Smart Home System using Renewable Energy Source and Web of Things

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Abstract: Power plays an important role in our life as each and every devices are now being automated and this automated things requires electricity to perform their function. So to save electricity is main concern. As the electricity is generated from the fossil fuel which is non renewable sources which are depleting day by day and it also cause pollution which affects the society. The alternative to this is renewable sources which does not cause the pollution and it is one time investment ultimately it reduces the cost. Web of things plays an important role because each device is smart and it can be controlled as well as monitor through web. This paper describes how to save electricity by using renewable sources and monitoring the resources and also controlling the resources by using WOT. The different sensor are being used to control the on/off of the devices which will send the command to the controller i.e. raspberry pi by which the controlling action will be done. Controlling of the devices can be done through web page or through SMS from the mobile.

Keywords: Home automation, Renewable energy source, Web of things, smart home.

I. INTRODUCTION

Energy sources are mainly of two types renewable energy source and non renewable sources. The use of renewable energy source is very limited compared to non renewable sources to produce electricity. Non renewable sources are not eco friendly and also affects the human being while renewable sources is eco friendly and it is one time investment. Automated is the word which is being populated in day today life. Most of the devices or application works with less human interference. In automated world web of things plays an important role for controlling and monitoring the devices. The GSM module is also an important aspect which provides a security for the system and different sensors can be deployed. GSM system is best for long distance communication.

The main aim of this system is to control and monitor the devices by using the renewable energy sources so as to save the electricity. Solar panel is being used as sun is the best example of renewable energy sources. The various sensor are used so as to control the on/off of the devices. The web page will have its own IP address for login of the system which will show the device control page along with the power consumption of the devices. Using web of things the system can be monitor the sensor threshold value as well as power consumption and also it will control the on/off of devices through web page. The GSM module is also used so as to control the on/off of the devices by a single command is being send to the raspberry pi microcontroller so as to perform the controlling action. The advantage of the system is saving of the electricity, security is provided and the use of the available resources is properly utilized with less investment i.e. cost effective

II. LITERATURE REVIEW

S. c. Son et al. [1] proposed a lightweight time synchronization algorithm for CoAP-based home automation system networks. The option field and a header are used to include time-stamps in the home automation system. The scheme can thus be applied to the system with or without IP address.

F. Fezai et al. [2] proposed device collects the RF energy with six independent antennas and realizes the conversion and summation of the dc voltages. The main aim is to perform uniform coverage of a room with a gain superior to a single and omnidirectional antenna. The application can be energy harvesting or detection for the command unit in home automation.

J. E. Giral Sala, et al. [3] proposed the development of a firmware for a Smart Switch, which can control the on/off of the device by the use of internet through home. The Smart Switch is connected to internet via Wi-Fi, through a mobile, PC, tablet or any device to operate the internet. In order to perform this connection it is necessary to write the program to create an IP address into the Smart Switch in a web browser with the aim to load the Smart Switch server, write the data of the user's network into the configuration page.

M. Andries, O. Simonin and F. Charpillet, [4] the paper presents a detection, tracking, and recognition technique which uses objects' weight. It works continuously even when tracking individual persons becomes impossible. This technique processes the image of floor pressure by segmenting the blobs containing objects, tracking them, and recognizing their content by combinational and interference search mix together.

N. K. Suryadevara et al. [5] proposed the design and development of a smart monitoring and controlling system for household electrical appliances in real time. The system principally monitors parameters of household appliances such as voltage and current and power consumed is consumed.

Oliveira, L.M.L et al [6] proposed this system presents a power energy monitoring and actuating system and it is for home environments. This system include 6LoWPAN to connect to the Internet a smart object network which is based on two layer 2 technologies:
power line communication and IEEE 802.156.4. IPv4 to IPv6 transition mechanisms were added to provide connectivity to both IPv4 and IPv6 Internet end systems.

Shivraj, V.L. et al [7] the proposed system presents the suitability of an authentication scheme based on One Time Password (OTP) for IoT and a scalable, efficient and robust OTP scheme is proposed. The proposed scheme uses the lightweight Cryptography scheme and Lamport's OTP algorithm. The system proposed scheme can be implemented in real-time IoT networks and is the right candidate for two-factor authentication among devices, applications and their communications in IoT.

Hussain, S. et al [8] the system try to make life simple and easy to control the peripheral, where the installation can be done anywhere which protocol user i.e. Bluetooth, Wi-Fi etc. It also controls the peripheral using Web service (http) or Android application as a way of Internet of things. This system analyzes the data packet of different nodes in window as well as Linux terminal for detecting fault or error in any particular node. User can access and also peripheral can be control anywhere from the world via Internet.

S. Li, J. Li, X. Nie and L. Kon, [9] proposed the designed and implemented based on Android smart home control system. The ARM9 of embedded operating system is used as a server, and Android smartphones as a client. The Key Technologies like components resources provided by Android, Socket Communications, SQLite database, and so on, which are used to design intelligent home control terminal software, 2.4G wireless technology used to set home interior local area network, achieve the intelligent home control systems.

Zipperer et al. [11] proposed the state of the art in electricity management in smart homes, the various enabling technologies that which will accelerate the concept, and topics around consumer behaviour with respect to energy usage.

A. Zualkernan, [15] proposes a universal remote control based on AV device virtualization, called virtualization based universal remote control, to control AV devices V-URC dynamically generates user interfaces, which conform to the current state of devices; it also simplifies the operation of AV devices, but also eliminates the issues caused by LCM display and OSD-based AV devices.

III. METHODOLOGY

The following steps and methodology shall be adopted to complete the proposed work:

- Literature survey
- Selection of suitable controller unit
- Interfacing of Temperature Sensor, light sensor, ADC circuit.
- Interfacing of GSM to controller.
- Transferring all sensor values as well as current and voltage reading along with units on the web page.

Fig 1: Block Diagram of SMART Home System using Renewable Energy Source and Web of Things
The raspberry pi acts as a minicomputer which has its own memory. The raspberry pi microcontroller have digital input and the output will be in digital format. The above system design based on raspberry pi using ARM11 controller is used to control the on/off of the devices through web page as well as through SMS and some devices by threshold value, sensor used in this system such as LM35 sensor and LDR sensor this all the sensors analog output is interface to controller by using analog to digital convertor and signal conditioning circuit. The sensor which are connected to ADC firstly it check the threshold value if it exceed or goes below the threshold the required action will be performed whether to on/off the devices. The web page also plays an important role along with GSM module.

The GSM module is connected with the RS232 for TTL compatibility. The web page will display the overall power consumption in terms of voltage, current and how much power device has been consumed will be displayed on the web page in units. The web page will also display the temperature sensor value and also the LDR value. The few devices which is to be controlled by web page will have an icon on the web which will show which device is present and whether to on/off the device. And all the output of this sensor showed in PC through RS232 serial communication in Linux window. The GSM modem is interfaced to controller by using RS232 interface. GSM is used for transmit and receive message as per the action send whether to on the device or off the device. The GPRS module is used for track the exact location of the device.

Designed system required +5V power supply by using voltage regulator LM7805 is converted to +5V is regulated voltage. 5V power is required for operating the ARM controller. The current transformer along with voltage transformer because of energy meter which will display the current, voltage of the overall system. Optocoupler IC is being used for isolation purpose of the energy meter as the high voltage is provided to the energy meter but the device requirement is of very low voltage so it should not damage the device by providing high voltage. The GSM will send the command bulb on or off once the message is delivered it will perform the action. The web page will be opened with its IP address which will display the web page and it will display the value.

The web page is created using HTML having its own IP address. The system is designed in such a way that it can be controlled through the mobile by entering the IP address as well as through SMS. The system saves the electricity by using the controlling system as well as by using the web of things. The overall power consumption is in units as the system is refreshed it will display the new values in units The python language is being used for this system.

IV. RESULTS

The system is provided with the 230V of power supply and also the battery as a renewable source which is of 12V. The raspberry pi microcontroller requires 5V supply which is provided by the charger. The led, motor, fan, bulb is being used as a device which is to be turn on/off. The system is provided with temperature sensor which will have an threshold value once it goes above the threshold value the fan will be on. The LDR sensor is used to turn on and off the device which will also have the threshold value once it goes below threshold value the bulb will be on.

![Fig 2: LED_ON](image1)

The web page will have an IP address which will open that page once the bulb is on the power consumption of the devices will be displayed along with the temperature value as shown in fig.3.

![Fig 3: Output of The Sensor and Overall Power Consumption](image2)

The on off of the devices can also be done through GSM module as shown in fig 4. The web page will also control the on off of the motor and led through web page.

![Fig 4: SMS to Turn On and Off The Motor and Led](image3)
V. ADVANTAGE

There are certain advantages of the system they are as follows:

- The power required to the system is very less as the controller requires only 5V of the supply.
- It is the cost effective.
- Saves lot of energy.
- It is eco-friendly.

VI. CONCLUSION

In this project ARM11 is being used as a controlling device to monitor home appliances & to create a database on web page. Both energy sources renewable & non renewable energy sources is considered. In one sentence it is simple to install and easily scalable, that is system implementation is very easy and low power consuming and cost effective. This technique makes the effective use of renewable energy resources. Internet of Things (IoT) refers to the network of internet enabled physical objects which can communicate other internet-enabled devices and systems. So this energy management technology that makes it possible to data acquisition and control the action.

VII. REFERENCES


