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SPEECH BASED WHEELCHAIR CONTROL USING VOICE RECOGNITION KIT

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Abstract: There is always a need for a physically challenged persons to seek help of others for moving from one place to another. Thus, the problems that they are facing can be solved by using speech recognition technology to move the wheelchair. Speech recognition technology is a key which may provide a new way of human interaction with machines or tools. The proposed work is to facilitate the movement of people who are disabled or handicapped and elderly people who are not able to move well. Here the Voice Controlled Wheelchair moves by using speech recognition module and with the possibility of avoiding obstacles. A program is designed to interface with the Renesas microcontroller and voice recognition unit that recognizes a voice and in turn controls the movement of wheelchair. The design of this smart system will allow certain people to live a life with less dependence on others.

***Index Terms* – Renesas microcontroller, Speech recognition, Android.**

I. INTRODUCTION

Speech recognition is a popular topic in today 's life. The applications of Speech recognition can be found everywhere, which make our life more effective. For example, the applications in the mobile phone, instead of typing the name of the person who people want to call, people can just directly speak the name of the person to the mobile phone, and the mobile phone will automatically call that person [1][2]. If people want send some text messages to someone, people can also speak messages to the mobile phone instead of typing. Speech recognition is a technology that people can control the system with their speech. Instead of typing on the keyboard or operating the buttons for the system, using speech to control system is more convenient [2][3]. It can also reduce the cost of the industry production at the same time. Robotic wheelchairs have enhanced the manual wheelchairs by introducing locomotion controls. These devices can ease the lives of many disabled people; particularly those with severe impairments by increasing their range of mobility. This robotic enhancement will provide benefit people who cannot use hands and legs. The proposed voice-controlled wheelchair is aimed to counter the above problems. The wheelchair can be controlled using joystick as well as using voice commands [7]. He or She just needs to say the direction or move the button for that direction and the wheelchair moves in the desired direction. In hardware development, we are using voice recognition module which correlates commands to do speech processing and give the result to Android which is further programmed with respective locomotive commands.

The idea of using voice activated technology for controlling the motion of the wheelchair is to prove that it can be a unique concept that would stand apart from the rest of the work. The use of this new technology in conjunction with a mechanical system in order to simplify everyday life and it would spark interest in an ever-growing modern society. Many people with disabilities do not have the dexterity necessary to control a switch on an electrical wheelchair. This can be a great for the quadriplegics who is permanently unable to move any of the arms or legs and they can use their wheelchair easier only using voice commands.

II. RELATED WORK

M. Prathyusha, K. S. Roy, Mahaboob Ali Shaik (2013) Described an intelligent motorized wheel chair for handicapped person using voice and touch screen technology. It enables a disabled person to move around independently using a touch screen and a voice recognition application which is interfaced with motors through microcontroller. To change the direction, the touch screen sensor is modelled to direct the user to required destination using direction keys on the screen and that values are given to microcontroller. Depending on the direction selected on the touch screen, microcontroller controls the wheel chair directions. This can also be controlled through simple voice commands using voice controller. The speed controller works by varying the average voltage sent to the motor by switching the motors supply on and off very quickly using PWM technique. The methodology adopted is based on grouping a microcontroller with a speech recognition system and touch screen.

Aruna. C, Dhivya Parameswari. A, Malini. M and Gopu. G (2014) Proposed intelligent wheelchair system uses dual control for navigation in familiar environments. The two modes of input are control used to the wheelchair are voice recognition and touch screen. When one want to change the direction, the touch screen sensor is modelled by pressing finger against the various quadrants on the touch screen, which has different values programmed for different direction. This can also be controlled through simple voice commands using voice controller. Here the wheelchair consists of DC brushless motors at the rear end and it is controlled by using PWM technique. A brake control mechanism is included to control the wheelchair. In this system wheelchair movement in all direction and Voice recognition has been achieved successfully. This device helps the disabled to have automatic advancement to their destination through predefined paths in the indoor system.

M.Senthil Sivakumar (2013) In this system, the wheelchair is operated automatically or manually by turning the wheels using hands or external aids. But this system is not helpful for paralysed persons. In this technique, the voice based controlled wheelchair robot is developed for particular elder or physically challenged person by predefining their voices in the system. This system presents the construction and design of voice-based wheel chair robot. The voice of the person is detected by voice capture module and that compared by voice recognition module with predefined voices loaded into the system. According to the received voice, the destination is automatically understood and the wheelchair moves according to the route which is predefined. It is also equipped with obstacle avoidance technique, where the person may not be able to provide proper voices at the right time. The wheel chair can automatically navigate from one point to other point in the home as per command from the voice module.

The development of voice operated wheelchair will solve the query about the mobility of patient and make them independent of mobility. The project designed here is a microcontroller based embedded system interfaced with voice kit to recognize the words. The voice kit 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 proposed system can be used by elderly and physically challenged people in day-to-day life even if they are alone at home in easy way.

III. Methodology

The wheelchair module (Fig 1) controlled by Renesas microcontroller works in coordination with voice kit, LCD display and ultrasonic sensor.

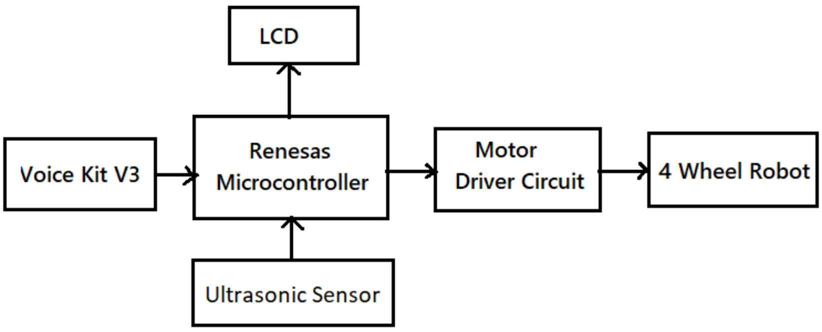

Fig 1: Block diagram of the wheelchair control.

Renesas microcontroller is the heart of the project and is located at the centre of the block diagram and controls all the operations of the project, LCD is used to indicate the status using microcontroller, Voice kit is used to detect the voice inputs from the user, L293d DC motor driver is used to drive the 4-wheel robot, and ultrasonic sensor is used to detect the obstacles. When user gives voice input at the voice kit that is in the analog form, is then converted into digital values from voice kit and this digital value is then fed to microcontroller, based on the received data microcontroller controls the wheel chair movements. While in the movement if any obstacle occurred that is indicated by the ultrasonic sensor, then microcontroller takes necessary actions to avoid that obstacle. The development board is prepared using glass epoxy Printed Circuit Board (PCB).

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3.1 Hardware Analysis

Voice is one of the forms used for communication, the proposed work is designed in such a way where using voice the wheelchair is being controlled. The voice input command is recognized by the voice kit v3 which is send to the microcontroller. The microcontroller is interfaced with ultrasonic sensor LV-MaxSonar®-EZ1 which is capable of detecting obstacle ranging up to 6.45meters. LCD indicate the direction moving Forward, Backward, Right and Left direction. The driver circuits are used to control the operations of firing unit, laser unit & audio reception unit present on the robotic module. Here three types of driver circuits are used they are ground driver, laser driver and motor driver circuit. These driver circuit drives the motors of the robot. Two L293D are used to drive four motors (Fig 2). When both the inputs are low the motor will be in the halt state, when the first input is high and the second input is low the motor will move in the forward direction, when first input is low and second input is high the motor will move in the reverse direction and when both the inputs are low the motor will be in the halt state.

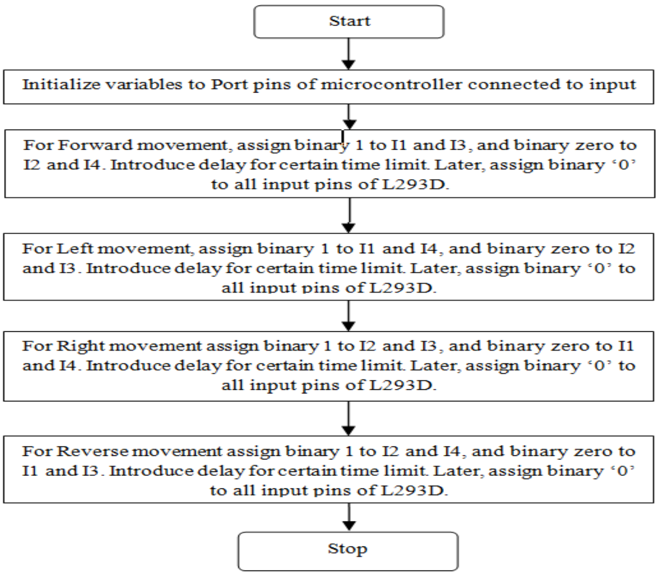

Fig 2: L293D For Robot Movement

3.2 Software Analysis

As an alternative the wheelchair is also controlled wirelessly with the help of Bluetooth enabled Android App in a Mobile device. Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android offers an open and equal alternative. Without artificial barriers, Android developers are free to write applications that take full advantage of increasingly powerful mobile hardware. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. The programming is done in Java Platform, Micro Edition, or Java ME, is a Java platform designed for embedded systems (mobile devices are one kind of such systems). Target devices range from Industrial controls to mobile (especially feature phones) and set-top boxes. The mobile device from which the wheelchair is operated with the help of Bluetooth connection.

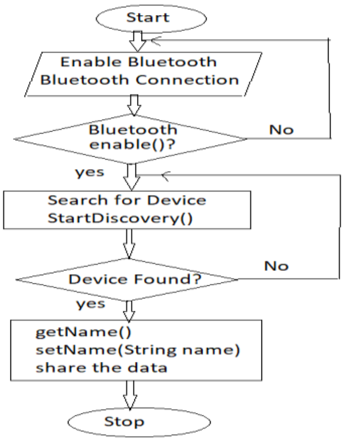

Fig 3: Android Bluetooth interface

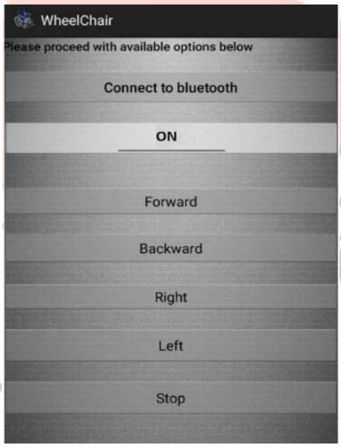

Fig 4: Mobile control Display

IV. RESULTS AND DISCUSSION

Wheelchair control through voice provides reliability, safety and comfort. Patients and physically challenged persons able to move their wheelchair around independently through speech control. The voice kit output is a digital ID for the particular word string that is feed to a Renesas microcontroller to decode and control the devices connected to the microcontrollers through the specific relay drivers (Fig 5). The microcontroller based system interfaced with voice kit to recognize the command words and move the wheelchair in desired direction. The Android mobile application can easily recognize the rapid change in the input.

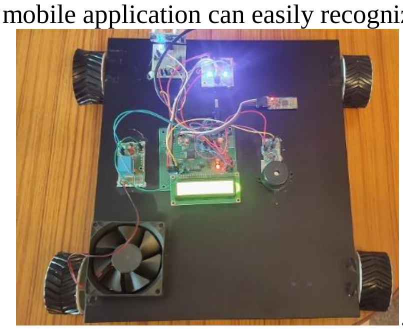
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Fig 5: Wheelchair Module

V. CONCLUSION

The proposed system is designed to provide the desired results, and can be successfully implemented as a Real Time system with certain modifications. The paper presents a prototype module of wheelchair. In future, this work can be taken to the product level. To make this module user friendly and durable, we need to make it compact and cost effective. Going further, most of the units can be embedded along with the controller on a single board with changing technology, thereby reducing the size of the system.

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