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Voice Controlled Smart Wheelchair for Physically Challenged People

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ABSTRACT: A voice controlled wheelchair prototype was developed using commercially available manual wheelchairs to assist people with upper and lower limb disabilities. The Arduino microcontroller processes voice commands control the movement of the wheelchair. To control the motor, motor driver module has been used. Microcontroller checks the data coming from the Bluetooth module. If the voice commands are matched, then it sends an activation signal to the motor driver circuit for controlling the movement of the motor according to the preloaded code and thus we get the desired direction of the device according to the input command. An ultrasonic sensor is used to detect the obstacle.

KEYWORDS: Bluetooth module, Motor driver shield, Ultrasonic sensor.

I. INTRODUCTION

Wheelchairs are used by the elderly or people with physical disabilities. A wheelchair is a mechanically controlled device that allows the user to move independently. This minimizes the user effort required to move the wheels of the wheelchair. You can control the stroller using voice commands and control buttons. This widget is very useful when moving from one place to another. When an obstacle is detected, it sends a signal to the microcontroller and stops the wheelchair. A new generation of wheelchairs is being developed and implemented using technology that easily personalizes the user.

II. LITERATURE SURVEY

In this paper [1], Palash Pratin Dutta et. al., explained about the voice controlled wheelchair using smart phone with android application and microcontroller board is used to receives the voice commands from Bluetooth module via smart phone or from voice recognition module from microphone attached to it.

In this paper[2], Muneera T N, Dr. Dinakardas C N., explained by used this system disabled person can do some kind of therapies without the help of another person. An obstacle sensor is included in the system to detect the presence of obstacles in the way of movement.

In this paper [3], Miss. Gaikwad sayali. S' et.al., explained an eye controlled device on image processing is designed to be used as an intelligent mobility aid for the paralyzed. This system helped the handicapped people to move everywhere freely, with the help of eye gesture control wheelchair.

In this paper [4], Nasrin Aktar et. al., explained where the patient can operate the wheelchair using voice commands and the location of the patient can be traced using GPS module in the wheelchair that tracks and sends the information to smartphone application fire-base.

In this paper [5], Siti Nur Suhaila Mirin et. al., explained the voice recognition mode and touch mode helped the elder lies and physically disabled people to move their wheelchair independently. The system designed has undergone a few tests and successfully completed the basic performance.

III. EXISTING SYSTEM

The existing system consists of a joystick which can be used to control the movement of wheel chair. According to the output came from joystick, microcontroller give instructions to the motor and move wheel chair to the desired location. When the voice is detected, the wheelchair can be controlled to move in that direction by giving commands to the wheelchair. The electrical signals are transferred to these motor using some hardware ports, called the communication ports.

A joystick is known as proportional control. This is the most generally utilized kind of control. The powered wheelchair moves in the direction that the user points it with the joystick. The power wheelchair typically moves at a faster rate the further the joystick is pushed.

The current framework comprises of a joystick which can be used to control the development of wheel seat. Joystick is a creative gadget that takes physical development of human hand and converts the developments for use in a control machines. It deals with a basic rule where the machine acknowledges the hand development of client with the assistance of resource of sensors and afterward changes over it into a numerical code, which is at last moves the body in the PC in the ideal manner.

As per the yield came from joystick, microcontroller give directions to the engine and move wheel seat to the ideal area. As innovation has created joystick controlled wheel seat are generally accessible from one side of the planet to the other. Yet, for deadened, truly crippled or impaired people, having issues connected with fingers or hands, it needs hand development for controlling joystick.

The functioning standard is basic what's more, depends on vertical and even developments. For moving both ways, level pivot is utilized. Front and back development is empowered by vertical pivot. For moving right and front the worth changes from focus worth to 1024. For moving left and back the worth will brought down to 0 from focus esteem goes from 550 to 560. The result of joystick is broke down by microcontroller. The gadget is involved here as a discretionary one in furious spots where the voice can't be perceived.

Moreover old aged people have poor wrist movement face problems to use the joystick. So an alternative is necessary to overcome the necessity of joystick in controlling movement of wheel chair.

The brain control wheelchair, cerebrum controlled wheelchairs are a few restrictions to BCI innovation since it is moderately new despite everything for the most part in the examination stage. The greatest restriction is exactness in perusing the signs. There are billions of neurons in the human body that are terminating different signs at some random time.

IV. PROBLEM STATEMENT

Autonomous versatility is significant for advancement of physical, mental, informative and interactive ability for genuinely debilitated individuals. The exorbitant cost of the electric wheel seats. This undertaking is consequently focused on the advancement of something else complex control conspire for electric fueled wheelchair. The fundamental issue of the wheelchair is that can't be utilized by incapacitated individual, so the kind of counterfeit guide required by a handicapped individual to move about depends, generally, fair and square of his insufficiency. So don't bother handles behind the seat to permit it to be moved by someone else.

V. PROPOSED SYSTEM

The goal of this system is to develop a wheelchair that moves at the user's command. The motor driver module is used to control the motor. First, the smartphone receives voice input from the user through the Android app. The voice commands entered in this way are transmitted to the Arduino UNO board via the HC-05 Bluetooth module. For your convenience, voice commands are recorded, saved and remembered in English. These commands are "Forward", "Back", "Left", "Right" and "Stop". The Arduino UNO sees all data coming from the Bluetooth module. If the voice command matches, it sends an activation signal to the motor driver circuit, which controls the movement of the motor according to the preset code, to obtain the desired orientation of the device based on the input command. Ultrasonic sensors are used to detect obstacles. Commands that do not match are ignored by the Arduino.

As after train the voice module, connect it with Arduino. Depending on the voice command the voice module send some code to the Arduino, Arduino work on the program that is written by User that at what command which task should be perform depending on the condition. The PWM signal is sent to the driving Circuit of motor. If the signal to move Wheelchair forward is sent than according to condition 24v will be provided to both motors.



The Sensor in front of wheelchair are connected to avoid the accident. Sensor input is connected to Arduino Interrupt pin. Interrupt pin function is that it will stop the execution of program and run the specific portion of code which is attach to that interrupt pin. That portion is consisting of how to stop the wheelchair to avoid that accident.

The target of this undertaking is to control the wheelchair development utilizing the engine initiated by the voice controlled application and sensors. The voice acknowledgment framework will be more protected, precise and quicker than a self-controlled wheel seat. This might decrease the gamble of occurrences.

This undertaking is remembered for assistive innovation. For incapacitated and depended debilitate it is more free, useful and pleasant living. To carry out roles a disabled individual with train inabilities needs a wheelchair that require the person in question to move around. He/ She can do so physically by pushing the wheelchair with his/her hands. Anyway a significant number of us have powerless upper appendages or find the manual method of working excessively tiring. In this manner it is attractive to give them a mechanized wheelchair which is constrained by moving a voice orders. Since mechanized wheelchair is critical that it have the option to stay away from obstructions consequently progressively, it can move at a fair speed.

VI. MOTIVATION

The motivation behind VOICE CONTROL WHEELCHAIR USING ANDROID APPLICATION project is to build an automated wheelchair that helps the physically disabled people to locomotive from one place to another. And to develop the smart wheel chair to make the life easier of physically challenged persons. This voice controlled smart wheel chair comes with enhanced features like electric powered, voice control, line follower with obstacle avoidance etc.,

VII. CIRCUIT DIAGRAM

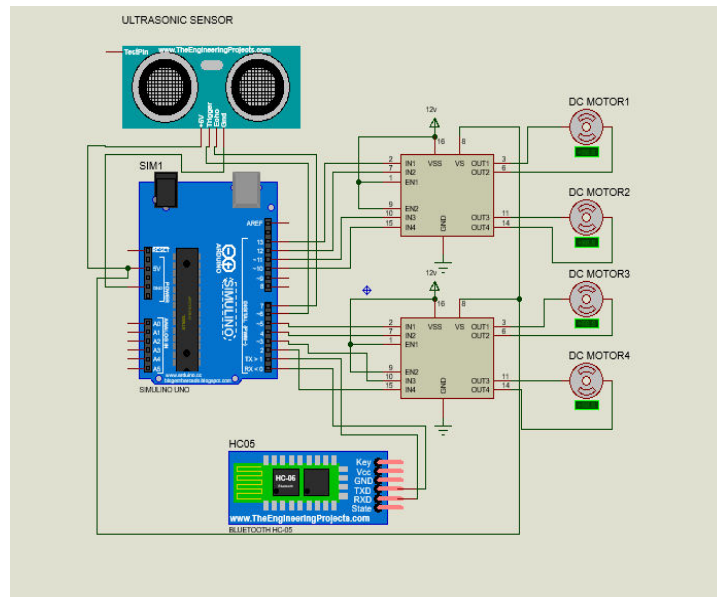


Fig 1: Circuit diagram of voice controlled smart wheelchair

VIII. FLOWCHART

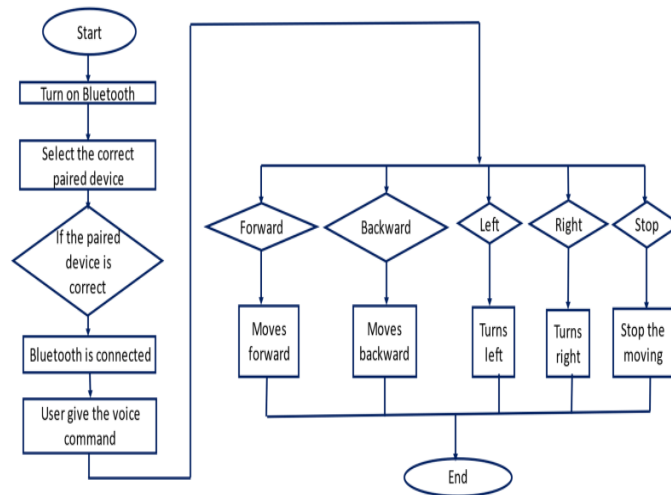


Fig 2: Flowchart of voice controlled smart wheelchair

IX. BLOCK DIAGRAM

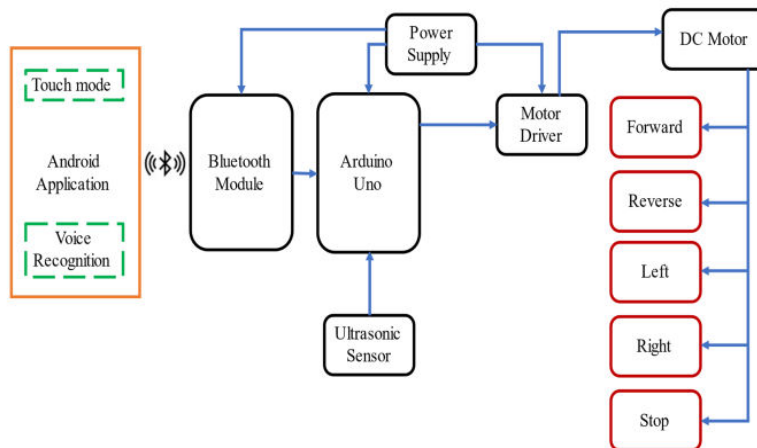


Fig 3: Block diagram of voice controlled smart wheelchair

X. DESCRIPTION

1) Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins, 6 analog inputs, that may be communicated to various shields and further circuits.

The command given by the user is transmitted to Arduino Uno via the Bluetooth module. Arduino Uno will read and execute the command and send the digital values to the motor driver device.

2) Bluetooth Module (HC-05)

It is used to connect small devices like mobile phones using a short-range wireless connection. It uses the 2.45GHz frequency band. The transfer rate of the data in range of 10 meters. The HC-05 module can be operated within 4-6V of power.

For the voice recognition mode the user must turn on the Bluetooth on the android smartphone, and then select the correct paired device to connect. When the Bluetooth is connected, the user can start to give command.

3) Motor Driver shield (L298N)

The motor driver will direct the wheelchair according to the preloaded command. The L298N is a dual H-Bridge motor driver which allows speed and direction control of two DC motors at the same time. The module can drive DC motors that have voltages between 5 and 35V, with a peak current up to 2A.

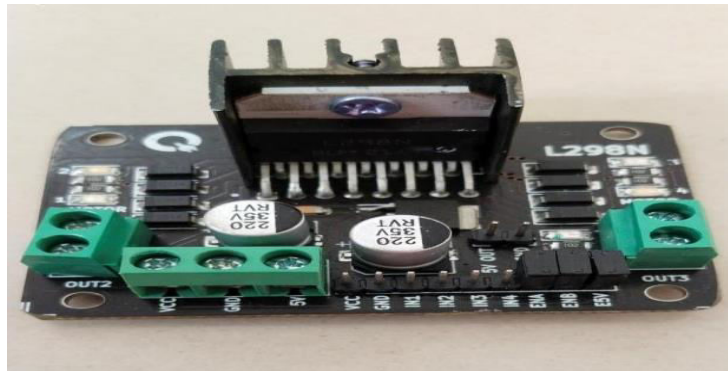


Fig 4: Motor driver shield (L298N)

4) Ultrasonic Sensor (HC-SR-04)

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves.

If the object is detected, the movement of the wheelchair will be stop.

5) DC Motor

A DC motor is a class of electrical motors that convert direct current electrical energy into mechanical energy. From the above definition, we can conclude that any electric motor that is operated using direct current with range of 12-24V or DC is called a DC motor.

6) Power Supply

The power supply is used to supply electrical energy to the Bluetooth module, Arduino Uno, motor driver and motor. Power supply is provided by battery. We use the Li-Po battery for the power supply.

7) Android app (for Bluetooth connection)

In this project, user can control the movement of the wheelchair by giving command using mobile app via the android smartphone. There are two modes are available,

- a. Voice Recognition
- b. Touch mode

8) Arduino IDE

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++.



XII. RESULTS

```
bluetooth_control_voice_obstacle | Arduino 1.8.7
File Edit Sketch Tools Help

bluetooth_control_voice_obstacle
#include <NewPing.h>
#include <AFMotor.h>

int IN1 = 5;
int IN2 = 6;
int IN3 = 10;
int IN4 = 11;
const int trigPin = 8; //Ultrasonic sensor pins
const int echoPin = 7;

int distance;
char value;

void setup() {
  pinMode(IN1, OUTPUT);
  pinMode(IN2, OUTPUT);
  pinMode(IN3, OUTPUT);
  pinMode(IN4, OUTPUT);
}

void loop() {
  //Ultrasonic sensor code
  distance = ping(8, 7);
  Serial.println(distance);
  if (distance < 10) {
    digitalWrite(IN1, HIGH);
    digitalWrite(IN2, LOW);
    digitalWrite(IN3, LOW);
    digitalWrite(IN4, HIGH);
  } else {
    digitalWrite(IN1, LOW);
    digitalWrite(IN2, HIGH);
    digitalWrite(IN3, HIGH);
    digitalWrite(IN4, LOW);
  }
}

Done compiling
Sketch uses 2974 bytes (9%) of program storage space. Maximum is 32256 bytes.
Global variables use 193 bytes (9%) of dynamic memory, leaving 1855 bytes for local variables. Maximum is 2048 bytes.
```



Fig 5: Results of voice controlled wheelchair

XIII. CONCLUSION

The Arduino based voice controlled wheelchair prototype was successfully built and tested to respond to voice commands. The smartphone is used with android application and microcontroller receiving signals by HC-05 Bluetooth module. The system offers movement of wheelchairs using voice commands. The voice operated wheelchair will give freedom to the patients to move around freely without the help of any other family member or person. The system designed has undergone a few tests and successfully completed the basic performance. The objectives were achieved as the software and hardware implementation work well as expected. The future scope is to develop a mobile app based wheelchair with some additional facility like disabled people can do their many works with the help of that mobile app.

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