Arduino Based Voice Controlled Robot

Minor Project Report

Submitted for the partial fulfillment of the degree of

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In

Electronics and telecommunication Engineering

Submitted By

Mansharam Dawar

0901ET201034

UNDER THE SUPERVISION AND GUIDANCE OF

Dr. Shubhi Kansal

Assistant Professor

DEPARTMENT OF ELECTRONICS ENGINEERING

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR (M.P.), INDIA
माधव प्रौद्योगिकी एवं विज्ञान संस्थान, ग्वालियर (म.प्र.), भारत
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January-May 2024

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I further declare that the work reported in this report has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

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0901ET201034

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Guided By:

Dr. Shubhi Kansal

Assistant Professor
DEPARTMENT OF ELECTRONICS ENGINEERING
MITS, Gwalior

Departmental Project Coordinator

Dr. Varun Sharma
Assistant Professor
DEPARTMENT OF ELECTRONICS MITS, Gwalior

Approved by HOD

Dr. V. V. Thakre
DEPARTMENT OF ELECTRONICS
MITS, Gwalior

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0901ET201034

Checked & Approved By:

Dr. R P Narwaria
Assistant Professor
DEPARTMENT OF ELECTRONICS ENGINEERING
MITS, Gwalior

ABSTRACT

This project is designed to be remotely operated through voice commands as the means of control. An application developed using android on a mobile platform while a microcontroller is used for required tasks. The link of the specifically designed android app and the selected vehicle is created with the assistance of Bluetooth. The de servo motors are incorporated at the receiver end along with the microcontroller for the smooth functioning of the robot.

The commands from the application is in form of electrical signals and is transmitted through the Bluetooth RF transmitter to an appropriate range (about 100 meters) to the second part of the robot. In the receiver end the signals gets decoded and than it is passed to the microcontroller and the microcontroller control the DC motors for the required work. The main purpose of the voice controlled robotic vehicle is to accomplish the desired task within the specified environment by responding to the voice commands given by the operator. Here, informed by the analysis of the collected data, a preliminary session is required for the normal functioning of the robot by the user. Therefore, for this a code is used to provide instruction to the controller.

Keywords: Artificial Intelligence, Robotics, Creation, Device, Actuation.

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I personally take great pleasure along with having a deep feeling of gratitude and expressing it to the great my esteemed, Madhav institute of Technology and science (MITS), Gwalior (M. P.), for providing me opportunity to fulfill this project.

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I do not forget to thank our director Dr. R. K. Pandit for the support and the available resources in the completion of this project.

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Finally, I would like to express my gratitude to all the people whom I met during my working on this project. In particular, I wish to express my profound gratitude to those who contributed a lot to the realization of this project.

Mansharam Dawar

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ACRONYMS

Programming and communication: IDE
Integrated Development Environment (such as Arduino IDE)
TX: Transmit (pin used to send data).
RX: Receive (pin used to receive data).
VCC: Voltage Common Collector (power supply pin)
GND is the ground or reference point in an electrical circuit.

Sensors and Modules: - Infrared (for obstacle detection)
US Ultrasonic (distance measurement sensor)

Components
UNO
Universal Nano Optimizer (also known as Arduino UNO, a microcontroller board)
VRM (Elechouse Voice Recognition Module V3)
MCU: Microcontroller Unit (Arduino UNO)
Direct Current (DC) is the electrical current used to power motors.
PWM (Pulse Width Modulation) controls motor speed.
H-Bridge
A circuit in which a voltage can be supplied across a load in either
Direction (used in automobile driving)

Control and Operations- F: Forward (instruction to move the robot forward).
Backward (instruction to move the robot backward)
L: Left (order to turn the robot left)
R: Right (instruction to turn the robot right).
Stop (instruction to stop the robot)

NOMENCLATURE

Components-

Arduino UNO
A microcontroller board based on the ATmega328P. It processes input information and controls the robot's movements.
Vocal Recognition Module
A module that receives and interprets speech commands before translating them into digital signals for the microcontroller.
The Motor Driver (L298N)
module regulates the speed and direction of DC motors, enabling the robot to move depending on microcontroller commands.
DC motors
power the robot's wheels, allowing movement.
Ultrasonic sensors
detect impediments by measuring the distance between items in their path.
Power Supply
A rechargeable battery pack provides power to the microcontroller, voice recognition module, motor driver, and motors.

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CHAPTER 1: INTRODUCTION

Introduction

In the fast growing field of robotics, the incorporation of voice command technology has become a watershed moment, providing a more intuitive and efficient means of directing robotic devices. The invention of a Voice Controlled Robotic Vehicle (VCRV) is a significant advancement in this field. This device, known as a Speech Controlled Automation device (SCAS), uses voice instructions to control a robotic vehicle, allowing for hands-free operation and improving accessibility, particularly in tough circumstances.

The major goal of this project is to build a prototype VCRV that can be operated via voice commands provided from an Android smartphone. This smartphone acts as a sophisticated interface, using advanced features to connect with the autonomous car using Bluetooth technology. The commands are relayed wirelessly and interpreted by the robot's microprocessor, which subsequently performs the appropriate operations. Basic commands include forward, reverse, left, right, and stop.

The implementation of voice control requires a period of accent training to ensure accurate command recognition, after which the system can reliably understand and act on the user's instructions. This capability is especially beneficial for applications where manual control is impractical or impossible, such as in hazardous environments or for individuals with physical disabilities. The system also has potential uses in industrial settings, medical facilities, and environmental monitoring.

The VCRV achieves its functionality by combining hardware and software components. The hardware consists of the mechanical design of the robot, the selection of appropriate motors, and the integration of electronic devices to power the robot's joints. The software includes high-level algorithms for speech recognition, which converts spoken words into a series of movements, as well as control algorithms that ensure exact movement.

The invention of such a system simplifies robotic vehicle control systems while also improving their safety and operating effectiveness. The VCRV links the real and digital worlds by using voice commands, allowing humans and robots to interact more naturally and effectively. This research will demonstrate the viability and benefits of voice-controlled robots, paving the way for future advancements in the field.

CHAPTER 2: LITERATURE SURVEY

The literature survey for the Voice Controlled Robot project explores various research papers, articles, and projects related to voice recognition technology, microcontroller applications, and robotic systems. This survey provides insights into the existing technologies, methodologies, and innovations that contribute to the development of voice-controlled robotic systems.

1. Voice Recognition

Technology Overview of Voice Recognition

Voice recognition technology has significantly advanced over the past few decades, enabling machines to interpret and act upon human speech. It involves the conversion of spoken language into text or commands through complex algorithms and machine learning models.

Applications in Robotics

Voice recognition is increasingly being used in robotics to facilitate hands-free control and improve human-robot interaction. Research has shown that integrating voice recognition with robotic systems enhances their usability and accessibility.

2. Microcontroller-Based Robotic Systems

Arduino as a Popular Choice

Arduino microcontrollers, notably the Arduino UNO, are widely used in educational and hobbyist robotics due to their ease of use, low cost, and strong community support. They offer a versatile framework for constructing a wide range of robotic applications, including voice-controlled robots.

Programming and Integration

Programming microcontrollers to interface with voice recognition modules and control motors involves understanding both hardware and software aspects. Several studies have focused on optimizing code and improving the efficiency of robotic systems controlled by microcontrollers.

3. Motor Control and Obstacle Detection

Motor Drivers and Control Techniques

Controlling the movement of a robot requires efficient motor drivers, such as the L298N, which can handle the required current and provide precise control over the motors. Pulse Width Modulation (PWM) is a commonly used technique for controlling motor speed and direction.

Obstacle Detection Technologies

Robot autonomy relies heavily on obstacle detection. Infrared (IR) and ultrasonic sensors are often employed to identify and avoid obstacles. These sensors supply the microcontroller with the data it needs to make real-time decisions.

4. Real-Life Applications

Assistive Technologies

Voice-controlled robots have significant potential in assistive technologies, helping individuals with disabilities perform daily tasks. Research has shown that these robots can greatly improve the quality of life for users by providing greater independence.

Educational Tools

In educational settings, voice-controlled robots serve as effective tools for teaching programming, electronics, and robotics. They offer hands-on learning experiences that can inspire and engage students.

Conclusion

The literature review discusses the advancements and promise of voice-controlled robotic systems.

By integrating voice recognition technology with microcontrollers and sensors, these robots offer innovative solutions for various applications, from assistive technologies to educational tools. The research reviewed provides a strong foundation for the development of the Voice Controlled Robot project, emphasizing the importance of efficient motor control, real-time obstacle detection, and effective programming techniques.

CHAPTER

Material Required

The following parts were used to model and design the VCRV, as well as to program the arduino and develop the software, which was created using app inventor on the internet.

1. Gear Motor

A DC motor is a type of rotary electrical equipment that transforms direct current into mechanical energy. All types of DC motors contain an internal mechanism, either electronic or electromechanical, that can alter the direction of current flow in the motor's path on a periodic basis.

2.Wheels

A wheel is a circular block of durable and strong material that is put in an axil and turns when a moment is applied by torque or gravity, resulting in one of the simplest machines.When positioned under a load-bearing platform, the wheel spinning on the horizontal axil allows for the transportation of big weights.

3.The Arduino UNO Board

Adruino UNO is an open source microcontroller board based on the ATmega328p microcontroller, produced by Adruino.cc. The board features 6 analog pins and 14 digital pins, which can be programmed using the Arduino IDE and a Type B USB connector. It can be powered by an external main-voltage battery.

4. L298D Motor Driver

The L298 Driver is a high voltage, high current twin bridge driver that accepts conventional TTL logic levels and drives inductive loads. The emitter of the lower level transistors of each bridge is connected together to the corresponding external terminal, which can be utilized to connect an external sensing resistor. Figure 5 shows the L298D Motor Driver.

5. HC05 Bluetooth Module

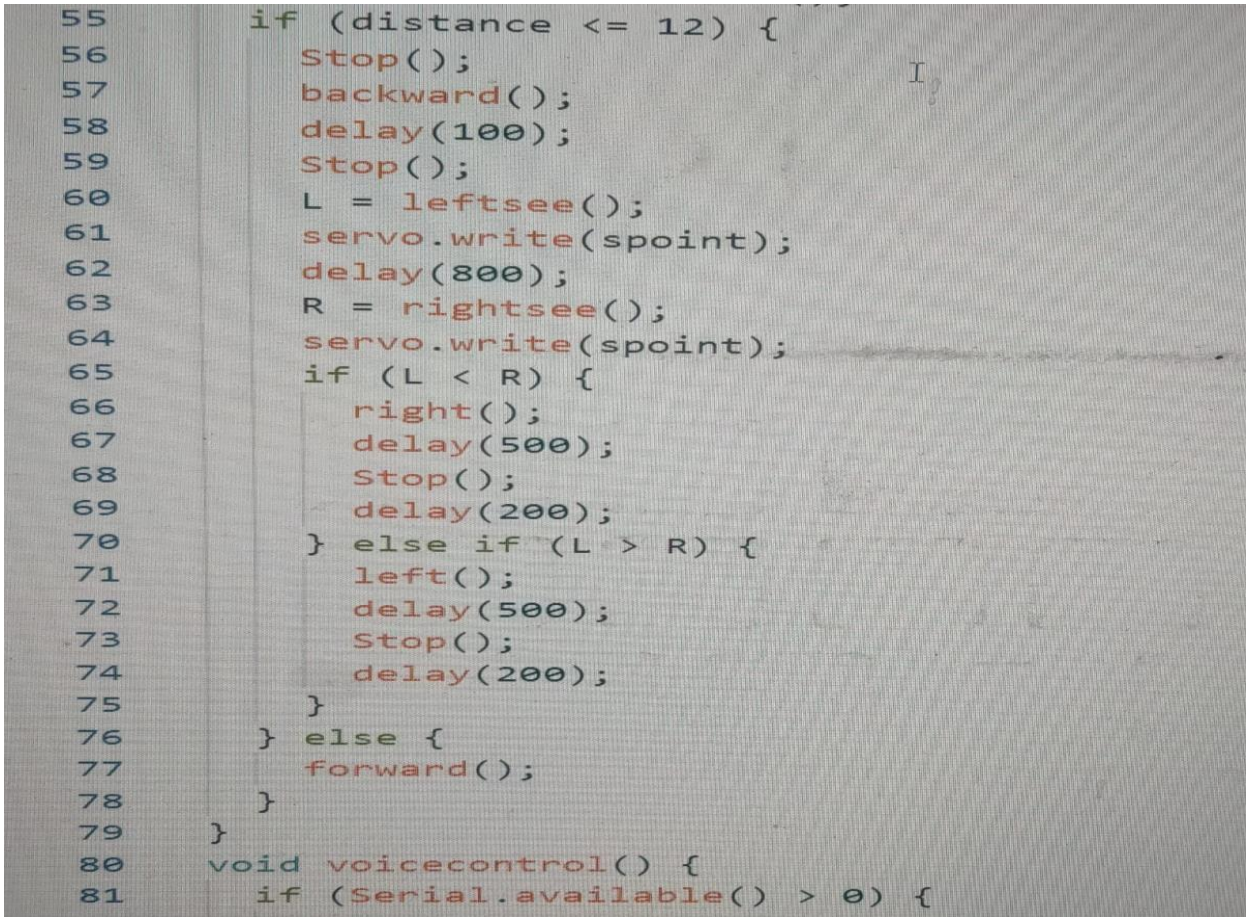
The HC05 module is a simple Bluetooth serial port protocol module intended for wireless serial connection establishment. It has a footprint as small as 12.7mm x 27mm. It will make the entire design process easier. The project offers various advantages, some of which are listed below:

• It may be transformed into a real-world vehicle for transportation purposes.
•The robotic vehicle can be utilized in situations where humans are impossible to reach but human voices can be heard, such as a small pipeline, a fire, or severely poisonous locations, etc.
•It may be integrated with wheelchairs to help impaired people.
•It can be used to transport and store tiny goods.
•In military uses, such as observing enemy camps using webcams.

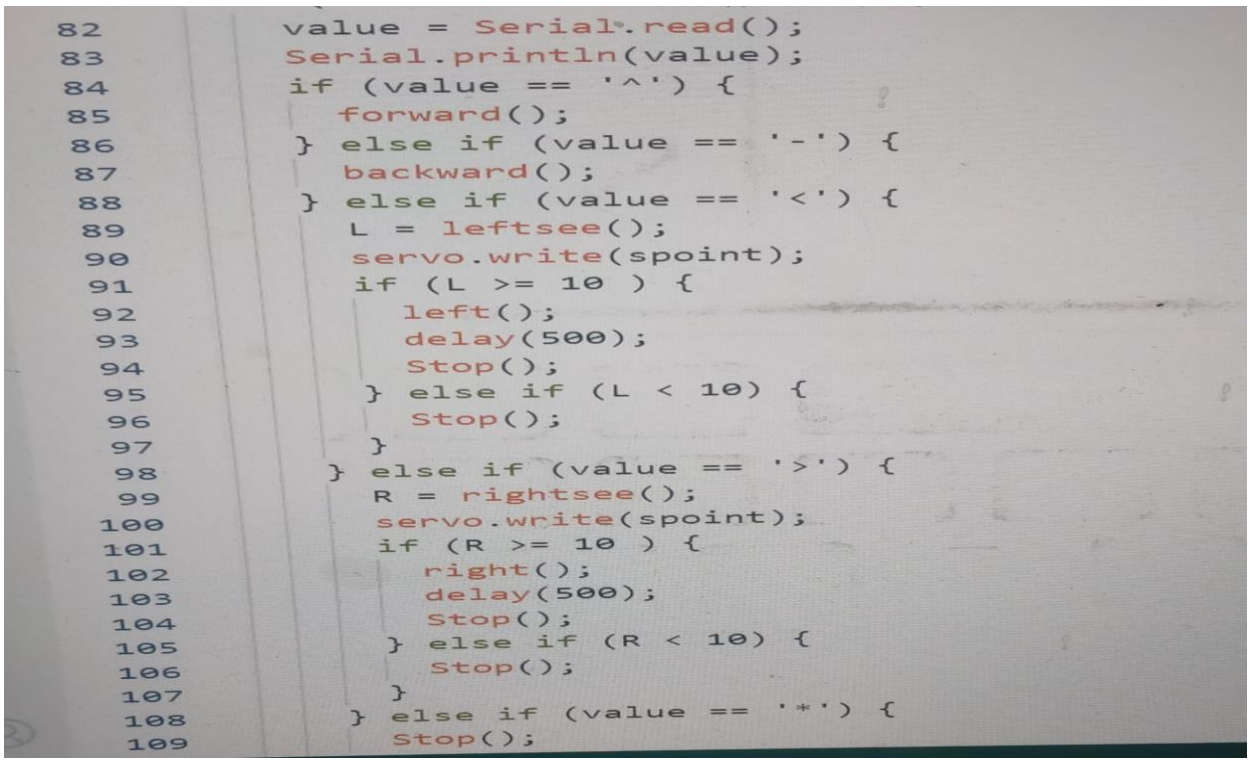
CHAPTER

SOFTWARE SIMULATION

```
#include <Servo.h>
#include <AFMotor.h>
#define Echo A0
#define Trig A1
#define motor 10
#define Speed 170
#define spoint 103
char value;
int distance;
int Left;
int Right;
int L = 0;
int R = 0;
int L1 = 0;
int R1 = 0;
Servo servo;
AF_DCMotor M1(1);
AF_DCMotor M2(2);
AF_DCMotor M3(3);
AF_DCMotor M4(4);
void setup() {
  Serial.begin(9600);
  pinMode(Trig, OUTPUT);
  pinMode(Echo, INPUT);
  servo.attach(motor);
  M1.setSpeed(Speed);
  M2.setSpeed(Speed);
  M3.setSpeed(Speed);
  M4.setSpeed(Speed);
}
void loop() {
  Obstacle();
  //Bluetoothcontrol();
  //voicecontrol();
}
void Bluetoothcontrol() {
  if (Serial.available() > 0) {
    value = Serial.read();
    Serial.println(value);
  }
  if (value == 'F') {
    forward();
  } else if (value == 'B') {
    backward();
  } else if (value == 'L') {
    left();
  } else if (value == 'R') {
    right();
  } else if (value == 'S') {
    Stop();
  }
}
void Obstacle() {
  distance = ultrasonic();
```

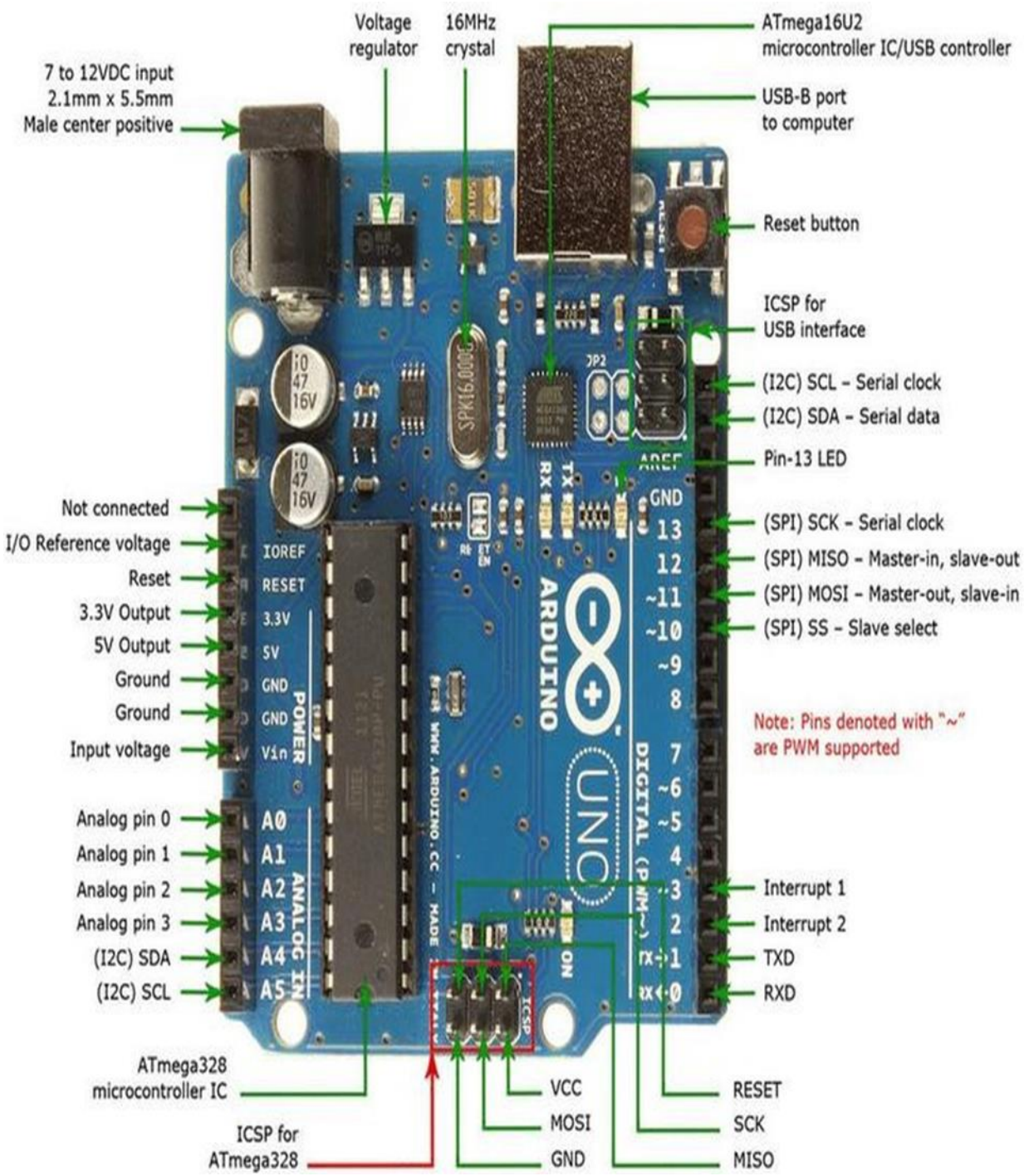


```
55      if (distance <= 12) {
56        Stop();
57        backward();
58        delay(100);
59        Stop();
60        L = leftsee();
61        servo.write(spoint);
62        delay(800);
63        R = rightsee();
64        servo.write(spoint);
65        if (L < R) {
66          right();
67          delay(500);
68          Stop();
69          delay(200);
70        } else if (L > R) {
71          left();
72          delay(500);
73          Stop();
74          delay(200);
75        }
76      } else {
77        forward();
78      }
79    }
80    void voicecontrol() {
81      if (Serial.available() > 0) {
```



```
82        value = Serial.read();
83        Serial.println(value);
84        if (value == '^') {
85          forward();
86        } else if (value == '-') {
87          backward();
88        } else if (value == '<') {
89          L = leftsee();
90          servo.write(spoint);
91          if (L >= 10 ) {
92            left();
93            delay(500);
94            Stop();
95          } else if (L < 10) {
96            Stop();
97          }
98        } else if (value == '>') {
99          R = rightsee();
100         servo.write(spoint);
101         if (R >= 10 ) {
102           right();
103           delay(500);
104           Stop();
105         } else if (R < 10) {
106           Stop();
107         }
108       } else if (value == '*') {
109         Stop();
```

```
110         }
111       }
112     }
113     // Ultrasonic sensor distance reading function
114     int ultrasonic() {
115       digitalWrite(Trig, LOW);
116       delayMicroseconds(4);
117       digitalWrite(Trig, HIGH);
118       delayMicroseconds(10);
119       digitalWrite(Trig, LOW);
120       long t = pulseIn(Echo, HIGH);
121       long cm = t / 29 / 2; //time convert distance
122       return cm;
123     }
124     void forward() {
125       M1.run(FORWARD);
126       M2.run(FORWARD);
127       M3.run(FORWARD);
128       M4.run(FORWARD);
129     }
130     void backward() {
131       M1.run(BACKWARD);
132       M2.run(BACKWARD);
133       M3.run(BACKWARD);
134       M4.run(BACKWARD);
135     }
136     void right() {
137       M1.run(BACKWARD);
138       M2.run(BACKWARD);
139       M3.run(FORWARD);
140       M4.run(FORWARD);
141     }
142     void left() {
143       M1.run(FORWARD);
144       M2.run(FORWARD);
145       M3.run(BACKWARD);
146       M4.run(BACKWARD);
147     }
148     void Stop() {
149       M1.run(RELEASE);
150       M2.run(RELEASE);
151       M3.run(RELEASE);
152       M4.run(RELEASE);
153     }
154     int rightsee() {
155       servo.write(20);
156       delay(800);
157       Left = ultrasonic();
158       return Left;
159     }
160     int leftsee() {
161       servo.write(180);
162     }
```


Voltage regulator
16MHz crystal
ATmega16U2 microcontroller IC/USB controller
7 to 12VDC input 2.1mm x 5.5mm Male center positive
USB-B port to computer
Reset button
ICSP for USB interface
(I2C) SCL – Serial clock
(I2C) SDA – Serial data
Pin-13 LED
(SPI) SCK – Serial clock
(SPI) MISO – Master-in, slave-out
(SPI) MOSI – Master-out, slave-in
(SPI) SS – Slave select
Note: Pins denoted with "~" are PWM supported
Not connected
I/O Reference voltage
Reset
3.3V Output
5V Output
Ground
Ground
Input voltage
Analog pin 0
Analog pin 1
Analog pin 2
Analog pin 3
(I2C) SDA
(I2C) SCL
Interrupt 1
Interrupt 2
TXD
RXD
ATmega328 microcontroller IC
ICSP for ATmega328
VCC
MOSI
GND
RESET
SCK
MISO

.Result and Discussion

The Android smart phone's microphone is used to identify human voice. Artificial Intelligence software and the Android operating system codes are used to evaluate this voice and translate it into English words. The multidisciplinary discipline of computational linguistics known as "speech recognition" creates the methods and tools necessary for computers to understand spoken language and convert it into text. Other names for it include speech to text (STT), computer voice recognition, and automatic speech recognition (ASR). includes research and expertise from the domains of electrical engineering, computer science, and languages.

Speaking about technology, speech recognition has a lengthy history and has seen numerous significant breakthrough waves. Recent developments in big data and deep learning have helped the field. The industry's widespread adoption of various deep learning techniques in the development and implementation of voice recognition systems is a more significant indicator of the advancements than the increase in scholarly publications in the subject.

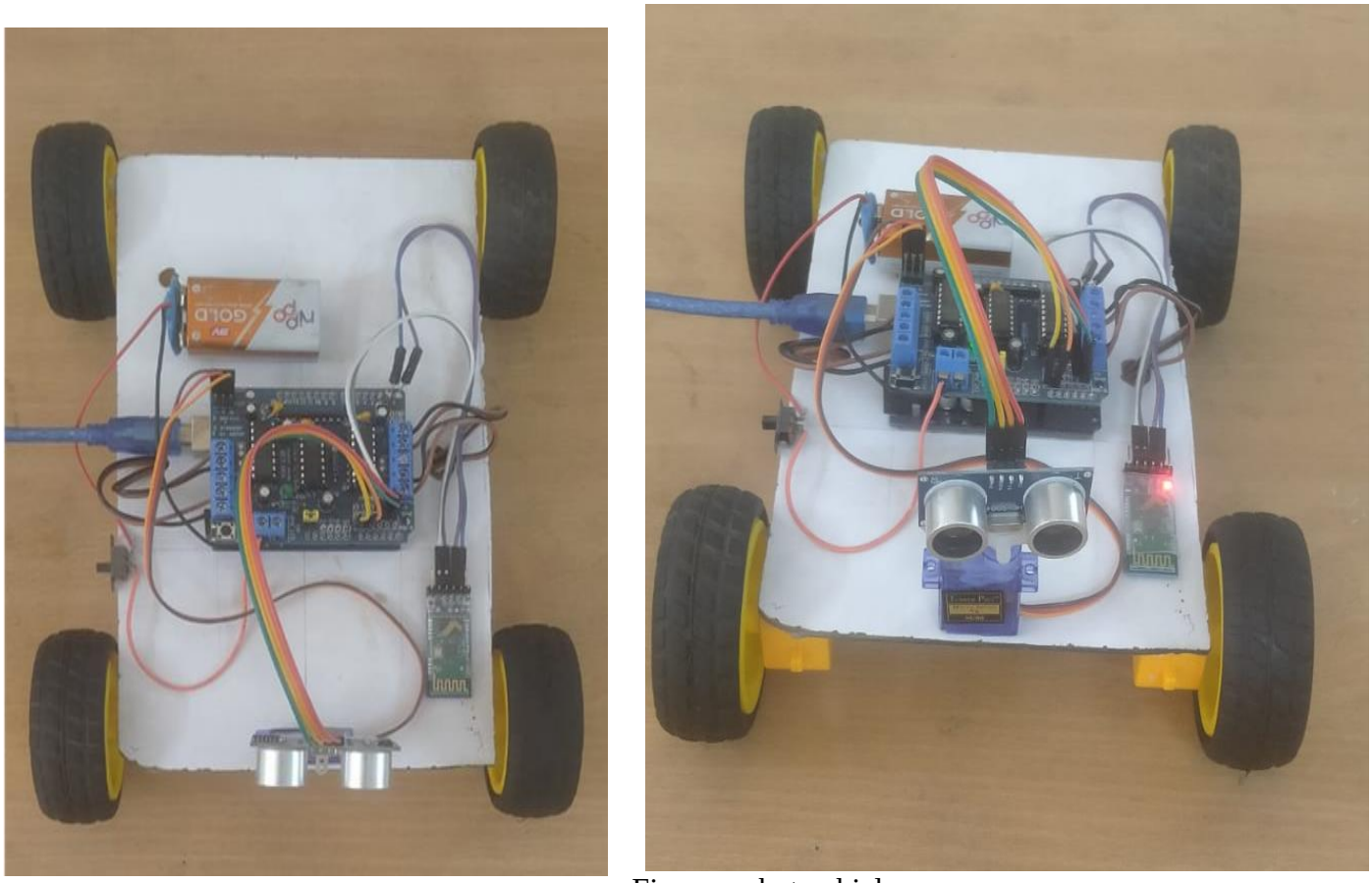


Figure- robot vehicle

Shows the assembly image for a voice control robot built with Arduino software. The job was done according to the specifications and requirements. Simple movements can be controlled using the voice. The suggested system is based on Voice Controlled Robotic Vehicle, which allows users to drive robots using voice instructions received via an Android application. The vocal Controlled Vehicle is controlled by vocal commands delivered by the project's operator. These voice commands must be entered using an Android app installed on the user's Android device.Speech recognition is performed within

the Android app, and the resulting command is relayed to the voice-controlled robot car.The microcontroller installed on the vehicle decodes these commands and sends a suitable command to the motors linked to the vehicle

Conclusion

The "voice-controlled robotic vehicle" The project has several uses, both now and in the future. The project can be made more effective by introducing more features in the future. The project has a wide range of applications, including military, home security, rescue missions, industries, and medical support. We were able to create a crude model of a voice-controlled robotic vehicle using the resources that were available. This project is simple to implement, therefore this robot will benefit human life. The voice control robot is useful for people with disabilities and for monitoring purposes. It operates on simple vocal commands, making it simple to use. It is handy for regions that humans cannot reach. This robot's modest size allows us to So we can utilize this robot for surveillance purposes. It can be used for surveillance. We can install a webcam in this robot for security purposes. The voice recognition software is accurate in identifying voice commands and is also very sensitive to background noise.

REFERENCES

1 https://www.youtube.com/watch?v=aE_J7B-O4VQ&t=0s
2 https://www.arduino.cc/pro

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