# SPEECH BASED WHEEL CHAIR CONTROL USING ANDROID BLUETOOTH TECHNOLOGY

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*Abstract:* Independent mobility is an aspiration for every person with some or the other physical disability especially in the case of quadriplegics and multiple sclerosis. These are the patients who are paralyzed below neck and people suffering from back bone problem and knee joint problem. People with disabilities meet barriers of all type. We know that technology is manual for wheelchair but as per survey more than 70 percent of manual wheelchair users will develop shoulder pain at some point in their life. But the quadriplegic and knee joint patients cannot move any of the limbs below the neck. Hence manual and even joystick operated wheelchair is out of question for the quadriplegic patients. So, the development of voice based wheelchair will give the solution to this query about the mobility of patient and make them independent of mobility. Ultrasonic and IR sensors are integrated into this wheelchair which provides best possible and safe movement. Wheelchairs can be designed for various purpose like wheelchairs can be handled by hands, mouth, or any other functioning. Smart wheelchair is a combination of standard driver modules and collection of sensors with a user interface by using android app. This feature makes it useful for those disabled persons.

*IndexTerms* - Motor Driver, Smart wheelchair, Disability, Sensors, Android

## I. INTRODUCTION

The Internet of Things is a concept for computing the ideas which describes everyday' s physical objects that are connected to the internet and communicates or identifies themselves with the other devices. Most of the people think that are connected in terms computers, smartphones, tablets etc. But IoT describes anything, everything that can be connected and communicated in an intellectual manner. We can also tell that the physical objects as internet of things is becoming a very informative system. In IoT objects represents themselves digitally then it is most significant and the object not only belongs to the user but also connected to the surrounding objects/things.

The cost for connectivity is decreasing as more devices are being created with Wi-Fi capabilities and sensors, and also technology costs are going down, and smartphone penetration is sky-rocketing hence these things are creating a "perfect storm" in the IoT as it is an effective growing technology for communication.

[3]In the reality IoT allows devices to connect virtually by providing endless opportunities that takes place, even though many of us can't even think it's impact of today or in future. Some of the issues we are facing are security, data sharing, privacy etc. where IoT gives a way to solve all these issues hence it is a hot topic even today.

Smart wheelchair gives the independence and mobility to the quadriplegics i.e. who are unable to move their hands and legs or even provides freedom for elderly people. In this implementation voice command is given as a input where voice gets converted into digital form and performs the operations as per the commands by displaying the corresponding messages.

Section 1 tells about the domain of the project and the project description, section 2 tells about the survey of the project, section 3 tells about the proposed system and its objectives, section 4 tells about the system design with the components, section 5 tells about the implementation and dataflow diagram of the project, section 6 tells about the experimental outcomes or the results and finally section 7 gives the conclusion of this project.

## II. LITERATURE SURVEY

The below description gives the research on Intelligent wheelchairs that have been conducted and still on-going process at some institutions and it provides idea for the different approaches that can be used:

- **IBM T.J. Watson Research Center**

[1]Connell and Viola, [Connell & Viola, 90] implemented a work of intelligent wheelchairs system in which chair is mounted on robot to make that mobile and they also said that chair can be controlled by using the joystick which is mounted on the chair by users. The user can also have control to the system to perform certain functions like avoiding the obstacles. Control is sent from the user to wheelchair through a toggle switches. And behaviors were used to control the wheelchair's movement and each small

rule becomes a toolbox to perform the goal. These sets can be enabled or disabled by switches which is controlled by the operator/user.

- **CALL Centre, University of Edinburgh**

[2]CALL Centre, University of Edinburgh has developed the CALL Centre Smart Wheelchair. The main purpose that wheelchair is for motivating educational and therapeutic resource for disabled children. It was designed for assessment and development of social, cognitive, physical and communication skills. They developed and evaluated thirteen chairs in three local schools. The observer or the subsystem responds and reports its perceptions to the user. The software which they developed will run on multiple 80C552 processors communicating via 12C serial link by monitoring the sensors and user commands.

- **TIDE Programme**

[8]TIDE means "Technology Initiative for Disabled and elderly people" programme of the European Union started in 1991 with 21 development projects and budget of ECU18 million. The SENARIO project (SENsor Aided intelligent wheelchair navigation). The initial project included 6 members from Greece, Germany, UK, and France to develop the intelligent powered wheelchair for navigation. System which they developed had four subsystems are Risk Avoidance, Sensoring, Positioning, Control panel and the system operates in teach and run mode.

## III. PROPOSED SYSTEM

The motivation to implement a smart wheelchair is to provide independence, mobility, comfortless and enjoyable activities to the quadriplegics and to make elderly people's life much easier by providing the freedom.

**Objectives:**

- The project designed here is a microcontroller based embedded system interfaced with an android based voice processor to recognize the words.
- The voice processor is connected with a local microphone to accept direct voice. The selector switch can select the mode either from local to wireless. The word strings are also fielded programmable by the user.
- The voice processor output is a digital ID for the particular word string and that is feed to a Renesas microcontroller and decoded to control the devices connected to the microcontrollers through the specific relay drivers.
- This is an embedded system designed to process voice and recognize the word string and decode the words to perform the action. The voice communication to the processor can be directly fed using Android app.
- It should be able to control two high current electric motors independently, efficiently and safely.
- It should be able to avoid collision with an obstacle and provide protection to the user.
- It should operate with a good response using wireless joystick or touch screen.
- It should provide a safe movement to the user.

## IV. SYSTEM DESIGN

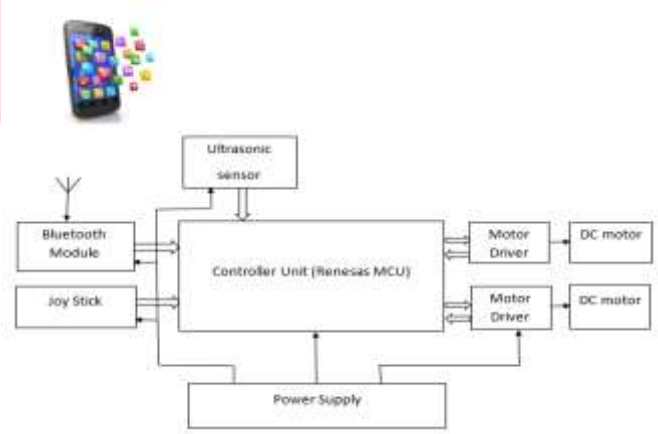


Figure4.1: System architecture of the proposed system

The above figure explains the project architecture:

This is implemented by grouping Ultrasonic sensor, Bluetooth module, motors, microcontroller, LCD and android app to control the wheelchair. The connection between android application and the wheel chair is done using Bluetooth. Ultrasonic sensor helps to detect the obstacle by sending continuous signal from the transmitter and if receiver receives the signal then there is obstacle and it outputs the voice saying obstacle detected. Firstly, power Supply is given to all the components. Secondly, the user gives the voice commands from the android app to the microcontroller through the Bluetooth module by paring with the device. Bluetooth module converts the voice command to binary format and sends to the microcontroller which acts as a master. Then microcontroller executes the commands received from the Bluetooth and sends the digital or binary values to the device motor driver and finally the DC motor starts moving the wheelchair and display the particular message on the LCD.

**4.1 Components:**

- **Hardware Requirements:**
  - Ultrasonic Sensor
  - Renesas microcontroller (64 bit)
  - Bluetooth module (HC-05)
  - DC motors
  - Android phone
  - Power supply
- **Software Requirements:**
  - Cute Suite+
  - Renesas Flash Programmer
  - Android IDE(Eclipse)

## V. IMPLEMENTATION

When the setup is ready firstly,

- The user has to give the input as a voice through the android app.
- Then they have to check for the Bluetooth connection if it is not connected then they have to turn on the Bluetooth and connect to the wheelchair.
- Then user has to select the auto mode. And should give the following commands to make the wheelchair to operate
- Front, Back, Left, Right and Stop to make the wheelchair movements in particular direction.
- If the ultrasonic sensor detects any obstacles then it gives the voice Output saying Obstacle detected.

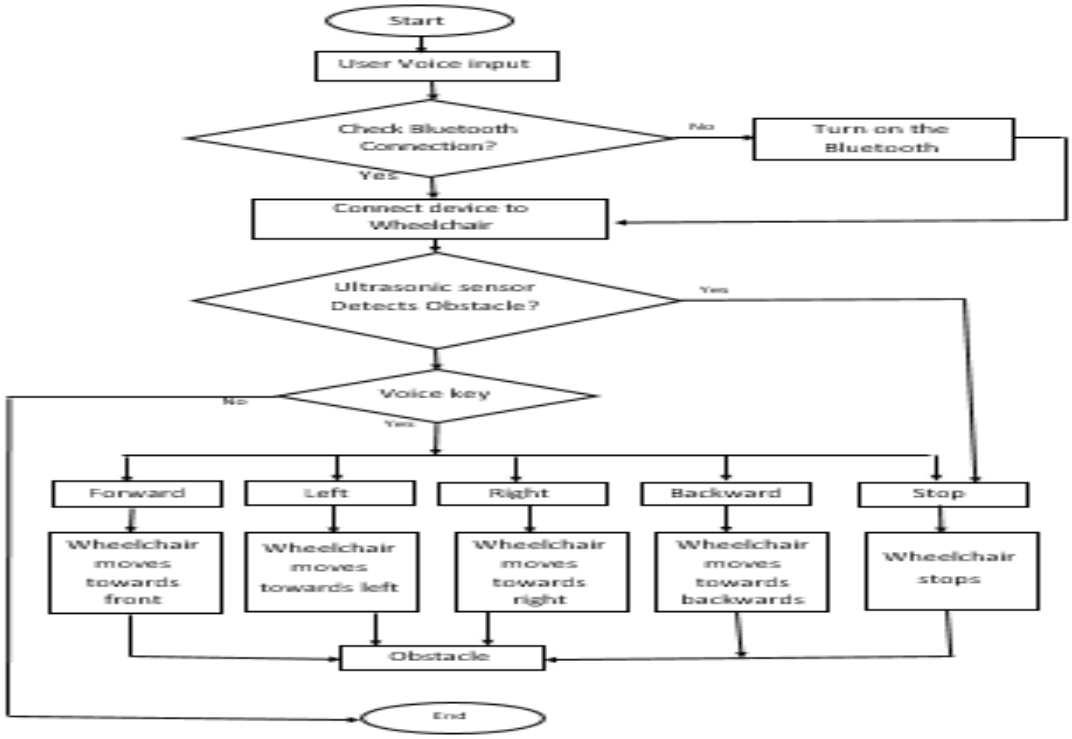


Figure5.1: Flow Chart for the proposed system

## VI. RESULTS AND DISCUSSION

**Ultrasonic sensor:** LED in the Ultrasonic sensor has to blink when it detects an obstacle as shown in the Figure6.1

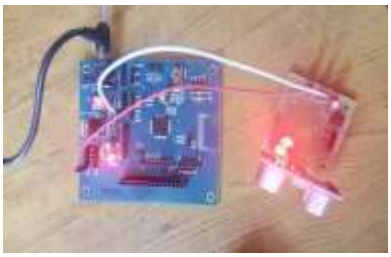

Figure6.1: LED blink during obstacle detection

Once the commands are given then it performs the operations as per the commands and the hardware components looks like as shown in the Figure6.2.

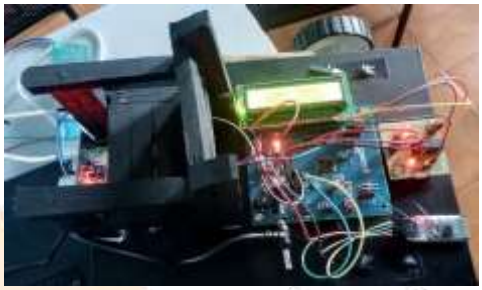

Figure6.2: Working of the hardware components

**6.1 Test Cases**

During testing some of the operations are tested and it outputs as shown in the below table6.1.

| SL.NO | TESTCASES | EXPECTED RESULTS | OBTAINED RESULTS |
|---|---|---|---|
| 1 | FRONT | Wheelchair should move towards front. | As expected |
| 2 | LEFT | Wheelchair should move towards left. | As expected |
| 3 | RIGHT | Wheelchair should move towards right. | As expected |
| 4 | BACK | Wheelchair should move towards backward. | As expected |
| 5 | STOP | Wheelchair should stop. | As expected |
| 6 | OBSTACLE | It should give voice output saying obstacle detected | As Expected |
| 7 | NO OBSTACLE | It as to perform the operations as per the commands | As Expected |

Table6.1.1: some of the commands test cases during testing

**Advantages:**

- Provides reliability
- Self-confidence
- Self-esteem and independence.
- Easy to drive the wheelchair with negligible efforts.
- It reduces the man power and dependency on other human to drive the wheelchair.
- Low power consumption and easy to operate.

## VII CONCLUSION

Portability and autonomy is person's rights to carry on with their life cheerfully however for quadriplegics individuals it is exceptionally troublesome as dependably they ought to be a human help for their versatility. Subsequently this task gives an awesome help to the individuals who are subject to others for their versatility. Renesas microcontroller is utilized which acts an ace to which the Bluetooth, ultrasonic sensor are joined. Bluetooth goes about as an interface between android application and controller while ultrasonic sensor is utilized to recognize the deterrents. Once the hindrance is distinguished it yields the voice as "deterrent identified". In future Bluetooth can be supplanted by GPS to make an impression on the concerned specialist when the impediment is recognized. This undertaking for the most part centers around physically tested individuals to give opportunity to their versatility yet this is additionally appropriate for elderly individuals, it can likewise be utilized as a part of doctor's facilities, maturity homes and can likewise can be utilizing as a part of playing toys i.e., remote autos and so on.

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