Smart Wheelchair with Voice Control for Physically Challenged People

Md Abdullah Al Rakib, Salah Uddin, Md. Moklesur Rahman, Shantanu Chakraborty, Md. Ashiqur Rahman, and Fysol Ibna Abbas

***Abstract* — A wheel chair is a mechanically operated device that allows the user to move about independently. This minimizes the user's personal effort and force required to move the wheelchair wheels. Furthermore, it allows visually or physically handicapped people to go from one location to another. Voice commands and button controls can be used to operate wheelchairs. In recent years, there has been a lot of interest in smart wheelchairs. These gadgets are very handy while traveling from one location to another. The devices can also be utilized in nursing homes where the elderly have difficulties moving about. For individuals who have lost their mobility, the gadgets are a godsend. Different types of smart wheelchairs have been created in the past, but new generations of wheelchairs are being developed and utilized that incorporate the use of artificial intelligence and therefore leave the user with a little to tamper with. The project also intends to develop a comparable wheel chair that has some intelligence and so assists the user in his or her mobility.**

***Key words* — Arduino Mega, Bluetooth Module, Smart Wheel Chair, Voice Control, Motor Driver Module.**

I. INTRODUCTION

People with arm and hand impairments find it difficult to utilize a standard wheelchair since their hands are incapable of operating it and cannot move it in any direction. As a result, a voice operated wheel chair is designed to overcome such people's difficulties and enable them to manage the wheelchair. The wheelchair will be controlled by voice instructions using the input provided. The Arduino will handle all of the user's desired directives. Each direction's instructions are written in the form of a program in the Arduino itself. The unilateral mic, which will be positioned according to the user's comfort, will provide spoken commands to the wheelchair. The HC05 Bluetooth module will do speech recognition. Arduino then receives the output from this module [1]. The Arduino's pre-written algorithms assist Arduino in converting these vocal commands into significant output, and the wheelchair will move appropriately. People will gain independence by using a wheelchair control system. The wheelchair control system makes use of a speech recognition technology to trigger and control all of its motions. The technology allows users to operate the wheelchair by just speaking into the wheelchair's microphone [2]. The fundamental movement functions are forward and reverse motion, left and right turns, and stop. The spoken words are sent to the speech recognition processor via a flexible microphone that can be bent to the user's specifications. Many physically handicapped people are unable to move any limbs below the neck. As a result, manual and even joystick-controlled wheelchairs are out of the question for these individuals. As a result, the development of voice-activated wheelchairs will answer the question of quadriplegic patients' movement and make them independent of mobility [3]. In our project, we have both voice command and switch control. In this case, we utilized Arduino as a programming device. Where c has used programming to better the project. The major goal of this project is to Wheel Chair System Project for the main aim of creating a smart system so that we may reap numerous benefits from a single project. These are utilizing voice command or switching for wheel chair control, which sick patients or elderly people can easily operate; the goal is to build a contemporary one primarily for sick patients or the elderly. There are numerous advantages to such a system, including the following: it reduces human efforts, it is beneficial to physically disabled people who are unable to operate home appliances with their hands, it will help to save energy to some extent, because some people are too lazy to go and switch off the appliances manually, it is simple to use for those who have tried it and do not need to operate the home appliance manually by hand, and it reduces risk [4]. The suggested system has several drawbacks as well, such as the fact that it requires an additional supply to operate the model and that the module only recognizes the inserted voice and button. This type minimizes the amount of physical effort required to acquire and identify the command for controlling the mobility of a wheelchair. The given commands can be used to control the wheelchair's speed and direction. Thus, all that is required to ride the wheelchair is a trained voice [5]. Aside from that, the development of this project may be done at a low cost. However, certain changes are needed to make this system more dependable. The wheelchair's design might be enhanced by including wireless communication. We can immediately improve the lives of handicapped persons in the community

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by establishing this system. Finally, we believe that this type of device will help to advance wheelchair technology. The intelligent wheelchair's motor drive and control system has been shown [6]. The voice-controlled intelligent wheelchair based on a microcontroller would be more convenient for handicapped individuals. By avoiding collisions with walls, immovable objects, furniture, and other people, the device can also improve the safety of users who use standard joystick-controlled powered wheelchairs [7].

II. Prototype Design

Our project is the voice control wheel chair. In this project, we first built a robot chair and then set up numerous systems for sick patients and the elderly. Which may be taken anywhere by using the voice command and button control while seated in the chair. The wheel chair was initially intended to help the sick and aged. The goal of this article is to create a wheelchair that moves in response to the user's orders. This system is controlled by the wheelchair user's voice or button instructions. The technology is completely self-contained, since the user does not require the assistance of another person to move the wheelchair. There are generally five commands and depending on whatever command is provided by the user, the wheelchair will move appropriately [8].

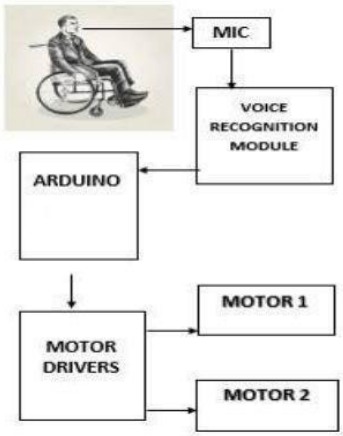

Fig. 1. System Architecture.

In the first stage, the user's vocal instructions are recognized. When a command is acknowledged, it is translated into the corresponding instructions that drive the system. This system is made up of two primary apps and modules: voice recognition and motor driving. The voice recognition is performed via a voice recognition software. The output of this Bluetooth module is sent to Arduino, which drives the motors with a motor driver IC. The unilateral voice recognition app, Bluetooth, motor driver module, Arduino, and motors are used to power the voice-controlled wheelchair. The phone app serves as the system's input. It can take voice commands from the user and ignore other sounds. The mobile app will be positioned according to the user's preference the output is in the form of speech signals, which are sent to the voice recognition software, which serves as a bridge between the Bluetooth module and the Arduino [9]-[12]. The output from the speech recognition software is then received by the Arduino, which converts it to binary code. Any language other than binary code is unintelligible to the system. As a result, the produced voice command is translated into machine-readable form. The Arduino Mega is used in this setup. It is linked to motors that allow the wheelchair to be driven anywhere. The wheelchair's mobility is controlled by motors. As a result, motors get input from the Arduino and move in accordance with the kind of instruction. This system has four motors that are linked by a motor driver. The motors may be given four distinct commands: forward, back, left, and right [13]. The wheelchair's mobility is solely dependent on these four instructions. The wheelchair reacts to vocal commands from its user to accomplish any movement's tasks.

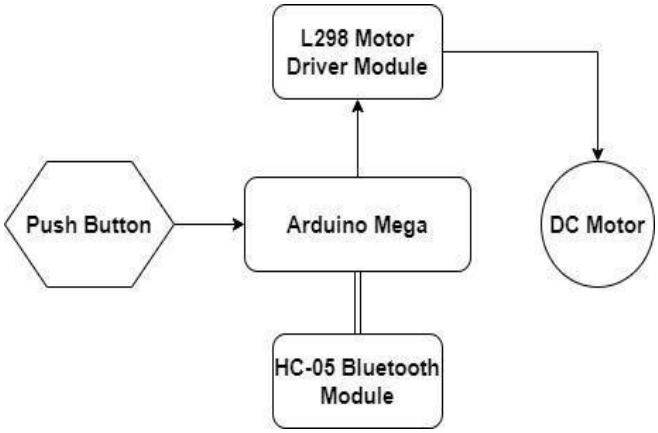

Fig. 2. Block diagram of this work.

The fundamental movement functions are forward, left, and right. The speech recognition processor must be taught with the words shouted out by the user who will control the wheelchair in order to recognize the spoken words. In our project, we have both voice command and switch control [14].

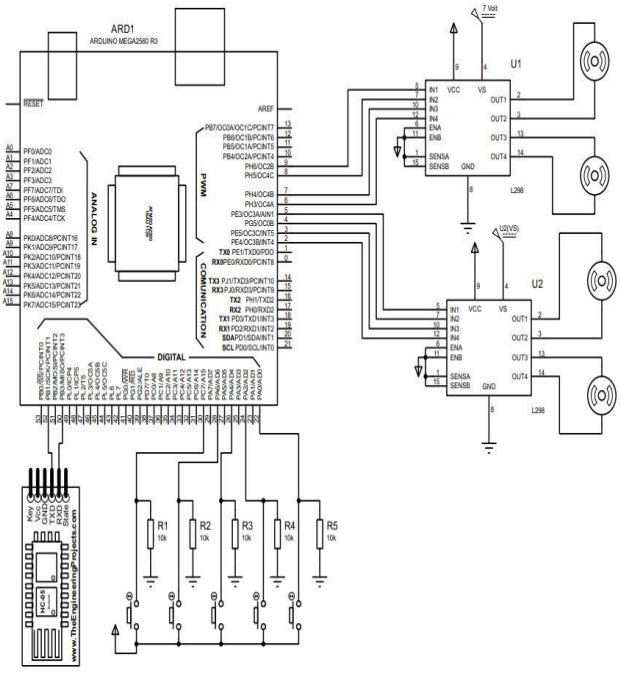

Fig. 3. Circuit diagram of this work.

Serial wireless data transfer is simple using the Bluetooth Module HC-05. Its operational frequency is in the 2.4GHz ISM frequency range (Industrial, Scientific, and Medical). It

adheres to the Bluetooth 2.0+EDR specification. The signal broadcast time of different devices in Bluetooth 2.0 is 0.5 seconds.

Seconds' intervals are used to minimize the burden on the Bluetooth chip and conserve more sleeping time for Bluetooth. This module is equipped with a serial interface, which makes it simple to use and shortens the entire design/development cycle [15].

Fig. 4. Bluetooth Module.

TABLE I: PIN OUT OF BLUETOOTH MODULE HC-05

HC-05	Sun Founder Uno Board
VCC	5V
GND	GND
TXD	RX0 (pin0)
RXD	TX0 (pin1)

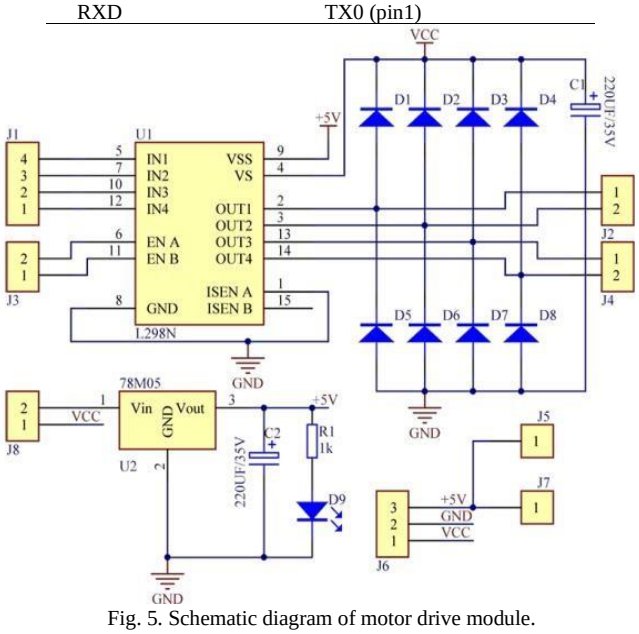

Fig. 5. Schematic diagram of motor drive module.

Installation and configuration of the Arduino software:

1.We downloaded and installed the Arduino software from www.arduino.cc on the computer (This was NOT connected to the PC). After that, we accessed the software file and installed the arduino.exe application. Two program setups are critical and should be examined.

a) On the Arduino software, choose the board to which we wish to connect. The "Arduino Uno" is referred to as the "Arduino / Genuine Uno" in this context [16]-[19].

b) We must select the correct "Serial-Port" to inform the computer to which port the board has been attached. That is only feasible if the USB driver has been properly installed. It may be verified as follows.

Proteus 7.0 is a Virtual System Modeling (VSM) application that integrates circuit simulation, animated components, and microprocessor models to co-simulate whole microcontroller-based systems. This is an ideal tool for engineers who want to test their microcontroller ideas before building a physical prototype in real time. This application allows users to interact with the design by utilizing on-screen indications and/or LED and LCD displays, as well as switches and buttons if they are connected to the PC.

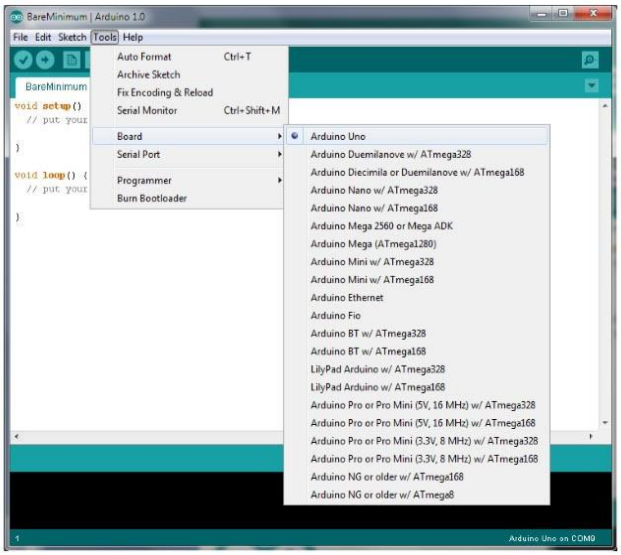

Fig. 6. Program installation process -1.

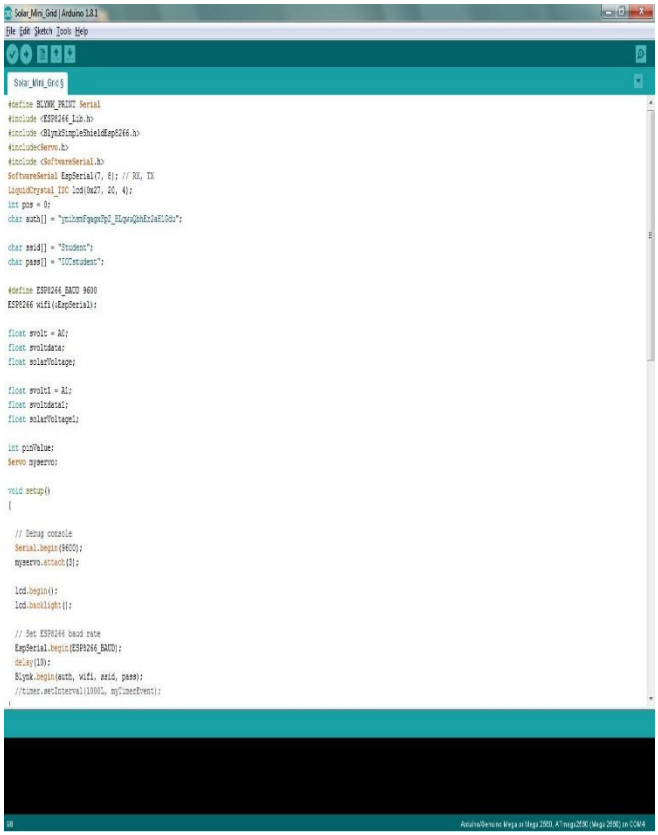

Fig. 7. Program installation process-2.

The Circuit Simulation product, which employs a SPICE3f5 analogue simulator kernel coupled with an event-driven digital simulator, is one of the core components of Proteus 7.0. It allows users to use any SPICE model from any vendor. For a tidy design prior to hardware implementation, Proteus VSM includes comprehensive debugging tools like as breakpoints, single stepping, and changeable display. In conclusion, Proteus 7.0 is the application to use if you wish

to mimic the interaction between software running on a microcontroller and any analog or digital electrical device attached to it [20]-[28].

TABLE II: COST ANALYSIS OF THIS WORK

SL NO	Components Name	Quantity	Unite Price	Total Price (BDT)
1	Arduino Mega	1	920	920
2	Battery	1	1050	1050
3	Motor Driver Module	2	250	500
4	Bluetooth Module	1	320	320
5	Button Switch	5	4	20
6	Car chassis With Gear Motor			800
7	Others	1	500	500
			Total Cost	4,110tk

III. RESULTS

The project will begin once the power is turned on. The mobile module in the project must be linked to the Bluetooth module. We offer wheelchairs that are controlled by voice using smart phone apps. It may be simply moved to the desired location with the use of a voice command and a switch.

The below image is showing the total system is in OFF mode.

Fig. 8. Hardware part of the prototype.

System operation state (ON):

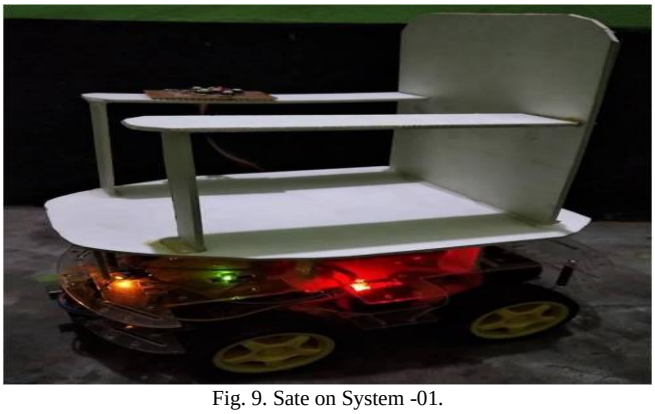

Fig. 9. Sate on System -01.

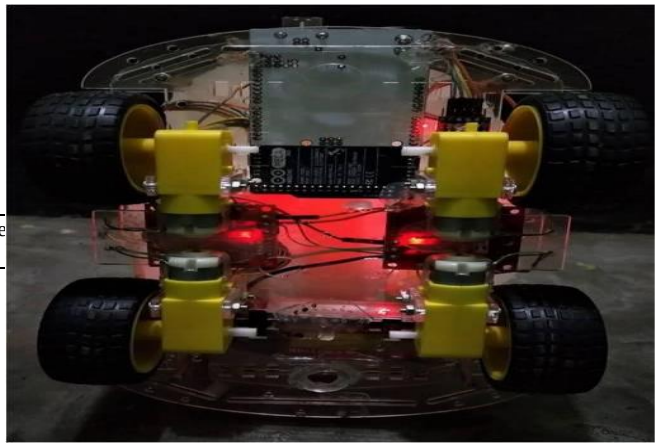

Fig. 10. Sate on System-02.

Our smart wheel chair project uses voice control, which can be accessed via a mobile phone via a set of Android Apps. We've developed the Android applications' functions to change the system control with a single tap.

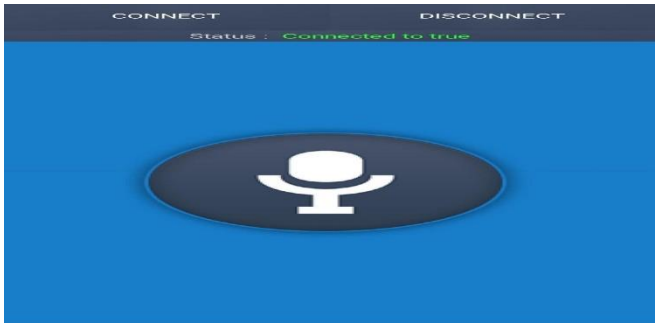

Fig. 11. Arduino Voice Control App.

The advantages of this work are simple-to-control, easy to use, nobody needs a medical specialist to run it, we can use it at home, cheap installation costs, dependable in an emergency.

IV. CONCLUSION

The design of a smart, powered, voice command, and push button controlled wheelchair utilizing an embedded system is described in this article. The proposed design has a voice activation system for physically disabled people, sick patients, and the elderly. This article depicts a "speech and push button controlled Wheel chair" for physically disabled people, in which the motions of the wheelchair are controlled by a voice command or a switch command. The voice command or switch command is supplied via a Bluetooth-enabled cellular device, and the command is transmitted and translated to string by the smart phone app or switch Control for Arduino and is transferred to the Bluetooth Module linked to the Arduino board for Wheelchair control. For example, when the user commands, the chair will move forward, and when he commands, the chair will travel backward, and similarly, "Left," "Right," and "Stop" to rotate it in the left and right directions, respectively, and "Stop" to make it stop. This method was conceived and built to save the patient's money, time, and energy. Even though there is no manufacturing at this level, the project is deemed a success. The above-mentioned problems will be handled, the implementation phase will be completed in order to complete

the job economically, and this project will be a success because the components utilized are not expensive.

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