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Virtual Assistant Car Using Raspberry Pi

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VIRTUAL ASSISTANT CAR USING RASPBERRY PI

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ABSTRACT

Smart devices as voice assistant are a prevalent feature in the cars these days. Voice assistants are software agents that can interpret human voices or commands and respond through smart speakers. Users can convey any feature and the voice assistant can provide answers to what they ask and user can handle and control the car as they want using the commands over voice. Along with this, the special features to the voice assistant which can execute any task given by the user. The basic feature of this technique is to set off controlling the Air conditioning depending on the weather condition and the temperature of the surrounding, functionality of wipers, controlling the music system, varying the window lights and car lock system, which can be controlled by using voice assistant with the help of Raspberry Pi. In order to secure the car from the access of an outsider or unauthorized user, RFID is used. The RFID band is used here which contains a specific serial number, the door gets unlocked when the reader recognize the correct serial number.

Keywords: Google Speech Recognition, Car Automation, Raspberry pi, RFID Band

I. INTRODUCTION

Automation is the application of machines to perform the tasks performed by human beings or the problems that are difficult to solve. Car automation plays a vital role in the high-tech automobiles from current generation where several functionalities are performed automatically by voice commands.

1.1 AUTOMATION

In today's life, automation plays a major role in order to make the process/task simpler, without the help of Human power. The major aspect of implementing automation is to reduce the work, time and error made by a normal human being. Automation or automatic control is the technology were a range of control systems for operating equipment such as machinery, automobiles, switching on telephone networks, aircraft and other applications are performed with reduced human involvement.

The benefits of automation are Labor savings, Savings in electricity costs, Savings in material costs and Improvements to quality, accuracy, and precision.

1.2 CAR AUTOMATION

Automation implemented in the cars performing some special features is called as Car automation. Self-driving cars are also called as Autonomous vehicle, robo-car and driverless car. There are a variety of sensors used to recognize the surroundings like RADAR, SONAR, LIDAR and GPS. Driver assistance technologies implement in the latest cars of current technology are already helpful in saving live and it prevents injuries. No human intervention is required during the driving as the entire feature controlling is done automatically by the commands integrated manually in the car. It makes the driving much easier and simpler with a high technology at low cost.

II. EXISTING SYSTEM

A micro computer can monitor the speed of the vehicle using the data from velocity sensors and the speed is compared with the desired speed, which controls the throttle. When the system is enabled, it manually processes and takes the user to the required destination.

2.1 BLOCK DIAGRAM

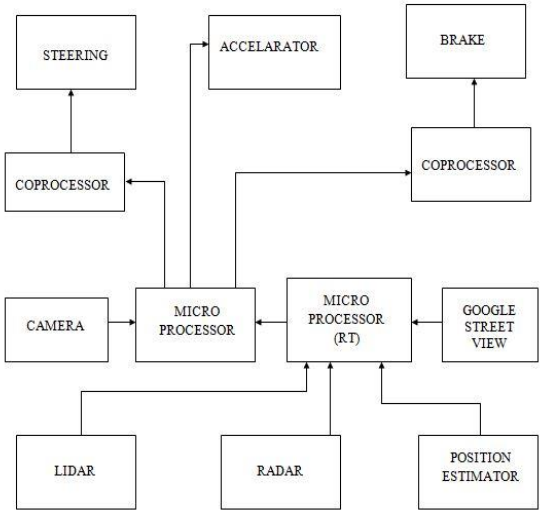

Fig 2.1 *Block diagram of the system*

The block diagram of automatic car from fig. 2.1 is working based on the principle of sensing the environment and makes the speed changes whenever necessary. Sensors are used to alert the car driving on the road and to ensure the Goggle street view with AI software that relates the input from the video cameras inside the car. A LIDAR sensor on a vehicle, a RADAR sensor on the front of a vehicle and a position sensor attached to the rear side. The combination of all the techniques which are currently implemented in driverless car like video based lane analysis, brake actuation system and steering will become a fully autonomous system.

Speech To text

The conversion from speech to text has the following steps from fig. 2.2. The input is given to microphone in the form of voice command which is first compressed into file. With the help of Google speech API, the compressed file is uploaded into Google speech recognition where ADC (analog to digital converter) can convert Analog speech into digital speech. Unwanted noise can be filtered and separated into different band of frequency. The output is received from API and parsing is done to get the output in the form of required text.

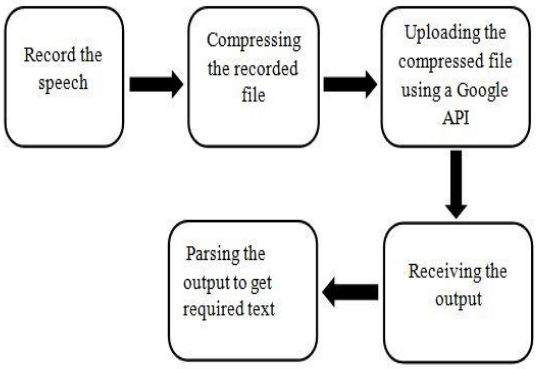

Fig. 2.2., *Speech to Text conversion*

2.2 Working

2.2.1 Drive by Wire Technology

The working of the system is explained by the integration of drive by wire technology and processors using the artificial intelligence and the algorithm. Only three following driving parts has to controlled:

1. Steering
2. Brake
3. Throttle

Drive-by-wire, DbW, by-wire, or x-by-wire technologies can replaces the traditional mechanical control systems with electronic control systems. It is done with the help of electromechanical actuators and human-machine interfaces such as pedal and steering feel emulators. Hence, the traditional components such as the shafts, hoses, belts, vacuum servos, pumps, steering column and coolers are eliminated from vehicle. Electronic throttle control and brake-by-wire are some examples.

2.2.2 Steer by wire

Steer by wire is explained by the help of electronic power steering technology. All the modern vehicles are based on electronic power steering (EPS). EPS systems have variable power assistance, where the speed of a vehicle decreases and less assistance at higher speeds. When no steering assistance is required, they do not require any significant power to operate. Because of that, they are more energy efficient than hydraulic systems.

2.2.3 Brake by wire

Brake-by-wire is a technology where electronic sensors and actuators to carry out the function of braking in a vehicle replace the mechanical and hydraulic components of traditional braking system. It is a combination of electronic control systems coupled with a set of human-machine interface and electromechanical actuators.

The use of brake-by-wire systems is operating noises and vibrations, weight reduction, quicker reaction time due to the absence of mechanical linkages and space saving, which would result in shorter stopping distances. For successful application on an extensive basis, with a clear indication of its benefits over conventional braking systems to warm vehicle consumers and manufacturers alike to the idea of its ubiquitous implementation in vehicles, the wrinkles in the system's working need to be ironed out to devise a fail-safe version.

III PROPOSED SYSTEM

In this system, the car is able to perform several tasks like temperature detecting and varying the Air conditioning temperature accordingly, depending on the commands the music system, wiper, car lock are controlled, where it does not require much human power except for the voice commands of the owner.

3.1 BLOCK DIAGRAM OF THE PROPOSED SYSTEM

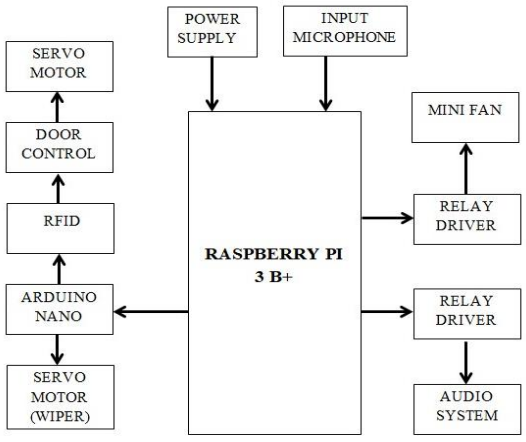

Fig 3.1., *Block diagram of the proposed system*

The input is given via microphone Fig 3.1. The Monitor is used to display the output which is connected to one of USB port of the Raspberry Pi and the microphone is connected to another USB port of Raspberry pi.

3.2 HARDWARE MODULE & INTERFACING

RASPBERRY PI

The Raspberry Pi is a small series of single-board computers. It is also called as mini-computer. It is operated at 5V and 2A power source. The Raspberry Pi 3 Model B+ has processer speed range of 700 MHz to 1.4 GHz p and a three-times faster gigabit Ethernet. Other features are Power over Ethernet, four USB boot and network boot. Its operating temperature was -40 to $+85^0$ C.

RADIO-FREQUENCY IDENTIFICATION

Radio-frequency identification (RFID) uses Electromagnetic waves to identify and track tags which is attached to objects. The tag consists of a tiny radio transponder, radio receiver and transmitter. When it is triggered by an electromagnetic pulse from a RFID device, the tag transmits digital data, in the form of identifying inventory number and back to the reader. This number is used in inventory goods.

. RELAY

A relay is popularly known as electrical switch. Relay had set of input terminals used to connect more than single control signals and a set of operating contact terminals. Relays are used mainly to control a circuit which as low-power signal, or where several circuits which must be controlled by one signal.

AIR COOLER

An air cooler is an automobile car cooler to produce evaporative cool air which is also known as swamp cooler. It is the process of cooling the water into vaporization. Water inside the cooler evaporates and then it emits the heat outside providing a cool moisture-laden air inside. If the humidity is low, the latent cooling of evaporation is higher.

MICROPHONE

The voice commands given by the user is used as input is given through the microphone which is connected to the device. The voice command is converted into text and in that text the specific keywords are searched to help the device to perform its own functions and give output according to the result.

AUDIO SYSTEM

In vehicle such as car, heavy duty vehicle uses audio system for entertainment and for getting information about what is happing around us. Audio System in dashboard of car had few buttons used for controlling the volume, changing the channel and recording purpose. Instead of using buttons it can be controlled by voice command input by user.

SERVO MOTOR

Servo motor is linear actuator that will control linear or angular position, velocity and acceleration. Servo motor consists of motor coupled to a sensor for feedback of position. The input is controlled by analog or digital signal representing the position for output shaft

3.3 FLOW CHART OF THE PROGRAM

The flow chart of the system is shown in fig.3.2.

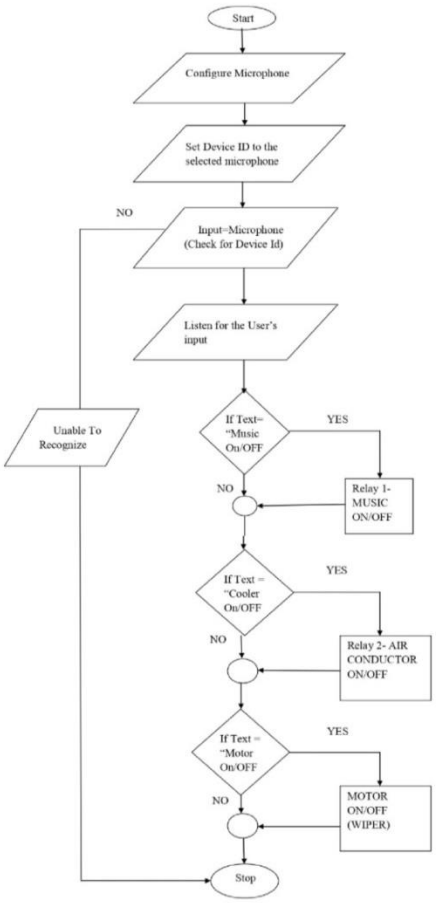

Fig 3.2., *Flow chart of the program*

3.4 WORKING PRINCIPLE

The image of the hardware set up is given below in Fig.3.3. The different controlling system like wiper circuit, door circuit, audio system, cooling circuit and mike are integrated with Raspberry Pi B 3+.

The working prototype and required output was implemented successfully. The output screen is the Python Shell where the output of the Raspberry Pi is obtained. In this, the different parameters are detected by giving voice as input.

For example, a voice command is given as "Cooler on", the voice command is recorded and compared with given set of command in the program and the command is displayed on the screen for acknowledgement.

Case 1: If the given input command matches with the list of command, the corresponding GPIO port in the Raspberry Pi gets enabled, then the corresponding circuit gets turned on and the output is produced.

Case 2: If the voice is not recognized properly due to noise or if the command is not I the given list of commands, the user gets a message that "Google Speech Recognition could not understand audio clearly".

Case 3: If there is any problem in the network connectivity, the user will get a notification message "Could not request results from Google Recognition service".

Fig 3.3., *Hardware setup*

3.5 Working Flow

The working flow of the hardware set up is given below:

Step 1: Initially the hardware setup is connected to the monitor and a power supply with the help of USB cables.

Step 2: The GPIO pins of Raspberry Pi are connected to the pins of different components of the hardware set up.

Step 3: The sample rate is set as 48000 and the chunk rate is set as 2048 in order to reduce the surrounding noise level.

Step 4: The Raspbian OS is set off and the voice command is given by the user via speaker and the voice is recorded.

Step 5: The voice is compared with the given list of command configured in the Raspberry Pi with help of Google Speech Recognition software.

Step 6: If the given command matches with the list of command, the corresponding circuit is enabled.

Step 7: Finally, the circuit produces an output by driving the circuit and the data are displayed in the monitor.

3.6 SOFTWARE MODULE

The software module deals with the coding part of the proposed system using Raspberry Pi. Here, Raspberry pi b3+ is used for the better output and results. This provides the accurate output with much better results efficiently.

Raspbian (Operating System)

Raspbian is the Foundation official supported operating system. The Best All-Around Operating System for Raspberry Pi is Raspbian. This is one of the official operating system used in all models of Raspberry Pi. Raspbian is free available operating system which is the modified version of the popular Operating System Debian.

IV RESULT

The working prototype and required output was implemented successfully. The output screen is the Python Shell (fig. 4.1) where the output of the Raspberry Pi is obtained. In this, the different parameters are detected by giving voice as input.

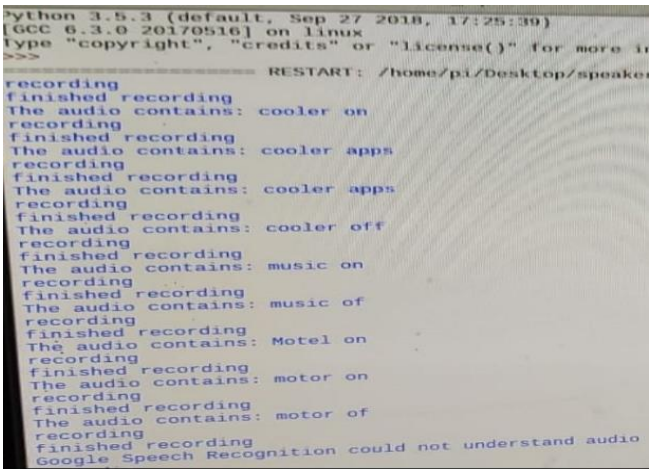

Fig 4.1**.,** *Python Shell (output of raspberry pi)*

4.1 WORKING OF COMPONENTS

4.1.1 Cooler Circuit

The air conditioning circuit shown in below Fig4.2 is constructed with help of cooling circuit. The cooler circuit is connected to the GPIO pin number 18. When the user gives a voice command as "Cooler On", the corresponding relay will be powered on which helps the cooling fan to start rotating until the command "Cooler Off" is said.

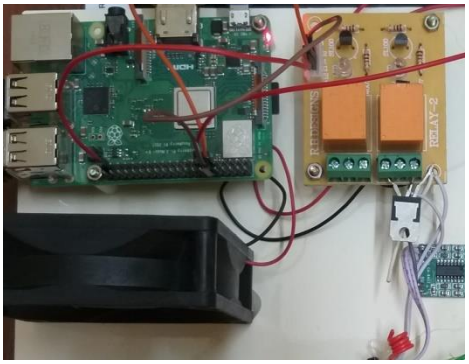

Fig 4.2 *Cooling setup*

4.1.2 Audio System

The audio system shown in below Fig 4.3 is constructed with help of a FM and an amplifier which is connected to the GPIO pin

number 17. When the user gives a voice command as “Music On”, the corresponding relay will be powered on which helps the FM system to play music of different FM channel until the command “Music Off” is said. The FM channel can be changed as user wish and can adjust the volume with help of an amplifier.

Fig 4.3 *Audio system*

4.1.3 Wiper

The wiper circuit shown in below Fig 4.4 is constructed with help of a servo motor and an Arduino UNO which is connected to the GPIO pin number 27. When the user gives a voice command as “Motor On”, the Arduino will be powered on which helps the motor to rotate by using pulse width modulation technique until the command “Motor Off” is said. .

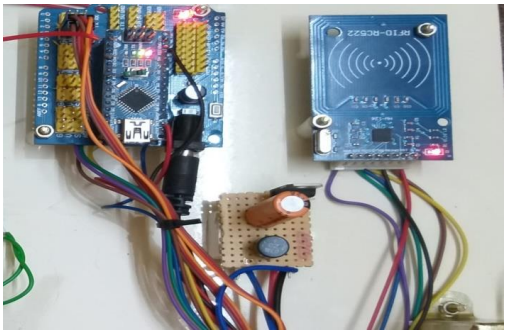

Fig 4.4 *Wiper setup*

4.1.4 Door Locking System

The door locking system shown in below Fig 4.6 is constructed with help of a servo motor, RFID band and a RFID Reader (fig. 4.5) which is connected to the Raspberry Pi. The RFID band shown in Fig 4.6 is a transmitter which contains a serial number present in it and the RFID Reader act as a receiver.

If the RFID band serial number match with the RFID reader, the servo motor starts to rotate from 0 to 90 degree thereby the lock gets opened or else the lock remains closed.

Fig 4.5 *RFID READER*

Fig 4.6 *RFID Band*

4.2 ADVANTAGES

1. Highly secured
2. The accessibility of voice control is simply easy
3. Hand mobility

4.3 LIMITATIONS

1. The Application can be connected only through Wi-fi
2. The input voice command has to be clear and little loud
3. Raspberry Pi 3 B+ is used since wifi module is present in it
4. The prototype must be connected with Monitor

V CONCLUSION

There are many technologies evolving in creating autonomous vehicle system currently. Automated features like GPS, lane keeping assistance and automated cruise control are available too. The combinations of the all special features for automating a car can bring about a new technology in

future. The implementation of the automated features will bring up the problem of replacing humans with computers that can do work for them. As these features are integrated to the society, it will become more apparent and convenient for every users.

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