



# Assistive Wheelchair for Physically Impaired Using Bluetooth Technology

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**Abstract:** Every Wheelchair is manually operated to move in and around. However, a Smart Wheelchair brings independence and effortlessness to a person. A Smart Wheel Chair is a mechanically controlled device designed to have self-mobility with the help of the user command using his/her mobile effortlessly. This reduces the user's effort to drive the wheels of the wheelchair. Furthermore, this provides an opportunity for visually or physically impaired persons to move from one place to another. Even though a persons' body is fully or partially paralyzed only his head/hand movement will help the wheel chair to move front, back, left, right. There is wireless communication between the human and the wheelchair. The operation of the experimental model of our device is based on pairing the Bluetooth of the mobile to the Bluetooth module(HC-05) placed in the wheelchair. The Arduino bluetooth control app acts as an intermediate to find movement of the human and the Arduino uno helps in assisting the Bluetooth and wheels movement according to the code. The L293D motor drivers in between the Arduino and wheels helps in converting the voltage that is required for wheels movement. The Bluetooth module along with change in direction of Mobile, accordingly the signal is given to the microcontroller. Depending on the direction of the Acceleration, the microcontroller controls the wheel chair directions like LEFT, RIGHT, FRONT, BACK and STOP with the aid of DC motors.

## I. INTRODUCTION

This paper is contrived as an idea to ease the lives of those among us who are unfortunate enough to have lost the ability to move their legs due to a significant amount of paralysis, accident or due to old age. Many differently abled people usually depend on others in their daily life especially in moving from one place to another. For the wheelchair users, they continuously need someone to help them in getting the wheelchair moving. Their lives are made difficult by the fact that there is a lack of an intuitive control system for their wheelchairs that allows moving independently. Using an electrical wheelchair leads to a large amount of independence for persons with a physical disability who can neither walk nor operate a mechanical wheelchair alone as it requires great effort and help from other people.

The problem is that in some cases the disability causes someone to have a person besides him/her, therefore in this case, the way of controlling a power wheelchair can be done using a Bluetooth controlled app just by moving the mobile in different directions leading to an interesting and promising outcome. But, still the availability of the smart wheelchair solutions is often limited due to the high costs and not-so-friendly operation. By the proposed approach, described in this paper, the low-cost, simple and friendly solution for the Bluetooth controlled platform will be presented that is user friendly, fully-customizable according to the movement of the mobile by the user and will help in enhancement of user's independent mobility. Using a Smartphone as the "brain" of a robot is already an active research field with several open opportunities and promising possibilities. Another research is based on Voice-controlled Wheelchair design based on mobile platforms, by means of Bluetooth technology, design and implementation of wireless remote control solutions. But our recent research and very successful technology, Bluetooth, has changed how people usedigital devices at home or office, and has transferred traditional wired digital devices into wireless devices. In this work, Smart Wheelchair control using Arduino Uno microcontroller and Bluetooth Module via android application is presented. For this study secondary data has been collected. From the website of KSE the monthly stock prices for the sample firms are obtained from Jan 2010 to Dec 2014. And from the website of SBP the data for the macroeconomic variables are collected for the period of five years. The time series monthly data is collected on stock prices for sample firms and relative macroeconomic variables for the period of 5 years. The data collection period is ranging from January 2010 to Dec 2014. Monthly prices of KSE -100 Index is taken from yahoo finance.

## II LITERATURE SURVEY

The objective of this research project is to equip the present motorized wheelchair control system with a voice command system at low-price and friendly operation. By having these features, differently abled people especially with a severe disability who are unable to move like normal people will be able to move independently. Prototypes of several smart wheelchairs have been developed, based on advanced technology to help the differently abled. In 2012, Megalingam, Rajesh Kannan, et al, proposed a system that uses a small camera mounted very close to the user's hand, which tracks the small movements of their fingers to understand the direction of movement of the wheelchair. A gesture recognition system which identifies the gesture is then interfaced to the wheelchair control system in order to move it to the desired location [4]. In 2014, Andrej Škraba et al, presented a prototype speech controlled cloud based wheelchair platform. The control of the platform is implemented using low-cost available speech WebKit in the cloud. Besides the voice control, the GUI is implemented which works in the web browser as well as on the mobile devices providing live video stream [5]. In 2014, Sobia, M. Carmel et al, proposed a wheelchair command interface that does not require the other's hands. It includes 3 major modules. They are face detection, facial expression recognition and command generation. The software contains digital image processing for face detection, principal component analysis for facial expression recognition and generating command signals for interfacing the wheelchair [6]. In 2014, Klabi I. et al, presented control of the movement of wheelchairs in different directions by monitoring voice commands and also the simple movement of the patient's face. Automatic obstacle detection and avoidance had been done using ultrasonic and infrared sensors which helps the patient to apply a temporary brake in case any obstacle suddenly comes in the way of the wheelchair. Also wall tracking and target tracking algorithms had been developed in the wheelchair [7]. Each one of the works above has its drawbacks and weaknesses. In this project, a simple package with very cheap electronics that would not intricate the wheelchair and with high efficiency voice recognizer that could achieve sometimes to 100% of recognition rate, is used to build an effective voice-controlled smart wheelchair.

## III METHODOLOGY

The system has two parts, namely; hardware and software. The hardware architecture consists of an embedded system that is based on Arduino Uno board, a Bluetooth Module(HC-05), Motor Driver(L293D) and an Android phone(a bluetooth controlled app). The Bluetooth Module provides the communication media between the user through the android phone and the system by means of hand moment as a scope of MEMS(Micro electromechanical systems). The user interfaces with a software application installed in the android phone that is connected through Bluetooth with Bluetooth Module HC-05. The moment of mobile command is converted to an array of string and the string is passed to Arduino Uno connected to it. Once the Bluetooth Module receives the message, the command sent will be extracted and executed by the microcontroller attached to it and depending on the commands fed to the Motor Driver, the servo motors will function accordingly. The system will interpret the commands and control the Wheelchair accordingly via android application.

### III.I HC-05 BLUETOOTH MODULE

HC-05 is a Bluetooth device used for wireless communication with Bluetooth enabled devices (like smartphones). It communicates with microcontrollers using serial communication (USART). Default settings of HC-05 Bluetooth module can be changed using certain AT commands. As HC-05 Bluetooth module has 3.3 V level for RX/TX and microcontroller can detect 3.3 V level, so, there is no need to shift TX voltage level of HC-05 module. But we need to shift the transmit voltage level from the microcontroller to the RX of the HC-05 module.



Fig1. Bluetooth module

### III.II MOTOR DRIVER L293D

L293D is a dual H-Bridge motor driver, so with one IC we can interface two DC motors which can be controlled in both clockwise and counter clockwise direction and if you have motor with fix direction of motion you can make use of all the four I/Os to connect up to four DC motors. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover, for protection of circuits from back EMF output diodes are included within the IC.. The output supply (VCC2) has a wide range from 4.5V to 36V, which has made L293D a best choice for DC motor driver.



Fig2. MOTOR DRIVER L293D

### III.III DC SERVO MOTOR

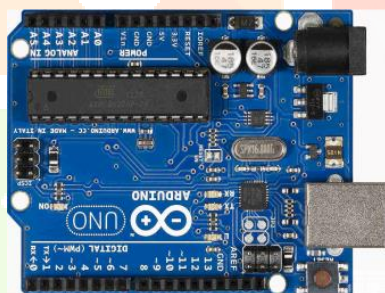
A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angle or distance, then a servo motor is used. It is a simple motor which runs through servo mechanism. Geared DC motors can be defined as an extension of a DC motor which already had its insight details demystified here. A geared DC Motor has a gear assembly attached to the motor. The speed of the motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure.



**Fig3. DC SERVO MOTOR**

### III. IV ARDUINO UNO

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. It's an open-source physical computing platform based on a microcontroller board, and a development environment for writing software for the board. In simple words, Arduino is a small microcontroller board with a USB plug to connect to your computer and a number of connection sockets that can be wired up to external electronics, such as motors, relays, light sensors, laser diodes, loudspeakers, microphones, etc., They can either be powered through the USB connection from the computer or from a 9V battery. They can be controlled from the computer or programmed by the computer and then disconnected and allowed to work independently. Anyone can buy this device through an online auction site or search engine. Since the Arduino is an open source hardware designs and create their own clones of the Arduino and sell them, so the market for the boards is competitive. An official Arduino costs about \$30, and a clone often less than \$20. The name "Arduino" is reserved by the original makers. However, clone Arduino designs often have the letters "duino" on the end of their name, for example, Fredonia or DFRduino. The software for programming your Arduino is easy to use and also freely available for Windows, Mac, and LINUX computers at no cost.

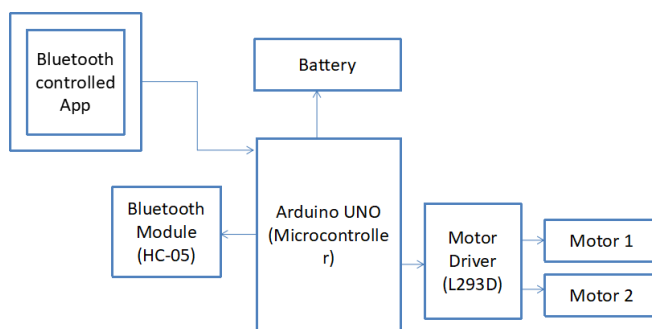


**Fig4. ARDUINO UNO**

### IV. WORKING MODEL

Micro electromechanical systems (MEMS) (also written as micro-electro-mechanical, Micro Electro Mechanical or microelectronic and micro electro mechanical systems) is the technology of very small mechanical devices driven by electricity and it merges at the nano scale into nano electromechanical systems (NEMS) and nanotechnology. MEMS are separate and distinct from the hypothetical vision of molecular nanotechnology or molecular electronics. MEMS are made up of components between 1 to 100 micrometers in size (i.e. 0.001 to 0.1 mm) and MEMS devices generally range in size from 20 micrometers (20 millionths of a meter) to a millimeter. They usually consist of a central unit that processes data, the microprocessor and several components that interact with the outside such as micro sensors. The main aim of this project is to control the wheel

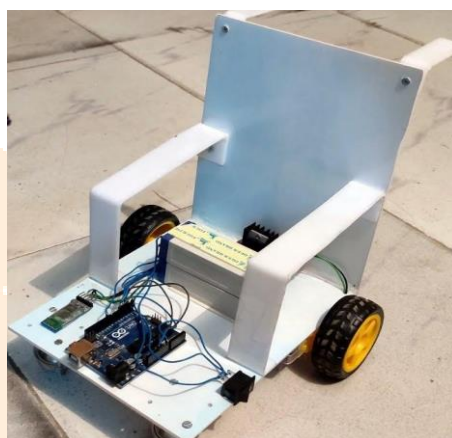
chair using MEMS. Whenever the hand moves in a particular direction, the mechanical movement of the hand will be recognized by MEMS. MEMS converts this mechanical hand movement into equivalent electrical signals (X, Y, Z coordinates) and sends it to the microcontroller. The communication between microcontroller and MEMS takes place based on the i2c protocol. In this protocol microcontroller acts as a master and MEMS acts as a Slave. The master receives the signals from slave and based on them it controls the wheel chair. The Wireless Wheelchair has two D.C servo motors. These motors move in 2D direction with the help of driver IC L293D according to its input signals. This project uses regulated 5V, 500mA power supply. 7805 three terminal voltage regulator is used for voltage regulation. Full wave bridge rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.



**Fig5. Block Diagram**

## V. RESULTS

This project elaborates the design and construction of Assistive Wheel Chair for physically impaired with the help of Bluetooth Module. The circuit works properly to move as the command given by the user. After designing the circuit that enables the physically disabled to control their wheel using an android application in their smartphones.



**Fig 6. Final prototype of the chair**

## VI CONCLUSION

This wheelchair system is a combination of mechanical, electrical and communications systems. The main agenda were to design an bluetooth android application that can direct the movement of a wheelchair by MEMS, to help the elderlies and physically disabled people to move their wheelchairs independently and to provide the elderlies and physically disabled people with the ability to control the movement of the wheelchairs by using android smartphones. The system has undergone a few tests and successfully completed the basic performance. The objectives were achieved as the software and hardware implementation worked well as expected. From the conducted research, it can be seen clearly that a mobile controlled wheelchair will have a bright future. It should be continued and developed in the future as it has a huge potential to improve its performance, reliability and safety.

## VII FUTURE SCOPE

For future work, it is suggested to use a more powerful and lighter weight motor to support various weights of users. Besides, this system needs a lot of enhancements to improve its accuracy and functionality. This can be further improved by decreasing the time delay in voice mode and an obstacle sensor can be attached to avoid the collision of wheelchairs.

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