

## DESIGN FOR SMART AND INTELLIGENCE OF WHEEL CHAIR

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controller, Text processing, ARM voice, Speech recognition, Voice Commands

### I. INTRODUCTION

**Abstract:** Nowadays, the number of elderly people has increased. Some of them live with their children, some live-in parents' homes and some live alone. Problems arise when older people lose the ability to move. Not everyone can be by their side all the time to help them. The project is designed to help those who have trouble using their feet to walk like disabled adults or those who have been paralyzed by accidents. The purpose of the project was to develop a Wheelchair System and Control using a wireless Android consisting of an Android smart phone and a control box that can control the movement of the wheelchair using a motor. The source code is written in C++ software. Arduino Nano and 5V 4 channel relay module is the main controller that controls the motor, sends signals to the Bluetooth HC-05 signal receiver and receives serial data from the android smartphone. Bluetooth communication protocol is used to communicate between android smartphones and controller boxes. The direction and speed of the motor are controlled using the L298N motor driver. The way to control wheelchair movement is by using smartphone software and manually pushing the wheelchair. The four movement options are forward, backward, left and right. The system also has the ability to control the movement of electricity by laying down and sitting using Bluetooth as wireless communication. Electrical equipment can be switched on and off wirelessly using the use of android smartphone software that sends alerts to recipients of electrical equipment. In conclusion, this product not only allows people with disabilities to control their own wheelchair without the help of others, but also allows others to use android smartphones to control wheelchairs and electrical.

In this project we are using Android Application and bluetooth System. But many of individuals with disabilities who need wheelchairs are satisfied with it, few members of the disabled community find it is difficult or impossible for operating a standard power wheelchair. This project is included in assistive technology. For handicapped and depended disable it is more independent, productive and enjoyable living To perform functions a handicapped person with locomotive disabilities needs a wheelchair that require him or her to move around. He/she can do so manually by pushing the wheelchair with his/her hands. However, many of us have weak upper limbs or find the manual mode of operating too tiring. Therefore, it is desirable to provide them with a motorized wheelchair which is controlled by moving a smartphone command. Since motorized wheelchair is important that it be able to avoid obstacles automatically in real time, it can move at a fair speed. Cost of this motorized wheelchair is affordable for many handicapped people as possible, as well as for organizations that support it. With these requirements in mind we propose an automated wheelchair with real time Herald avoidance capability. The power wheelchair control interfaces currently still not enough to provide mobility for substantial number of persons with disabilities. Through research and design wise, the wheelchair to control development along safe and effective. To perform functions a handicapped person with locomotive disabilities needs a wheelchair that require him or her to move around He she can do so manually by pushing the wheelchair with his/her hands However, many of us have weak upper limbs or find the manual mode of operating too tiring Therefore, it is desirable to provide them

**Index Terms:** Voice activated wheel chair

with a motorized wheelchair which is controlled by moving a smartphone command. Since motorized wheelchair is important that it be able to avoid obstacles automatically in real time, it can move at a fair speed. Cost of this motorized wheelchair is affordable for many handicapped people as possible, as well as for organizations that support it. With these requirements in mind we propose an automated wheelchair with real-time Heald avoidance capability. The power wheelchair control interfaces currently still not enough to provide mobility for substantial number of persons with disabilities. Through research and design wise, the wheelchair to control development along safe and effective use of the provision independence and self-use mobility. This project will provide disability weight innovative solutions to handle the wheel chairs to use voice interface.

### **Problem Statement**

Nowadays, the number of elderly people has increased. Some live with their children, some live in adult foster home and some even live by themselves. The problem arises when the elderly people lose their ability to move around. Not everyone can be present to help them at all time. Patients involved in physical injuries and disabilities with good mental strength struggle to get through places using the conventional hand powered wheelchair. A wheelchair is a chair with wheels, designed to be a replacement for walking. A wheelchair is a device used for mobility by people for whom walking is difficult or impossible, due to illness or disability. To face this problem, an android device that can control DC motor will be developed.

### **Objective**

The project is implemented in order to achieve the following objectives which are:

- i. To develop a system that can control the movement of a wheelchair by using android.
- ii To design android system that can control electrical appliances.

## **II.LITERATURE REVIEW**

Various studies have been conducted to produce a prototype of the wireless control wheelchair. The study was performed on the sensitivity of the controller, wheelchair's movement, method and issues. During the survey

we find that there is the need of smart wheelchair which is controlled by both voice and gesture. While we are studying or analyzing the other project based on wheel chair we found some problems. Some of them wheelchairs prototypes are: Automated Wheelchair: In this wheelchair ultrasonic sensor, infrared sensor is used for controlling of wheelchair. Also, in this wheelchair voice commands are used and for obstacles they are using infrared sensors. If any obstacle come then the infrared sensors which are connected with microcontroller, gives command and according to that motor will function. Wheel chair only using Gesture: This wheelchair is used for physically disabled people. They use their hand movements for the motion of the wheelchair. The accelerometer is used for the controlling the wheel chair. The above projects have some problems. So, after observing all these pros and cons we developed the smart wheelchair which is controlled by both voice recognition and hand gesture. Several studies have shown that both children and adults benefit substantially from access to a means of independent mobility, including power wheelchairs, manual wheelchairs, scooters, and walkers. Independent mobility increases vocational and educational opportunities, reduces dependence on caregivers and family members, and promotes feelings of self-reliance. For young children, independent mobility serves as the foundation for much early learning. No ambulatory children lack access to the wealth of stimuli afforded self-ambulating children.

This lack of exploration and control often produces a cycle of deprivation and reduce motivation that leads to learned helplessness. The author compares the smart accessible factor that ever produced Smart wheelchairs that navigate autonomously to a destination often do so with an internal map, commercialisation and future plan to upgrade smart accessible Smart wheelchairs have been used to explore a variety of alternatives to the more “traditional” input methods associated with power wheelchairs (e.g., joysticks, pneumatic switches). Voice recognition has often been used for smart wheelchairs (e.g., Nav Chair, SENARIO, Tetanuran because of the low cost and widespread availability of commercial voice recognition hardware and software. Authors identify the problems faced by smart wheelchairs i.e. technical weakness, high cost, cumbersome and lack of standard communication protocol. The

authors identify there are existing technologies which allow the users to use human gestures such as the movements of hands, movements of leg, tongue and head and synchronize them with the movements of the wheelchair for a better wheelchair controls for example smart wheelchair. A smart wheelchair is developed to help an elderly or physically disabled person (user) to move from one place to another independently. An android application is developed and installed in the android smartphone. The authors describe development of a smart wheelchair system with voice recognition and touch controlled using an embedded system.

An android application is developed and installed on the android smartphone. The system is divided into two main modes: voice recognition mode and touch mode. For the voice recognition mode, elderly or physically disabled people (users) can provide the voice input, for example, “go”, “reverse”, “turn to the left”, “turn to the right” and “stop”. The wheelchair will move according to the command given. For the touch mode, the user can select the specified direction displayed within the four quadrants on the screen of the android smartphone to control the wheelchair.

### III.EXISTING SYSTEM

There are many researches done in the field of speech and voice recognition. Due to sophisticated signal processing algorithms and powerful computers and components available, computer based speech processing system nowadays have reached high accuracy with complex structure. The challenge is to maintain standard performance while using limited computation and memory resources. Researches in the area of wheelchair control system are still going on. Many people with disabilities do not have the skill as required to control a joystick on an electrical wheelchair.

Joystick: The existing system consists of a joystick which can be used to control the

movement of wheelchair. According to the output came from joystick, microcontroller give instructions to the motor and move wheelchair to the desired locations technology has developed joystick controlled wheelchair are widely available all around the world. But for paralyzed, physically disabled or handicapped persons having issues related to fingers or hands, it needs hand movement for controlling joystick. 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 wheelchair.

### IV.PROPOSED SYSTEM

The purpose of this paper is to develop a wheelchair which will move as per the user's commands. This system works on voice commands given by the wheelchair user. The system is fully independent as the user do not need any other person to help him to move the wheelchair. There are basically five commands, which command is given by the user, accordingly the wheelchair will move. The voice commands of the user is recognized in the first step. Once it is recognized, the commands are converted into its equivalent instructions which drive the system. This system consists of two major modules namely Voice recognition module and motor driving module. The voice recognition is done through voice recognition module. The output of this module is directed to Arduino which uses a motor driver IC to drive the motors.

The voice controlled wheelchair works using unilateral mic, voice recognition module, Arduino and motors. The input to the system is the unilateral mic. It's capable to take user's voice commands and not bother about other noises. The mic will be placed as per the user's comfort. The output is in the form of voice signals and is transferred to the voice recognition module which acts as an interface between mic and Arduino. The Arduino then receive the output from voice recognition module thus converting it into binary code. The system is unable to understand any

language other than binary code. Thus, the generated voice command is converted into machine understandable form. This system uses the Arduino uno R3. It is connected with motors to drive the wheelchair anywhere. Motors are responsible for the movement of wheelchair. Hence, motors receives input from the Arduino and depending upon the instruction type, motors moves accordingly. This system uses two motors connected with motor driver. There are five different instructions that can be given to the antes, they are forward, backward, left, right and stop. The movement of wheelchair depends only upon these five commands The wheelchair responds to the voice command from its user to perform any movement's functions. The basic movement functions include forward direction, left and right turns and stop. In order to recognize the spoken words, the voice recognition processor must be trained with the word spoken out by the user who is going to operate the wheelchair.

Our smart and safe wheelchair should be able to:

- Avoid collisions with walls or other fixed obstacles, because we are using sensors
- Change the direction of wheel chair through voice and joystick.
- Our wheel chair should reduce the man power
- Wheel chair should be operate automatically with out any other person help

### V.Block Diagram

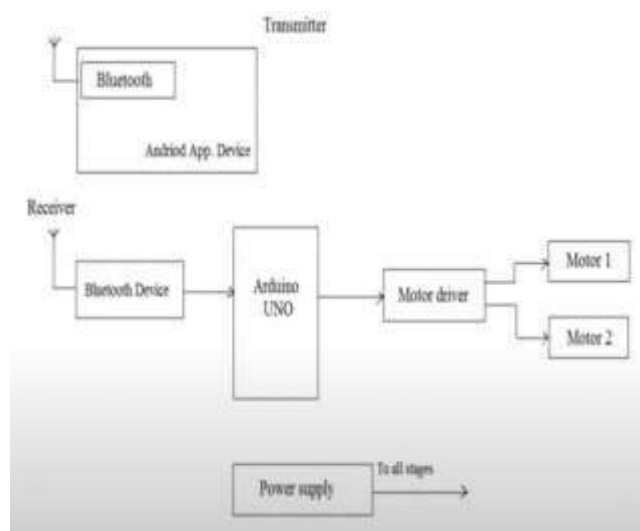


Figure 1: Block Diagram

Using micro phone human voice is converted into electrical signal. The audio signal which is converted to electrical signal goes to the HC 05 module to recognize the voice signal which has been train to the module. The human voice should be train to the voice module at the beginning before we give some command to the module. When the voice is train to the voice module the voice command is being train with the BCD input from the matrices keypad of the module, so later when we give some command to the voice module will display the appropriate BCD binary input which has been train. HC 05 Module will produce the binary output. The output of the module is being interface with the arduino where the arduino will process the output of the module for the motor direction. Arduino cannot be directly connected because it cannot give sufficient current to drive the DC motors. Motor driver is a current enhancing device, it can also be act as switching device.

Thus L239D IC motor driver is inserted between the arduino and the motor. Motor driver take the input signal from the arduino and generate corresponding output for motor. This motor driver IC can drive two motor simultaneously.

### Steps to construct the Project

Step-1: Building the Base



Figure 2: Base of wheel chair

To begin with, fix the motors to the chassis. In mycase, I used a wooden chassis. With

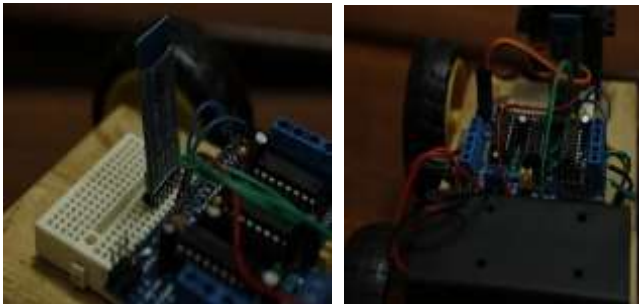
the help of double sided tape, get the four motors fixed in their respective corners. For safeties sake, I put a layer of scotch tape around the chassis and the motors. Make sure the wires coming out from the motors are neatly arranged for in case there's a problem, it's easily solved. Once the motors are attached to the chassis, fix the wheels to the motors.

#### Step-2: Getting Into the Circuit Part 1

**Figure 3: Arduino UNO connections**

Place the Arduino in the centre of the chassis as it will be acting as the brain for the robot. You will need four jumper wires. Place the first one in one of the Gnd port of the Arduino. The second wire in the 5v port. The third wire in the TX port and the fourth wire to the RX port of the Arduino. Once done, place the L293D Motor Driver right on top of the Arduino. After the motor driver is fixed properly on top of the Arduino board, take the motor wires one by one and with the help of a screwdriver, connect the wires of motor 1 to M1 of the motor driver, then motor 2 to M2. The motor M1 is connected to the right wheel and the motor M2 is connected to the left wheel.

#### Step 3: Getting Into the Circuit Part 2

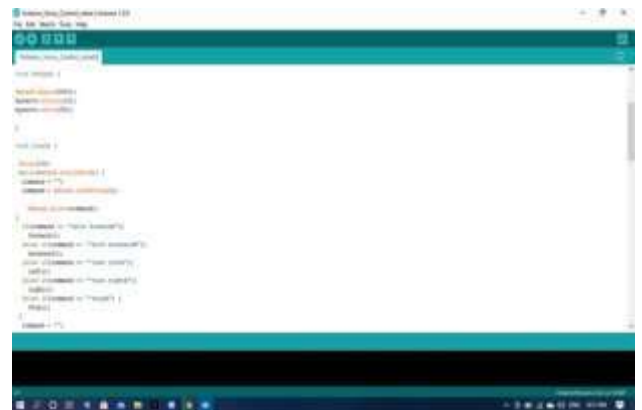


**Figure 4: Arduino to HC 05 connections**

Place the mini breadboard close to the Arduino. Fix the HC-05 bluetooth module onto the breadboard and connect the Gnd wire coming out of the Arduino board to the Gnd of the bluetooth module. Then connect the 5v wire to the VCC of the bluetooth module. Take the RX from the Arduino and connect it to the TX of the bluetooth module. And finally, connect the TX of the Arduino to the RX of the bluetooth module. Once the bluetooth module is connected, place the Servo Motor (MG995) right at the front of the chassis. I have attached the servo with the help of double sided tape, but if you have a glue gun, then you can use that as well.

Finally, fix the Ultrasonic Distance Sensor on top of the servo's head. In my case, I used a thin layer of polystyrene. I inserted the pins of the sensor into the polystyrene as it's a soft and light material. Connect the three wires coming out of the servo to the specific servo ports on the motor driver. In the end, connect the two 3.7v LiPo batteries to the motor driver's power source. Once done, you're ready with the hardware. Here the HC-05 Bluetooth module will function as receiver that receive the input text from the android app. It will act as a medium between the android app and the Arduino. It will receive the input text code from the android app and then it will send to the Arduino. To receive the input text the HC-05 bluetooth module should be in pairing with the Android app.

#### Step 4: Uploading the Software



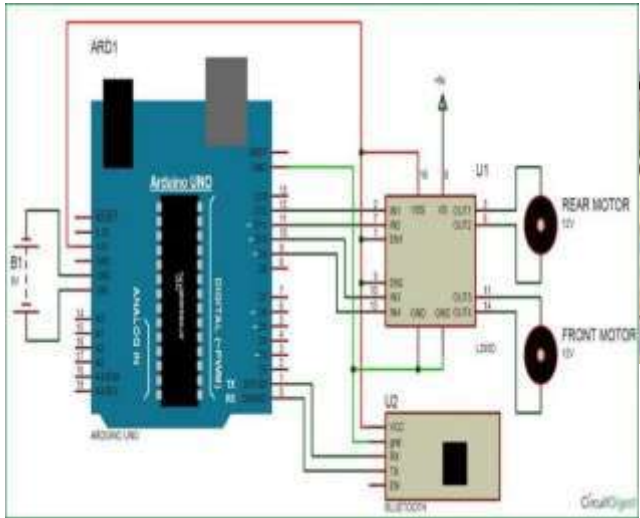
**Figure 5: Image of Arduino Ide code**

Make sure you have the Arduino IDE installed on your computer. Before uploading the code onto the Arduino, you'll need to download the AF Motors library. You will need to go to and download the respective library. Once downloaded, open the Arduino IDE, go to the library section and click of the AF Motors. You will also need to select the Servo library which comes preinstalled with the Arduino IDE. Before uploading the code onto your robot, make sure the RX and TX pin of the bluetooth module is disconnected. Also, make sure you choose the correct Port and Micro-controller before uploading the code.

#### Step 5: Install the App on your smart phone

slow blinking gesture which means you successfully connected your smartphone with your newly made robot.

**Step 6:** Command your newly built wheel chair



**Figure 7: Voice controlled wheel chair**

In order for the robot to go forward, simply say, "move forward" and to go backward say, "move backward". To make the robot turn left or right, command, "turn left" or "turn right". While your robot is performing a specific task, if you want it to stop doing what it's doing, simply command, "stop".

In forward direction to turn left one pin should be "high" and the remaining pins should be "low" and to turn right in forward first two pins should be "low" and remaining pins should be "high". In backward direction to turn left one pin should be "high" and the remaining pins should be "low" and to turn right first two pins will be "high" and remaining pins will be "low".

#### Working of the Project

**Figure 8: Schematic Diagram**

As we have already mentioned that this is an Arduino-based project, so Arduino is working here as the brain of the robot. Everything we command to move the robot will be processed by the Arduino Microcontroller. We have to write a suitable code that will help the Arduino to process and follow our instructions. Next we need a motor driver to control the speed of the motors according to the instruction given by the Arduino Microcontroller. So, here we are going to use an L293D motor driver shield which is really very easy to connect with the motors as we as the Arduino Board. Next, we want to send our voice command wirelessly. So here we have decided to use HC-05 Bluetooth Module which is compatible with Arduino & our Android Phone.

#### User Manual to use Wireless Control Wheel Chair



**Figure 6: Image of Android App**

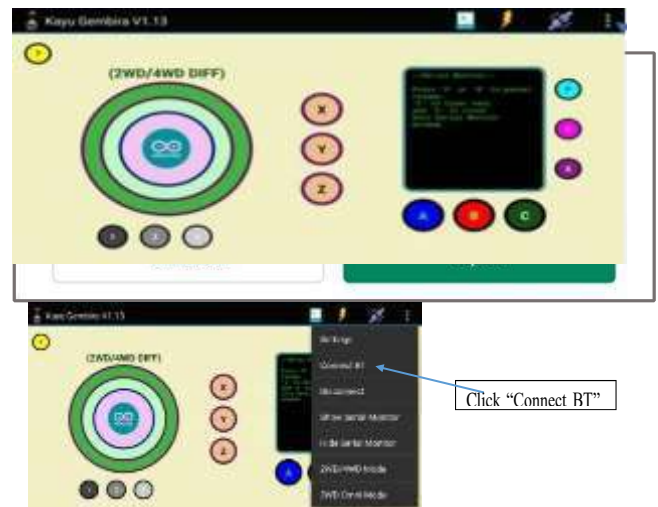
You will need to go to Google and search for the app called: ARM\_Voice. Once the app is downloaded, turn on your robot with the help of the external power supply and on your phone turn on bluetooth. From the app, choose the HC-05 Bluetooth Module option and you will notice that the fast blinking red light on the bluetooth module slowing down into a

**STEP 1:** Install wheel chair control application on PlayStore named “Kayu Gembira FREE”

**Figure 9: Android app Installation**

**STEP 2:** Turn on power button on right side wheelchair.

**STEP 3:** Connect Bluetooth between smartphone and wheelchair on the application



**VIRESULT**

**Figure 13: Image represent the connections of the circuit**

In the next step, we have to install an Android App and have to connect our phone with  
**Figure 10: Image to connect android app and Bluetooth**

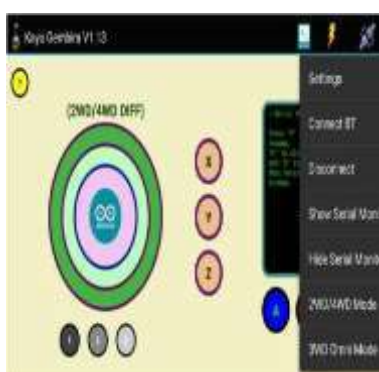
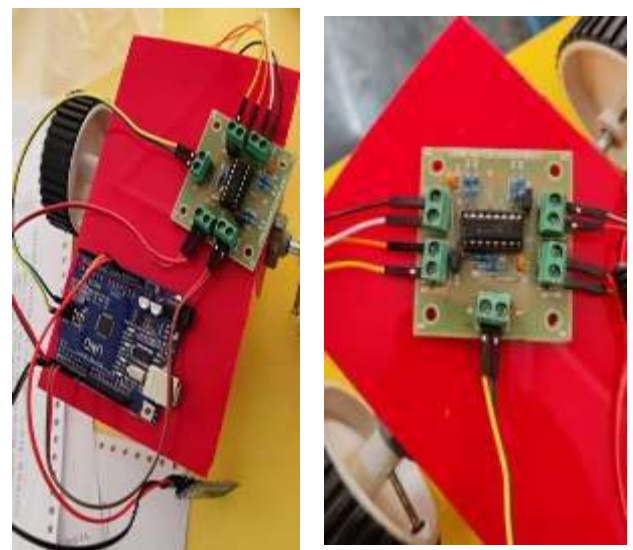
The boat via Bluetooth. Now we will send the voice command using the android app to move the boat as we wish.

Here we have added Five voice commands for Four different instructions. They are

- Move Forward – The motor will move in the forward direction for 2 second
- Move Backward – The motor will move in any

**STEP 4:** Choose HC-05 with password “1234”

**STEP 5:** To pair the HC-05 bluetooth module with the Android app we should create a password that is “1234” or “0000”.



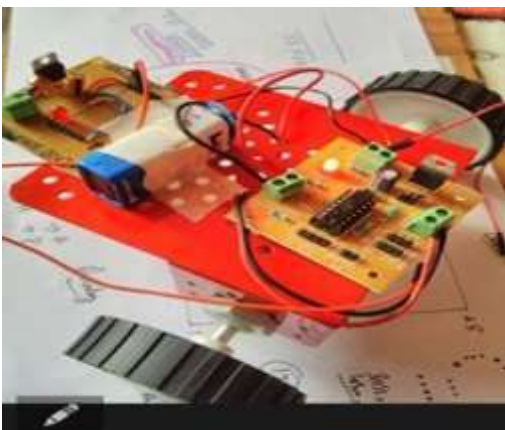
**Figure 11: Image to create a HC-05 PASSWORD**



Figure 14: Image represent the voice command based wheel chair

### VII.CONCLUSION

Since 90% of the people own a smart phone, smart wheelchair is one of the best solutions. As the person can remotely control



the wheelchair using smart phone the proposed system becomes more helpful and efficient. This gives him confidence for his life carrier. The patient monitoring system on the wheelchair will be constantly monitoring the health of the patient. If any abnormality is detected, the system will alert to the relative or doctor. Thus,

this system greatly helps the patients with lower limb impairment.

**FUTURE SCOPE:** We can say that Voice controlled robots can certainly dominate the future market for many industrial and domestic purposes related to automating daily tasks .Though it requires several tests but the robot works quiet well with very less errors in recognizing voice commands Little modifications in the android application can result in a much more clarity in voice recognition. For advancements in this research work we can use a long-ranged module which will result in connectivity with the robot for long distances and as a result overcome its limitation.

Best for handicapped people who can rely on this robot as there is very less chance of accident. The robot will stop instantly by slowing down once identifies an obstacle. As an application it can be used for military purposes where the commands can be given to robot without any risk of increasing the range and we can install cameras on the robot to get enemy view. Can also be used for Home Security purpose with installed cameras. Use of Artificial Intelligence along with voice commands will take this research to a new dimension.

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