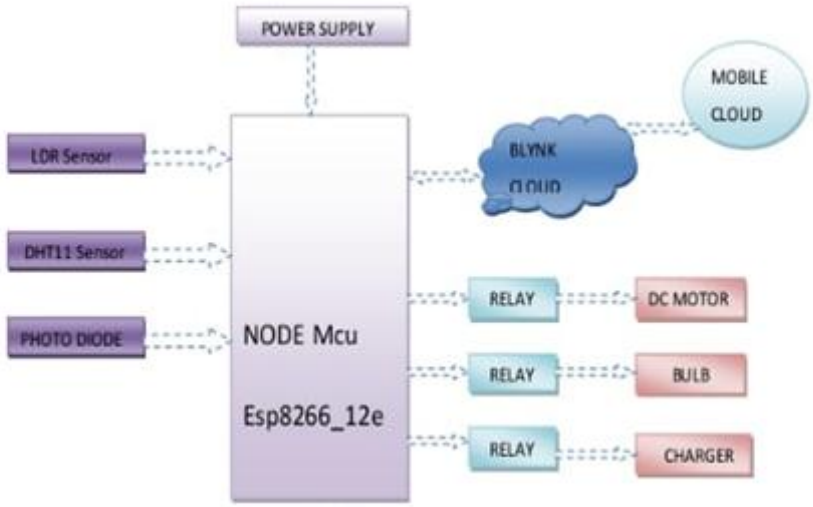

Fig 1: Block diagram of smart home energy meter using IOT's

IoT in recent years have become lifestyle of human being with great potential. Even it is focusing on different task that are requirement of human intelligence. In today's scenario IoT has opened doors to that cover up all requirements of human dealings in their daily life. Example like purchasing of goods, monitoring of resources and remotely control them from any corner of the world. Think about a world were personal refrigerator will provide you list of all your stuff required for upcoming few days base on your present utilization in it. Even envisage your fridge is interactive with home automation refers to remotely monitoring the conditions of home and performing the required actuation. Through home automation, household devices such as TV, light bulb, fan, etc. are assigned a unique address and are connected through a common home gateway. These can be remotely accessed and controlled from any PC, mobile or laptop. That can drastically decrease energy consumption and get better the living environment as well as enhancing the indoor safety. Along with the quick developments in technology, the devices in the recent past are becoming smarter.

The real-world appliances are being prepared with intellect and computing capability so that they can configure themselves accordingly. Sensors attached to embedded devices along with the low power wireless connectivity can facilitate to remotely monitor and control the devices. This forms an integral component of Internet of Things (IoT) network. IoT also helps in transferring of data from sensors through wireless network, achieving recognition and informational exchange in open computing network. Things that we are using in our daily life are becoming smart with the current technologies but it isn't sufficient until we connect them to act with the dynamic environment and in addition to make their own inter-network, that is, machine-to-machine communication. The Objects like electronics devices, software's, sensors, actuators, home appliances and vehicles are connected to a wireless network.

Statement of the problem

- Most conventional prepaid powers meters currently installed in households only display the total real time usage of its power and the amount of electricity available.
- There is no way to see what the days, weeks or months consumption was on these meters and often these power meters are placed in an inconvenient location which makes regular viewing somewhat difficult.
- These powers meters also lack the ability to monitor appliances individually; thus, hiding vital information about individual appliances.

Objective of the study

➢ The main objective of the use of smart home energy management system is to enable to the consumer to monitor and control the amount of energy consumed or to consume it in a more efficient way. For this,

the consumer should know how the energy is being used in his home which can only be computed when energy throughout the home is monitored. The main thing of SHEMS is to improve energy efficiency in homes and buildings.

- To design a smart Home Energy Management System that includes non-smart appliances into the energy efficient IoT space.
- To implement the proposed system under realistic test environments for possible use-case scenarios.
- To test the effectiveness of the proposed IoT-based solution at improving energy efficiency.

Review of Literature

Kumar Mandula discusses about the process of home automation using Bluetooth and Ethernet.When connectivity between Arduino and smart phone is established using Bluetooth, shortrange wireless connection is possible in an indoor environment. Ethernet module is used for connecting Arduino board from any part of the world.Mandula.k ,Parupalli.R , Murthy, c. A., Magesh, E., and Lunagariya, R., in the year 2015.

Bharat Bohora designed a system based on Blynk framework which controlled and monitored appliances via smart phone by using Wi-Fi as communication protocol and raspberry pi as private server. All the appliances and sensors are connected to the internet via Node MCU.Bohora , B., Maharajan, s., and Shreshta, B. R., in the year 2016.

Ming Wang in his paper discussed about his work on system that uses a smart central controller to set up a 433MH wireless sensor and actuator network (WSAN). A series of control modules, such as switch modules, radio frequency control modules, have been developed in the WSAN to control directly all kinds if home appliances. P. Siva Nagendra Reddy used android mobile to send commands to the Arduino board through Wi-Fi module and Arduino processed them to control all the home appliances. This system controlled the voltage levels of home appliances like fan, light etc. They got the status of their home appliances in their android mobile phone.Wang, M., Zhang, C., Zhang, J . and Li, C., in the year 2015 and Reddy, P.S. N., Reddy, K. T. K., Ramaiah, G. K., & Kishore, S. N. in the year 2016.

Muhammad Ihar Ramli, Mohd Helmy Abd Wahab, Nabihah developed a prototype electrical device control system using Web. They have developed a web-based controller, for controlling electrical devices. Whenever the condition of server is down, they also set they're with auto restart. The system does not use mobile technology. Being a web-based system; this application; this application is less effective since the use of headphones and Smart phones is increasing rapidly.Sharma, M. L., Kumar, S., &Mehta, N., in the year 2017 and Mulham B. Soudan, Homam M. Ai Rifai, Taha M. in the year 2018.

Research Methodology

Proposed project having two main sections. First section is the electric meter region, which continuously monitor the energy consumption. The second part of the project consist of a set of relays controlled by commands. Which are provided by making suitable changes in the system. The system follows a separate operation for each of the components that are attached to the relay. As we have explained in the previous section, the core of our project is NODE MCU board. Power is supplied to the relay and the current sensor. The electric meter, signal conditioning unit, rectifier, driver circuit are attached to the corresponding pins of the controller. A computer or smartphone can be used as a user interface to control and monitoring the appliances of home automation system.

The status of each system will be displayed on the mobile screen. The user can switch on and switch off appliances using the smartphone. The status of each power consumption terminal will be displayed in Blynk app on mobile.

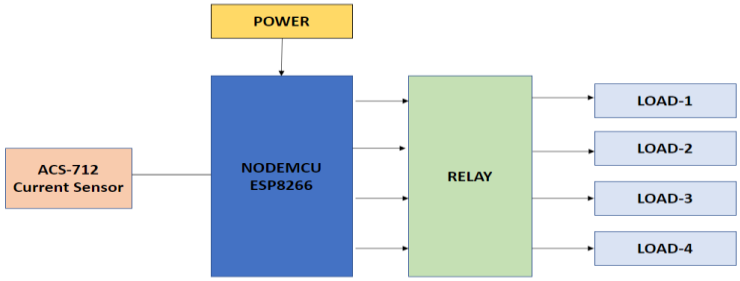

Fig 2: Block diagram of proposed system

The proposed system is a smart energy management system consisting of NODEMCU. The NODE microcontroller will vary the appearance usage that is propellor speed and light intensity. These amounts of current consumed by the appliances are captured. In existing system, we don't have any energy management system to monitor the energy meter and to control the appliances. Because of this the owner doesn't know how much power he/she is consuming and chances of power theft.

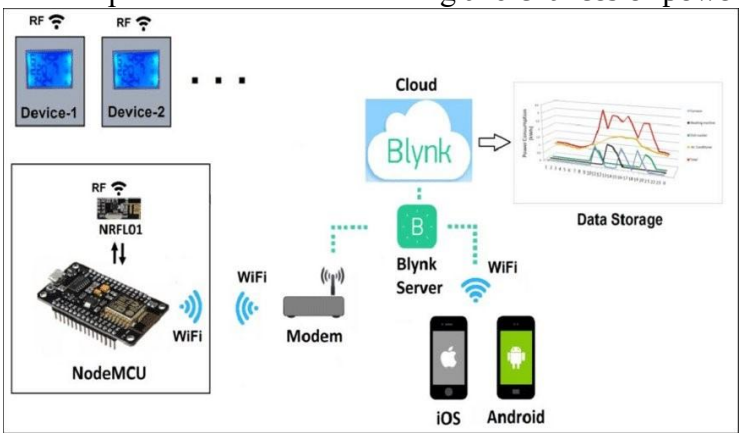

Fig 3: proposed structure

Blynk App

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things. Blynk is a platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5 mins.

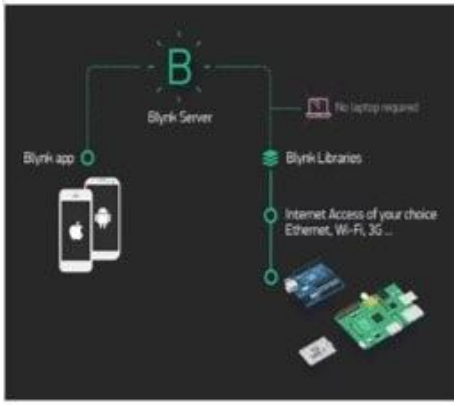

Fig 4: Blynk App Working System

Blynk server will check for internet connection, Node MCU with android hotspot, the Node MCU code includes the token code, the name of hotspot and its password. The information included to the code must be match with the hotspot information to allow ESP8266 connect with the WIFI to be as a channel

to exchange commands between smart phone and Node MCU. Remaining processes are just commands sent from Blynk application to Node MCU to control loads those are connected to the relay kit. And sensor output value is sent reverse to the Blynk application from Node MCU kit.

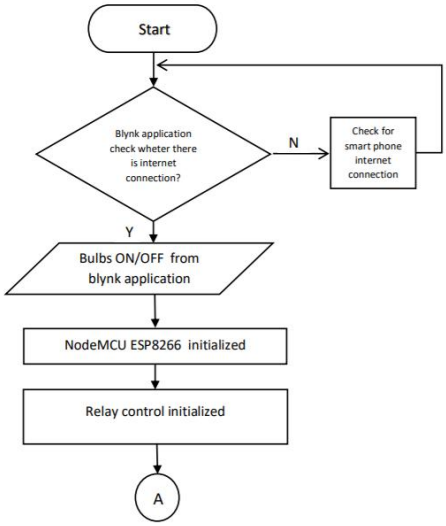

Fig 6: Flow chart of the system

Requirements	Ranges
4-Channel Relay	3.3Volts and 5Volt
Node MCU	0-3.3V
Current Sensor	Operating volt: 4.5 ~ 5.5V DC Measuring Current: -30 ~ +30 A
Bulb(use any load)	Maxwatt ranges

Result And Discussion

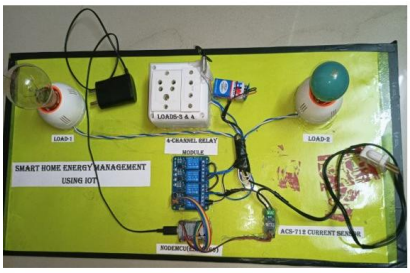

Fig 5(a): proposed proto type system **Fig 5(b): ON Condition of the system**

Output of the proposed system

OFF CONDITION

ON CONDITION

Conclusion

Based on the results, all the data obtained by a testing the smart home with the IOT based Node MCU, ESP8266 Module. The following conclusions can be obtained. Smart home with IOT based Node MCU ESP8266 module can be designed with various components hardware and software support so that it can be arranged into a smart home energy management system that is monitored and controlled with Blynk android applications. The smart home with this IOT based Node MCU ESP8266 module can be implemented to monitor and control the electronic home appliances.

This implementation provides an intelligent, comfortable and energy efficient home automation system. It is also assisting the old and differently abled persons are control the appliances in their home in a better and easier way.

References

[1]. Kumar Mandula discusses about the process of home automation using Bluetooth and Ethernet. When connectivity between Arduino and smart phone is established using Bluetooth, short range wireless communication is possible in an indoor environment. Ethernet module is used for connecting Arduino board from any part of the world.

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[5]. M L Sharma developed a system in which a home automation system was interfaced with Android mobile devices. The mobile device and system communicated with each other via Wi-Fi.

[6]. Somnath Singh in his paper discussed about designing a wed-based control of home appliances which allowed user to switch appliances on/off by clicking on a webpage specially designed to interact with those devices, by being anywhere in the world with a computer r a smart phone connected with Internet.

[7]. Miss Aboli Mane used Blynk app in her project of home management system and security. Different sensors were connected with Node MCU. With the help of Wi-Fi, Node MCU was connected with Blynk app. On detection of any unwanted incident by different sensors, messages were sent to Blynk app.

[8].N.Sriskanthan and Tan Karand in their have presented an application of Bluetooth Technology for Home Automation. The Bluetooth technology which arranged in late 1990's is used for implementing the wireless home automation system. Various appliances such as air conditioners, home theaters, cellular phones etc., are interconnected, thus creating a Personal Area Network in Home Environment. The communication between several client modules and the enhances communication between the host sever and the client modules. The wireless system aims at reducing the cost of Home Automation. But the system does not use the trending mobile technology.

[9]. A. Alker and U. Buhur have developed an internet based wireless home automation system for multifunctional devices. A flexible, low cost, wireless solution to the home automation is introduced. The transformation of the initial simple functionality control mechanism of devices to more complex devices has been discussed. The home appliances are connected through a server to a central node. The system is secured from unauthorized users by using SSL algorithm. During tests, the wireless communication was found to be limited to<100meters in a concrete building.

[10]. Muhammad Ihar Ramli, Mohd Helmy Abd Wahab, Nabihah developed a prototype electrical device control system using Web. They have developed a web-based controller, for controlling electrical devices. Whenever the condition of server is down, they also set they're with auto restart. The system does not use mobile technology. Being a web-based system; this application; this application is less effective since the use of headphones and Smart phones is increasing rapidly.