VOICE AND ANDROID APPLICATION CONTROLLED WHEELCHAIR

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***Abstract**: Voice controlled wheelchair aims at reducing the human effort of moving the chair. Disabled people, patients are dependent on other people. Common wheelchairs require the person to push the wait of the chair along with themselves. This is difficult to do disabled people. Most of the cases there is a person to move the patient with the chair. Integrating embedded system reduces the required manpower. This embedded system provides android as well as voice control. It is easy for the patient as it saves them the labor work needed. Voice commands given will move the chair in required direction. Microcontroller will drive the relay circuit according to the commands given.*

Google API is used to recognize the speech. This system can also be controlled by android application. Basic four command keys give the required commands for the movement. Integrating voice and android application gives the patient independent control.

I. INTRODUCTION

The dependence of physically impaired patients on others is a huge problem even after the advancement of technology. A wheelchair bound patient may always need an assistant to carry out smooth movement from one place to another. So, a person should be present most of the time to give a push for wheelchair movement. It is true that some paralytic patient may have strong working arms but most of the paralytic patients may not have strong arms and their movement is just limited to their fingertips.[1] There are cases when a person has to use a wheelchair for a limited period of time to recover from a particular injury, in that case a patient may not be able to use a wheelchair efficiently and he/she will have to rely on someone else. In our country there are many patients who may not have any close aid and an assistant may not be affordable, in that case the patient is helpless and his/her life becomes challenging. There are different types of wheelchair depending upon the purpose required. Various methods are implemented to move the wheelchair.

The objectives are

- To program the ARM LPC2138 to control relay switches and motors.
- To develop a voice controlled system to help movement of the chair.
- To establish a wireless connection between the controller and the android device using Bluetooth.
- To develop an Android App to control the wheel chair remotely.

II. PROPOSED WORK

A. Hardware Design:

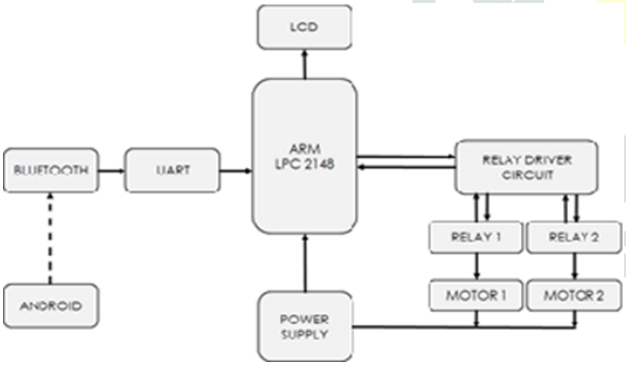

Fig 2.1: Block Diagram

The Figure2.1 gives the brief idea of the system. The system can be given input through voice as well as android application. The android application is connected to the hardware circuit through Bluetooth.[3] The commands received are carried to microcontroller. These commands are also displayed on the LCD display connected to the system. The appropriate signal is the given to the relay circuit driver. The relay circuit then drives the motors accordingly. Power supply is used to provide power to all the hardware present on the module. Two 50W, 12V motors are used for controlling the movement of the chair. HC-05 Bluetooth module is used for wireless communication.

B. PCB Design:

The PCB is designed in OrCAD software. The PCB designer includes various automation features for PBC design, board level analysis and design rule checks. The PCB design is accomplished using manual tracking of tracks. Relay circuit is also designed using this software. When power is supplied to the board it is indicated by a LED. Connection outlets are provided for LCD, Bluetooth module as well as the relay circuit. Pin number 36 and 40 are used for driving relay switches. The Bluetooth module is serially connected to UART0(P0.0 and P0.1) while UART1(P0.8 and P0.9) is used for programming of the microcontroller. [6]

C. Android Application Development:

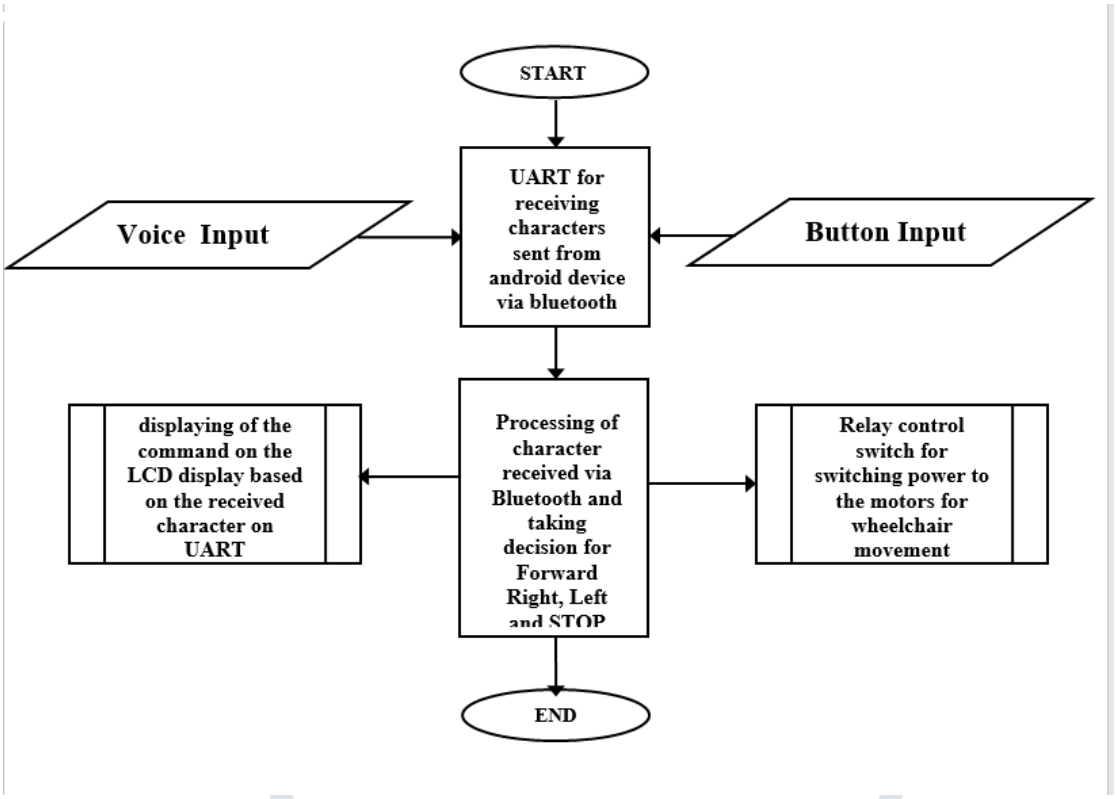

Figure 2.2 Android Application Flowchart

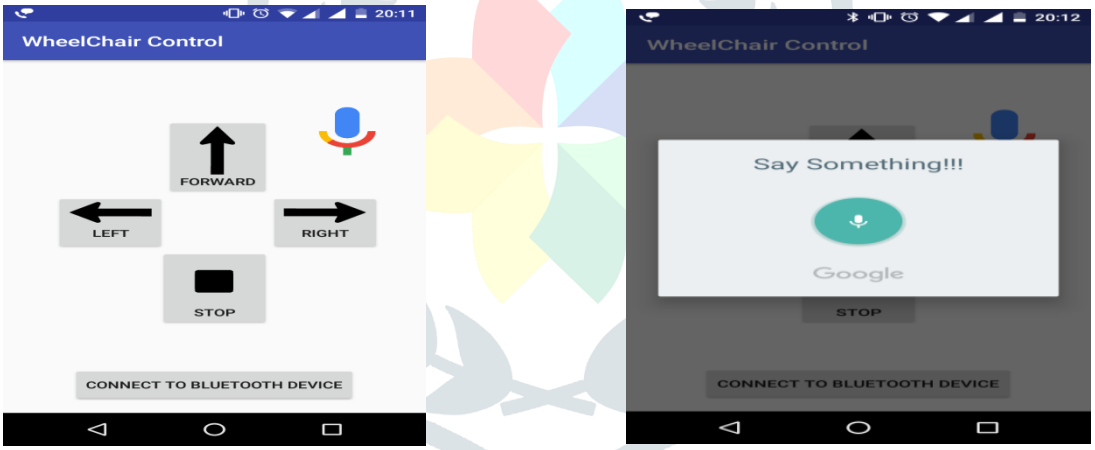

Figure 2.3 Android Application

The Android application named "Wheelchair Control" has five input buttons and one voice button as shown in the Figure 2.3. The button "CONNECT TO BLUETOOTH DEVICE" is clicked and if the device's Bluetooth is not on already a prompt message pops up as shown in the screen 2. On pressing "ALLOW" the Bluetooth is turned on. After turning on the device's Bluetooth the button "CONNECT TO BLUETOOTH DEVICE" is pressed again to establish a connection with the Bluetooth module (HC-05). The commands through buttons "FORWARD", "LEFT", "RIGHT", "STOP" and the voice input can be transmitted when the Bluetooth connection is successfully established. When the voice input is pressed the screen three is generated and device's mic is automatically turned on. The mic waits for the speech/command input. The voice input is converted into test using a Google API for voice.[6] As soon as the mic turns off the text command is transmitted via Bluetooth to the module. Similarly, when a command button is pressed the respective command is transmitted via Bluetooth to the Bluetooth module. In both the above cases an integer which denotes a certain command is transmitted, which is again converted back to the original command at the controller's side. In case of buttons the movement of the wheelchair is instantaneous while there is a lag of 2-3 second when voice input is provided. The program from is explained in flowchart Figure 2.2

III. Progress

The project started with designing system specifications. All the required modules required for project were studied n selected, Bluetooth was chosen for communicating between the android device and the controller circuit. LCD was selected to display the command given. Circuit diagram was made with reference to arm standard interface diagram. All the required software's were downloaded and studied. Next phase started with designing of PCB for controller circuit as well as relay circuit for driving motors. OrCAD software was used for designing of PCB. Controller PCB consists of UART ports as well as output pins for LCD as well as for relay circuit. Relay circuit was designed to drive 12V motors. Relays are normally off. PCB were manufactured and components were purchased. These components were then soldered on the

boards. Boards were tested with test points and multimeter by checking voltages at pins. After hardware was successfully tested, software is designed. Android application development through online videos and through android studio was studied and practised. Embedded coding was done by referring the datasheet of arm controller. Firstly, individual codes were written for modules n tested which upon giving desired results were then integrated into one code. Android application was designed in various phases. Voice api was then added in the application which also provided feature to connect, disconnect from Bluetooth and also displayed the list of devices which were paired with the application. Application was tested by pairing it with other android devices. Along with software development search for wheel chair was also carried on. Upon finding the wheelchair which sufficed the need of the project it was given to a mechanic to design the base for integrating the motors. After the base was designed the components were mounted on the wheelchair and testing phase started.

III. RESULT

Our main objective was to design a system which could enable the user to control the wheelchair by using application as well as through voice. This was achieved successfully. Relay circuit, motors, Bluetooth modules was interfaced successfully to microcontroller and desired results were obtained Android application was developed which could be used to control the wheelchair using buttons provided on the screen as well as by using speech input to control the movement. The delay introduced by using voice was of 4 seconds while delay by using buttons was negligible and system performed efficiently. Battery is used to provide power for the motors as well as the controller circuit with a backup of 30 mins. Charging circuit is also designed for battery.

IV.CONCLUSIONS

The system proposed can complete the targeted objective of automated wheelchair. The system also provides an inexpensive alternate option to the user. Relay circuit required for driving the motors was designed in OrCAD software and PCB has been made. Relay circuit drives 2 motors. All required hardware components like Bluetooth Module, ARM controller, wheelchair etc. were purchased and integrated together. Android application is developed and voice api is integrated in it to control the wheelchair using voice. Wheelchair is working as desired and is tested by making actual user sitting on it and issuing commands.

V. FUTURE SCOPE

Wheelchair is a basic need for all patients with physical disability or for people who have suffered with an accident. Currently in practical life a separate person is required for pushing the wheelchair. This might be tedious for people. Our model will reduce this human dependency by providing voice control as well as control through the android application. Our proposed model lacks control from remote area or from a specific range as android phone will be on the wheelchair to aid the patient in moving the wheelchair. No external person can control the wheelchair from other location like from other floor or other room. Also, voice control uses specific commands to operate the wheelchair. Additional support can be added which will aid in movement in crowded places. In future work can be done to recognize the voice so that the wheelchair cannot be operated by someone else in the surrounding as hospital is a noisy place n noise is an important factor. Until now work has been done to control the wheelchair with voice successfully[3]. Also, work has also been done to control the wheelchair using joystick. Our proposed system will include both voice n app-based control. The wheelchair is working efficiently as desired. The limitation that was observed from testing phase was that voice control introduced a delay of 4 seconds which is out of acceptable range. This can be improved upon by further designing better application interface and by using other api. The wheelchair can also be given a joystick to control in case of fault in voice as well as application. Health monitoring can also be added like heart rate monitoring.

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