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Voice Controlled Robotic Vehicle Using Arduino

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ABSTRACT- In this project, we aim to create a robotic car controlled by voice commands from an Android application. The vehicle uses a Bluetooth module to establish a seamless connection between the Android app and the robot platform. Additionally, ultrasonic sensors are integrated into the vehicle design to help prevent problem detection and stop work. The main goal of the project is to create a user-friendly and intuitive tool for controlling the robot car, increasing its usability and usefulness. Using voice commands, users can easily interact with the vehicle for seamless navigation and control. Additionally, the integration of ultrasonic sensors can improve the safety and efficiency of the vehicle by detecting obstacles on the road and activating the braking mechanism to prevent collisions. With the implementation of this project, we aim to demonstrate the potential of voice-controlled robotic vehicles in a variety of applications, including surveillance, research search and service in a hazardous environment. Additionally, this project supports the advancement of human-computer interaction technology and paves the way for better understanding and effective control of robot interventions. The designer's voice-controlled car can be operated using 5 simple commands: forward, backward, left, right and stop. The speech recognition system will help translate commands into commands. The ultrasonic sensor used by the robot can help the robot detect problems within a range of 50cm. It stops immediately if a problem occurs.

Keywords— Voice, Arduino, Step-Motors, Smart Vehicle.

1.INTRODUCTION

With the development of science and technology in the last decade, electronic devices that make life easier have become widely used. A sensor is a device that converts electrical signals into electrical signals. Sensors act as a bridge between the environment and various electronic devices. The environment can be a physical environment such as a military base, airport, factory, hospital, store, or an electronic device such as smartphones, robots, tablets, and smart faces. These devices have many applications in the control, prevention, measurement, and evaluation of business processes. Today, with the development of technology, hundreds of types of sensors have been developed such as heat, pressure, impact recognition and human body detection. Sensors for lighting. We have experienced rapid growth with the use of technology in the electronics industry. In this context, updates or applications can be developed to make life easier every day. This article presents the remote control of robotic vehicles using sensors from the perspective of interference and avoidance. The connection between the robot and the Android device is made via Bluetooth technology. The sent data will be processed by Arduino UNO and the robot will be able to work according to the user's input. There are two main modes to control the robot car via Android app (mobile phone). These are user-controlled mode and automatic mode. A menu appears with buttons for selecting actions. These buttons will be used to move the robot forward, backward, right, left, stop and switch to control mode. By selecting automatic mode, the user loses

control of the robot, and the robot can find its way without intervention. The robot catches and warns the animals it encounters. When the robot encounters a problem, it finds its way without getting discouraged, hears the sound and stops. It is also detected by the body temperature sensor and gives a warning via red LED. In this study, we developed a new vehicle design with real-time obstacle detection and avoidance capabilities. To our knowledge, real-time detection and avoidance have not been investigated before using Arduino UNO and Android platform.

2. LITERATURE REVIEW

This research study proposes a voice-activated motion control system for a robotic vehicle using an Arduino Mega controller and Li-Fi technology. It replaces light sensing resistors with indoor solar panels as receivers. Mel-frequency cepstral coefficients are used for voice recognition, trained using the Levinson-Marquardt learning algorithm in a two-stage, four-input neural network model. Experimental results show the lowest MSE for voice samples as iterations increase. [1]

This article introduces a user-controllable voice-activated robotic automobile using speech recognition technology. The AT89S52 micro controller is used for commanding the robot, with a 75% accuracy rate in low-noise conditions. The system is highly susceptible to environmental changes, as certain sounds may be mistaken for spoken commands. The wireless communication uses an R.F. transmitter and receiver, and the AT89S52 micro controller is responsible for the robot's operation. [2]

This article introduces a voice-activated robotic automobile that uses speech recognition technology to issue and process commands. It uses an R.F. transmitter and receiver for wireless communication, and the AT89S52 micro controller for commands. The speech recognition system performs better in low-noise conditions, with an accuracy of 75%. However, it is sensitive to changes in its surroundings, as certain sounds may be mistaken for spoken commands. [3]

The "Voice Controlled Robotic Vehicle" project utilizes an Android application and microcontroller to operate a robot using voice commands. Bluetooth technology enables easy connection between the robot and software. Two DC servo motors move the robot, translating commands into digital signals via a Bluetooth RF transmitter. This small operation positively impacts disabled people, especially in remote areas. [4]

This article discusses the development of a voice-activated robotic car, which uses a Texas board, a Wi-Fi module, CC3100 booster pack, Android app, IFTTT, and Blynk to relay voice commands. The microcontroller is connected via a Wi-Fi module to an Android smartphone for voice control. The Android app converts voice commands into text, sending the controller data needed to drive the robot. Blynk, an online cloud server, processes voice instructions in real time. This voice-activated robotic car is designed for use in hazardous situations and can be operated using Google Assistant. [5]

The study focuses on remote control of a robotic vehicle using voice commands, an Android application, and an ARM series microcontroller. The Android application is linked to the robot's Bluetooth module, allowing voice commands or push buttons to communicate with the robot. Two DC servo motors are connected to the microcontroller, and the Bluetooth RF transmitter can receive speech or switch press orders. This project transforms robotic vehicles, enhancing its functionality and potential for home security and military applications. [6]

A robotic vehicle uses voice commands to operate in high-risk areas. It's controlled by an Android device with a Bluetooth module. The Arduino program operates the vehicle in four directions, using a motor driver circuit and a wireless camera. A robotic arm is mounted at the front, and an LCD screen displays commands. An obstacle detector is also added for protection. [7]

The Intelligent Personal Assistant (IPA) is a voice-controlled robot designed to assist the elderly and disabled by reducing manual tasks. It can perform

tasks like movements, turns, and reading and recognizing characters. The robot also provides trending information like weather and politics. The project aims to make life more normal for these individuals by using an autonomous voice command and an ultrasonic sensor to move without obstacles. [8]

This paper presents a pick and place robotic arm vehicle using an Android application for voice commands. The Arduino programming language was used to program the controller, which can lift 250g and communicate at 12m with high precision. The fully functional, voice-controlled robotic arm vehicle is suitable for various industries, including maritime, manufacturing, and military sectors. [9]

This work focuses on the production of industrial and commercial robotics, specifically in autonomous robotic vehicles. It covers motor control and obstacle navigation algorithms, motor types, feedback devices, control strategies, vision hardware, and navigation software. The content is aimed at robotic vehicle designers and provides background material for researchers to enter the field of electric smart car technology. [10]

3. METHODOLOGY

Implementation and evaluation of voice control in a mobile robot using the microphone of an Android smartphone to recognize the human voice. Using the Android operating system and smart software, the speech is processed and converted into English. Speech recognition is a multidisciplinary field of mathematics that explores methods and techniques that allow computers to recognize spoken words and convert them into text. Automatic speech recognition (ASR) is another name for computer speech recognition and speech-to-text (STT). It combines communication, computer science and electrical engineering skills and research. Speech recognition has a long history as a technology and has made many significant advances. Advances in deep learning and big data have advanced this field recently. These developments are reflected not only in the increasing number of academic journals on the subject, but also in the commercial adoption of various deep learning methods that enhance and apply international language-related knowledge. Combine the picture. The project was carried out in accordance with the requirements and specifications. Voice can be used to control things easily.

4. WORKING

1. An android application is used to recognize voice commands given by the user.
2. The android app is connected to the Bluetooth module Hc-05, which receives the command from the user and transfers it to L298N Motor Driver via Arduino Nano. The motor driver is responsible for controlling the Dc motors.
3. Arduino Nano receives commands from the transceiver and performs specific actions. When the user gives forward command the robot will move forward, backward command will make robot move in backward direction, left and right commands will move the robot in eft and right direction respectively, and stop command will stop the robot from moving.
4. In addition to this voice controlled robotic vehicle, ultrasonic sensor is used to avoid any collision with an object. The range of the ultrasonic sensor is set about 50 cm that means if the ultrasonic sensor recognizes any object within the range less than or equal to 50 cm it will apply stop command automatically.

BLOCK DIAGRAM-

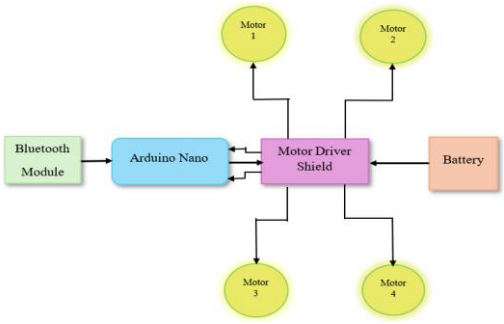

Fig-1: Technical Specifications of the Robotic Car

Robotic vehicles consist of Bluetooth module, Arduino nano, motor driver, DC motors and power supply. As shown in the block diagram, the Bluetooth module sets up a wireless connection between the robotic vehicle and the android application. Voice commands given using an android application are sent to Arduino nano. 5 basic commands are set in this robot that is forward, backward, left, right and stop. These commands are given to the motor driver which controls the RPM and the direction of rotation of the dc motors of the vehicle. Further an ultrasonic sensor is attached with Arduino nano which helps in the braking system whenever there exist an obstacle Infront of the vehicle within the range of 50cm.

5. COMPONENTS USED

1. Arduino NANO

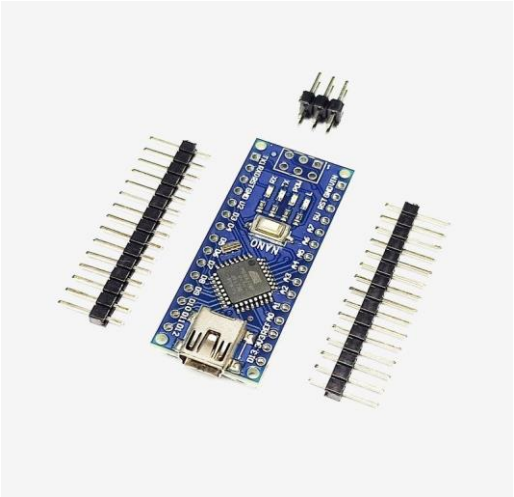

Fig-2: Arduino Nano

The Arduino Nano is a small microcontroller board powered by an ATmega328P chip, featuring 14 digital I/O pins, USB connectivity, and compatibility with the Arduino IDE. The figure 3.7 is popular for its compact size and versatility, suitable for a wide range of projects including DIY electronics, robotics, and IoT applications.

The Arduino Nano is very much like the Arduino UNO. They use the same Processor (Atmega328p) and hence they both can share the same program. One big difference between both is the size. UNO is twice as big as Nano and hence occupies more space on your project. Also, Nano is breadboard friendly while Uno is not. To program an Uno, you need a Regular USB cable, whereas for Nano, you will need a mini-USB cable.

2. HC-Bluetooth Module

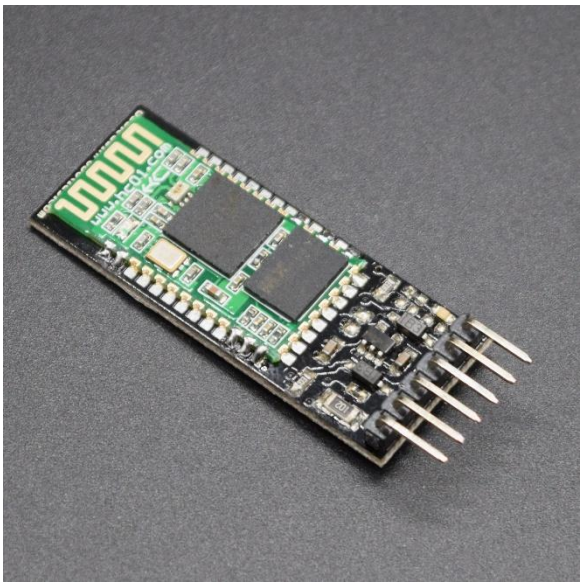

Fig-3: HC-Bluetooth Module

The HC-05 is a Bluetooth-to-Serial-Bridge module that allows wireless communications between two microcontrollers or between a microcontroller and a smartphone, laptop, or desktop PC with Bluetooth capability. It's perfect for directly replacing a wired asynchronous serial interface.

Best of all, these mods are very easy to use. No need to bother with Bluetooth protocol or stacking. Just send the data over the serial interface; data will be sent to any Bluetooth connected device.

3. DC Motor

Fig-4: Dc Motor

Direct current (DC) motors use direct current to convert electrical energy into electricity. DC motor is an electric motor that works on the principle of "when the current carrier enters the magnetic field, it is exposed to moisture". The formula for the applied force is F = BIL. The main components of the DC motor consist of 6 components. These are coils, magnets, rotors, brushes, stators and DC power supplies. In this study, the purpose of the DC motor is to rotate the wheel. The armature is placed in the magnetic field created by the coil and rotates using direct current to create mechanical force.

4. Arduino IDE:

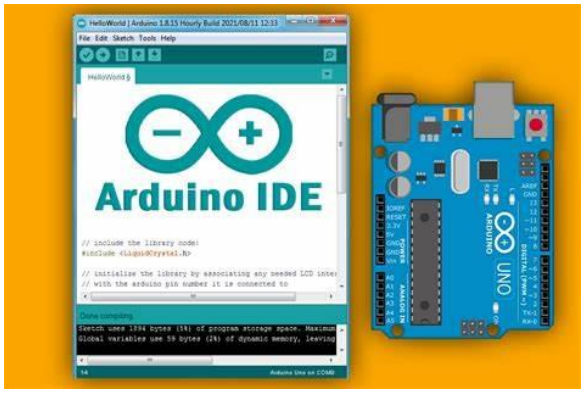

Fig-5: Arduino IDE

Arduino IDE is a software development platform that allows you to use Arduino devices, write code, and upload code directly to the Arduino Uno (connected to a USB port on your computer). This platform uses the C/C++ language. It has two general functions for C/C++ languages:

- set: This function starts running at the beginning of the program.
- loop: This function runs in a loop until the car is turned off

5. Android Platform:

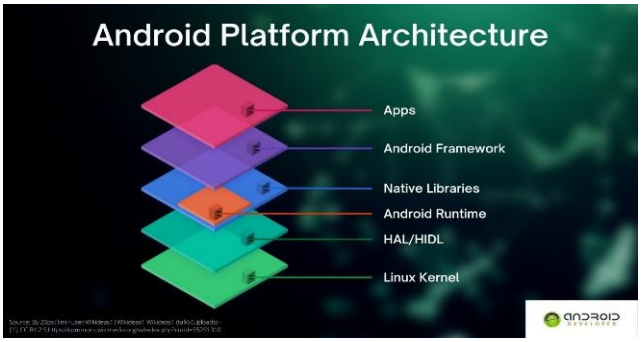

Fig-6: Android Platform

The Android platform consists of a Linux-based operating system developed by communities such as Google and the Open Handset Alliance. It is low cost and open source. It was originally used for tablets and smartphones. The Android operating system consists of 4 layers. 1- Linux Core 2- Libraries and Android Runtime 3-Application Framework 4-ApplicationsCore is the first layer of Android operating system and is used for memory management, Process control and communication. The second layer is Libraries and Runtime, which contains all the functional libraries of the Android operating system written in C and C++. It is called from the Java interface. This set works with the Dalvik virtual machine. This also acts as a kind of translation between the application and the function. The third layer is the application framework, which determines the structure of the Android operating system application. The fourth and last layer is the application that provides the interaction between the JavaScript and the user. The app connects to the robot using a Bluetooth connection.

5. Ultrasonic sensor:

Fig-7: Ultrasonic Sensor.

Ultrasonic ranging module HCSR04 has pseudo r ange from 2cm to 400cm and accuracy of 3mm. Modules include ultrasonic transmission**,** receiver and communication modules**.** The working mode l of our system is as follows**:** Module 8 sends 40kHz pulse and uses IO to generate a hi gh signal of at least 10 us to check if there is a back signal pulse**.** The time it takes for ultrasound waves to propaga te from the transmitter to the receiver is called the effective IO interval**. (**Time pressure / speed of s ound (340 M/S) / 2 = measured distance.

6. CONCLUSION

In summary, significant advances have been made in autonomous driving and human-machine interaction with the creation of voice-controlled vehicles with co-search capabilities. Through this study, we demonstrated the effectiveness and efficiency of using voice to control a robot car through a mobile application, providing users with a user-friendly time navigation interface. We increase the performance and safety of the vehicle by using an ultrasonic sensor in the design, which allows the vehicle to detect obstacles in its path and brake to prevent an accident. This increases the vehicle's overall usability and improves its ability to adapt to dynamic environments, making it suitable for a variety of applications such as surveillance, reconnaissance and support in hazardous situations. Future research and development can focus on improving the control system, simplifying problem detection algorithms, and improving the ability of robotic vehicles to control difficult tasks and environmental conditions. Additionally, research into the integration of additional technologies such as lidar systems or cameras could improve vehicle perception and navigation capabilities. This project is an important step towards creating a useful and user-friendly product that will complement the robot and its applications in various industries. Functions such as forward, reverse, turn left, right and stop. According to the forward command, 1,2 motors move clockwise, 3,4 counterclockwise, and under the reverse command, the robot car moves forward, 1,2 motors move counterclockwise, 3,4 moves clockwise, and the robot car moves forward. The car retreated. The 1.2 motor on the left is commanded to move only clockwise and the robot car turns left. On the right side, the 3.4 motor is commanded to move only to reverse, and the robot car turns right. After receiving the stop command, all motors stop rotating and the robot car stops working. Additionally, the robot car is integrated with ultrasonic sensors and will stop as long as there are obstacles in front of the car.

VII. REFERENCES

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