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Electricity Saving using Smart Home Monitoring

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Abstract: ***There is a lot of electricity loss caused when we accidentally keep the lights, fans, AC or any other daily appliance of our home ON. This is a common scenario and leads to a massive electricity loss of a whole city is considered for example. So, what my project does it that the Walabotsensor continuously monitors the room for any human presence it, and when it senses no human presence in the room, it sends this data to the raspberry pi which is connected to my mobile app through the internet. Now the pi will send this information to the app which will then give a notification on the user's phone stating that which appliances are on.***

Keywords: Smart Home Monitoring, Electricity Saving, Embedded System, Mobile.

1. Introduction

This smart home monitor is a system designed using a Raspberry pi and a Walabot Sensor, which constantly monitors the room for some human presence, and sends a notification to the android app whenever it doesn't detect any human presence in the room. The Raspberry Pi is the brain of the whole system, which fetches the sensor data, sends it to the android app and performs the operations triggered by the app buttons, which would be for turning off the devices, that are currently turned on in the room, which are also visible on the app. The data will be sent and received by the Raspberry Pi via internet, and so will be the real time status of all the appliances at our house.

2. Objective

- The first objective is to develop a smart home monitoring system which can detect human presence in real time.
- The second objective is that the device should also provide real time status of all the appliances in the room, which can be obtained by using a current rating sensor.
- The third objective is that all this data should be available in a graphical interface in the android app, along with control buttons for controlling the switching of appliances at our home remotely.

3. System in Detail

3.1 Hardware Requirements and Functioning

3.1.1 A Portable Computing Unit

The system requires a central processing unit, which would be compatible with the walabot sensor, and process the data obtained. For this project, we have used the Raspberry Pi, which is one of the most popular low cost pocket sized computer. It usually runs on the Raspbian OS out of the box, if purchased along with the SD card. Moreover, the Walabot SDK is supported by Pi, making the compatibility a lot more feasible.

Figure 1: Raspberry Pi

Now, the Walabot is connected to the Pi via a micro USB cable, and the Pi is connected to the internet, which allows it to send the Sensor output data to the app, and receive the app commands.

3.1.2 Walabot Sensor (Sensor of Human Presence detection)

Walabot is a 3D imaging sensor which composes of 15 high accuracy radio frequency antennas for in wall imaging and micro movement detections. So, this sensor can detect any movement which happens within its range of operation, which is almost 8 meters (obtained by experimenting), which is more than enough for a small room.

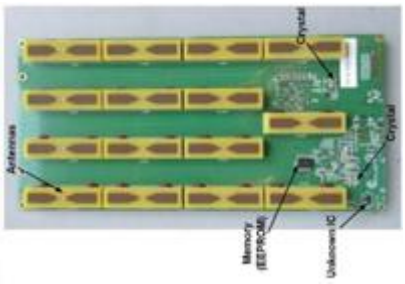

Figure 2: Walabot Sensor

3.1.3 The Current Sensor

This sensor is used for obtaining the real time status of all the home appliances connected to this smart monitoring system. It basically calculates the load current on a particular appliance, which would be non-zero if the appliance was on.

Figure 3: Current Sensor

3.1.4 Relay Module

It is an electrical gadget normally fusing an electromagnet, whose initiation is by an electrical signal in one circuit to open or close another circuit.It is used when a low power signal can be used to control a circuit.it is used where only one signal can be used to control a lot of circuits.

Figure 4: A 8 channel Relay Module

It will be used to control the switching the appliances off, which is done by providing it with a digital high DC signal from the Pi to its control pin.

3.2 Software Requirements

3.2.1An Operating System for the Portable Computer

The Raspberry pi requires an OS to run and perform the required task of obtaining the sensor data. So, we use the Raspbian as our Pi operating system, and use Python Language to control the Relay modules, current sensors and to fetch the Walabot Sensor Data.

3.2.2Android OS

Android is an operating system used in mobile devices. We use this platform to develop the app for our project, which will be used for monitoring and controlling the system.

4. Working of the System

The system setup is shown in the diagram below.

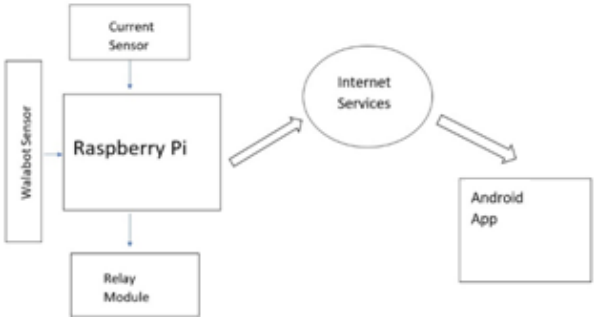

Figure 5: Block Diagram of the System

This is the Block diagram of the system, which explains how the system data flows, that is the input and output data. The actual system setup will look like the following image shown below:

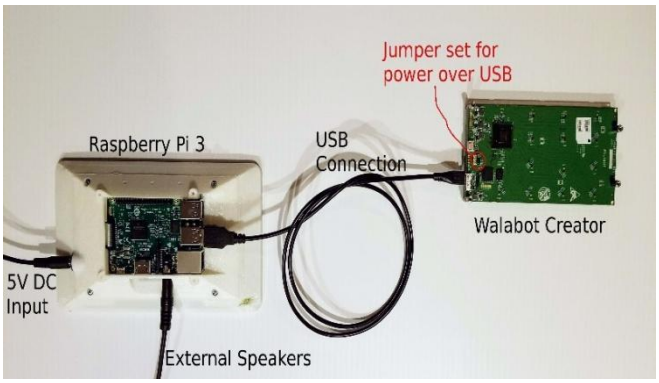

Figure 6: Actual Setup of the system (GPIO connections excluded)

Now, we just have to connect the current sensors and the relay module to the GPIO pins of the Raspberry Pi, and our system is ready.

Now, the step by step working of the system is explained below:

1) After the system is given power, the program runs automatically and the walabot sensor readings are first fetched by the Pi in real time.
2) When the system detects that there is no human presence in the room, it sends this data to the app via internet, which generates a notification for the user.
3) Now, in the app's interface, the user can view the status of the appliances, which is provided by the Pi using the current sensor data.
4) Now, the user can act to this information by turning off the devices, which are currently in on condition in that room, hereby saving a considerable amount of electricity.

The app interface example for the following is shown below:

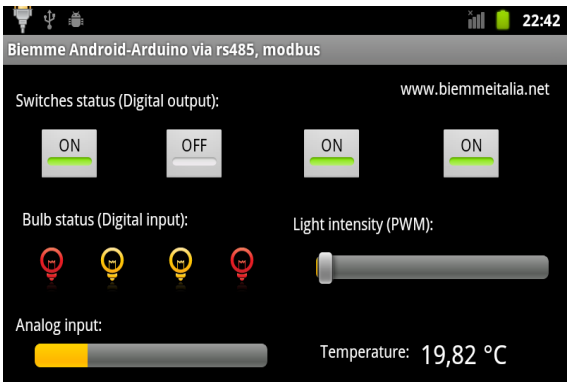

Figure 7: Android App Interface

The temperature feature can be simply added by using a DHT11 sensor with the Raspberry Pi. This is one option for app development, that is creating the app from scratch using a software like android studio.

Another option is using Blynk, which allows you to communicate with your Pi without any coding! It provides

an interactive and easy to use interface. This is an android app currently available on the Google Play Store.

The next figure shows a sample android app for smart homes, created using Blynk.

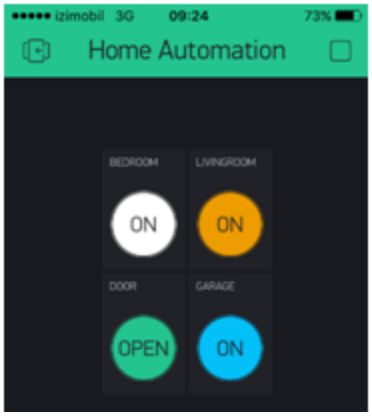

Figure 8: Blynk app Interface

So, this is all about the android app development for this system.

5. Conclusion

After researching extensively on this kind of systems, I could conclude that these systems have a great impact in the overall electricity consumption, and it has the potential to save an extensive amount of electricity, which can be utilized in the remote areas of the country, where still there is no electricity available.

When implemented on a large scale, this system would have a great impact on the electricity usage of a country as a whole, which would lead to various applications and developments in the future.

References

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[2] Walabot information –
[3] www.walabot.com
[4] Figure 6 courtesy: https://www.hackster.io/user5016473805/drone-race-practice-companion-7c368a
[5] Figure 7 courtesy: http://www.biemmeitalia.net/blog/android-project-smart-home-automation/
[6] Figure 8 courtesy: https://community.blynk.cc/t/home-automation-example/11657

Author Profile

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