Voice-Controlled Robots: Voice Interface in Robotic Systems

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Abstract :-Earlier robots were controlled using some electronic devices which was some what time consuming. So now we have developed a robotic car which recognizes our voice commands and complete the given task. This research paper explores the challenges and advancement in implementing voice control system for cars. The robotic vehicles main goal is to recognize voice commands from user and complete the given task. An android app is needed for Bluetooth HC-05 module communication. The Motors are used to power the robotic vehicle, which is controlled by Arduino for hardware. The Ultrasonic sensor helps to detect the obstacles. When an abrupt obstruction is detected, the Arduino and Ultrasonic sensors work together to assist with autonomous vehicle braking and will change the direction accordingly.

INTRODUCTION

Robots were invented as human labors. Earlier Robots were given commands using some kind of electronic devices. But now we have developed a technology by which we can control and give commands to robot just by using our voice, also called voice command. These types of systems are also called as Speech Controlled Automation System. This voice controlled robot can be very useful in many industries like automotive industry. Also this new technology can be very time saving. The design presented in this system is just a prototype of the above mentioned system. The robotic vehicle is connected with a android app using a Bluetooth technology which is Bluetooth HC-05 module communication. The movement of robot is controlled by DC motors which is connected to Arduino. Voice controlled cars are in so much demand and also very useful. In this prototype of car we have used many

components like DC motors, Ultrasonic sensor,ESP32 camera module, Bluetooth HC-05 module, IR sensors, LED lights, buzzer and Arduino. 4 DC motors are connected and power supply is provided through arduino . Ultrasonic sensor is used to detect the obstacles, once the obstacle is detected Arduino and Ultrasonic sensor work together to assist with autonomous vehicle braking and will change the direction accordingly. The car is connected to a android app using a Bluetooth HC-05 module. The voice commands are given by android app and then the car recognizes the commands and act accordingly, and thus complete the given task. Buzzer is attached to prototype, by giving voice command to ring buzzer the buzzer will start ringing. Buzzer can be used to alert in the dangerous situations. LED lights helps for better vision at night. Camera module is used which helps to capture images , it is connected to our mobile and thus we can see it on our mobile. This voice controlled cars if manufactured is small size as prototype can be useful in households too. It can be like a toy to children and also there safety gadget if alone at home, as we have joined a camera module to it through which we can check our surroundings just by sitting at one place on our mobiles. Also this technology can be useful for big projects in many industries to advance the machines with Speech Controlled Automation System.This research paper explains the components used in this system, Methodology used to develop this technology, Explains the circuit diagram, shows the result and discuss it's challenges and future scope. Also the references are mentioned at the end.

LITERATURE REVIEW :-

[1]"Alice Joseline and Mrs. S. Benila.(year-2018)" This paper mainly focus on easy identification of voice and second important thing on which they focus

is assembly of different part of vehicle. researchers takes the help of Artificial intelligence algorithm for recognition of voice accurately and also uses different useful module like arduino for the same.main aim of that paper is to identify the voice of perticular person amongs the all.

[2]"Prof.Bhuvaneshwari Jolad,Mohnish Arora,Rohan Ganu and Chetan Bhatia.(year-2018)"Main aim of this paper to make a car automatic and control it using mobile software.For implementing all of that things researchers use blutooth module and using mobile application they try to control the movement of vehicle.they also use transmitter in thier project and receiver MAX 232 transceiver is also used in their project for communicating with HC05 blutooth module

[3]"Hans Tiwari and Ashish Jha .(year-2019)"Main goal of this paper to make a movement of car using mobile application .researcher uses alexa to control to give command to vehicle .this car car exactly performs the movement according to the controller's order . researchers uses arduino module blutooth module for controlling the movement of the car.

[4]"Ayesha Shafiq,Humera Tariq,Fareed Alvi and Usman Amjad (year-2017)"Main aim of that project this project is to make a car automatic so it can be easily control by controller voice .researchers uses a MFCC(MEL frequency cepstrum coefficient) and HMM(hidden markov model) in vechicle to make it automatic and their try make car so it can be easily and properly control without any failure.

[5]"R.Veeramani,R.madhanmohan,Deepak Prajapati,Aman Kumar and Sidhart Kumar.(year-2019)" Purpose of this project to make a car so it can be easily and automatically control by controller .researcher try to make automatic car for that purpose they uses arduino and blutooth module and other require things.

[6]"C.Jeeva,Anwar Naseer Khan,Junaid Azad Wani and Amit Kumar.(year-2016)"Main goal of this project is to make the vehicle so the movement of it easily and properly control by mobile software according to the controller order .this project also focus on the speed of the vehicle .when the vehicle goes through school area, hospital area etc. where car reduces it's speed automatically because of RF module.so, that percentage of happening the accident definitely reduces.

[7]"Arti Paswan, Ajay Kumar Gautam, Bhartendu Vimal, Farheen and Arun Kumar Mishra.(year-2019)" The main aim of that prototype project to make vehicle so that it can be easily control by controller order. this is an IOT based project in which users uses the HCI(Human-computer interaction) and HRI (Human-robot interaction).researcher uses camera module in their project.

[8]"P R Bhole. N L lokhande , Manoj L Patel ,V D Rathod and P R Mahajan.(year-2017)" Main goal of this project is to make a robotic vehicle so that it can be easily control by controller order. researcher takes the help of AI sensor in this project and they focus on reducing the controller effort for controlling vehicle

[9]"Sathish Kumar and Dr . Radhika Baskar.(year-2019)" Main purpose of this paper is also to control vehicle using software according to the controller order. accuracy of recognizing the voice of controller is upto 90%.and researcher also focus on the reducing the effort of controller.

[10]"Ayesha Shafiq, Humera Tariq, Fareed Alvi and usman Amjad.(year-2019)" This project also focus on movement of vehicle so it can be easily control by using controller order using mobile application. researcher uses the MFCC (Mel frequency cepstrum coefficient) and HMM (Hidden markov model) to make vehicle automatic. researchers focus on reducing the effort of users.

METHODOLOGY :

Voice controlled car which we can control with voice commands will require a standard controller.

Arduino is used for all kinds of applications since it is a user friendly and features that are useful for that are useful for this application. Let's revise which components are used to build this car:
• Arduino UNO
• L298N
• Ultrasonic sensor
• 9V Battery
• Breadboard
• 4 LEDs
• HC-05 Bluetooth Module
• 4 DC motors
• Buzzer

The Bluetooth module (HC-05) is used to determine a communication connection between the vehicle and individual voice commands via Android Application. The Bluetooth device's RF transmitter can accept vocal commands from users that are then turned into electronic data that is encoded, giving it a respectable range up to 100 meters away from the car. Before supplying the data to the microcontroller

ATMEGA16U2, the receiver decodes it so that motor driver L298N may activate DC motors for the required tasks. The battery is directly connected to the L298N. An Arduino UNO is programmed to examine voice orders and react accordingly. To locate the obstacles, Ultrasonic sensor is used. Ultrasonic Sensor measures the distance to an object using Ultrasonic sound waves. It uses a transducer to send and receive Ultrasonic pulses that relay back information about an objects proximity. When ultrasonic waves travel and hits the object it reflects and travels back at receiver, the time taken for waves to travel back is used to measure distance between car and obstacle. 4 LEDs are used in order to ensure that the signal are received by the motor. Also, a buzzer is used so that when obstacle is detected and the car won't move in forward direction. Further, on giving command "HORN" the buzzer will make noise. The car can controlled in 3 ways like voice, gesture and text command. The "HORN" command can not be used in gesture control. For this purpose an application "Srito Hobby " is used.
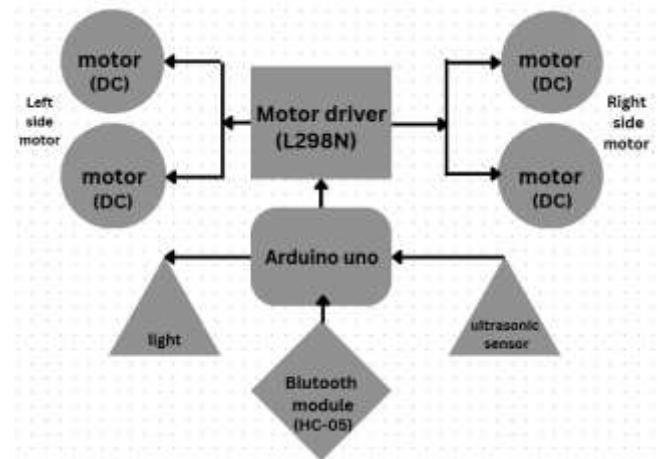
CIRCUIT DIAGRAM :
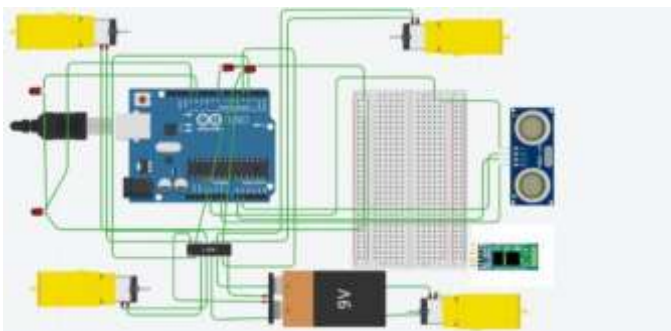
(Fig 1: Circuit diagram of Voice Controlled Car)

Fig 1. explains the circuit diagram of voice controlled car. As shown in above figure we have used 4 DC motors , Arduino UNO, 9V Battery, Ultrasonic sensor, L298N, Breadboard, 4LEDs, Buzzer and H05 Bluetooth Module. The system consists of a transmitter (Android Smartphone) and a receiver (Robot).

Block Diagram:

Above figure shows the block diagram of voice control car.It indicates how the components are connected to each other.It contain Arduino Uno,Motor driver(L298N),DC motor,Ultrasonic sensors and bluetooth (HC-05).In which bluetooth module and ultrasonic sensor give input to arduino Uno and according to it arduino Uno give command to motor driver and DC motors runs accordingly.

FEATURES :

Voice Recognition: The robot can understand and interpret spoken commands given by the user.

Command Execution: It can perform various actions or tasks based on the commands it receives through voice.

Mobility: The robot can move around, either on wheels or legs, based on instructions given through voice commands.

Interaction: It can engage in basic conversation or provide responses to queries using synthesized speech.

Integration: It may be integrated with other smart devices or systems, allowing it to control or interact with them based on voice commands.

Feedback: Provides audible or visual feedback to confirm receipt of commands or completion of tasks.

Learning Capability: Some advanced voice-controlled robots can learn and adapt to user preferences or behaviors over time.

Safety Features: Incorporates safety mechanisms to prevent accidents or harm to users or surroundings.

Remote Control: Can be controlled from a distance using voice commands, enabling operation even when not in close proximity to the robot.
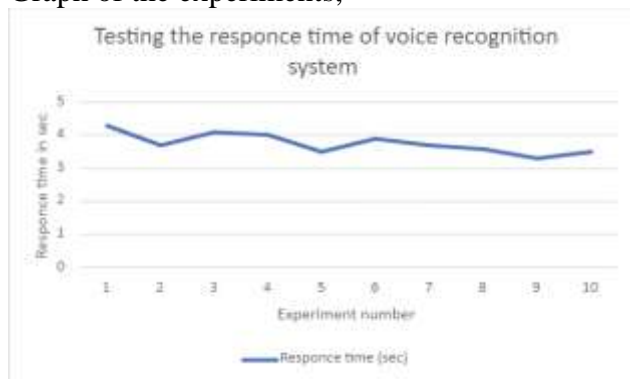
Customization: Allows users to personalize certain aspects such as voice commands, preferences, or appearance.

RESULT AND DISCUSSION:

Reading of experiments,

Experiment	Responce time (sec)
1	4.3
2	3.7
3	4.1
4	4
5	3.5
6	3.9
7	3.7
8	3.6
9	3.3
10	3.5

Graph of the experiments,

Above graph shows how much the time takes when we give command to perform work.Here,we performs the 10 number of experiments and takes the reading of it and plot the graph accordingly.

The voice-controlled robot successfully performed various tasks based on voice commands. It accurately recognized and responded to commands such as "move forward," "turn left," "pick up object," and "stop." The robot demonstrated mobility, interaction, and task execution capabilities, showcasing its effectiveness in responding to user instructions.

The voice-controlled robot proved to be an efficient and user-friendly tool for interacting with robotic systems. Its ability to understand and execute commands through voice recognition enhances accessibility and ease of use, particularly for individuals who may have difficulty with traditional manual controls. This technology opens up possibilities for applications in areas such as home automation, healthcare assistance, and education.

IMAGES OF PROJECT :

(TOP VIEW)
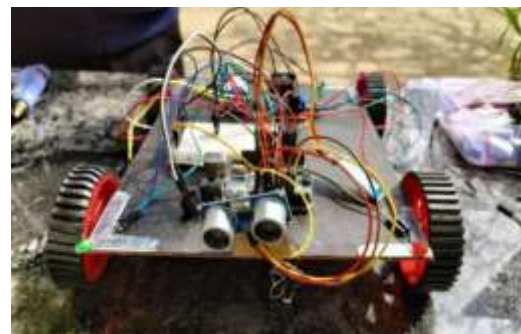
(SIDE VIEW)

CHALLENGES :

Voice Controlled Car faces challenges such as:
• Accurately interpreting diverse accents and languages
• Handling background noise interference
• Ensuring user privacy with sensitive voice data
• Distraction or misinterpretation of commands

FUTURE SCOPE :

In future we will try to join arms to the voice controlled robot , so that it can be used by old people to grab things using this robot. Also we will add many other languages to it so that it can be used by vast amount of population. And also we will try to make a smaller version of this same prototype, so that it can be used by police or in army as Spy Bots.

CONCLUSION :

he voice-controlled robot represents a promising advancement in robotics technology, offering an intuitive and accessible interface for interacting with robotic systems. Through accurate voice recognition and seamless task execution, the robot demonstrates its potential to enhance user experience and accessibility in various domains. voice-controlled

robots are a big step forward in making robots easier to use. They're great at understanding what we say and doing what we ask them to. Although they still have some hiccups with background noise and different accents, they're getting better all the time.

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the human voice and commanding the robot accordingly. Construction of components are used like Arduino UNO, Bluetooth module, DC motors, batteries, ultrasonic sensor etc. There are two types ofenvironment: normal environment and noisy environment. Speechfaridalvi@email.comusmanamjad87@gmail.com University of Karachi, Karachi, Pakistan. IJCSNS International Journal ofComputer Science and Network Security, VOL.19 No.1, January 2019.

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