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IoT Based Home Automation using Raspberry Pi with Efficient Security Alerting System

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ABSTRACT

Technology has been developing to a greater extent since last decade, Even though today's home automation systems are a much more advanced concept. Home automation technology converts a regular home into a smart home. It is a remote program device which can either be wireless, wired, or both. Now a Days Internet of Things (IoT) is one of the promising technologies which can be used for connecting, controlling and managing intelligent objects which are connected to internet through IP address. This paper discusses about IoT and Image Processing and it can be used for realizing smart Home Automation with security Alerting System using Raspberry Pi. Firstly system is about the security in which Image processing is used, and we are using facial recognition algorithm using Python to Find out that the Person is intruder or not. For Automation purpose, Relays are used to ON and OFF the Devices like Bulb. along with that we are using DHT11 Sensor, IR sensor, LDR Sensor which helps to automizes Home in effective way. And lastly we are using An open source platform for deploying Data Fusion Application in IoT Environments called Cayenne, Cayenne was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, analyze and do many other cool things. By using this System user can easily handle the Home Appliances through Application Along with this Security and Automization of the Home is also maintain. So this Home automation System provides great insight with security

Keyword :- *IoT , Image processing , Python , Raspberry Pi , Relay, Sensors, cayenne*

1. Introduction

World is progressing very fast today. Every field of life is enhanced with respect to its past and transformed into more comfortable and sophisticated than before. Automation is a technique, which reduces the requirement of human assistance for completion of a task or procedure. In-home automation, it permits users to control an electrical device using either a computer or a smartphone. Home automation system uses the portable devices as a user interface. They can communicate with home automation network through an Internet gateway, by means of low power communication protocols like Zigbee, Wi-Fi etc[1-2]. Internet of Things (IoT) is one of the promising technologies which can be used for connecting, controlling and managing intelligent objects which are connected to

Internet through an IP address[3] . IoT based system also provides remote access to the user from an android mobile application to control electrical appliances[4]. In this paper , for Security purpose Image processing [5] Concept is also used in which we are using face recognition algorithm via Python .The image analysis and detection has been very significant in various applications .This paper presents IoT Based Home Automation using Raspberry Pi with Efficient Security Alerting System. It will turn ON or OFF the home appliances by using relay circuits with the concept of IoT [3] , Along with this we can handle the appliances from Internet server , when we are outside the Home. This is implemented by using Raspberry Pi and for Security, Image Processing concept is used. The organization of this paper is as follows, Section 2 summarizes the background study of its benefits and problems. Section 3 and 4 describes about the Hardware and Software requirements. Section 5 gives the brief description about the proposed system with block diagram. Section 6 deals with the results and discussion of the model followed by conclusion in the Section 7.

2. Literature Survey

When we are using IoT concept , then there must have strong internet connection. The system using Internet of Things (iot) will allow mobile devices and computers to remotely control all the functions and features of home appliances from anywhere around the world in which cloud computing is important part [6]. In Paper [1] the research is about to develop an IoT based system that provides remote access to the user from an android mobile application to control electrical appliances. Furthermore, it is focusing on proposing a solution which will help cut down the energy consumption by following automated behavior which it is programmed to do . if we want to work on large area then ,The paper [7] presents the design and implementation of an Ethernet-based intelligent automated system for conserving electrical energy using a INTEL GALILEO 2ND generation development board which can be used in large organizations like a University or an office. The need of security systems for Home is considered as one of the important aspects of our modern life, [8] This paper gives an outline for automatic system to control and secure the home, based on digital image processing with the help of Internet of Things (IoT). one of the approach which discussed in Paper[9] which is Securing an IoT based Home using Digital Image Processing and an Android Application[10] and server. In Paper [5] , IoT project implements a Client-Server based home automation with intruder alert to the user mobile phone. The user can also retrieve the image of the person entered in to the home ,in which Matlab is used in security alerting system for facial recognition..

3. Hardware Requirement

3.1 Raspberry Pi

Fig -1: Raspberry Pi 3 Model B+ .

Raspberry Pi is a low cost credit card size computer that plugs into a computer monitor or TV and uses a standard keyboard and mouse. Most importantly it's open source hardware. Computing Programmable Language like python and scratch under Linux platform. The Raspberry Pi 3 Model B+ is the final revision in the Raspberry Pi 3 range with specification Broadcom BCM2837B0, Cortex-A53 (ARMv8) 64-bit SoC @ 1.4GHz,1GB LPDDR2 SDRAM, 2.4GHz and 5GHz IEEE 802.11.b/g/n/ac wireless LAN, Bluetooth 4.2, BLE

3.2 Relay

Fig -2:One channel Relay module.

A relay is an electrically operated device It is frequently used in automatic control circuit. To put it simply, it is an automatic switch to controlling a high-current circuit with a low-current signal. one channel relay diagram is shown in figure 4. This is a 5V, 10A 1-Channel Relay i board. It can be controlled various appliances, and other equipment with large current. It can be controlled directly with 3.3V or 5V logic signals from a microcontroller.

3.3 Dc motor

Fig -3:.DC motor

A DC motor is any class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current

flow in the part of DC motor**.** Small DC motors are used in tools, toys, and appliances. DC motor is shown in figure. 3

3.4 Motor Driver circuit

L298N is an integrated circuit multi watt 15 package and capable of giving high voltage. It is a high current dual full-bridge driver that is designed to accept standard TTL logic levels. It can drive inductive loads e.g relays, solenoids, motors (DC and stepping motor), etc.
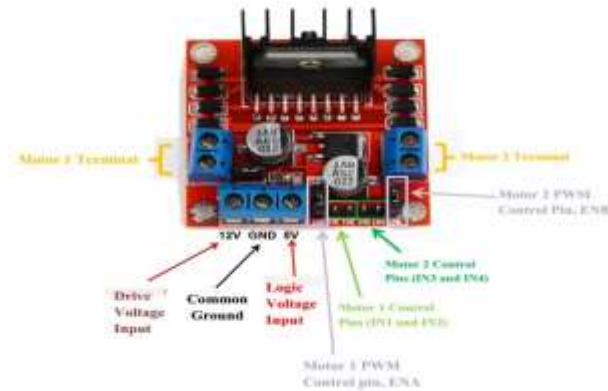

Fig -4: Motor driver Module

3.5 Buzzer

Fig -5: Buzzer

A buzzer is a small yet efficient component to add sound features to our project/system. It is very small and compact 2-pin structure hence can be easily used on breadboard, Perf Board and even on PCBs which makes this a widely used component in most electronic applications
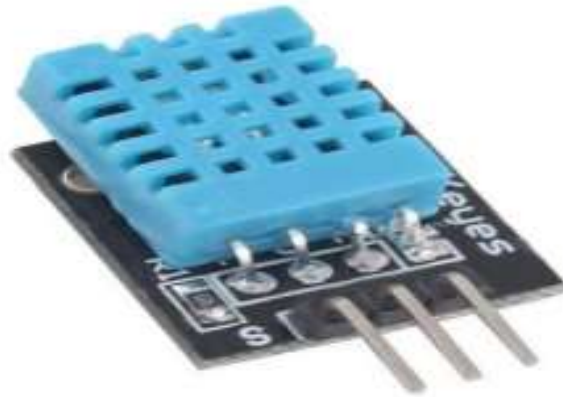
3.6 DHT11 Sensor

Fig -6: DHT11 Sensor Module

The DHT11 is a commonly used Temperature and humidity sensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers.The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%. So if you are looking to measure in this range then this sensor might be the right choice for you.

3.7 IR Sensor

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

Fig -7: IR Sensor Module

3.8 LDR Sensor

The LDR Sensor Module is used to detect the presence of light / measuring the intensity of light. The output of the module goes high in the presence of light and it becomes low in the absence of light. The sensitivity of the signal detection can be adjusted using potentiometer.
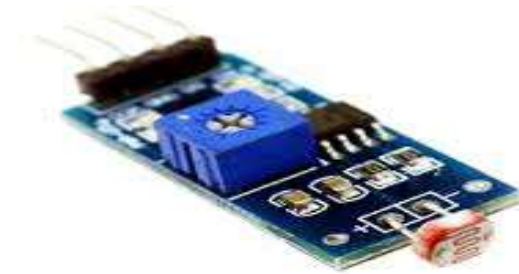
Fig -8: LDR Module

3.9 Camera module

Fig -9: Camera Module

Features:- Model- Quantum QHM495LM PC Camera with 6 Light, High Quality CMOS Sensor25 Mega Pixels (Interpolated) , Colour Saturation, Brightness, Sharpness and Contrast, Anti-Flicker: 50Hz,60Hz or outdoor , Image quality RGB24 or 1420

4. Software and Other Requirements

4.1 Python Image Processing (Using OpenCV)

What is Open CV? ,it stands for 'Open Source Computer Vision Library' initiated by some enthusiast coders in '1999' to incorporate Image Processing into a wide variety of coding languages. it is a free open source library used in real-time image processing. It's used to process images, videos, and even live streams .It has C++, C, and Python interfaces running on Windows, Linux, Android and Mac. In this system, we are processing images in Python using the OpenCV library.

4.2 Terminal in Raspbian

The terminal (also known as the shell or command-line interface) is a text-based interface that accepts and interprets your commands. You can use terminal commands in Raspbian to run programs, execute scripts, manipulate files, etc.The default terminal on the Raspberry Pi devices running Raspbian is called LXTerminal**.** The terminal has accepted our input and displayed the result of the command execution

4.3 my Devices Cayenne

Cayenne is the first of its kind drag and drop IoT project builder that empowers developers to quickly create and host their connected device projects. Cayenne was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, analyze and do many other cool things.
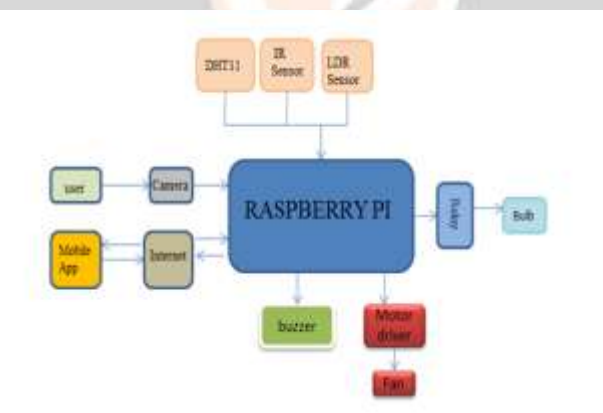
5. Proposed System:-

Fig -10: Block Diagram of System

The proposed system basically consist of two ideas that is Iot and Image Processing. Firstly the System Started with idea of Image processing ,because Security is one of the important part of System in which we are taking help of openCV for Face Recognition with Python .OpenCV is the most popular library for computer vision. Originally written in C/C++, it now provides bindings for Python. for capturing image we are connecting Webcam to the system via USB port. With OpenCV, we can capture a video or image from the camera then it will perform desired operations on that image. That image will compare to the database image which are already saved on Database. after comparing images ,if that person is correct then further process will occur.if the person is intruder then buzzer will ON automatically for Alerting purpose.if person is correct ,then user will enter into System.in the System ,there are three sensors are used which are DHT11,IR Sensor and LDR Sensor.LDR Sensor is used to find out whether there is Day or Night and IR Sensor is used for whether there is person detected or not.
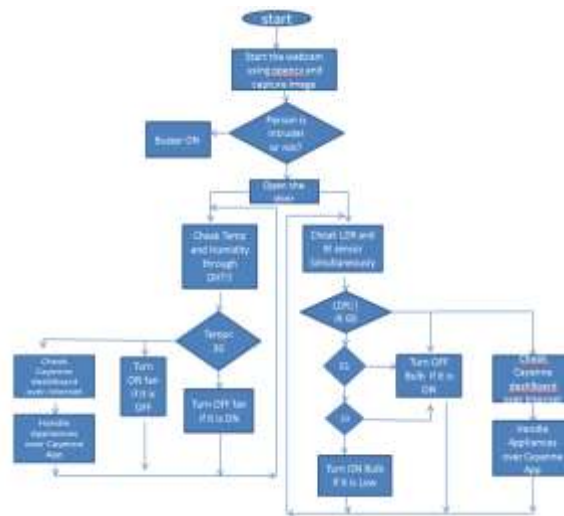
Fig -11: Flow chart of System

IR Sensor and LDR sensor Work Together, whatever result we will get from IR And LDR on basis of that Bulb will Turn ON or OFF automatically. Again we using DHT11 sensor for calculating Tempreture and Humidity of that Particular Room, Whatever Result gets from DHT11 sensor, FAN will turn ON and OFF automatically. For Bulb to turn ON and OFF , 1 channel relay used. In the System DC motor is used for FAN purpose ,and for that with the help of DC motor Driver. If the user is outside the Home ,user will also handle the Home Appliances over internet for that myDevices cayenne is used which is an drag and drop IoT project builder that empowers developers to quickly create and host their connected device projects. By using myDevices Cayenne, it is easy to turn ON And OFF the Home Appliances over the internet. This all Home Automation based on IoT , for that there is must Strong a Internet and Wi-Fi Connection , Such IoT based systems depend on the collection of data. The data is then used for monitoring, controlling and transferring information to other devices via the internet. This allows specific actions to be automatically activated whenever certain situations arise.

6. Result

This section presents the results which were gathered after the successful implementation of the system. As the System first started with Security .So correspondingly the webcam gets activated via OpenCV-Python . The face detection and comparison is done in OpenCV. Fig 12 shows how it will capture the image and find out the person is intruder or not. The database has facial features of subject one.
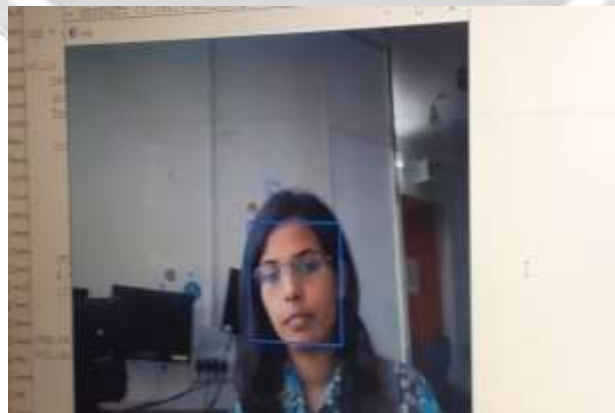

Fig -12: The face detection for the image

if image is not available in the database and there by facial recognition algorithm finalizes it as intruder and informs it to the Raspberry Pi and there by it will triggers Buzzer .if is not an intruder then there will not be any alert and

after that there is entry into the System. Fig 13 is the Overview of System in which 3 Sensors are used for Automation purpose in which IR sensor and LDR sensor will work together. IR sensor used to find out Person is present or not in the Room ,and simultaneously LDR find out the intensity of light in that Room. Fig 14 shows the Output Of IR and LDR sensor ,On basis of that Bulb will turn ON and OFF automatically

Fig -13: Overview of System

DHT11 sensor will show value of Temperature and Humidity value in that particular Room as Shown in Fig 14. Along with this One Bulb (LED) and FAN (DC motor) is connected to the System which Automatically turn ON and OFF depends on DHT11 Sensors value
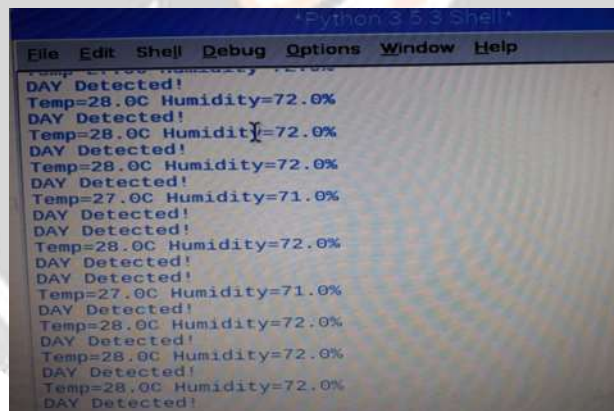

Fig -14: Sensors OUTPUT

If the Tempreture value is grater than 30 degree then automatically FAN will turn ON Otherwise it remains OFF. There is another option is also available for turnning ON and OFF the Appliances called Cayenne Dashboard, fig 15 show the Cayenne Dashboard through which we can easily handle the Appliences over Internet

Fig -15: Cayenne DashBoard

7. CONCLUSIONS

The proposed system is developed with the emphasis to decrease the energy consumption using Internet of Things (IoT) technology and also it is a budget friendly. System is basically about Home Automation along with Security. This work is carried forward by integrating relays to Raspberry Pi board for controlling Home appliances along with this sensors are Connected to Raspberry Pi to Monitor the Home status. User can also easily handle the Home Appliances over the Internet .Along with this Security of the System is also maintain by capturing the image of user through camera and then comparing it with database image to find out person is intruder or not. So this System can take care of Security of Home along with Automation**.**

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