IoT Based Intelligent System for Home Automation Using Voice Recognition

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Abstract: Home automation is a modern technology that modifies our home to perform different sets of tasks automatically. It guarantees security, surveillance, automation of devices for the user to make their life more comfortable. In the proposed method, the voice recognition and web app are used to control the functioning of the electrical appliances like fan and light. A small-scale prototype is also implemented for intrusion detection and web app using Raspberry pi. This method is integrated with wireless home automation system and it sends email alert to the respective user. The face recognition is done for the security features for the purpose of identifying the unauthorized person.

Keywords: Raspberry Pi, Voice Recognition, WebApp.

I. INTRODUCTION

In communication systems, especially the home automation is playing an important role in the daily life. The proposed system is composed of a monitoring and controlling unit. This system is based on Python, Open CV, Raspberry pi, web application and is neither user predicted nor condition controlled. The appliances are controlled by Raspberry Pi. Raspberry Pi is a small computer and the programming has been developed in Python environment for Raspberry Pi operation. It is connected with microphone, relays, camera and sensors which monitor the state of electronics devices. A door monitoring system is designed based on recognition from a camera and face detection, where camera is installed outside the main door. The interesting feature is that the appliances can also be controlled over voice recognition. The recorded voice is converted it into the text in which it would be processed by Raspberry Pi. In the home section, various sensors are placed for sensing the home environment and the on and off of the fan and light are automatically controlled over sensors. The user can monitor the home and control the home appliances either by web application or by voice recognition. web server is used in home appliances in order to remotely access and control the devices. The web app will be consisting of login system and User Interface (UI) for the user for the purpose of security. All these data are updated in the cloud database via internet.

II. LITERATURE SURVEY

Yash Mittalet al., [1] proposed a paper on multi- functional `Smart Home Automation System' (SHAS), where users can be using a voice-commands to control their home- appliances and gadgets, for the different functionalities and purposes. This proposed system can be adapted to a user's voice and recognise the voice-commands, independent of the speaker's personal characteristics such as accent.

Cyril Joe Baby et al., [2] proposed a paper on web application is used to enable home automation also has its security feature that only enables certain users to access the application. Some light and fan at home are fully automated based on sensor inputs. The lights are automated based on the inputs and from a motion detected and the fans are automated based on the temperature. The door lock can be controlled by giving the voice commands.

Paul Jasmin Rani et al., [3] proposed a paper on smart home solutions in the market that aim is to be automate. However, most of these systems focus on the micking the basic operation of the electrical switch. The user sends a command through the speech to the mobile devices, which interprets the message and sends the appropriate command to the specific appliances.

M. Bayin et al.,[4] proposed a paper on intelligence home application based on voice recognition was improved. By the aim of this, database belonging to intended control voices like turn on and off the lamp, close the curtain was created by pre-processing the steps of the voice samples taken from five people.

D. Sunehra et al.,[5] proposed a paper on home automation and control. The first scheme presents about a prototype of Home Automation System (HAS) for remote controlling the appliances at home through the subject of e- mail. Python Integrated system Development Environment (IDE) is used for developing the necessary software. The second scheme uses the Bluetooth technology for controlling of the devices when we are at home. It uses a HC-05 Bluetooth module and Bluetooth Controller as mobile application for switching on or off the appliances.

III. PROPOSED METHODOLOGY

Now a day's Home automation system plays a significant role. In this method, a prototype is designed to monitor and control the home appliances and security over the web application and also through voice recognition. The home automation system was developed by the following steps as shown below.

Home automation is a modern technology that modifies our home to perform different sets of tasks automatically. It guarantees security, surveillance, automation of devices for the user to make their life more comfortable. In the proposed method, the voice recognition is taken as input to control the functioning of the electrical appliances like fan and light, also web application is developed to control the appliances from remote area by using natural language. This detection system is integrated with wireless home automation system and it sends email alert to the respective user. Face recognition is also done for the security purpose for identifying the unauthorized person.

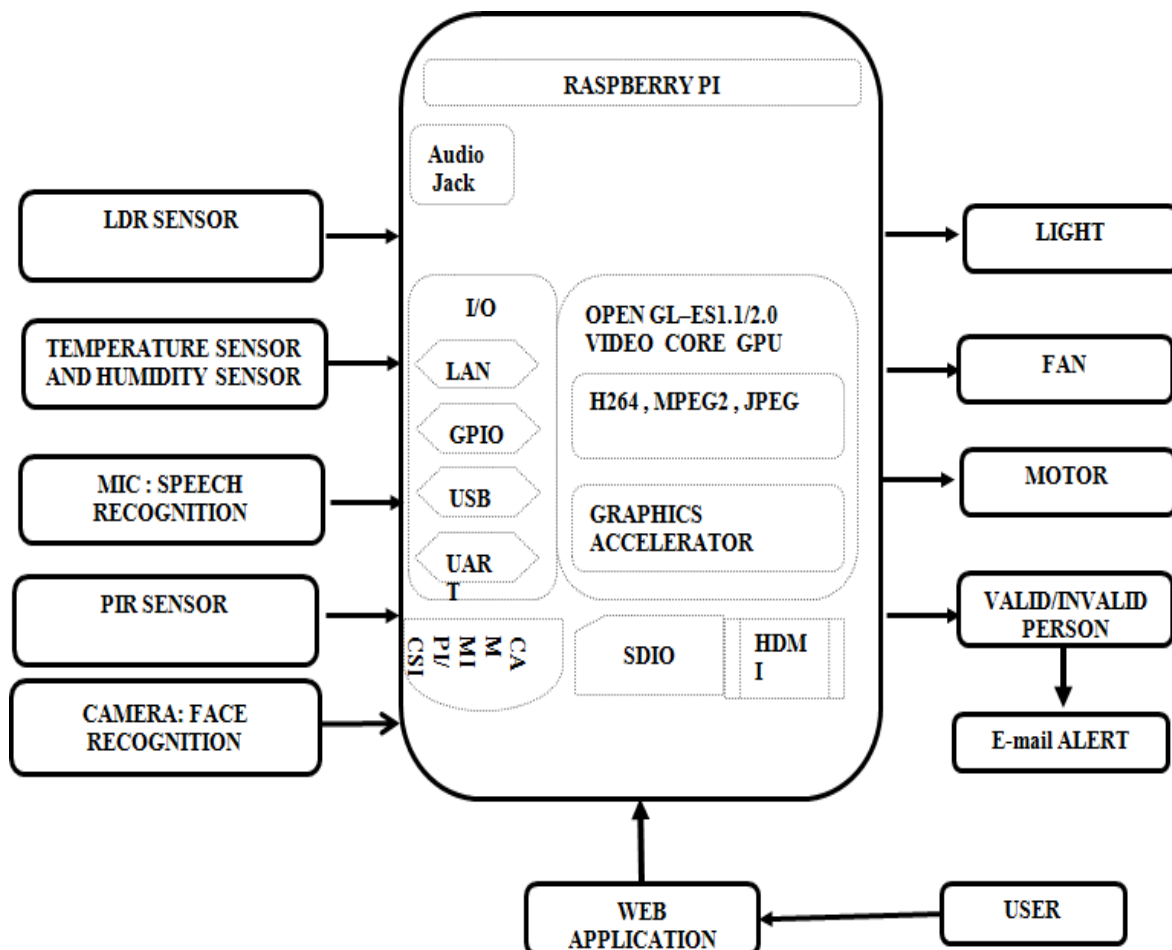### A.   Architecture of the proposed system

Fig. 1. Block diagram Architecture of the proposed system

B.   Components Required
1)   Software Requirements

•   **Raspbian:** Raspberry pi is a Debian based computer operating system. It is a free OS supported Debian, optimized for the Raspberry pi. An operating system is the set of basic programs and it utilities the make to run the Raspberry pi. It provides a pure OS: it comes with over 35,000 packages, pre-compiled software for easy installation on Raspberry Pi.

•   **Python**: It is an open source programming language that is supported by Raspberry Pi. Python syntax is extremely clean, with a stress on readability, and uses Standard English keywords. Python can be used to access GPIO and these results in the combination of object orientation and microcontroller capabilities into one platform.

•   **WebIOPi:** It is software for Raspberry pi that enables GPIO control over Local Area Network using a Web App. WebIOPi is the perfect Swiss-knife to form connected things, which was developed by Eric PTAK and it runs on Raspberry Pi.

•   **Hyper Text Markup Language (HTML):** To create web application HTML is used. It creates an electronic documents (called pages) that are displayed on the World Wide Web. Each page contains a series of connections to other pages called hyperlink.

•   **JavaScript:** To link Hyper Text Markup Language (HTML) web application button to GPIO pins of the Raspberry Pi. Java Script may be a client scripting language which is employed for creating web sites. It is a standalone language developed in Netscape, which is used when a webpage is to be made dynamic and add computer graphics on pages like rollover, roll out and lots of sorts of graphics.

2)   Hardware Requirements
•   Raspberry pi with Wi-Fi module: Raspberry pi is a single board computer which runs on Linux based operating system and is best suited for Internet of Things.
•   Relay board with transistors
•   Temperature Sensor
•   Humidity Sensor
•   Light Dependent Resistor (LDR)
•   PIR Motion Detector and Relay Board
•   Mic
•   Pi Camera

C.   Hardware Descriptions

RELAY BOARD WITH TRANSISTORS:
A relay is an electrically-operated switch which are connected to the power supply. Relay board are computer board with an array of relays and switches. It is used for ON/OFF of fan and light.

TEMPERATURE SENSOR:
The temperature sensor is a device, which requires a thermocouple or Resistance Temperature Detectors (RTD) to measure the temperature through an electrical signal. The thermocouple is prepared by the two dissimilar metals in which it generates the electrical voltage indirectly proportional to the change in temperature in a precise manner or within the linear.

TEMPERATURE SCALES:
Temperature scales are based on the "temperature standard points", points at which the phenomenon occurs at constant temperature. Fahrenheit scale was developed by Daniel Gabriel Fahrenheit (in 1724) and it supposedly based on the lowest temperature achieved at the time (0ºF) and using 180 degrees between the freezing and the boiling point of water, where 32 ºF and 212 ºF, respectively. The kelvin scale (K) is based on the absolute zero with 100 degrees between the freezing and the boiling point of water. The zero value of Celsius scale is based on the freezing point of water and the degree range is same as in Kelvin and the SI units are represented in Kelvin, compared to all these temperature scales the most commonly used scale is Celsius scale.

TEMPERATURE SENSOR WORKING:
The measurement of the temperature sensor is about the coolness or hotness of an object. Working of it is based on the sensors, the voltage value is read across the diode. If the voltage increases, then the temperature rises and there will be a voltage drop between the transistor terminals of the base & the emitter, and those values are recorded by the sensors. If the difference in voltage is amplified, then analogue signal is generated by these devices and it is directly proportional to the temperature.

FEATURES OF TEMPERATURE SENSOR:

- It is Calibrated directly in ˚ Celsius (Centigrade)
- Range from full l −55˚ to +150˚C
- It is Suitable for remote applications
- Low cost due to wafer-level trimming
- It Operates from 4 to 30 volts

These temperature sensors are used for the purpose to measure the temperature of the boilers in thermal power plants.

HUMIDITY SENSOR:

A humidity sensor measures and reports both the moisture and the air temperature. The ratio of moisture in the air is to the highest amount of the moisture at a particular air temperature is called the relative humidity. Relative humidity becomes an important factor because for its comfort.

Humidity sensors is working by detecting the changes that alter the electrical currents or temperature in the air.

There are three basic types of the humidity sensors, they are

- Capacitive
- Resistive
- Thermal

All three types of sensors are used to monitor minute changes in the atmosphere in order to calculate the humidity in the air.

LDR SENSOR:

Although they have a Sunrise / Sunset clock built in that will determine when the sunrises and sets. Hence if it is Dark or Light outside, and it often inside light is a totally a different subject. The system needs to know what the light level is in a particular area when automating internal lighting, it needs to know if the lights should be activated or it defeats the purpose of energy by saving the automating of lights for cost savings.

As the LDR is very small (approximate 5 mm x 4mm x 2 mm) so it can be installed anywhere. Although it can be installed on a PIR detector. By consideration the amount of light near the ceiling in a corner is compared to a lower level near the floor. As a suggestion that you could mount it on a blank electrical plate which is attached to the wall near the floor / power point level where the light is more even. This would change from site to site, and room to room. The LDR Sensor is wired directly to any of the Zone input as it does not need power.

PIR SENSOR:

Passive Infrared Sensors (PIRs) are electronic devices which are utilized in some security systems of alarms to detect the motion of an infrared emitting source such as person's body. The pyroelectric sensor which is made up of a crystalline material that generates a surface electric charge when it is exposed to heat in the form of infrared radiation.

When the amount of the radiation striking the crystal changes, the amount of charge and also changes can then be measured with a sensitive FET device to build into the sensor. This radiation is invisible to the human eye but it can be detected by the electronic devices. The actual sensor on the chip which is made from the natural or artificial piezoelectric materials.

MIC:

The audio input, USB sound cards which can readily be used with the Pi systems. Some of them also have microphones built in the inputs itself and the line inputs with which it can use a microphone preamp.

PI CAMERA:

The Pi Camera module is a camera which can be used to take the pictures and the high definition video. Raspberry Pi Board has the CSI interface to which it can attach to the Pi Camera module directly.

The Raspberry Pi Camera Module v2 is a high quality 8 mega pixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi. The featuring is fixed and the focus lens is of 8 mega pixel native resolution sensor is capable of 3280 x 2464-pixel static images. This supports 1080p30, 720p60 and 640x480p90 video.

D. *Voice recognition Application*

The speech recognition uses a python script called speech recognition phyton, which uses speech recognition library to record and process the speech. User provides the speech through the mic, once the audio file reaches; it converts it in to text using their advanced speech recognition algorithm. Then the text is sent back to the python script. In the python script it is checked with the predefined commands to turn home appliances to ON or OFF.
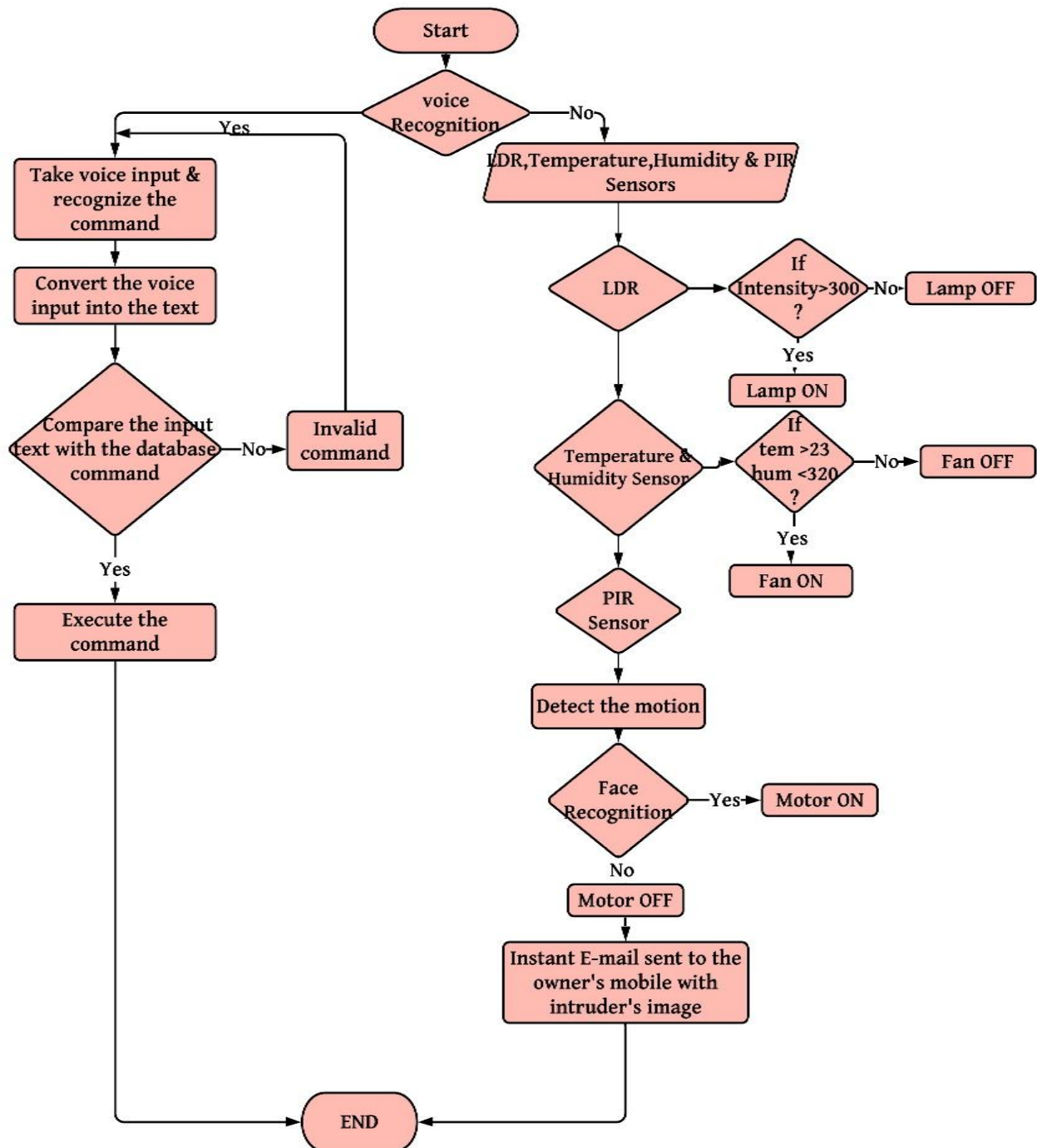
Fig. 1 Flow chart of the voice recognition application

DESIGN FLOW:

- Step 1: Get the control instruction through the Mic.
- Step 2: It capture the audio signal and converts the sound waves into string.
- Step 3: The input string is compared with the database.
- Step 4: If the string is matched with the database it gives a signal to the relay board through Raspberry Pi.
- Step 5: And it controls the system.
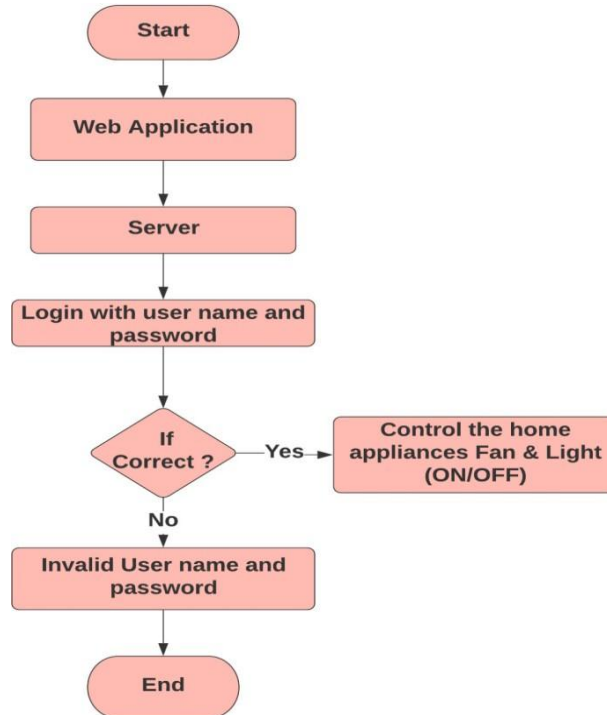- Step 6: End.

E.   *Web Application*

Fig. 2 Flow chart of the Web application

DESIGN FLOW:

- Step 1: The web application is entering into the server with the user name and password.
- Step 2: The login person should give the user name and password.
- Step 3: If the user name and password is correct it will give permission to access the home appliances.
- Step 4: If the user name and password is incorrect it will display it as invalid user name and password.
- Step 6: End.

IV.   RESULT AND DISCUSSION

In this, the proposed method consists of a web application, and it is coded with HTML program for the frontend and PHP is used as backend web processing. Here raspberry pi is coded with python program for monitoring the appliances and finally the home appliances like fan and light are controlled anywhere, anyplace using web application   by the Iot.
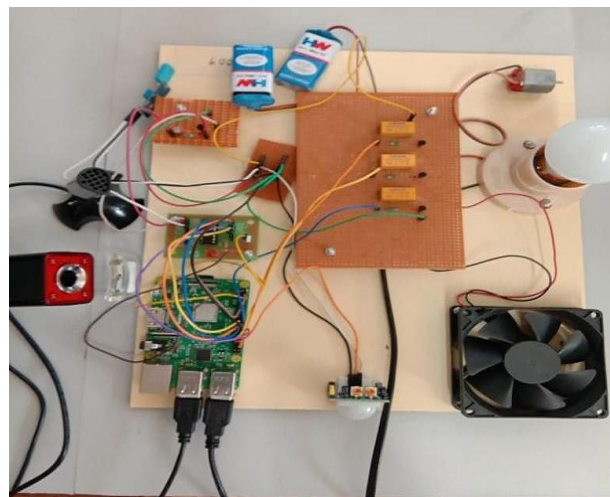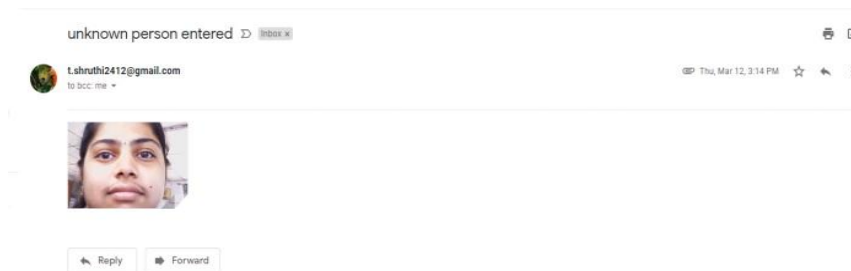
OUTPUT

Fig. 2 Hardware Module

Fig.3 E-mail received at the user end when unknown person is entered.

V.   CONCLUSION

The voice controlled home automation using Raspberry Pi is proposed for the benefit of easy use and control of devices by elderly and disabled people. This proposed system provides a basic home automation which can be easily implemented and used effectively for a real time application of voice controlled home automation. Thus, the Raspberry Pi is used to be smart, economic and efficient platform for implementing the home automation system.

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