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Voice Controlled Robotic Vehicle

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ABSTRACT
This paper presents the design and implementation of a voice-controlled robotic vehicle using Arduino. The vehicle is equipped with a Bluetooth module, a microphone, and a speaker to receive voice commands and provide feedback. The system is based on the EasyVR voice recognition module to recognize and interpret voice commands. The Arduino communicates with the motor controller to control the movement of the vehicle based on the voice commands. The robotic vehicle is capable of performing tasks such as moving forward, backward, turning left, turning right, and stopping. The proposed system provides a user-friendly interface that allows for intuitive control of the robotic vehicle, making it suitable for various applications, such as exploration, surveillance, and entertainment. The system's effectiveness is demonstrated through several experiments and tests, showing that the vehicle can reliably recognize and execute voice commands. The use of Arduino makes the system more affordable and accessible to hobbyists and enthusiasts interested in robotics and automation.
*Keywords***:** Voice control, robotics, vehicle, Arduino, motor controller, microphone, speaker, Google Speech Recognition API, EasyVR, Bluetooth, movement control.

I.   INTRODUCTION

A voice-controlled robotic vehicle is a type of robot that can be controlled through voice commands. It uses a microphone to receive voice commands and a speaker to provide feedback. The vehicle is equipped with motors and a motor controller that enable it to move in different directions based on the voice commands. The use of voice commands as a control interface makes the system intuitive and user-friendly, allowing for more natural and faster interaction. Voice-controlled robotic vehicles can have various applications, such as exploration, surveillance, and entertainment. They can be used in hazardous environments, such as search and rescue missions, where it may be unsafe for humans to enter. They can also be used for educational purposes, such as teaching children about robotics and automation. Additionally, they can be used for entertainment purposes, such as remote-controlled toy cars. The design of a voice-controlled robotic vehicle typically involves integrating various components such as a microphone, speech recognition software, and a motor control system. The microphone is used to capture the user's voice commands, which are then processed by the speech recognition software. The software analyzes the voice commands and converts them into digital signals that are sent to the motor control system. The motor control system then uses these signals to control the movement of the robotic vehicle.

1.1   MOTIVATION AND OBJECTIVE OF THE PROJECT

The motivation behind this undertaking is to plan a robot for the exchange of information from one end to other in firms to

make the data development less demanding by only a transmitting voice charge from smart phone, with the assistance of an android application on through Bluetooth arrangement. The main objective of this project is to develop a simplified robot that works based on human voice commands. There are various previous robots based on this principle but their implementations are harder compared to our prototype. Our main objective is to develop our robot in such a way that it also comes to use in military purposes, transportation purposes, object detection, bomb detection and in numerous fields.

1.2 LITERATURE SURVEY

Many researchers have worked in the development of robots and have come up with new approaches. These researches serve as the basis for the new innovations. An attempt has been made to list out some papers mentioning the technology used and advantages of each.

"Robot Control Design Using Android Smartphone" by Mrumal.K.Pathak, Javed Khan, Aarushi Koul, Reshma Kalane, Raunak Varshney This paper explains the controlling of robot through phone adopting Bluetooth technology and some of its features, mobile component and robot. The solutions derived are very much comfortable and they act as platform for robot building. The cost is very less, computation speed and sensing of the control device, smartphone is good. The paper aims to provide simple robot hardware architecture with sophisticated android domain which is powerful enough.

"Smart Phone Controlled Robot Using ATMEGA328 Microcontroller "by Aniket R. Yeole, Sapana M. Bramhankar, Monali D. Wani, Mukesh P. Mahajan. The paper is about robot designing making use of the application of android phone. In this paper, the direction of the robot and what is the distance of the robot from the obstacle will be communicated. This information shared through phone through Bluetooth. The control commands are sent incorporating features like motor speed control and sensing the data.

"Android Mobile Phone Controlled Bluetooth Robot Using 8051 Microcontroller" by Ritika Pahuja, Naren A robot can be defined as electro-mechanical machine governed by programming computer and electronic hardware. Robots are been used in factories all over the world in the Manufacturing units. In this paper, motion of the robot is controlled by the buttons of the android application. Bluetooth module is used for interfacing of smartphone and the controller. This is done through the help of UART protocol.

"Robot Controlled Car Using Wi-Fi Module" by S R Madkar, Vipul Mehta, Nitin Bhuwania, Maitri Parida. In this paper, robot-controlled car designed in android application making use of Wi-Fi in the smartphone. The devices can be controlled even though android phone is not physically present through the SMS. In this project, inclusion of spy camera using which live 4 videos can be streamed to the user making use of Wi-Fi. Instead of using normal lithium-ion battery, this project makes use of solar cells leading to energy efficiency.

"Lab VIEW Model of Voice Commands for Mobile Robot Motion Control using Internet of Thinks Module" by Snezhana Georgieva Pleshkova, Aleksander Bogdanov Bekyarski and Zahari Todorov Zahariev. The interaction of the people with the robots are been satisfied through many mobile robot methodologies done by many of the researchers. In all the methodologies, commonly the voice commands are the interaction domain. This is required for operating the motion of the mobile robot. This is accomplished in this article by proposing a creation of LabVIEW model for the reception and recognition of voice commands which is transmitted from the person to the mobile robot. The experimentation and testing of LabVIEW model are carried out in the Internet of Thinks which is sophistically adopted on the mobile robot domain.

1.3 TECHNOLOGIES USED FOR BUILDING A VOICE-CONTROLLED ROBOTIC VEHICLE

Voice recognition software: The software processes the audio input and converts it into actionable commands that the robot can execute.

Microphone: The microphone is used to capture the user's voice input and transmit it to the voice recognition software.

Motor and motor driver: The motor and motor driver are used to control the movement of the robotic vehicle.

Sensor: Various sensors such as ultrasonic sensors, infrared sensors, or cameras may be used to detect obstacles or other objects in the environment.

Microcontroller: The microcontroller acts as the brain of the robotic vehicle, processing the input signals from various sensors and executing commands to control the motor and other functions.

Wireless communication: The robotic vehicle may use wireless communication technologies, such as Wi-Fi, Bluetooth, or Zigbee, to connect with other devices and receive commands from the user.

Battery and power management: The robotic vehicle may be powered by a battery, and a power management system is needed to manage the battery charge and ensure that the vehicle operates reliably.

II. RESULTS AND DISCUSSIONS

Voice-controlled robotic vehicles have been an area of active research and development in recent years. The technology has the potential to revolutionize the way we interact with machines, particularly in environments where hands-free operation is required or where manual controls may be difficult to use. Several studies have been conducted to evaluate the performance of voice-controlled robotic vehicles, and they have shown promising results. These vehicles have been shown to be effective in a variety of scenarios, including industrial settings, military applications, and consumer products. One key advantage of voice-controlled robotic vehicles is that they can be operated without the need for physical input devices, such as joysticks or keyboards. This makes them particularly useful in situations where hands-free operation is required, such as in hazardous or sterile environments, or when the operator needs to focus on other tasks.
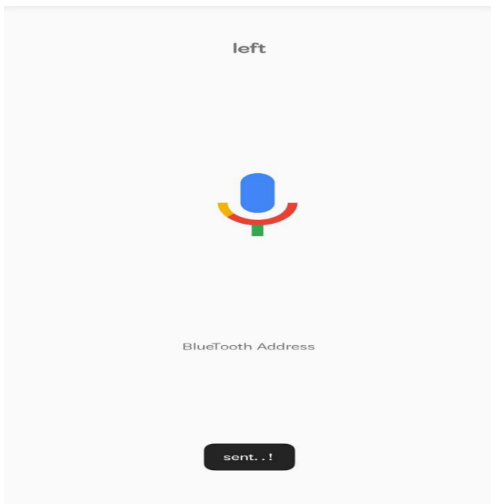
Fig-1: After successful recognition of the left command, the data is sent to the device and the respective operation takes place.
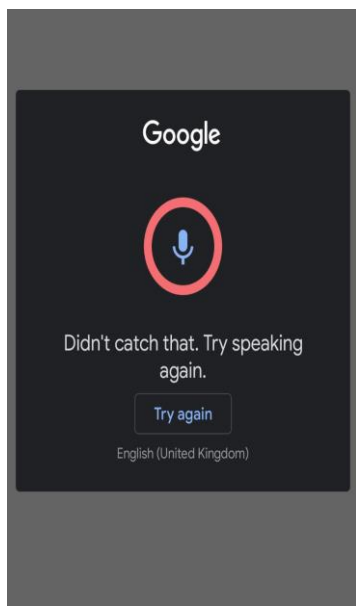

Fig-2: A warning is given by the application if the user's voice is not detected.

2.1. TESTCASES

Test case	Input	Expected output	Output	Result
When the voice is not recognized by application	To test this, the voice command should be processed by the speech recognition module, which should recognize the command "Turn left and move forward".	To verify the output, the movement of the vehicle should be observed and compared with the expected output.	It warns the user to try again	Failure
When the voice is recognized and a correct command(direction) is given	The microcontroller/procoessor should then generate appropriate control signals for the motor control module, which should turn the vehicle left and move it forward.	The output can also be monitored using sensors or cameras attached to the vehicle, and the results can be analyzed to ensure that the vehicle is moving as expected.	The message will be sent to perform respective operations and moves in that direction	Success
When a wrong command is given	In the input it cannot process	It may be a wrong command	The application alerts the user with a wrong message	Failure

Table-1: Few tests done through Bluetooth to the robotic vehicle that includes passed cases and failed cases.

2.2. ROBOTIC MODEL

The robot will be based on microcontroller Arduino Uno because of its versatile features along with numerous advantages which is based on Atmega328P and an open-source platform with the benefit of physical computing. The system will utilize Bluetooth technology and Standard communication interface safe, less power consuming device to connect and exchange data between devices without using of any kind of physical contact like wires and cable.
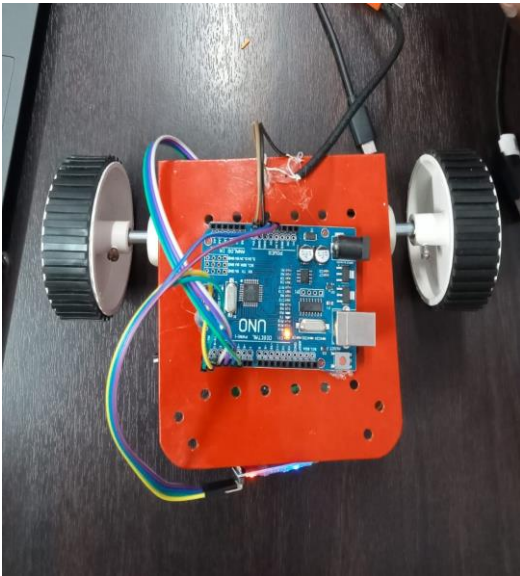
Fig-3: Component's picture of the robotic vehicle

III. CONCLUSION AND FUTURE SCOPE

We present a voice recognition system for the mobile robot control. The accuracy reaches a level of 95% which is much higher than the ones provided by commercial systems in the market. The core acoustic modelling was achieved by using the HMM method and more words than the five commands are built in the linguist database to improve the accuracy by reading the past recognized words in the buffer and increase or decrease of the possible occurrence of the output words. The system has been successfully implemented and tested on a voice based controlling robot. As we know nothing in this world is perfect everything is trying to make itself better and more effective compared to others. So, on the same note, this technology also requires lots more development. Thus, expanding its applications farther where at present we can't think of. Further enhancement in project can be used for Home security and military purposes where the commands can be given to robot without risk by increasing the range and by installing cameras.

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