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DESIGN OF ENERGY MANAGEMENT AND MONITORING SYSTEM USING IOT

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ABSTRACT

The Internet of Things (IoT) plays a crucial role in present-day energy management .The usage of electrical equipment like electric heaters, kettles, heating rods, etc. are prohibited in hostel rooms purely for security reasons but are still used secretly .Since cameras cannot be used to keep watch on such inactivity the use of such things can be controlled by developing a system which will not only aid energy monitoring but also give controlled access to the power and thereby ensuring security of hostels and boardings from fire hazard. The Internet of Things technology facilitates power networks to analyse collected data, monitor power consumption, and enhance the energy efficiency. This paper presents one step forward in implementing IoT for energy monitoring and management purpose. The main function of the developed system is collecting and storing voltage, current and power data and presenting them in a user-friendly way along with controlling power supply to connected load within prespecified limit. Also, the problem of high energy bills can be solved by monitoring power consumption of each equipment using developed system when power controlling operations are excluded.

Keywords: Internet Of Things, Energy Management, Monitoring System, Controlling Power, Sensors.

I. INTRODUCTION

The use of heating rods, electric iron, toaster, electric heater is prohibited in the hostel rooms for cooking food, heating water and other purposes for purely security reasons. A heat resistance to an electrical wire improperly can catch fire at any moment, especially if it is left unattended in a quince being not able to watch; the fire can spread throughout the entire building residents, and it can cause loss of life and property. Also, the hostel rooms are resting places for hundreds of students. Hence, use of these devices is restricted by stringent laws to ensure complete relaxation to all occupants. This law is probably applicable in all boarding schools in high schools, and even in large homes of workers around the world, not just in India. In some countries tenant university residences, each school year must sign a contract to implement fully. In spite of having all these laws existing, many of the things are secretly used and its use cannot be prevented by keeping watch through cameras as a protective measure. Since many of the devices used for heating operations draws a very high amount of power, their use can be easily sensed by monitoring power consumption across elements connected in electrical distribution board. Also, cameras cannot be used to keep watch on use of these prohibited things. Hence a system is needed that will not only monitor the power consumption across equipment but also control the power being supplied to each load connected in the system depending on the predetermined value. If power demand by a load connected is within the prespecified value, a normal operation will be carried out. If power consumed by a load connected in system exceeds the predetermined value then relay will get activated and power supply to that particular load will be automatically cut off. Many a times the problem of high energy bills is faced by consumers. Also, it becomes difficult to figure out root cause of high energy bills. This problem can be solved by monitoring energy consumption profiles of each equipment. The developed system can be used as energy monitoring system by withdrawing the relay operations.

II. METHODOLOGY

At the outset, the proposed IoT-based system gets the voltage and current data from voltage and current sensors respectively. These data can be envisaged through LCD display and Blynk mobile application. The estimated power is compared with a preset value on ground of the rating of the monitored device. If the calculated power exceeds the set limit, the respective relay is set on to operate to deactivate this device;

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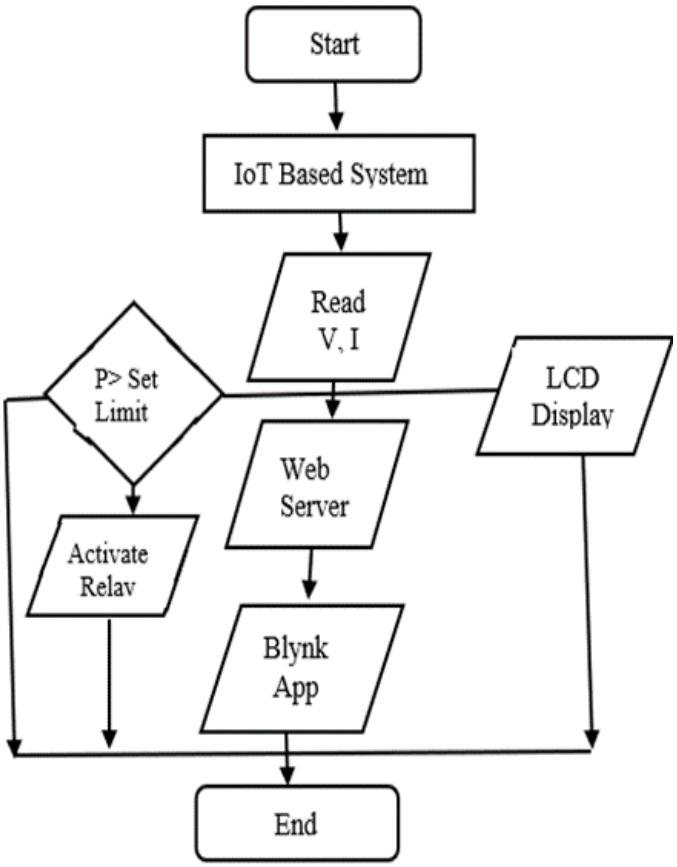
otherwise, the normal operating condition is maintained. The pseudocode of the proposed method is detailed below.

1. Begin
2. Input the IoT based system
3. Read the collected data V, I from sensors
4. Register internet aided web server and display data.
5. Register internet aided Blynk mobile application and display data
6. Display data in LCD module
7. If P is greater than set limit value, Then
8. Relay is activated
9. Else
10. Relay remains deactivated
11. End If
12. End



III. MODELING AND ANALYSIS

The design steps and working principles of the system is organized into two different units like Hardware unit and Software unit. Hardware unit includes micro-controller, power supply section, display section, sensor unit and relay. Software unit includes the compiler to build the assembly program used in micro controller. The power supplied to the whole equipment connected to the electrical distribution system are under the control of ESP-32 microcontroller. The current and voltage across the loads connected to the system are recorded by the current sensor and voltage sensor respectively. This current and voltage data goes to the microcontroller. The power consumption across each element connected in system is calculated in accordance with the values obtained from voltage and current sensor. If the power consumed by a load connected to the system exceeds the predetermined value, the relay gets activated and cut off the power being supplied to each equipment.

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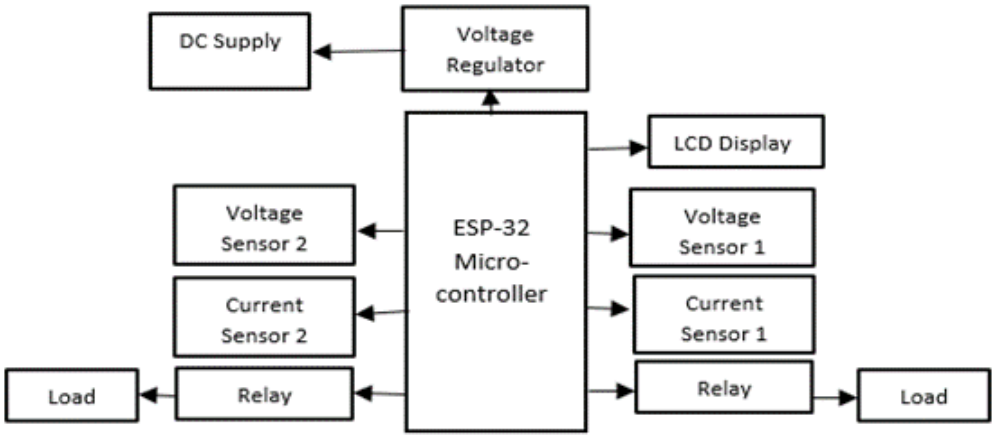


Figure 1: Block diagram of system

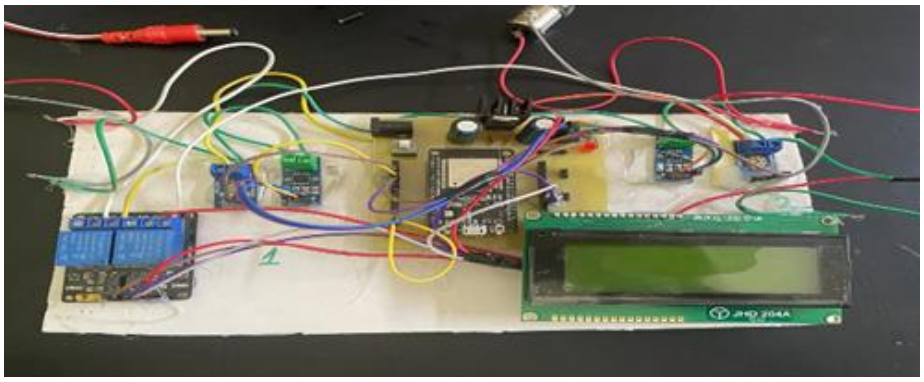


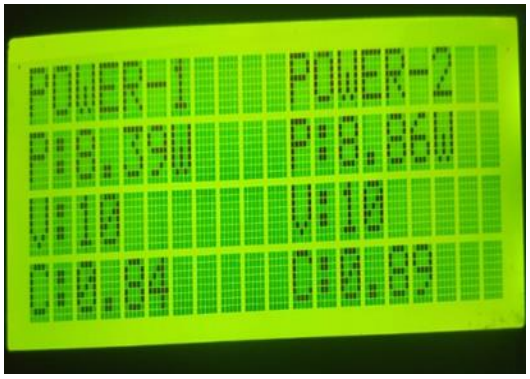
Figure 2: Hardware module of proposed system

IV. RESULTS AND DISCUSSION

The results of the proposed system can be visualized through LCD screen and Blynk mobile application displays as well. The obtained results are reckoned in two parts i.e. for before relay activation and after relay activation, as discussed below:

A] Results before relay activation:

The proposed model has been tested with loads including bulbs of different ratings. The purpose of the testing is to estimate the accuracy of the designed system. The selected loads were tested for some periods during which the voltage, current, and power consumption were recorded. The operating voltage for all of the loads was kept at12V.The measurement is displayed on the LCD as shown in first picture. Additionally, a user-friendly interface is facilated by Blynk application. In this regard, Blynk project accompanied by data screening (LCD) has been created. Data of voltage, current and power consumption is displayed as in second figure in Blynk application.



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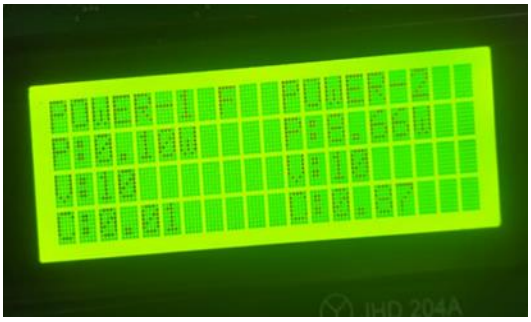
B] Results after relay activation :

Now, the load has been increased to test the main operating of the system. Due to increase in load the power exceeds the predefined limit which results in activation of relay and thereby device got disconnected. The then measure of voltage, current and power is displayed on LCD screen and in Blynk application as in figure.



V. CONCLUSION

As currently we are equipped with various electrical appliances, energy management of such devices has become essential. An IoT-based energy management system to monitor the performance of these appliances was developed in this study. The developed board can accurately monitor the current, voltage, and power consumption of several loads connected. Communication through Wi-Fi module has been presented where the measured data can be displayed on LCD and Blynk mobile application. The complete prototype was successfully developed and tested. The developed hardware based on IoT can monitor the usage of electricity and control the limit of power consumption. This feature enables users to monitor their appliances and promotes awareness on electricity consumption.

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