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Home Automation Using IBM Watson Platform With Intrusion Detection

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Abstract— IOT is a giant network of connected devices which aims at establishing a relationship between people-people, people –things and things-things. Research and advisory firm Gartner says that by 2020 there will be about 26 billion connected devices. IOT is most recent technology based on wireless system and this technology will drive the future. This paper focuses on monitoring our homes by controlling its devices remotely over the internet using a Raspberry pi with IBM Watson platform. We demonstrate the feasibility and effectiveness of home automation by connecting raspberry pi to the IOT platform which gives us the status of the two devices one being a Lamp and the other a PIR motion sensor. This project helps to promote the security, energy efficiency and the comfort of the home owners.

Keywords— Internet of Things (IoT), Raspberry Pi, PIR Motion Sensor, IBM Bluemix

I. INTRODUCTION

The Internet of Things (IoT) is the network of physical objects or "things" embedded with electronics, software, sensors, and network connectivity, which enables these objects to collect and exchange data [1]. In home automation smart devices and sensors that sense the physical experience and convert into stream of information data. The major element of home automation based on IoT is sensor network and raspberry pi. Sensor networks are used for sensing and monitoring while raspberry pi collects the data monitor the data and depending on collected data manages the device like fan, light, door motion and opening-closing of curtains. Suppose the ambient light is less and that I am going to feel darkness then according to ambient light it will automatically open the curtains.

Home automation refers to the application of computer and information technology for control of home appliances and domestic features. Its application varies from simple remote control of lighting to complex computer/micro-controller based networks involving varying degrees of intelligence and automation. Home automation results in convenience, energy efficiency, and safety benefits leading to improved quality of life [2]. The popularity of network enabled home automation has been increasing greatly in recent years due to simplicity and much higher affordability. Moreover, with the rapid expansion of the Internet, there is the potential for the remote control and monitoring of such network enabled appliances. However, the new and exciting opportunities to increase the connectivity of devices within the home for the purpose of home automation through internet are yet to be explored. Several definitions are available in the literature for home Automation [3].

In the present times there is an increasing need for Home security due to thefts and threats. And the benefits of automation are obvious. It is like a home where the lights came on after dusk, doors open for the home owner etc. There is also a need for surveillance in today's world, as well as energy management.

Nowadays the increase in various computing devices such as laptop, computers, mobiles etc. shows that users prefer things which are more comfortable to use i.e. rather than physically going to the place and controlling it doing the same thing remotely saves time. For example, if the Admin receives a message saying that there was a break in his house, he/she can connect to the internet and watch the video from the camera which is in the house to know what is happening. By receiving alerts on your device, users are informed of all possible issues occurring in the house and it gives them various possibilities to deal with the problems. This is how an automated system proves useful to people in providing them security, comfort and easily accessible.
The major elements of Home Automation based on Internet of Things (IoT).
1) Sensor network:
Sensor network are used for sensing and monitoring.
2) Raspberry pi:
Raspberry pi collects the data, monitors the data and depends on the collected date manages the devices like fan, light, door motion and opening closing of curtains.

II. RELATED WORK

A) Home Automation Using GSM [4]
This system presents a novel, stand alone, low-cost and flexible GSM- ZigBee based home automation system. The entire system depends on 8 bit to a ZigBee Transceiver and it communicates with each and every node present inside our home. The GSM Controller facilitate for the data follow between user and microcontroller. The GSM Controller uses mobile microcontroller named PIC (Peripheral Interface Controller) in this work. The Database equipment built around this Microcontroller and a GSM controller facilitate the heart of the system. This device is connected phone technology to communicate. From the mobile phone, command can be send via SMS to the Controller, which in turn interprets the command and then activates the required switch to control the electrical item. As long as there is GSM mobile phone signal coverage, it is possible to control all electrical items from anywhere in the world. The system is easy to operate, and is secure in that only pre-determined mobile numbers can operate the GSM Controller. The installation of the GSM Controller is relatively simple and can be adapted for any existing home system. Control of lights and geyser is done via the electrical distribution board (circuit breakers). Block diagram of system is as follows:

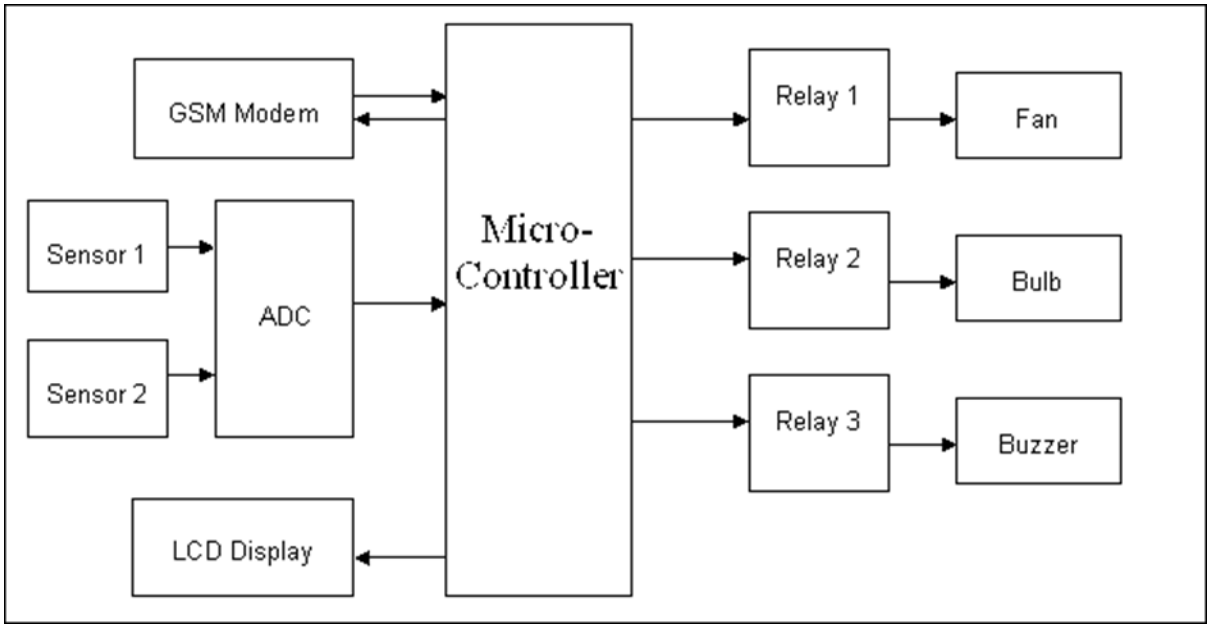


Fig. 1 Block diagram of home automation using GSM

B) Bluetooth Communication using a Touch Screen Interface with the Raspberry Pi [5]*:*
This paper brings a low cost stand-alone device which transmits data using the Raspberry Pi with Bluetooth and has a resistive touch screen display providing a user interface. The Raspberry Pi is a low cost, single-board computer which is controlled by a modified version of Debian Linux optimized for the ARM architecture. The display contains a graphical user interface which provides various fields for data entry via an onscreen keyboard. The display is connected to the Raspberry pi via HDMI. Background fields for displaying and entering the data has been implemented using html. Button press animations and buttons for navigating between different pages

of the GUI have been implemented using JavaScript. The user enters the data at the client end in the GUI. The acknowledgement received from the server end is displayed in the GUI. If the data received at the server end matches with the sent data, the values are displayed. Cyclic Redundancy Check for achieving data integrity during the transmission.

C) Java Based Home Automation System [6]:
This paper presents the design and implementation of a Java-based automation system that can monitor and control home appliances via the World Wide Web. The design is based on a standalone embedded system board integrated into a PC-based server at home. The home appliances are connected to the input/output ports of the embedded system board and their status are passed to the server. The monitoring and control software engine is based on the combination of Java Server Pages, JavaBeans, and Interactive C. The home appliances can be monitored and controlled locally via the embedded system board, or remotely through a web browser from anywhere in the world provided that an Internet access is available. Appliances at home are connected to an embedded system board (E-board). The control code on the E-board operates the appliances and communicates with Java-based code that resides at the server at home. The user can interact with the home automation system from anywhere at any time.
D) Enabling Mobile Devices for Home Automation Using ZigBee [7]:
Home automation systems are collections of interconnected devices for controlling various functions within a house, such as light control, heating, air conditioning, etc. Mobile devices are ideal in providing a user interface in a home automation system, due to their portability and their wide range of capabilities. They can communicate with a home automation network through an Internet gateway, but cannot directly communicate with devices in the network, as these devices usually implement low power communication protocols, such as ZigBee. There are several methods to equip an Android device with a dongle capable of ZigBee communication. The use of multiple communication channels, such as the TCP channel, that uses Wi-Fi to connect to a gateway, and the USB channel, that can connect to a device on the home automation network through an USB dongle as shown in Fig.1. Modern mobile devices have embedded modules for several wireless communication technologies such as WiFi, UMTS and Bluetooth. The home automation system consists of various home automation devices interconnected in a wireless sensor network, a gateway at the edge of the network and one or more client devices, that can be either smart phones, tablets, or laptops.

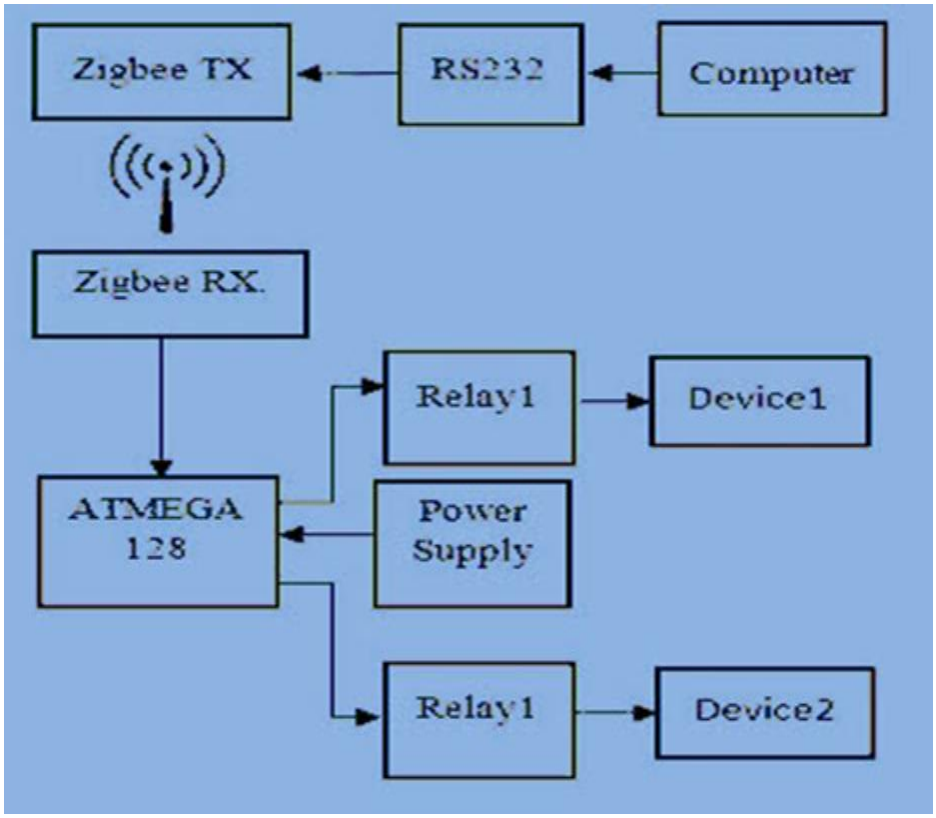


Fig. 2 Block diagram of Enabling Mobile Devices For Home Automation Using Zigbee

III. PROPOSED METHODOLOGY

The whole project can be divided into two parts:

1) Sending commands to Raspberry Pi:

The server side script running on our laptop or on a web server takes input commands from the user and correspondingly sends it to the client (Raspberry Pi). Here, we will be using commands to turn a light ON/OFF. When we pass the command to turn ON a light through the server side script, the information is relayed to the Raspberry Pi and it's GPIO pin turns ON a relay. The system also sends status updates to the server on whether the light is ON/OFF.

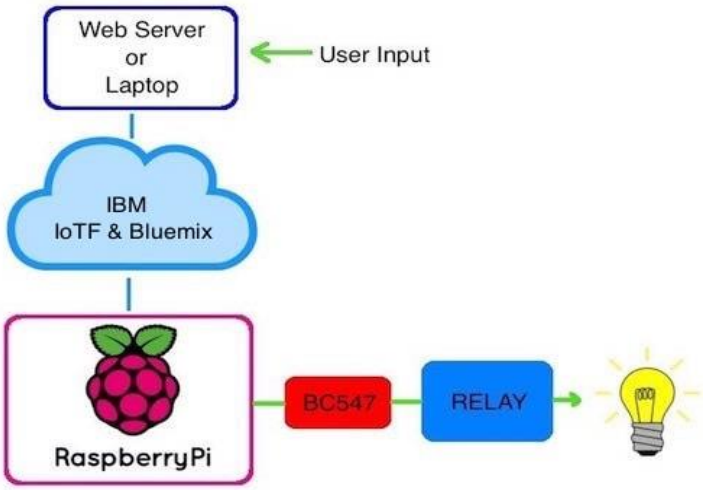


Fig 05: Sending commands to Raspberry Pi

2) Receiving data from Raspberry Pi

In case of sending data from the PIR motion sensor connected to the Raspberry Pi, we run a script which reads the sensor through a GPIO pin and broadcasts the data through the IoTF platform. This can then be viewed through the IoTF console or through a custom web application designed using the platform.

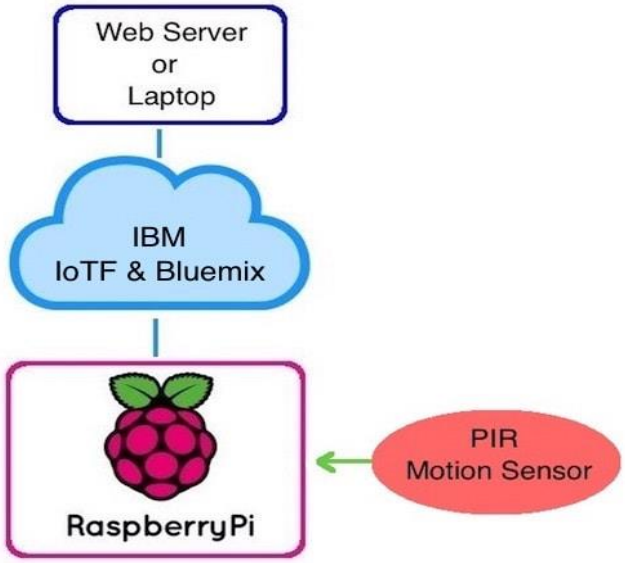
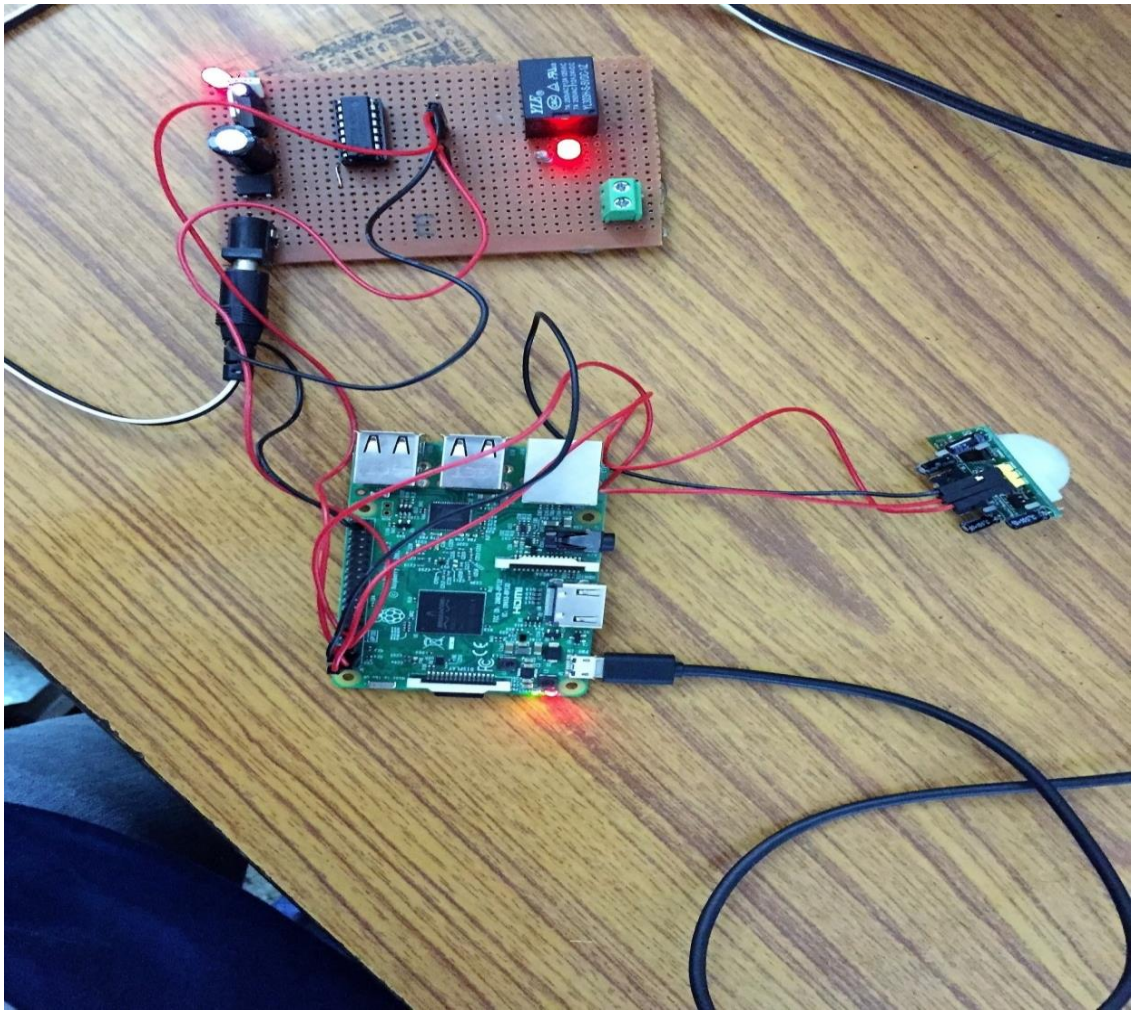


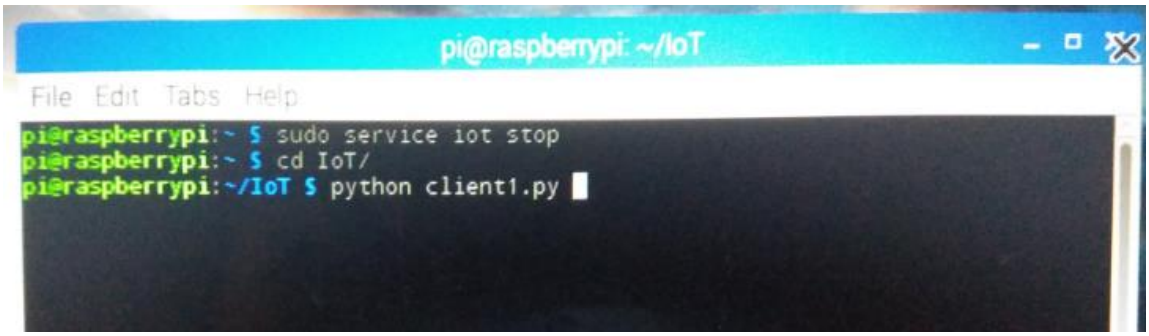
Fig 06: Receiving data from Raspberry Pi

PICTORIAL VIEW OF THE PROJECT:



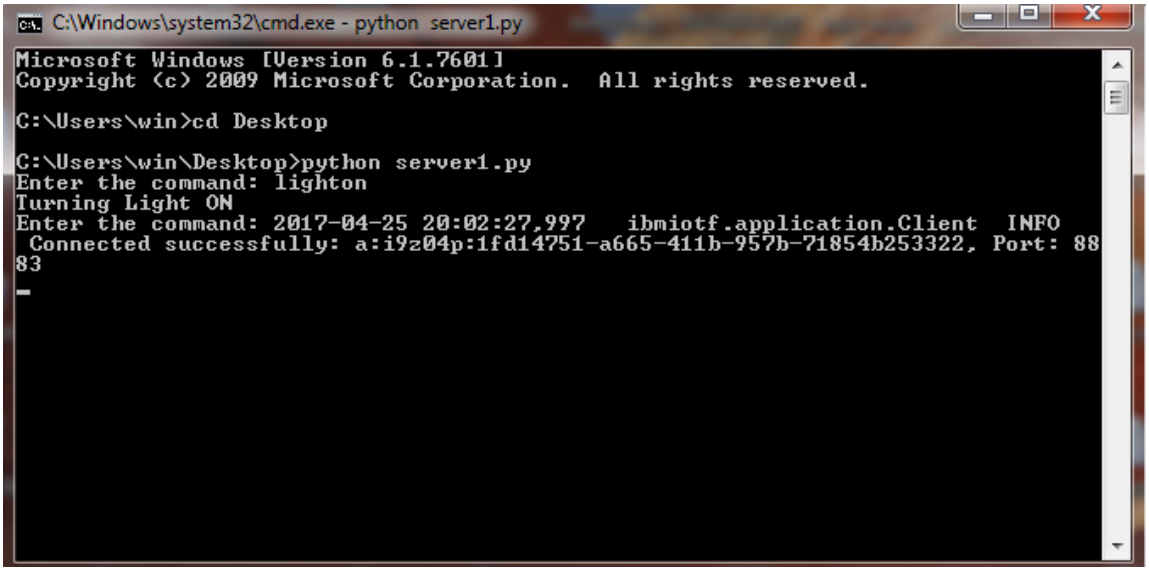
IV. RESULTS

1. Running the script on client side:



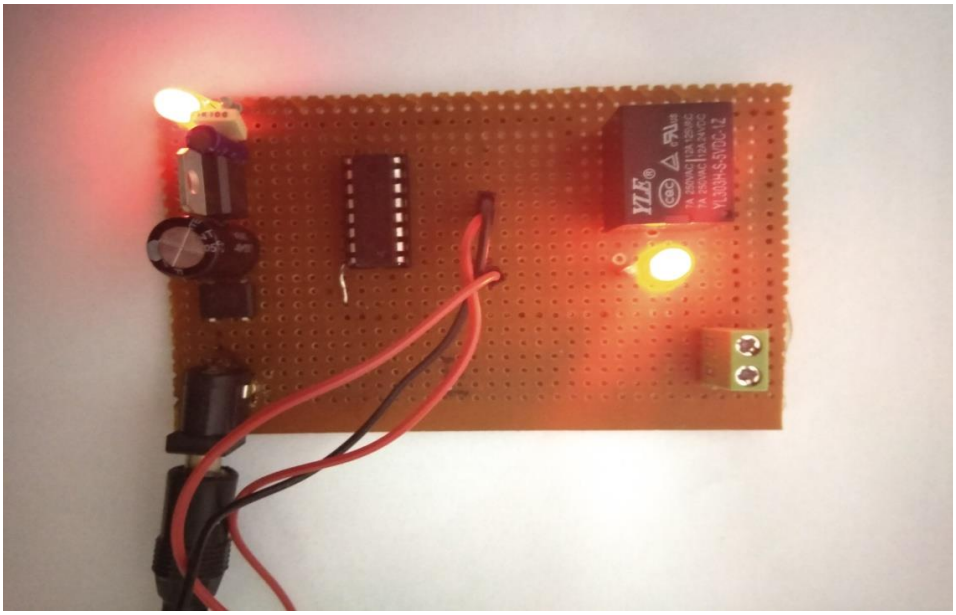
In this, we first open the raspberry pi terminal and change directory to IOT inorder to execute python client.py.

2. Running the script on server side(Giving command light on)



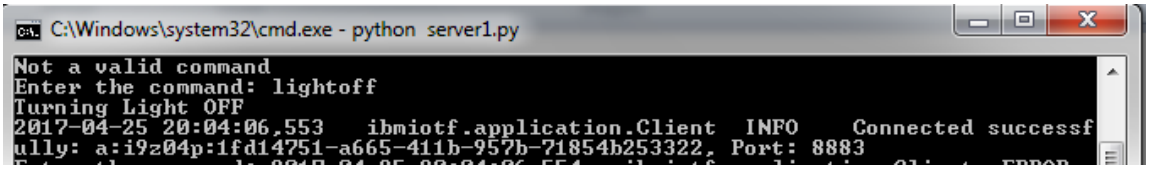
In this we open the cmd terminal on server side. After that we run the server.py python file. It requests us to enter the command. Here we have entered the "light on" command.

3. Output on PCB : Light on



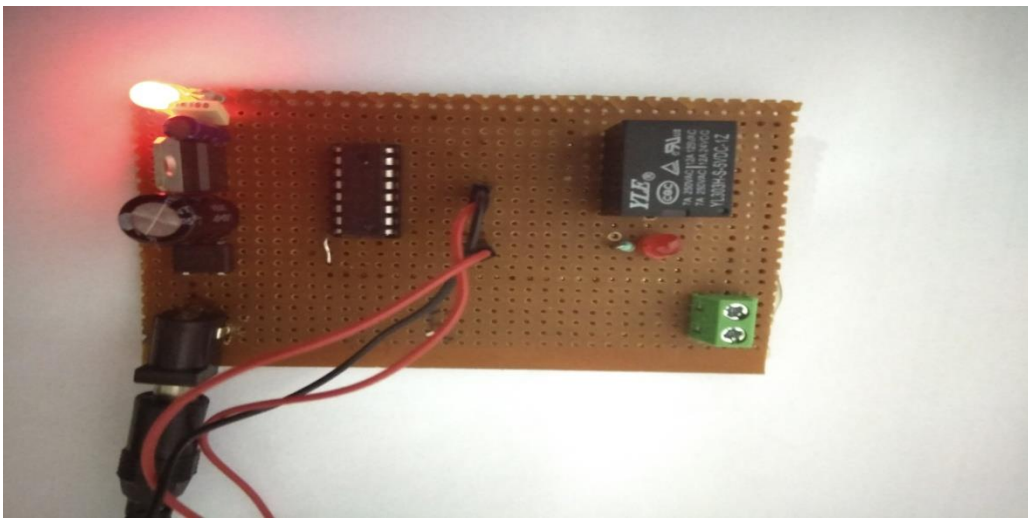
After giving the "light on" command, the LED on the PCB turns on as shown above.

4. Running the script on server side (Giving the command light off)



In order to switch off the light, we are giving the "light off command" on the server side as shown above.

5. Output on PCB: Light off



After giving the "lightoff" command on the server side, the LED turns off as shown below.

6. Sensor information

A) Intruder absent

Recent Events

Event	Format	Time Received
0	**json**	**Apr 25, 2017 8:11:15 PM**
0	**json**	**Apr 25, 2017 8:11:15 PM**

In the above figure, '0' indicates that the intruder is absent.

B) Intruder present

Recent Events

Event	Format	Time Received
1	**json**	**Apr 25, 2017 8:07:37 PM**
1	**json**	**Apr 25, 2017 8:07:38 PM**

In the above figure, '1' indicates that the intruder is present.

7. Overall information

Sensor Information

Event	Datapoint	Value	Time Received
1	**LightStatus**	**OFF**	**Apr 25, 2017 8:31:11 PM**
1	**Intruder**	**1**	**Apr 25, 2017 8:31:11 PM**
0	**LightStatus**	**OFF**	**Apr 25, 2017 8:43:31 PM**
0	**Intruder**	**0**	**Apr 25, 2017 8:43:31 PM**
status	**LightON**	**1**	**Apr 25, 2017 8:19:28 PM**
status	**LightOFF**	**0**	**Apr 25, 2017 8:20:57 PM**

The overall result about the intruder and the LED can be analysed from the above table.

V. CONCLUSIONS

This proposed system provides many advantages including, safety, security, improved comfort, energy and cost savings. In order to address the issues of flexibility and functionality, a novel, standalone, flexible and low cost, home controlling and monitoring system using Web services as an interoperable layer for communicating between the remotely present user and the home devices, have been designed. Performed research has shown that by using the Raspberry Pi and open source software it is possible to programmatically control many devices in a home in such a way that user can create his/her own solution customized to meet his/her individual needs. Thus, the proposed system is better from the scalability, flexibility and security point of view than the commercially available home automation systems.

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