

Smart Home Energy Management System Based on Raspberry Pi Using Iot

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Abstract: *The design and development of a smart monitoring and controlling system for household electrical appliances in real time, IOT based raspberry pi home automation has been reported in this project. Increasing power consumption is becoming a huge problem. In this project, we propose an intelligent energy distribution system with a fixed power use of every home. This is designed in order to reduce the frequent power cut off. Moreover monitoring and controlling of home appliances is developed with the help of internet automatically. The main aim is to provide low cost and flexible operation. The goal is to develop a newly equipped well designed prototype for consumers in home to limit the usage of power. This helps users and power distribution centre to manage the power in an efficient manner, practically applied in home with the help of Raspberry Pi. Internet provides the data effectively, in order to manage the power by controlling the home appliances.*

Keywords: *Raspberry pi, energy meter, wireless sensor network*

I. Introduction

Home Automation is becoming an inevitable thing in our fast developing environment and current life style. New trends in lifestyle have enhanced the installation of automated home appliances in many places. Home automation not only refers to the automation of appliances in a house but also the automation of things that we use in our daily life such as cars, telephones etc. Every product or quantity we consume in our day-to-day life is measured using some measuring devices called as meters like tachometer used for measuring speed of electric motors or generators, voltmeters used for measuring voltage, ammeters used for measuring current and so on. Similarly, electric power we consume in our daily life is measured using electricity consumption meters for calculating the electricity charges. These electricity consumption meters are generally called as energy meters. There are different types of energy meters such as prepaid energy meters, induction type energy meters, analog or digital electric energy meters, three phase or single phase energy meters, electromechanical energy meters, microcontroller based wireless energy meters, smart energy meters and so on. An electricity meter or energy meter is a device that measures the amount of electric consumed by a residence, business or an electrically powered device. But sometimes the limited functionality of these meters restricts their area of application; especially in inaccessible positions or in the area.

II. Literature Survey

Automation of appliances was firstly introduced in offices for ease of use and also for reduction in time and cost consumption. Nowadays, home automation systems are available in a number of varieties. A few have been discussed here.

- Java-Based Home Automation System.
- Home Automation using GSM.
- Zigbee based Home automation.
- SMS based Home automation

Even if many varieties of home automation systems are available, current system has got a number of limitations. Currently home automation systems are implemented with a large amount of hardware. The installation and maintenance of the current system is a difficult task. It also imposes a huge installation cost on the user or consumer. Current home automation systems are inefficient in security. They are also very poor in bandwidth utilization. They may either leave a large amount of bandwidth or it will be very less. In case of Zigbee the bandwidth is too low and in case of GSM it is too high. The java based home automation is very poor in security as the uses web pages to access and control the appliances. SMS based and GSM based home automation is costly for the consumer as it becomes expensive to communicate via SMS. The varieties of home automation system improve the quality of the resident's life by facilitating a flexible, comfortable, healthy safe environment.

III. System Block Diagram

The block diagram of the project shown in Figures below consists of different types of sensing units to perform the monitoring of temperature, motion detection, intensity of light and gas leakage. As the Raspberry Pi takes only the digital data we are using the PIC16F73 to which the sensors are connected.

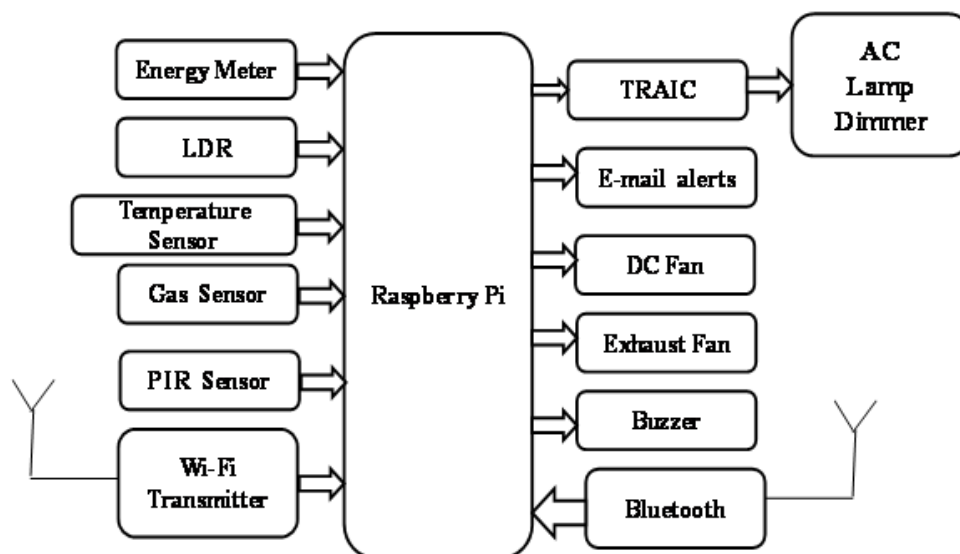


Fig.1 block diagram

Raspberry Pi has been chosen as the processing unit for the system because of its user friendly features and economical benefits. Further, python coded algorithm has been fed into the raspberry Pi and is connected to the internet through Modulator-Demodulator(MODEM) interface to access and send e-mails to the consumer. The Devices to be controlled have been interfaced with raspberry Pi using TRIAC due to different power ratings of devices and raspberry Pi. A display (optional) may also be connected to view the instantaneous status and processing of raspberry Pi. PIC16F73 has been chosen for analog to digital conversion. And also for protecting the Raspberry pi from dimmer circuit board. Here we are using dimmer module for dimming the light and it consists of opto-coupler, TRIAC, DIAC, and zenor diode. Energy meter is a device that measures the amount of electric energy consumed by residence power, commercial or industrial electrically powered devices. Basic unit of power in watts is 1000W. this meter measure the instant voltage on current calculate its product and gives power. PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses.

An LDR is made of a high-resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance. The LM35 series are precision integrated-circuit 2temperature sensors, with an output voltage linearly proportional to the Centigrade temperature. Thus the LM35 has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The MQ6 is a simple-to-use liquefied petroleum gas (LPG) sensor. It can be used in gas leakage detecting equipment in consumer and industry applications, this sensor is suitable for detecting LPG, iso-butane, propane, LNG. Avoid the noise of alcohol, cooking fumes and cigarette smoke. The sensitivity can be adjusted by the potentiometer.

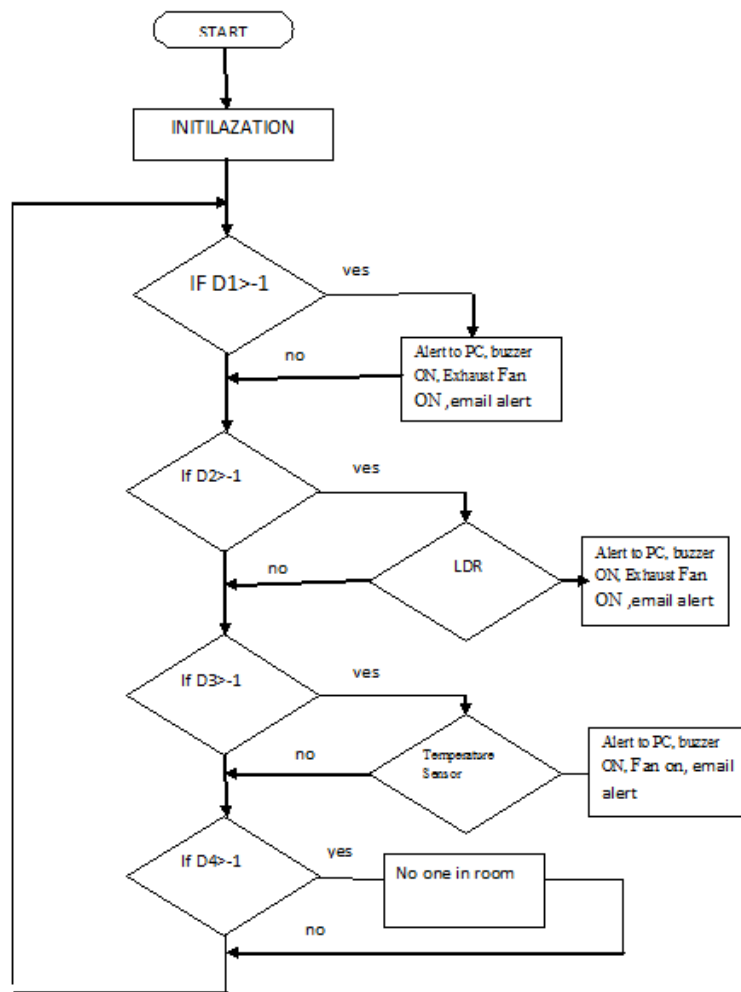


Fig.2 Flow chart

IV. Results and Discussions

Experimental set up of hardware kit is shown in figure 3



Fig.3 experimental setup

When we connect the power cable to the socket then automatically raspberry pi will boot by itself. When raspberry pi is booting then buzzer, DC fan and AC lamp will ON to show indication.

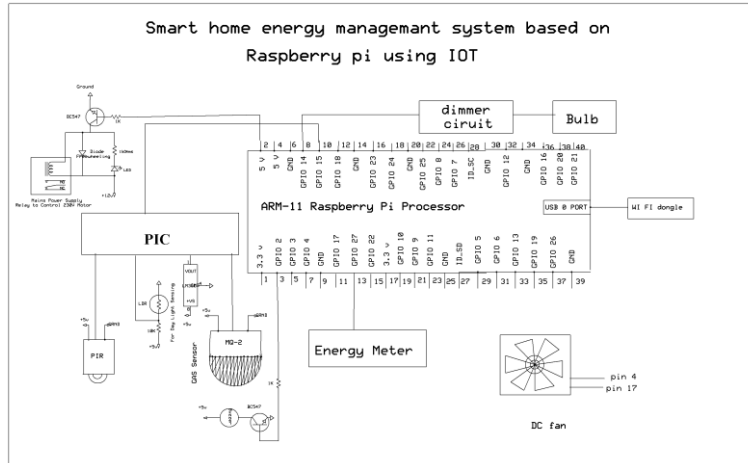


Fig.4 Circuit diagram

When person is detected, PIR will send information to PIC then to LDR. LDR will detect the presence of light and that output is given to the Raspberry pi. Then raspberry pi give to dimmer circuit then TRIAC will ON light. At the same time email will send as shown in figure 5. When person is detected, temperature sensor will sense the temperature and given to the PIC. PIC output is given to the raspberry pi as input. Now raspberry pi output to driver 1(transistor board) then driver will switch ON the DC fan and send email as shown in figure 6. When Gas sensor detect the gas then it will send to PIC. From PIC information is given to raspberry pi. Raspberry pi will give to the driver 2 then that driver will ON the exhausted FAN and Email will send as shown in figure 7.

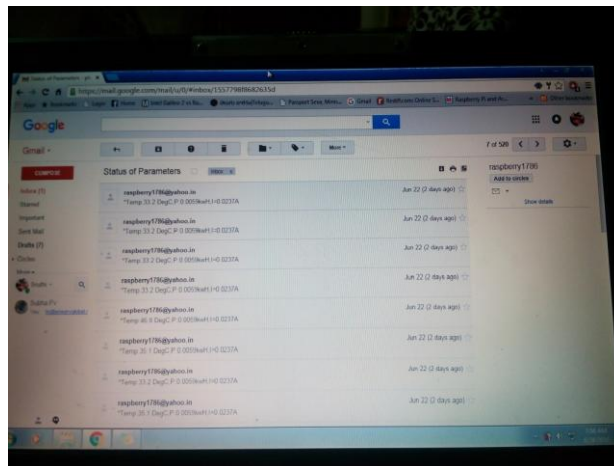


Fig.5 email alert for status of parameters

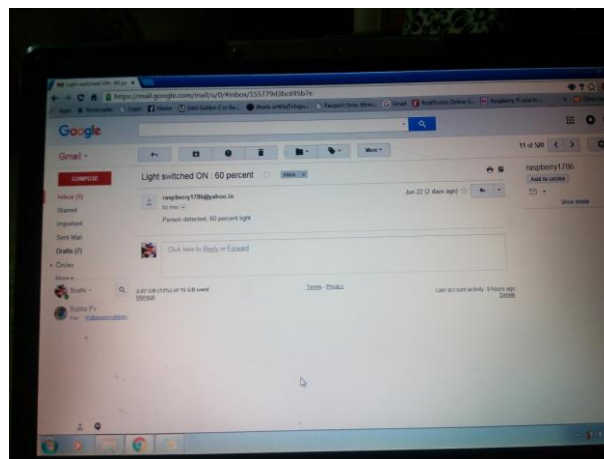


Fig.6 email alert for 60% of light

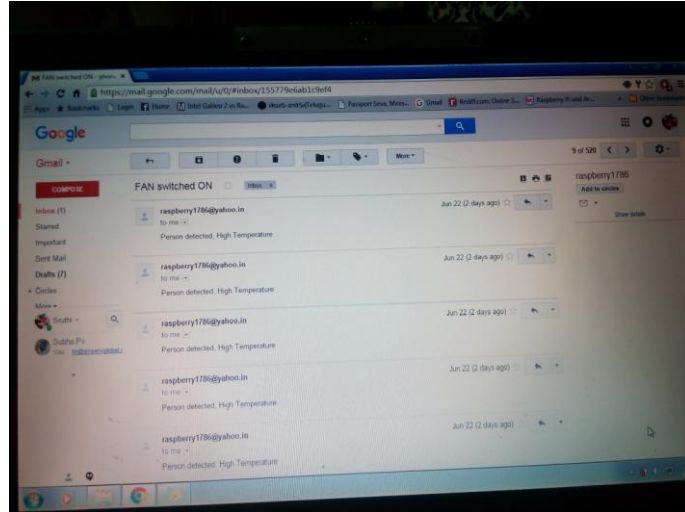


Fig.7 email alert for temperature

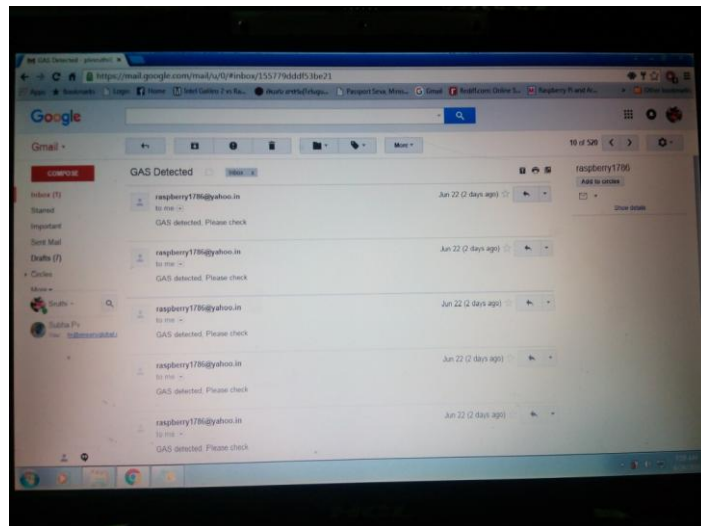


Fig.8 email alert for gas detected

All the above actions are monitored on phone through wireless node, Bluetooth is the wireless protocol used here as shown in figure 9.

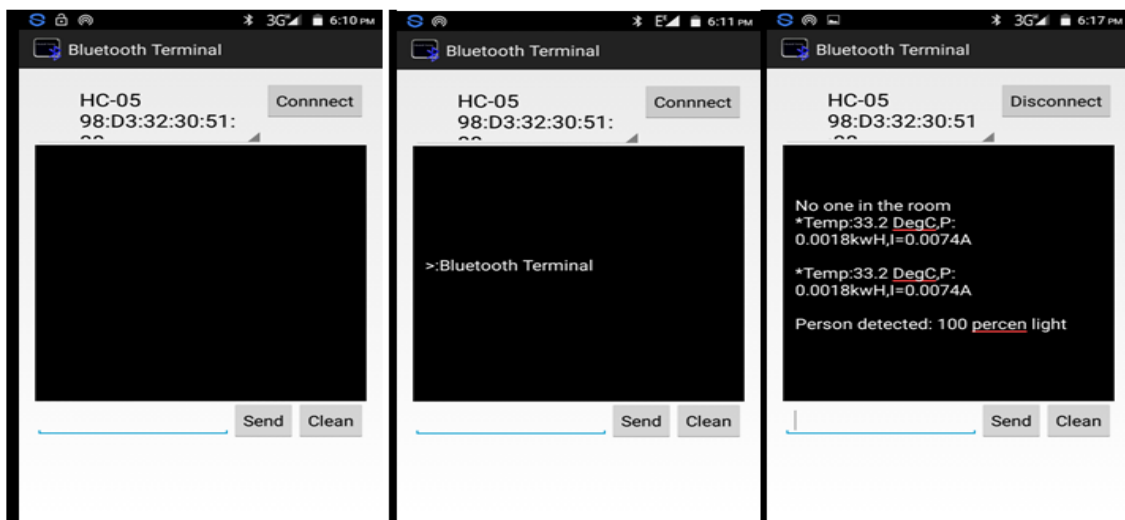


Fig.9 display on phone

V. Conclusion

A smart power monitoring and control system has been designed and developed toward the implementation of an intelligent building. The developed system effectively monitors the electrical appliance usages at an elderly home. Thus, the real-time monitoring of the electrical appliances status can be viewed through wireless devices. The system can be extended for monitoring the whole intelligent building. Aim to determine the areas of daily peak hours of electricity usage levels and come with a solution by which we can lower the consumption and enhance better utilization of already limited resources during peak hours. The sensor networks are programmed with various user interfaces suitable for users of varying ability and for expert users such that the system can be maintained easily and interacted with very simply. This study also aims to assess consumer's response toward perceptions of smart grid technologies, their advantages and disadvantages, possible concerns, and overall perceived utility. In future, the system will be integrated with co-systems like smart home inhabitant behavior recognitions systems to determine the wellness of the inhabitant in terms of energy consumption.

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