ARTIFICIAL INTELLIGENCE POWERED VOICE OPERATE WHEELCHAIR

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Abstract - The physically impaired people depend on others in their daily life to go from one place to another. For the wheelchair patient, they continuously need someone to help them to move the wheelchair. This invention will help physically impaired persons become independent. The proposed system uses wireless technology for controlling wheelchair, which uses a voice recognition system for controlling all the movements of wheelchair. It integrates Raspberry Pi, microphone, USB sound card, motor control interface board to move the wheelchair. By using this invention, the user are able to operate the wheelchair by using their voice to the wheelchair microphone. The movement of the wheelchair includes forward, reverse direction, left and right turns and stop commands. It utilizes a Raspberry Pi and Arduino to control the wheelchair operation. To accomplish task, a python program is written and stored in the Raspberry Pi's memory. In order to recognize the commands, the pocket sphinx library must be trained according to the user language who is going to operate the wheelchair. In case of voice failure wheelchair is going to operate using android application using connectivity with the Bluetooth module connected to Arduino Uno to recognize the spoken words. For obstacle detection ultrasonic sensor is used, which helps to stop the wheelchair automatically in case any obstacle comes in the way of the wheelchair and will inform to patient about obstacle distance from wheelchair.

Keywords— Raspberry Pi, Arduino Uno, Bluetooth, Android Application, Voice Recognition, Ultrasonic Sensor.

I. INTRODUCTION

World report on disability" (2011) jointly presented by World Health Organization (WHO) says that there are 70 million people are physically impaired in the world. The proposed wheelchair is made for the disabled and handicapped people. The device is completely automated systems for the especially able people. People with disability below vest often need to use a wheelchair. Unfortunately, due to increase road accidents as well as disease like paralysis the wheelchair requirement is increased. The disabilities percentage of physically handicapped person is large across the world. If a person is handicapped, then it has to dependent on other person for his day-to-day work. Therefore, a voice-operated wheel chair is develop which will operate automatically on the voice commands from the physically impaired user for movement purpose.

II. PROPOSED SYSTEM

A. Block diagrams

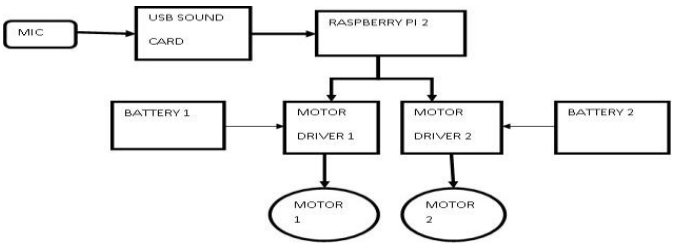

Figure 1: Block Diagram of Voice Operated Wheelchair

Microphone converts voice commands to electrical signal using Raspberry Pi, which uses pocket sphinx library for speech recognition, which converts voice command to text.

Now based on this text command Raspberry Pi decide what user wants to do e.g., Move forward/Move Back/Move Left/Move Right or Stop. According to the commands, motor is moving in clockwise or anticlockwise directions. Raspberry Pi is used as controller and coded according to the algorithm.

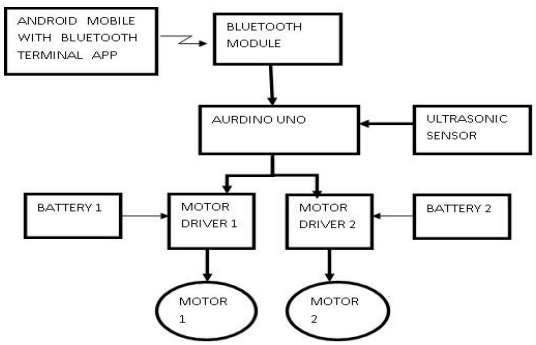

Figure 2: Block Diagram of Android Operated Wheelchair

Input is taken from the android mobile app as a text command. This text is transfer to the Arduino via a Bluetooth module wirelessly, which controls the movement and direction

of wheel chair. Arduino decides the operation of the two DC motors depending on the text received. TC 365 Brushless DC drivers are used to drive the motors. The two 12 volt lead acid batteries are connected in series to make 24 volt of supply voltage.

- Forward: Both motors rotate in forward direction.
- Reverse: Both motors rotate in reverse direction.
- Left: Left motor stopped and right motor rotate in forward direction.
- Right: Right motor stopped and left motor rotate in forward direction.
- Stop: Both motors are stopped

III. HARDWARE COMPONENTS

A. *Raspberry pi 3 (B model)*

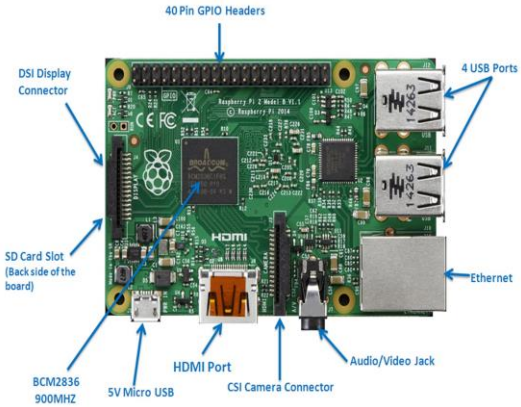

Figure 3: Raspberry pi 3 (B model)

The Raspberry Pi is a single-board computers device. Raspberry Pi 3 model B is used in the proposed idea. The Raspberry Pi board contains a processor and graphics chip, program memory (RAM) and various interfaces and connectors for external devices. Raspberry Pi has the ability to interact with the outside world, which is useful in proposed product to recognition human voice. Raspberry pi has 1GB of internal memory. Raspberry pi is a powerful ARM CortexA7 based quad-core processor that runs at 1.2GHz. It requires a USB microphone or USB sound card for voice communication. The raspberry pi is powered via the micro USB connector of at least 5v, 2a. It can be programmed with Python or any other language that will compile for ARM v8.

B. *Bluetooth module*

Figure 4: Bluetooth Module

HC-05 module is a Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. It operate at 2.4GHz radio transceiver and baseband. It is use to connect the smart wheelchair with the android application to control it.

C. *Arduino Uno*

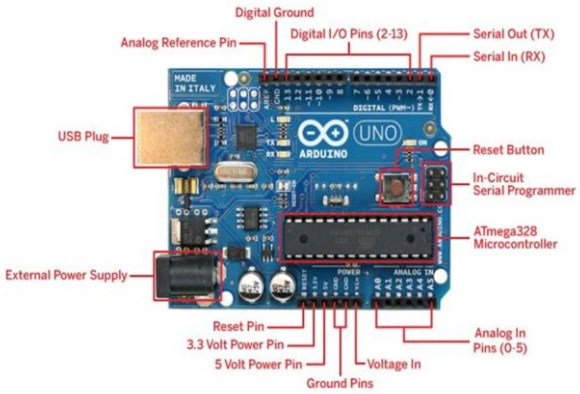

Figure 5: Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which six can be used as PWM outputs), six analog inputs. It is use to control the dc motor and drives of the wheelchair and provide required PWM to move in the respective direction giving by the user.

D. *Ultrasonic sensor*

Figure 6: Ultrasonic Sensor

Ultrasonic Sensor with Arduino calculate distances from objects to the module. In this case, user altering the output of how close an object is to the sensor. So the nearer the user will be alter. Therefore, if we start with the Arduino & Ultrasonic Sensor, an IC works by sending an ultrasound pulse at around 40 KHz. It then waits and listens for the pulse to echo back, calculating the time taken in microseconds. It can triggered pulse as fast as 20 times a second and it can determine objects up to 3 meters away and as near as 3cm. It needs a 5V power supply to run. Adding the Arduino & Ultrasonic Sensor to the Arduino is very easy, only four pins Power, Ground, Trigger and Echo required connecting to Arduino and communication will take place with the help of the UART serial communication.

E. *USB sound card QHM623*

Figure 7: USB Sound Card

Features of the Sound Card

- Integrated 2 channel
- USB Audio Controller
- Main Function
- Real USB Plug & Play
- Drives 2CH speakers Directly & supports 3D positional sound and virtual 5.1 CH sound track
- Uses USB port for power, no external power needed
- Digital Class-B Power Amplifier inside

F. Brushless Direct Current (BLDC)

Figure 8: BLDC Motor 24V

This chair is made for the disabled and handicapped people. We consider the maximum weight of a person is 80 kg. Therefore, the total weight with chair + motors + drivers + person + battery is 120 kg.

G. Motor drivers

Figure 9: Motor Driver

TC 365 Brushless DC drivers operates on 24V DC voltage. The speed of BLDC motor controlled using these drivers. Project used two separate drivers for two motors.

H. Battery

Figure 10: 12Volt DC Battery

Project contain lead acid battery of following specifications:

- Output Voltage : 12V
- Output Current : 26A

IV. FLOWCHARTS

A. Flowchart of voice operated wheelchair

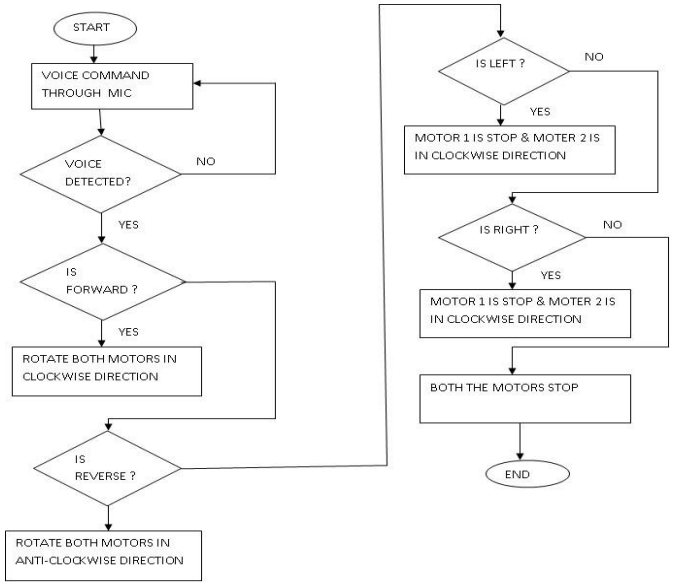

Figure 11: Flowchart of Voice Operated Wheelchair

B. Flowchart of android operated wheelchair

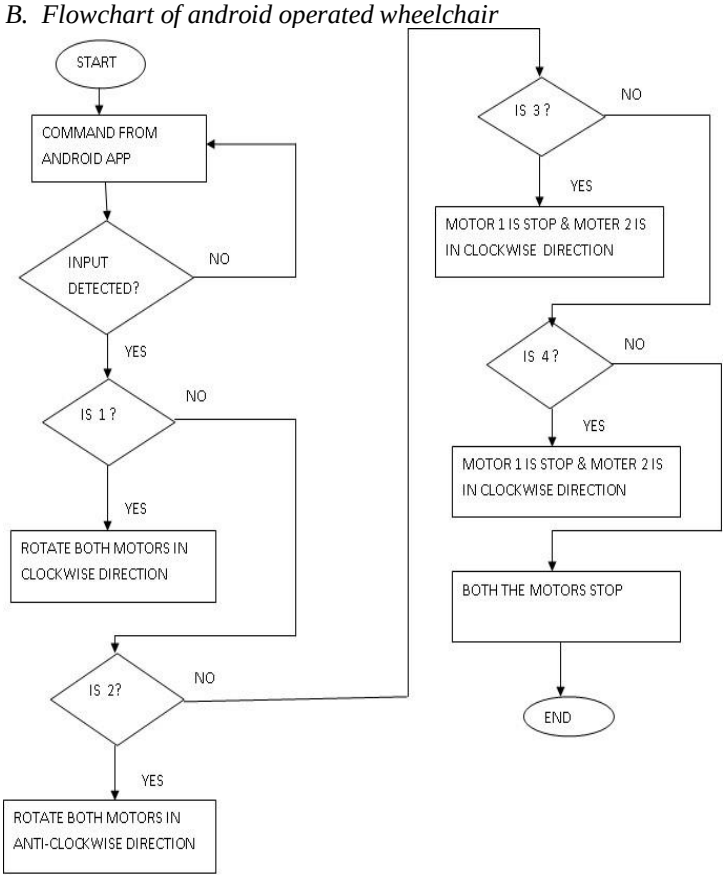

Figure 12: Flowchart of android operated wheelchair

C. Flowchart of obstacle detection in wheelchair

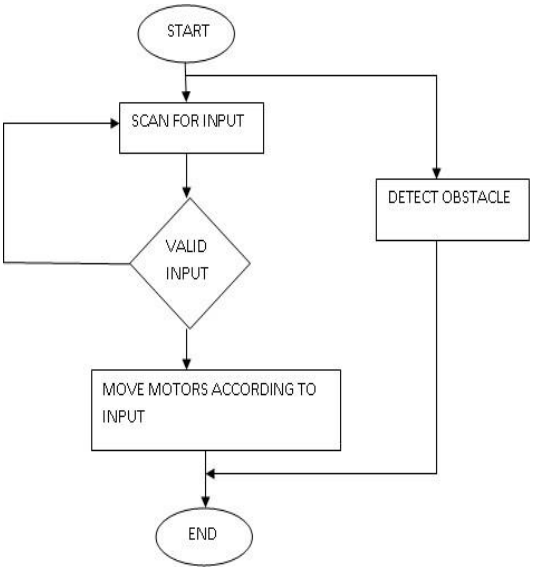

Figure 13: Flowchart of obstacle detection in wheelchair

V. Experimental setup

Figure 14: Modified Wheelchair

Figure 15: Wheelchair with Motor Casing

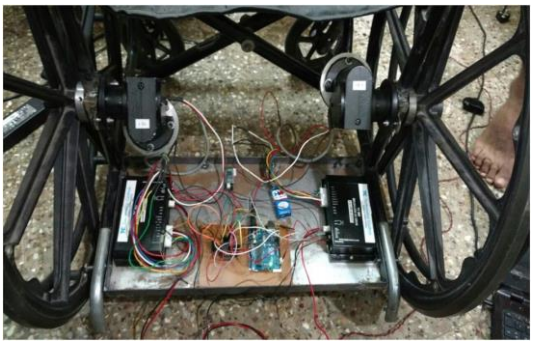

Figure 16: Final Assembly of Wheelchair

VI. Advantages

- Provides easy movement for physically impaired people.
- Support any language.
- Lightweight and Portable.
- Android application take input at a faster rate and hence control the movement of wheelchair.

VII. Conculsion

The proposed voice-controlled wheelchair for physically impaired people uses Arduino and voice recognition module for controlling the motion of a wheelchair. The direction of the wheelchair now are often select using the required voice commands in any language. The design reduces the manufacture cost compared with present market and will give great competent model with other automatic electrical wheelchairs. The only thing needed to ride the wheelchair is that the synthetic voice commands of the person with a backup of Android application. A system, which will directly enhanced the life-style of physically impaired people within the community.

VIII. Future scope

- Using gearbox we can generate high-speed moving wheelchair.
- Solar can use to power the wheelchair in outdoor.
- The wheelchair can also include the gesture feature to operate the wheelchair.

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