DESIGN AND CONSTRUCTION OF SMART WHEEL CHAIR

A project submitted to the Department of Mechanical Engineering

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In partial fulfillment of the requirements for the award of the degree
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Declaration

We hereby, declare that the work presented in this project is the outcome of the investigation and research work performed by us under the supervision of Md. Mahedy Hasan, Lecturer, Department of Mechanical Engineering, Sonargaon University (SU). We also declare that no part of this project and thereof has been or is being submitted elsewhere for the award of any degree.

Certification of Approval

This is to certify that this project and thesis entitled "DESIGN AND CONSTRUCTION OF SMART WHEEL CHAIR " is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Mechanical Engineering under the Faculty of Engineering of Sonargaon University in partial fulfillment of the requirements for the degree of Bachelor of Science in Mechanical Engineering. The presentation of the work was held on 03 January 2020.

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Authors

ABSTRACT

Nowadays, more and more inventions and researches are carried out for giving aid to disabled persons using different strategies. In order to make them feel independent simple automatic techniques have to be developed for movement of wheelchair and so on. These kinds of wheelchairs are getting more attraction during these days as they are easy to handle and use. This project deals with hand-controlled and Apps controlled wheelchair where the movement of a wheelchair is controlled by hand and Apps have given to Arduino. Along with this obstacle detection is also carried out using the ultrasonic sensor. It was also able to run a challenging place like this wheelchair is able to run on a stair. According to research, there are about 6 million populations in the world who are paralyzed or disable and need a wheelchair for their mobility. Earlier the wheelchairs had to be moved and be externally supported by any person. To help overcome this "Smart Control and Automated Wheel Chair for Disable People" are developed. But in regular use, these joystick-controlled wheelchairs became difficult to use. Especially in the case of paralyzed people, the use of joystick became more difficult due to the hard buttons and unidirectional use of the joysticks. To overcome these problems, This can be used in both hands and can be controlled to come to the user from a distance. The current work is implemented with Arduino based devices such as Arduino UNO processors and programmed through Arduino IDE.

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CHAPTER 1
INTRODUCTION

1.1 Introduction

Nowadays, more and more inventions and researches are carried out for giving aid to disabled persons using different strategies. In order to make them feel independent simple automatic techniques have to be developed for movement of wheelchair and so on. These kinds of wheelchairs are getting more attraction during these days as they are easy to handle and use. This paper deals with hand-controlled and Apps controlled wheelchair where the movement of a wheelchair is controlled by hand and Apps have given to Arduino. Along with this obstacle detection is also carried out using the ultrasonic sensor. It was also able to run a challenging place like this wheelchair is able to run on a stair.

1.2 Objectives of the project

- To also able to run on the wheel chair.
- To control using by push button and android apps.
- To make of simple chair for physcal challenging person.
- To make the wheel chair of simple automatic technic where have to developed wheelchair.

1.3 Folding of wheelchair

In 1932, engineer, Harry Jennings, built the first folding, tubular steel wheelchair. That was the earliest wheelchair similar to what is in modern use today. That wheelchair was built for a paraplegic friend of Jennings called Herbert Everest. Together they founded Everest & Jennings, a company that monopolized the wheelchair market for many years. An antitrust suit was actually brought against Everest & Jennings by the

Department of Justice, who charged the company with rigging wheelchair prices. The case was finally settled out of court. [1]

Fig.1.2: Folding of wheelchair

1.4 First motorized wheelchair (Electric wheelchair)

The first wheelchairs were self-powered and worked by a patient turning the wheels of their chair manually. Of course, if a patient was unable to do this, another person would have to push the wheelchair and patient from behind. A motorized or power wheelchair is one where a small motor drives the wheels to revolve. Attempts to invent a motorized wheelchair were made as far back as 1916, however, no successful commercial production occurred at that time.

Fig.1.3: First motorized wheelchair (Electric wheelchair)

The first electric-powered wheelchair was invented by Canadian inventor, George Klein and his team of engineers while working for the National Research Council of Canada in a program to assist the injured veterans returning after World War II. George Klein also invented the microsurgical staple gun.

Everest & Jennings, the same company whose founders created the folding wheelchair were the first to manufacture the electric wheelchair on a mass scale beginning in 1956. [1-2]

1.5 Scope and Applications

A wheelchair is used by people who have difficulty in mobility. Generally, people who use are,

- Lower limb disabled people
- Patients at the hospitals
- Elderly people.

CHAPTER 2
LITERATURE REVIEW

2.1 Literature Review

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 abed. 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 that identifies the gesture is then interfaced with 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. 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 controlled the movement of a wheelchair 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 weakness. In this project, simple packages 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.The University of Notre Dame, the U.S. in 1994–2000 made a wheelchair where users can automatically reproduce routes taught to the system by manually driving a wheelchair from starting point to goal point. Uses machine vision to identify landmarks in the environment. No obstacle avoidance mode. [6]

Osaka University, Japan, 1998-2003 has produced an intelligent wheelchair system that has two cameras, one facing toward user, second facing forward. The user provides input to the system with head gestures, interpreted by an inward-facing camera. The outward-facing camera tracks targets and allows the user to control the wheelchair with gestures when out of a wheelchair. Shares navigation with the user (obstacle avoidance). [7]

MAid RIAKP, Germany 1998–2003 made a wheelchair that has two operating modes: Narrow-Area Navigation (NAN) and Wide-Area Navigation (WAN). In NAN, the system knows to start position and orientation and navigates to goal position and orientation. In WAN, the system moves to goal destination but also identifies (and avoids) moving objects in the environment. Later an addition was the ability to follow moving objects. [8]

University of Alcala, Spain, 1999–2003 was fabricated a wheelchair where they used a testbed for various input methods (voice, face/head gestures, EOG). It provides obstacle avoidance. Uses machine vision to interpret the user's gaze for control of the wheelchair and to identify landmarks. Uses both laser and IR to detect drop-offs. Uses modular architecture based on commercially available building automation hardware. Allows chair to interact wirelessly with hardware nodes in the environment. [9]

2.2 EXISTING SYSTEM

While going through the statistical records of health conditions and diseases, a number of people with physical disabilities are much more. They have to depend on others for moving from one place to another. The manually operated wheelchair was the earliest form of a wheelchair. It is operated manually and does not require any electrical system. They are of various types namely self-propelled, attendant propelled and wheelbase. Electrical wheelchair which are powered wheelchairs with functions like tilt, recline, leg elevation, seat elevation and so on where also be used. Push-button controlled wheelchairs where common but more force is exerted for controlling the same.

2.3 Background

Though the recent developments of science and technology have drastically changed the way a normal person lives his life, there are certain groups of people who have not been able to benefit from this development. On particular handicapped people with have limited mobility are still living a miserable life. Many people are suffering from temporary or permanent disabilities due to illnesses or accidents. For cases of difficult or impossible walking, the use of a wheelchair is becoming essential. A manual wheelchair is satisfying for most of the low and medium level disabilities cases where patients can use the wheelchair independently. Researchers involved in a wheelchair are aiming at designing smart wheelchairs to solve problems. It aims to evaluate the currently available technologies and to discuss new future directions for our ongoing research project.

A wheelchair is a chair with wheels, used when walking is difficult or impossible due to illness, injury, or disability. Wheelchairs come in a wide variety of formats to meet the specific needs of their users. They may include specialized seating adaptions, individualized controls, and may be specific to particular activities, as seen with sports wheelchairs and beach wheelchairs. The most widely recognized distinction is between powered wheelchairs ("power chairs"), where propulsion is provided by batteries and electric motors, and manually propelled wheelchairs, where the propulsive force is provided either by the wheelchair user/occupant pushing the wheelchair by hand ("self-propelled"), or by an attendant pushing from the rear ("attendant propelled").

2.4 Types of wheelchair

There are many types of wheelchairs available in the market like manual or powered wheelchair and the choice of wheelchair depends upon the physical and mental ability of the user. General types of wheelchair are given below

- Manual self-propelled wheelchair
- Manual attendant-propelled wheelchairs
- Powered wheelchairs

- Mobility scooters
- Single-arm drive wheelchairs
- Reclining wheelchairs
- Sports wheelchairs
- All-terrain wheelchairs

We are select the design and fabrication of a multi-purpose smart wheelchair for differently-abled persons.

2.5 Proposed structure of smart and Bluetooth control wheelchair

A smart wheelchair or electric-powered wheelchair is a wheelchair that is propelled by means of an electric motor rather than manual power. Smart wheelchairs are useful for those who are not able to impel a manual wheelchair or who may need to employ a wheelchair for distances or over terrain which would be strenuous in a manual wheelchair. They may also be used not just by people with conventional mobility impairments, but also by people with cardiovascular and fatigue based conditions.

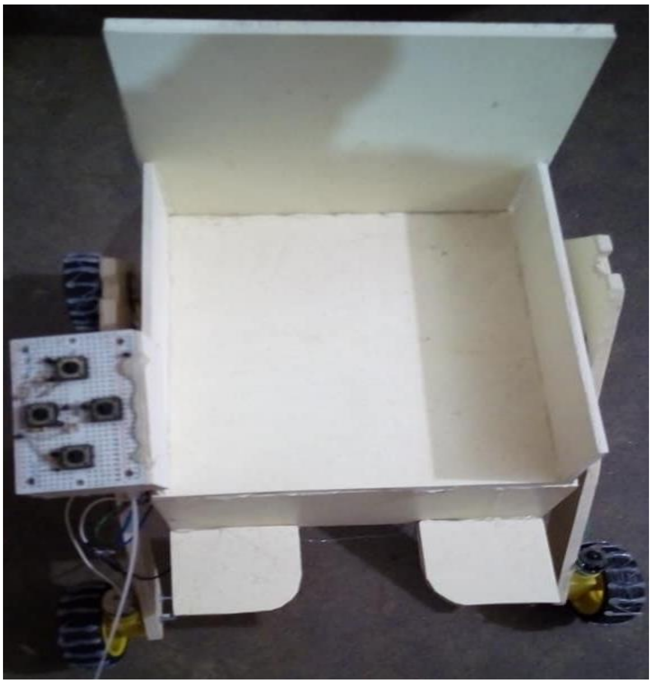

Fig.2.1: Proposed structure of smart wheelchair

Electric wheelchairs have enhanced the quality of life for many people with physical disabilities through the mobility they afford. The selection of power chair will rely on many factors; including the kind of surface setting the chair will be driven by the mechanical fabrication of chain coupling, electric motorized (DC gear motor) control and also programming control system. The most fundamental job of the chair is to take input from the user, usually in the form of a Bluetooth control of android apps, small joystick, and decipher that motion into power to the wheels to move the person in the preferred direction.

CHAPTER 3
THEORY & METHODOLOGY

3.1 Mechanical Design:

At present-day software is very essential for design and analysis. By the use of software (SOLIDWORK) researchers designed a different type of model, assemble the different sections of the proposed structure of a smart wheelchair. The design of principle parts of smart wheelchair is given below

- Wheel
- Structure of frame
- Controlling box
- DC motor
- The proposed structure of Smart wheelchair

3.2 Design of wheel

The design of the wheel with a different point of view is given below. Such as

- Wheel with an outer point of view
- Wheel with an inner point of view

Fig.3.1: Wheel view of outer side

Fig. 3.2: Wheel view of the inner side

3.3 Design of Stair

A flat surface, especially one in a series, on which to place one's foot when moving from one level to another. Each step is composed of tread and riser.

Fig.3.3: Design of stair.

3.4 Design of chain and motor

The design of the freewheel and driver component of the DC gear motor diameter.

Fig. 3.6: DC gear motor.

3.4.1 Design of proposed structure of smart wheelchair

The design solution of the wheelchair is developed in Solid Works. Based on wheelchair dynamics calculated parameters is established the necessary torque and speed of propulsion motors. The model of the wheelchair, designed in Solid Works is presented as shown in the figure with the side and front view.

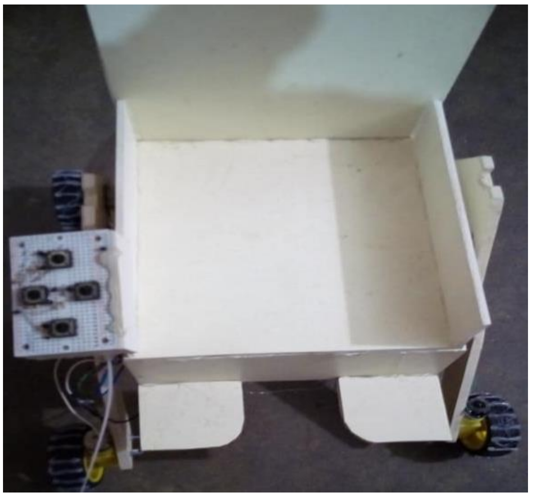

Fig. 3.7: Front view

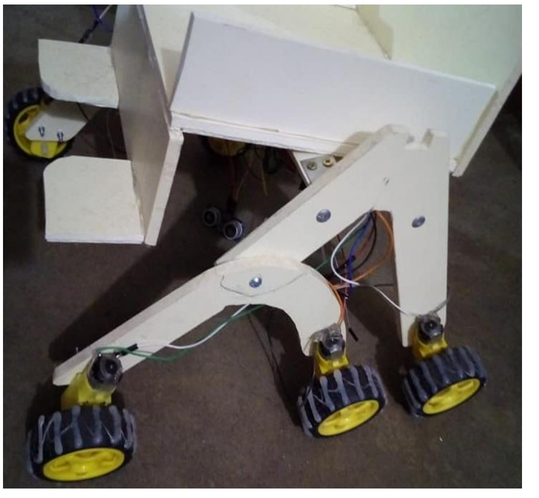

Fig. 3.8: Left front view

Fig. 3.9: Side view

Fig.3.10: Backside view

Such specifications

Height of the chair : 535mm

Breath of the chair : 215mm

Length of the chair : 255mm

3.5 Principle parts of the smart wheelchair

The smart wheelchair consists of following principle parts

3.5.1 On the basis of mechanical combination

- wheel
- PVC Board
- Screw
- Iron L Angle
- Nuts and bolts
- Stair
- Tie Cable
- Glue Gun & Glue Stick

3.5.2 On the basis of an electrical combination

- DC Gear motor
- Motor driver (BTS-7960)
- Jumper Wire
- Bread Board
- PCB Board
- Lipo battery
- Charger

3.5.3 On the basis of a micro-controlling combination

- Arduino (AT-mega 328)
- Push Button
- Bluetooth (HC-06)
- Sonar sensor (Max. range 4m)
- 10K Resistance

3.6 Description of principle parts

The overall principle parts description of the touch control wheel chair are given below.

3.6.1 Wheel

In its primitive form, a wheel is a circular block of a hard and durable material at whose center has been bored a circular hole through which is placed an axle bearing about which the wheel rotates when a moment is applied by gravity or torque to the wheel about its axis, thereby making together one of the six simple machines. When placed vertically under a load-bearing platform or case, the wheel turning on the horizontal axle makes it possible to transport heavy loads; when placed horizontally, the wheel turning on its vertical axle makes it possible to control the spinning motion used to shape materials (e.g. a potter's wheel); when mounted on a column connected to a rudder or a chassis mounted on other wheels, one can control the direction of a vessel or vehicle (e.g. a ship's wheel or steering wheel); when connected to a crank or engine, a wheel can store, release, or transmit energy The above rims are used to rear side of wheel chair [10].

Fig. 3.11: Wheel.

Such specifications

Wheel Outer Diameter	: 65mm
Wheel width	: 26mm
Internal material	: ABS plastic
External material	: Rubber

Single Weight : 36.33g

Color : Yellow and black

3.6.2 PVC Board

PVC foamboard is distinct from the extra-lightweight foamcore board, laminated of foam and card surfaces, used for indoor signage and modelling. Like PVC, closed-cell PVC foamboard is solid and has a very rigid structure. Where it differs is in its closed-cell foam structure, which makes it very light (as little as half the weight of solid PVC), highly resistant to moisture and some chemicals, and very easy to cut and shape. It also has thermoplastic properties, and begins to soften at around 65 °C (149 °F). Typically, closed-cell PVC foamboard can be cut as easily as wood, softened and shaped by immersing in boiling water or with a standard heat gun, and painted with standard automobile paints. In addition, Closed-cell PVC foamboard is made up of polarized molecules otherwise known as dipoles [11].

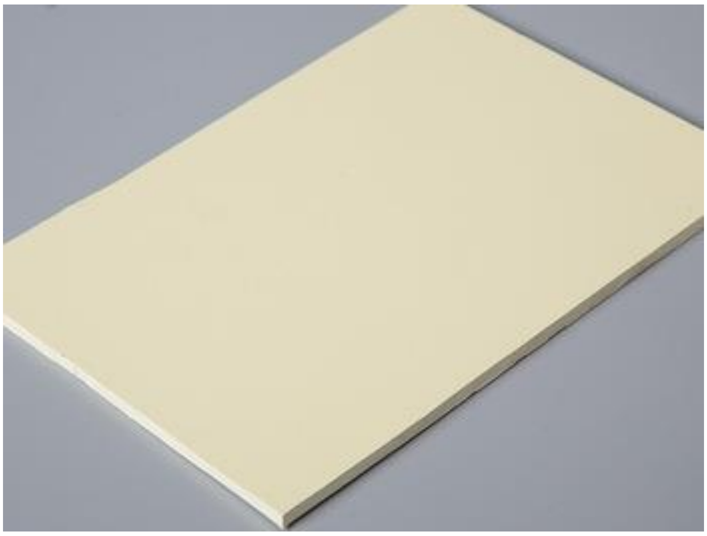

Fig.3.12: PVC Board.

Such specifications

Measurement System : Inch

Material : PVC foam

Color : White

3.6.3 Screw

A screw is a type of fastener, in some ways similar to a bolt (see Differentiation between bolt and screw below), typically made of metal, and characterized by a helical ridge, known as a male thread (external thread). Screws are used to fasten materials by digging in and wedging into a material when turned, while the thread cuts grooves in the fastened material that may help pull fastened materials together and prevent pull-out. There are many screws for a variety of materials; those commonly fastened by screws include wood, sheet metal, and plastic [12].

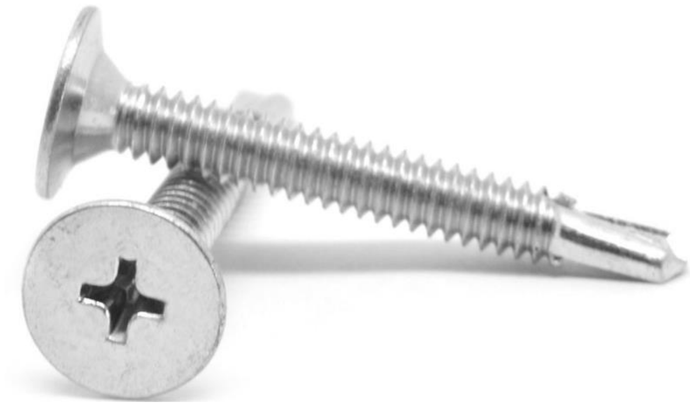

Fig.3.13: Screw.

Such specifications

Fastener Type	: Self Drilling Screw Phillips Wafer Head #3 Point
Size Description	: #10-24 x 3/4
Diameter/Nominal Size	: #10
Length	: ¾

3.6.4 Iron L Angle

Structural steel is a category of steel used for making construction materials in a variety of shapes. Many structural steel shapes take the form of an elongated beam having a profile of a specific cross-section. Structural steel shapes, sizes, chemical composition, mechanical properties such as strengths, storage practices, etc., are regulated by standards in most industrialized countries. Most structural steel shapes, such as Ibeams, have high second moments of area, which means they are very stiff in respect to their cross-sectional area and thus can support a high load without excessive sagging.

Fig.3.14: Iron L Angle

3.6.5 Nuts and bolts

A nut is a type of fastener with a threaded hole. Nuts are almost always used in conjunction with a mating bolt to fasten multiple parts together. The two partners are kept together by a combination of their threads' friction (with slight elastic deformation), a slight stretching of the bolt, and compression of the parts to be held together.

Such specification

Type	:	Metal
Color	:	Silver
Quantity	:	Twelve

Fig. 3.15: Nuts and bolts.

3.6.6 Stair

A stairway, staircase, stairwell, flight of stairs, or simply stairs, is a construction designed to bridge a large vertical distance by dividing it into smaller vertical distances, called steps. Stairs may be straight, round, or may consist of two or more straight pieces connected at angles. A stair, or a stairstep, is one step in a flight of stairs. In buildings, stairs is a term applied to a complete flight of steps between two floors. A stair flight is a run of stairs or steps between landings. A staircase or stairway is one or more flights of stairs leading from one floor to another, and includes landings, newel posts, handrails, balustrades and additional parts. A stairwell is a compartment extending vertically through a building in which stairs are placed. A stair hall is the stairs, landings, hallways, or other portions of the public hall through which it is necessary to pass when going from the entrance floor to the other floors of a building. Box stairs are stairs built between walls, usually with no support except the wall strings.

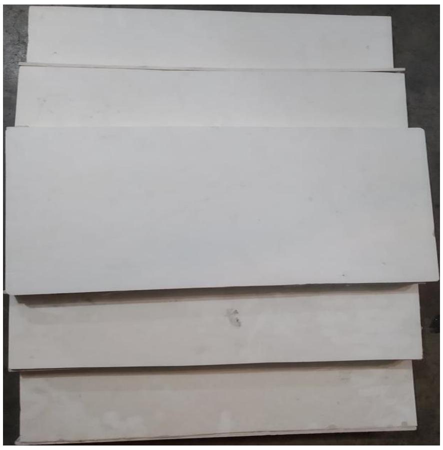

Fig. 3.16: Stair

Such specifications

Model : S16T

Teeth : 16T

Type : Rear

Quantity : Two

3.6.7 Tie Cable

A cable tie (also known as a hose tie, or zip tie, and by the brand names Ty-Rap) is a type of fastener, for holding items together, primarily electrical cables or wires. Because of their low cost and ease of use, cable ties are ubiquitous, finding use in a wide range of other applications. Stainless steel versions, either naked or coated with a rugged plastic, cater for exterior applications and hazardous environments. The common cable tie, normally made of nylon, has a flexible tape section with teeth that engage with a pawl in the head to form a ratchet so that as the free end of the tape section is pulled the cable tie tightens and does not come undone. Some ties include a tab that can be depressed to release the ratchet so that the tie can be loosened or removed, and possibly reused [13].

Fig. 3.17: Tie Cable.

Tire specifications

Type : Craft/Light Industrial

Stick Size : 1/2" (12mm) Hot Melt Sticks

3.6.8 DC Gear motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications [14].

Fig. 3.18: DC Gear motor.

Motor specifications

- Gear Ratio 1 :48
- No-load speed(5V) : about 208RPM
- Rated Torque : 0.8 Kg.cm @ 5V
- No-load current(6V) :≦350mA
- Size : 71mm x 27.4mm x 22.4mm
- Weight :28g
- Quantity : 6 (six)

3.6.9 Motor driver

The L298N is an integrated monolithic circuit in a 15- lead Multiwatt and PowerSO20 packages. It is a high voltage, high current dual full-bridge driver designed to accept standard TTL logic level sand drive inductive loads such as relays, solenoids, DC and stepping motors. Two enable inputs are provided to enable or disable the device independently of the input signals. The emitters of the lower transistors of each bridge are connected together and the corresponding external terminal can be used for the connection of an external sensing resistor. An additional supply input is provided so that the logic works at a lower voltage [15].

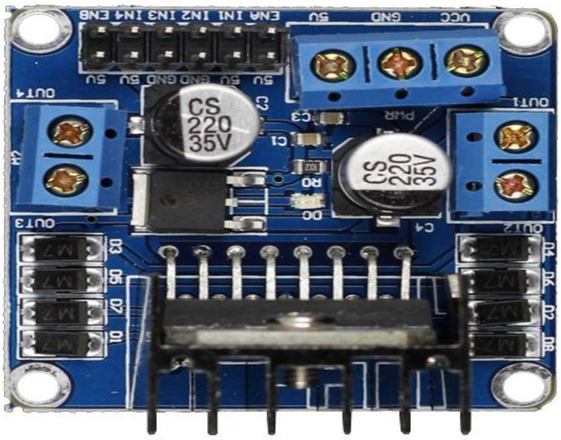

Fig. 3.19: Motor driver

Driver specifications

Specifications	: Double H bridge Drive
Chip	: L298N.
Logical voltage	: 5V Drive
Voltage	: 5V-35V.
Logical current	: 0-36mA Drive
Current	: 2A (MAX single bridge)

3.6.10-a Applications of the motor driver

- Current diagnostic
- Slope adjustment
- Dead Time generation

3.6.11 Jump Wire

A jump wire (also known as jumper wire, or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Fig. 3.20: Jumper wire.

3.6.12 Bread Board

A breadboard is a construction base for prototyping of electronics. Originally the word referred to a literal breadboard, a polished piece of wood used for slicing bread. In the 1970s the solderless breadboard (a.k.a. plugboard, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. Because the solderless breadboard does not require soldering, it is reusable.

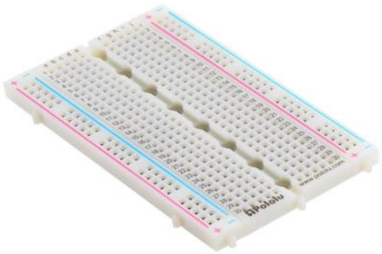

Fig. 3.21: Bread Board.

3.6.13 PCB Board

A printed circuit board (PCB) mechanically supports and electrically connects electrical or electronic components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate. Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it. Printed circuit boards are used in all but the simplest electronic products. They are also used in some electrical products, such as passive switch boxes. Alternatives to PCBs include wire wrap and point-to-point construction, both once popular but now rarely used. PCBs require additional design effort to lay out the circuit, but manufacturing and assembly can be automated. The specialized CAD software is available to do much of the work of layout. Mass-producing circuits with PCBs is cheaper and faster than with other wiring methods, as components are mounted and wired in one operation. Large numbers of PCBs can be fabricated at the same time, and the layout only has to be done once. PCBs can also be made manually in small quantities, with reduced benefits [16].

Specifications

Board Thickness	:031" / .062" / .093" / .125"
Copper Weight	:1 oz. Inner / Up to 2 oz. Outer
Trace/Space	:5 / 5 Mils
Solder Mask (LPI)	:Green

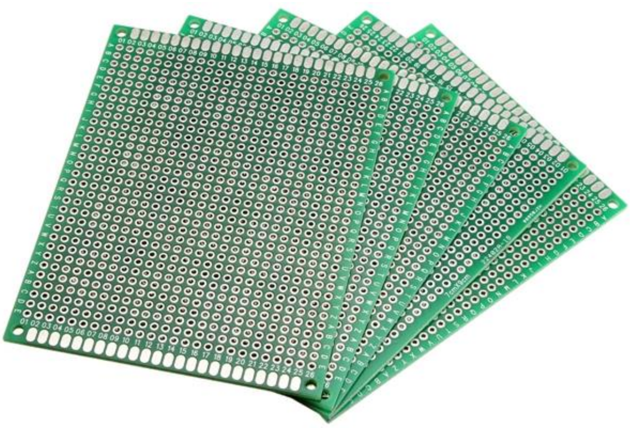

Fig. 3.22: PCB Board.

3.6.14 Lithium Polymer Battery

A lithium polymer battery, or more correctly lithium-ion polymer battery (abbreviated as LiPo, LIP, Li-poly, lithium-poly and others), is a rechargeable battery of lithium-ion technology using a polymer electrolyte instead of a liquid electrolyte. High conductivity semisolid (gel) polymers form this electrolyte. These batteries provide higher specific energy than other lithium battery types and are used in applications where weight is a critical feature, like mobile devices and radio-controlled aircraft.Just as with other lithium-ion cells, LiPos work on the principle of intercalation and de-intercalation of lithium ions from a positive electrode material and a negative electrode material, with the liquid electrolyte providing a conductive medium. To prevent the electrodes from touching each other directly, a microporous separator is in between which allows only the ions and not the electrode particles to migrate from one side to the other [17].

Battery specifications

Type	:	Rechargeable sealed lead acid battery
Capacity	:	1800mah
Discharge rate	:	Low rate
Electrolyte	:	Acid
Voltage	:	14.8 V
Weight	:	200g
Quantity	:	01(One)

Fig. 3.23: Li-Po Battery.

3.6.14-a Advantages of the dry cell battery

- Inexpensive and simple to manufacture.
- Mature, reliable and well-understood technology - when used correctly, lead-acid is durable and provides dependable service.
- The self-discharge is among the lowest of rechargeable battery systems.
- Capable of high discharge rates.

3.6.15 Li-Po Battery Charger

A battery charger, or recharger, is a device used to put energy into a secondary cell or rechargeable battery by forcing an electric current through it. The charging protocol (how much voltage or current for how long, and what to do when charging is complete, for instance) depends on the size and type of the battery being charged. Some battery types have a high tolerance for overcharging (i.e., continued charging after the battery has been fully charged) and can be recharged by connection to a constant voltage source or a constant current source, depending on battery type. Simple chargers of this type must be manually disconnected at the end of the charge cycle, and some battery types absolutely require, or may use a timer, to cut off charging current at some fixed time, approximately when charging is complete. Other battery types cannot withstand over-charging, being damaged (reduced capacity, reduced lifetime), overheating or even exploding. The charger may have temperature or voltage sensing circuits and a microprocessor controller to safely adjust the charging current and voltage, determine the state of charge, and cut off at the end of charge.

Fig. 3.24: Li-Po Battery Charger.

3.6.16 Arduino

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits. This board comes with all the features required to run the controller and can be directly connected to the computer through USB cable that is used to transfer the code to the controller using IDE (Integrated Development Environment) software, mainly developed to program Arduino. IDE is equally compatible with Windows, MAC or Linux Systems, however, Windows is preferable to use. Programming languages like C and C++ are used in IDE.

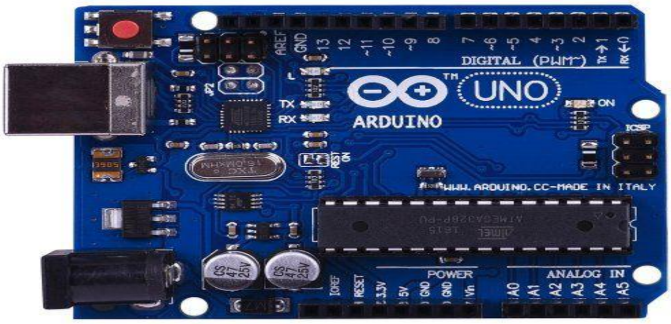

Fig. 3.25: Arduino

There are many versions of Uno boards available, however, Arduino Nano V3 and Arduino Uno are the most official versions that come with Atmega328 8-bit AVR Atmel microcontroller where RAM memory is 32KB [18].

3.6.16-a Principle parts of arduino

The micro controlling device of arduino consists of following principle parts. Such as

- DC power jack
- USB Port
- Voltage regulator
- Reset bottom
- Crystal oscillator
- Power source

- Analog pins
- Digital pins
- Programming header
- AT mega 328

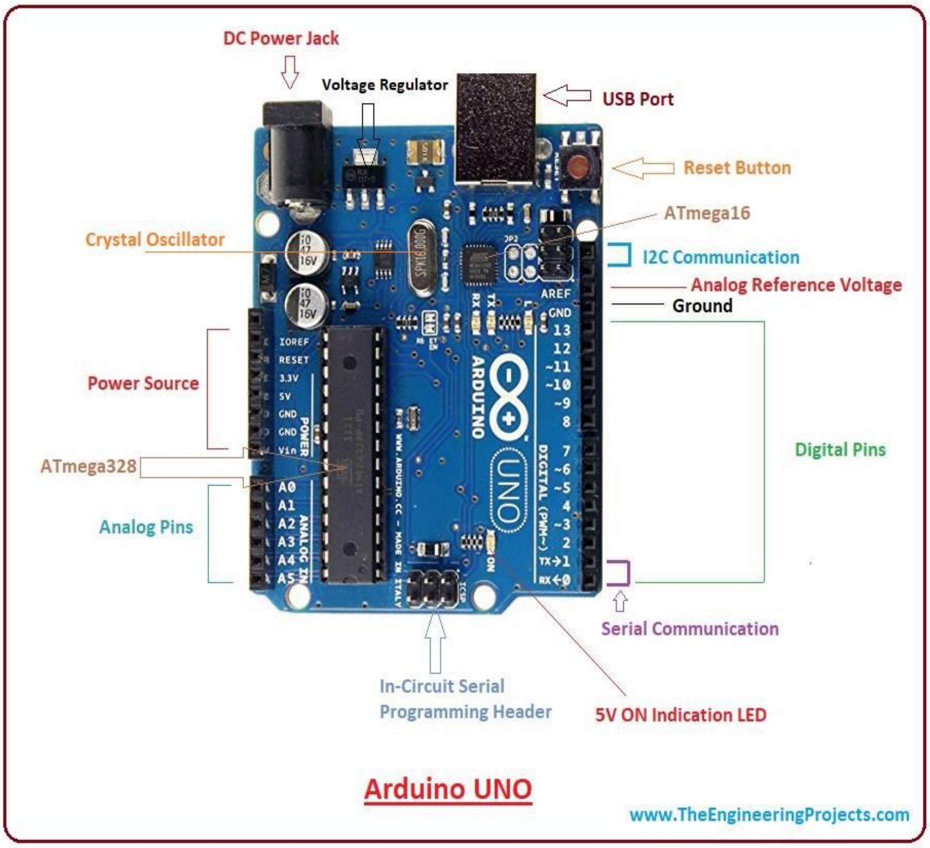

Fig. 3.26: Principle parts

3.6.16-b Features of Arduino Uno board

- Arduino Uno comes with USB interface i.e. USB port is added on the board to develop serial communication with the computer.
- AT mega 328 microcontroller is placed on the board that comes with a number of features like timers ,counters, interrupts , PWM,CPU,I/O pins and based on a16MHz clock that helps in producing more frequency and number of instructions per cycle . It is an open-source platform where anyone can modify and optimize the board based on the number of instructions and tasks they want to achieve.
- This board comes with a built-in regulation feature which keeps the voltage under control when the device is connected to the external device.

- Reset pin is added in the board that reset the whole board and takes the running program in the initial stage. This pin is useful when the board hangs up in the middle of the running program; pushing this pin will clear everything up in the program and starts the program right from the beginning.
-

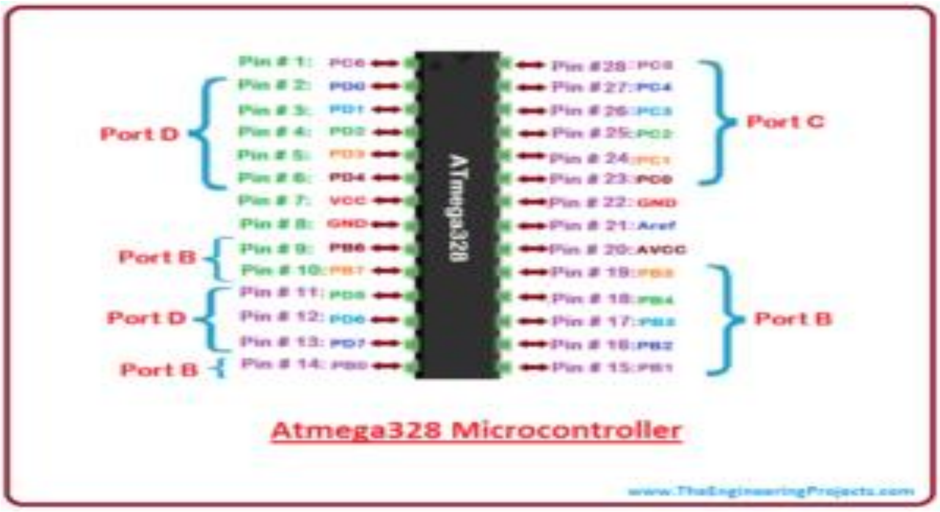

Fig. 3.27: AT Mega 328 microcontroller

3.6.16-c Arduino Uno pinout

Arduino Uno is based on an AVR microcontroller called Atmega328. This controller comes with 2KB SRAM, 32KB of flash memory, and 1KB of EEPROM. Arduino Board comes with 14 digital pins and 6 analog pins. ON-chip ADC is used to sample these pins. A 16 MHz frequency crystal oscillator is equipped on the board. The following figure shows the pinout of the Arduino Uno Board.

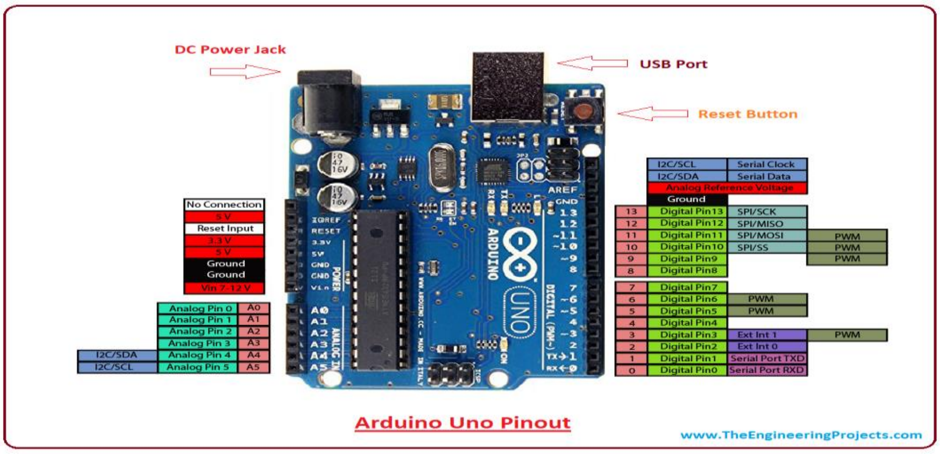

Fig. 3.28: Arduino Uno pin out

3.6.16-d Pin descriptions of arduino

There are several I/O digital and analog pins placed on the board which operates at 5V. These pins come with standard operating ratings ranging between 20mA to 40mA. Internal pull-up resistors are used in the board that limits the current exceeding from the given operating conditions. However, too much increase in current makes these resisters useless and damages the device.

- LED. Arduino Uno comes with built-in LED which is connected through pin 13. Providing HIGH value to the pin will turn it ON and LOW will turn it OFF.
- Vin. It is the input voltage provided to the Arduino Board. It is different than 5 V supplied through a USB port. This pin is used to supply voltage. If a voltage is provided through a power jack, it can be accessed through this pin.
- 5V. This board comes with the ability to provide voltage regulation. 5V pin is used to provide output regulated voltage. The board is powered up using three ways i.e. USB, Vin pin of the board or DC power jack.
- USB supports voltage around 5V while Vin and Power Jack support a voltage ranges between 7V to 20V. It is recommended to operate the board on 5V. It is important to note that, if a voltage is supplied through 5V or 3.3V pins, they result in bypassing the voltage regulator that can damage the board if the voltage surpasses from its limit.
- GND. These are ground pins. More than one ground pins are provided on the board which can be used as per requirement.
- Reset. This pin is incorporated on the board which resets the program running on the board. Instead of physical reset on the board, IDE comes with a feature of resetting the board through programming.
- IOREF. This pin is very useful for providing voltage reference to the board. A shield is used to read the voltage across this pin which then select the proper power source.
- PWM. PWM is provided by 3, 5,6,9,10, 11pins. These pins are configured to provide 8-bit output PWM.
- SPI. It is known as Serial Peripheral Interface. Four pins 10(SS), 11(MOSI), 12(MISO), 13(SCK) provide SPI communication with the help of SPI library.

- AREF. It is called Analog Reference. This pin is used for providing a reference voltage to the analog inputs.
- TWI. It is called Two-wire Interface. TWI communication is accessed through Wire Library. A4 and A5 pins are used for this purpose.
- Serial Communication. Serial communication is carried out through two pins called Pin 0 (Rx) and Pin 1 (Tx).
- Rx pin is used to receive data while T3.x pin is used to transmit data.
- External Interrupts. Pin 2 and 3 are used for providing external interrupts. An interrupt is called by providing LOW or changing value.

3.6.16-e Applications of arduino

- Embedded system
- Security and defense system
- Digital electronics and robotics
- Parking lot counter
- Weighing machines
- Traffic light count down timer
- Medical Instrument
- Emergency light for railways

3.6.17 Push-Button

A push-button (also spelled pushbutton) or simply button is a simple switch mechanism to control some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal. The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, although many un-biased buttons (due to their physical nature) still require a spring to return to their un-pushed state. Terms for the "pushing" of a button include pressing, depressing, mashing, slapping, hitting, and punching.The "push-button" has been utilized in calculators, push-button telephones, kitchen appliances, and various other mechanical and electronic devices, home and commercial.In industrial and commercial applications, push buttons can be connected together by a mechanical linkage so that the act of pushing one button causes the other button to be released. In this way, a stop button can "force" a start button to be released. This method of linkage is used in simple manual operations in which the machine or process has no electrical circuits for control.

Fig 3.29: Push-Button.

Push-Button specifications

Mode of Operation : Tactile feedback

Power Rating : MAX 50mA 24V DC

Insulation Resistance : 100Mohm at 100v

Operating Force : 2.55±0.69 N

Contact Resistance : MAX 100mOhm

Operating Temperature Range: -20 to +70 ℃

Storage Temperature Range : -20 to +70 ℃

3.6.18 Bluetooth

Bluetooth is a wireless technology standard for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific and medical radio bands, from 2.400 to 2.485 GHz, and building personal area networks [19].

It is a controlling device of a smart wheelchair according to the direction of android mobile or apps.

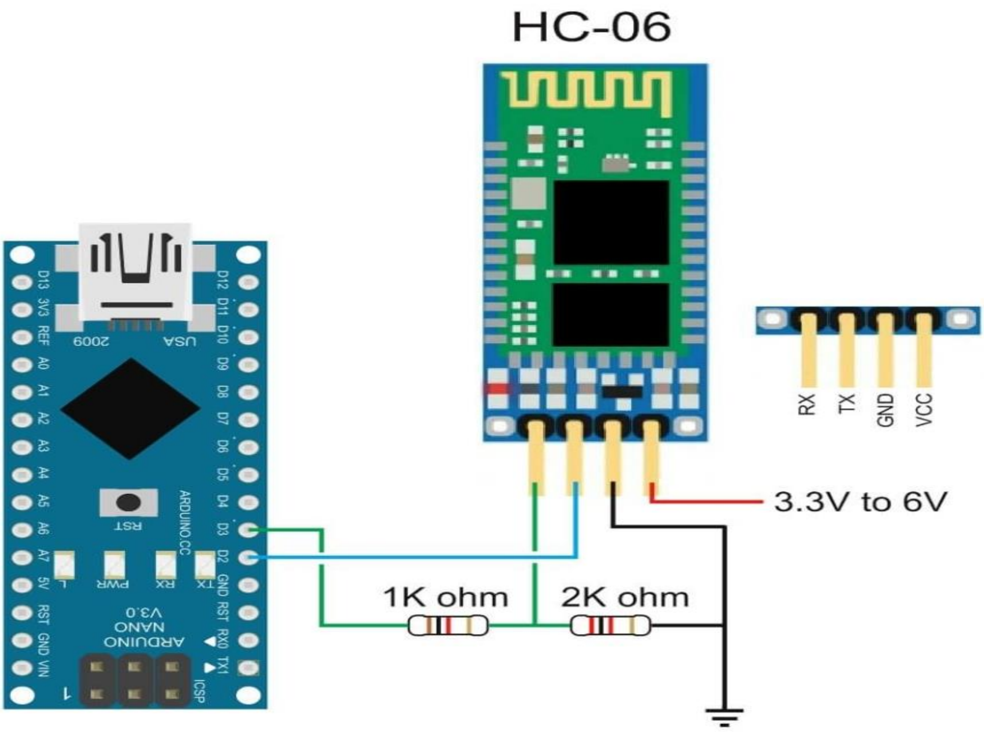

Fig. 3.30: Bluetooth

Such specification

Model	:Bluetooth HC-06
Bluetooth protocol	: Bluetooth 2.0+ EDR standard
USB protocol	: USB v1.1/2.0
Operating frequency	: 2.4GHz ISM frequency band
Modulation mode	: Gauss Frequency Shift Keying
Transmit power	: ≤ 4dBm, the second stage
Sensitivity	: ≤-84dBm at 0.1% Bit Error Rate
Transmission speed	:2.1Mbps(Max)/160kbps(Asynchronous) 1Mbps/1Mbps(Synchronous)
Safety feature	: Authentication and encryption
Supported configuration	: Bluetooth serial port (major and minor)
Supply Voltage	: +3.3 VDC 50mA
Operating temperature	: -20 to 55℃
Size	: 36.5*16mm

3.6.19 Ultrasonic

The HC-SR04 ultrasonic distance sensor uses sonar to determine the distance to an object with stable readings and a high accuracy of 3mm. The module includes an ultrasonic transmitter, receiver and control circuit. In order to generate the ultrasound, you have to set the trig on the high state for 10 microseconds. The trig pin will send out the sonic burst which travels at the speed of sound. The soundwave will be bounced back once it interacts with a solid or liquid and will then be received in the echo pin. The distance between the sensor and the object will be calculated using the time of travel. More explanations of work principles are outlined here if interested. One of the outstanding features of this distance sensor is that it can detect not only the distance between itself to a solid object, it can also detect liquids (used in the Cheers group).

Such specification

Working Voltage	: DC 5 V
Working Current	: 15mA
Working Frequency	: 40Hz
Max Range	: 4m
Min Range	: 2cm
Measuring Angle	: 15 degree
Trigger Input Signal	: 10uS TTL pulse
Dimension	: 45*20*15mm

Fig. 3.31: Ultrasonic.

3.6.20 Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat, may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage.

Fig. 3.32: Resistor.

CHAPTER 4
SOFTWARE ANALYSIS

4.1 Software Description

The software controls the operation of the system and hence it is imperative that the software is developed in a flawless manner so as to attain the desired result. In our project, all but one desired coding is stored in the microcontroller. It is the software that controls the overall functioning of the system. The stored program ina microcontroller controls all the basic functionalities of the function and the operation of the devices used in the system. The inputs are taken from sensors and the output of the program decides the action to be taken by the system. Software, being acrucial part of our project, is going to be discussed in detail in this section.

Coding

4.1.1 Final Wheel Chair Code Complete

```
String voice;
const int trigPin = 9;
const int echoPin = 10;
int j = 100,
stp = 300,
c = 1,

MotorPin1 = 2, //Connect LED 1 To Pin #2

MotorPin2 = 3, //Connect LED 2 To Pin #3

MotorPin3 = 4, //Connect LED 3 To Pin #10

MotorPin4 = 5; //Connect LED 4 To Pin #11

int en1= 6;
int en2 =7;


//-------------------------Call A Function------------------------------//



int i = 0;
```

```
int pos;
int button1 =A0; // up
int button2 =A1; // down
int button3 =A2;//left
int button4 =A3; //right

//----------------------------------------------------------------------//

void setup() {

  Serial.begin(9600);

  pinMode(MotorPin1, OUTPUT);

  pinMode(MotorPin2, OUTPUT);

  pinMode(MotorPin3, OUTPUT);

  pinMode(MotorPin4, OUTPUT);
  pinMode(en1, OUTPUT);
pinMode(en2, OUTPUT);
analogWrite(en1,200);
analogWrite(en2,200);


  pinMode (button1,INPUT);
   pinMode (button2,INPUT);
    pinMode (button3,INPUT);
     pinMode (button4,INPUT);




}

//----------------------------------------------------------------------//


  void loop(){

  while (Serial.available()){  //Check if there is an available byte to read

  delay(10); //Delay added to make thing stable

  char c = Serial.read(); //Conduct a serial read

  if (c == '#') {break;}

  //Exit the loop when the # is detected after the word
```

```
  voice += c; //Shorthand for voice = voice + c

  }
  if (voice.length() > 0) {
    Serial.println(voice);

  if(voice == "A"){
   while(voice == "A") {
  pinMode(trigPin, OUTPUT);
  digitalWrite(trigPin, LOW);
  delayMicroseconds(2);
  digitalWrite(trigPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(trigPin, LOW);

pinMode(echoPin, INPUT);
long  duration = pulseIn(echoPin, HIGH);
// convert the time into a distance
long inches = microsecondsToInches(duration);
long cm = microsecondsToCentimeters(duration);

  Serial.print(inches);
  Serial.print("in, ");
  Serial.print(cm);
  Serial.print("cm");
  Serial.println();

  if(cm < 30){

    digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,LOW );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,LOW );
            delay(2000);


    digitalWrite(MotorPin1,HIGH );
    digitalWrite(MotorPin2,LOW );
    digitalWrite(MotorPin3,HIGH );
    digitalWrite(MotorPin4,LOW );


{

    if (Serial.available()){      // bail out on sensor detect
      break;
    }
    delay(10);
}
```

```
  }
    if(cm >= 15 ){
    digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,HIGH );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,HIGH );

    {

    if (Serial.available()){      // bail out on sensor detect

       break;
    }
    delay(10);
}
  }
   delay(100);
   //break;
 }
  }
 if(voice == "dd")//down

    {
   digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,HIGH );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,HIGH);
delay(3000);
    }

   else if(voice == "LEFT" ){

    digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,HIGH );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,LOW );
              delay(500);
    digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,LOW );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,LOW );
    analogWrite(en1,250);
analogWrite(en2,250);


   }

   else if(voice == "RIGHT")
```

```
  {

   digitalWrite(MotorPin1,LOW );
   digitalWrite(MotorPin2,LOW );
   digitalWrite(MotorPin3,LOW );
   digitalWrite(MotorPin4,HIGH );
   delay(500);
   digitalWrite(MotorPin1,LOW );
   digitalWrite(MotorPin2,LOW );
   digitalWrite(MotorPin3,LOW );
   digitalWrite(MotorPin4,LOW );
   analogWrite(en1,250);
analogWrite(en2,250);



  }

  else if(voice == "uu")//up

  {

   digitalWrite(MotorPin1,HIGH );
   digitalWrite(MotorPin2,LOW );
   digitalWrite(MotorPin3,HIGH );
   digitalWrite(MotorPin4,LOW );
   delay(3000);

  }
  else if(voice == "STOP")

  {

   digitalWrite(MotorPin1,LOW );
   digitalWrite(MotorPin2,LOW );
   digitalWrite(MotorPin3,LOW );
   digitalWrite(MotorPin4,LOW );

  }

    else if(voice == "BL")

  {

   digitalWrite(MotorPin1,LOW );
   digitalWrite(MotorPin2,LOW );
   digitalWrite(MotorPin3,HIGH );
   digitalWrite(MotorPin4,LOW );
          delay(350);
   digitalWrite(MotorPin1,LOW );
```

```
    digitalWrite(MotorPin2,LOW );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,LOW );

}
   else if(voice == "BR")

   {

    digitalWrite(MotorPin1,HIGH );
    digitalWrite(MotorPin2,LOW );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,LOW );
              delay(350);
    digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,LOW );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,LOW );


   }




voice="";//Reset the variable after initiating
  }
if(digitalRead(A0)==HIGH)//UP
{
  digitalWrite(MotorPin1,HIGH );
    digitalWrite(MotorPin2,LOW );
    digitalWrite(MotorPin3,HIGH );
    digitalWrite(MotorPin4,LOW );
Serial.print(A0);



}
else if(digitalRead(A1)==HIGH)//BACK
{
  digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,HIGH );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,HIGH);
    Serial.print(A1);
}


else if(digitalRead(A2)==HIGH)//left
```

```
{
  digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,HIGH );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,LOW);
    Serial.print(A2);
}
else if(digitalRead(A3)==HIGH)//right
{
  digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,LOW );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,HIGH);
    Serial.print(A3);
}

else
{
  digitalWrite(MotorPin1,LOW );
    digitalWrite(MotorPin2,LOW );
    digitalWrite(MotorPin3,LOW );
    digitalWrite(MotorPin4,LOW);
    }


}

long microsecondsToInches(long microseconds)
{
  // According to Parallax's datasheet for the PING))), there are
  // 73.746 microseconds per inch (i.e. sound travels at 1130 feet per
  // second).  This gives the distance travelled by the ping, outbound
  // and return, so we divide by 2 to get the distance of the obstacle.
  // See: http://www.parallax.com/dl/docs/prod/acc/28015-PING-v1.3.pdf
  return microseconds / 74 / 2;
}

long microsecondsToCentimeters(long microseconds)
{
  // The speed of sound is 340 m/s or 29 microseconds per centimeter.
  // The ping travels out and back, so to find the distance of the
  // object we take half of the distance travelled.
  return microseconds / 29 / 2;
}
```

4.2 Software Development Process

It is important to go through a series of predictable steps to build a product or a system. The software process helps to get a series of steps. The software process is an automated process that simplifies project management and, what is most important, enhances the visibility of the project. It provides stability, control of the project. Software process requires a systematic and consistent approach to the project.

4.3 Choosing C language

C is a powerful, flexible language that provides fast program execution and imposes few constraints on the programmer. It allows low-level access to information and commands while still retaining the portability and syntax of a high-level language. C (/siː/, as in the letter c) is a general-purpose, procedural computer programming language supporting structured programming, lexical variable scope, and recursion, while a static type system prevents unintended operations. By design, C provides constructs that map efficiently to typical machine instructions and has found lasting use in applications previously coded in assembly language. Such applications include operating systems and various application software for computers, from supercomputers to embedded systems.C was originally developed at Bell Labs by Dennis Ritchie between 1972 and 1973 to make utilities running on Unix. Later, it was applied to re-implementing the kernel of the Unix operating system. During the 1980s, C gradually gained popularity. It has become one of the most widely used programming languages, with C compilers from various vendors available for the majority of existing computer architectures and operating systems. C has been standardized by the ANSI since 1989 (see ANSI C) and by the International Organization for Standardization.

4.4 APPLICATION INSTRUCTION

The different directions of motions possible are: forward, backward, left, right and stop. In achieving the task the controller is loaded with the program using the Arduino programming language and Arduino development environment.

- First make sure the Bluetooth module is paired with the android mobile. The default password for pairing is “1234” or “0000”.
- When the press “Start”, Button application sends the data in the form of string “*GO#” to the Bluetooth module connected to the circuit. When

microcontroller detects “GO”, the motor attached to the wheelchair moves FORWARD.

- When the press “BACK” button application sends the data in the form of string “*BACK#” to Bluetooth module connected to the circuit. When microcontroller detects “BACK”, the motor attached to the wheelchair moves REVERSE.
- When the press “LEFT” button application sends the data in the form of a string in form of string “*LEFT#” to Bluetooth module connected to the circuit. When microcontroller detects “LEFT” the moves the motor attached to the wheelchair LEFT side.
- When the press “RIGHT” button application sends the data in form of string “*RIGHT#” to Bluetooth module connected to the circuit. When microcontroller detects “RIGHT” the moves the motor attached to the wheelchair RIGHT side.
- When press“STOP” button which is in the Centre of remote the application sends the data in the form of string “*STOP#” to the Bluetooth module connected to the circuit. When microcontroller detects “STOP” the wheelchair gets stopped.
- Click on “DISCONNECT” icon to disconnect the paired Bluetooth module.

4.5 Block diagram of micro controlling devices with basement setup

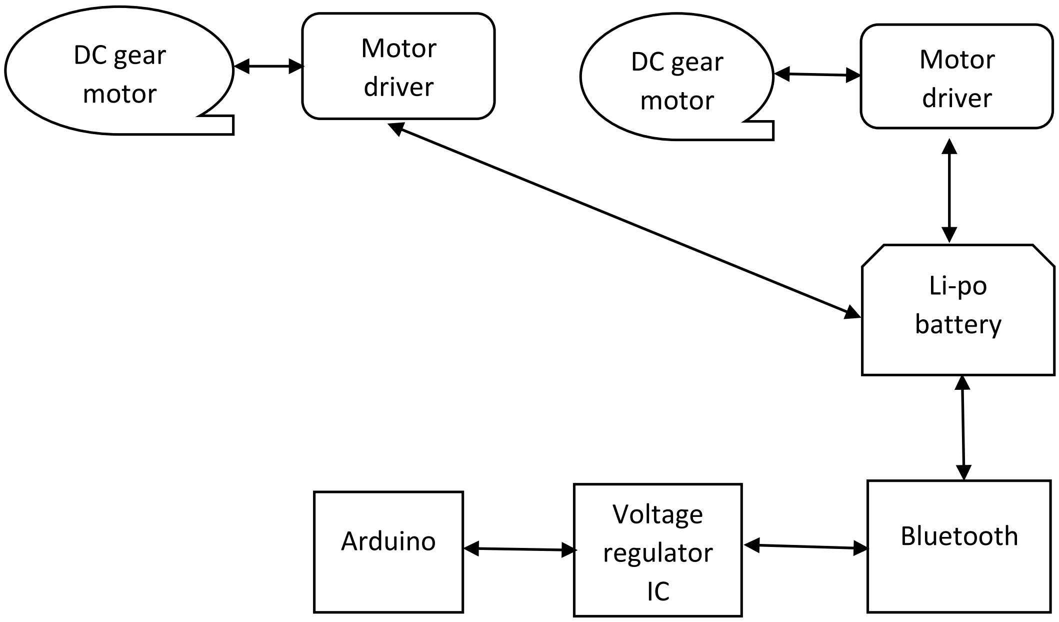

Fig. 4.1: Block diagram of micro controlling devices with basement setup

4.6 Circuit flow diagram of micro controlling system

The circuit flow diagram of micro controlling system for the design and fabrication of smart wheelchair are given below

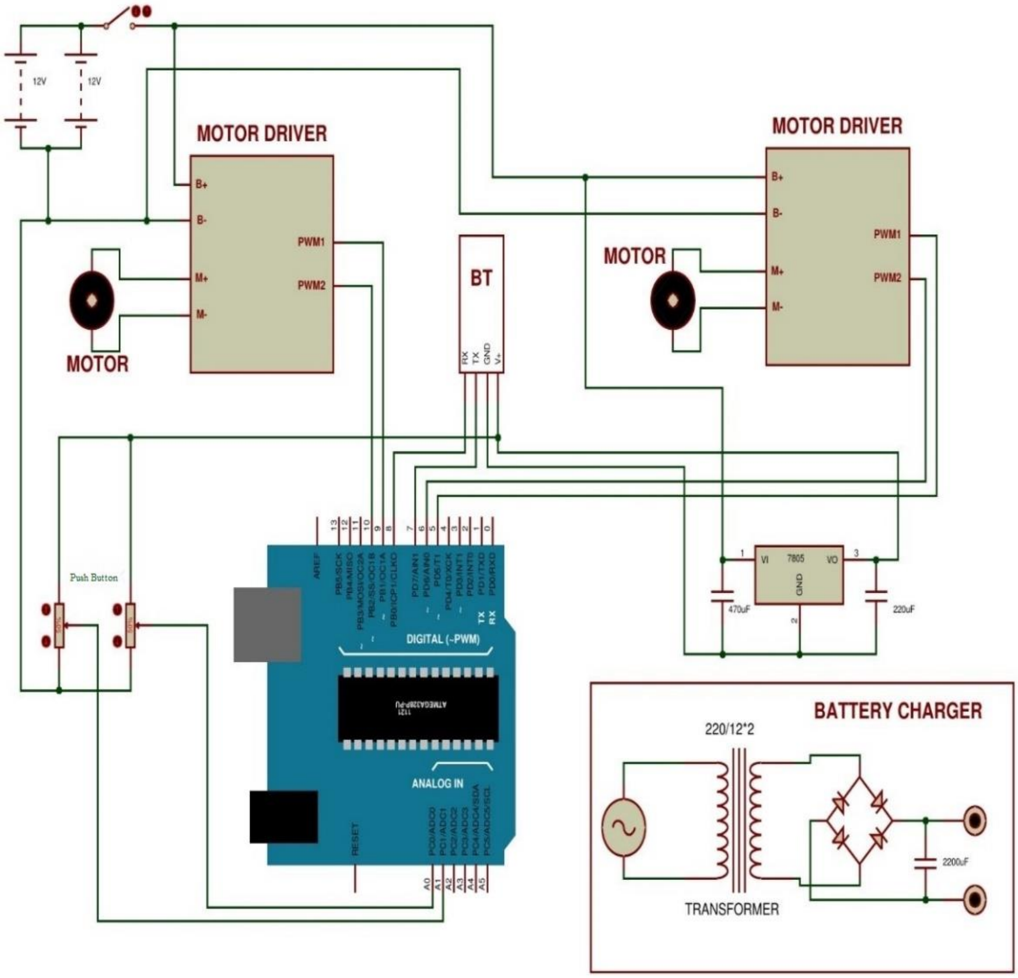

Fig. 4.2: Circuit flow diagram of micro controlling system

4.7 Final assembly

The overall principle parts, components and micro controlling devices are successfully assembled in according to the desired structure of push button and touch control smart wheelchair as shown in figure 5.3, 5.4, 5.5, 5.6.

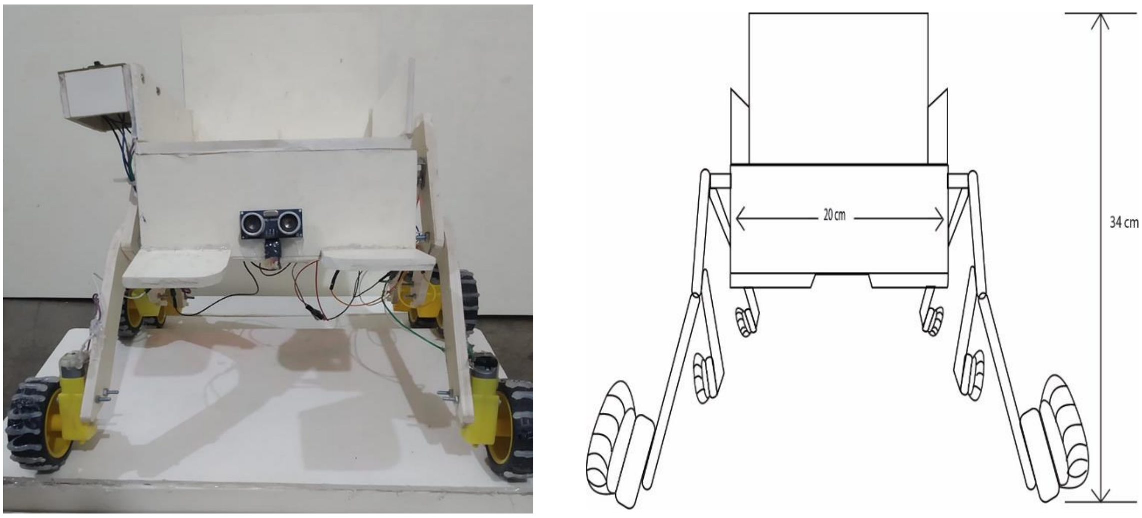

Fig. 4.3: Front view of final outcome.

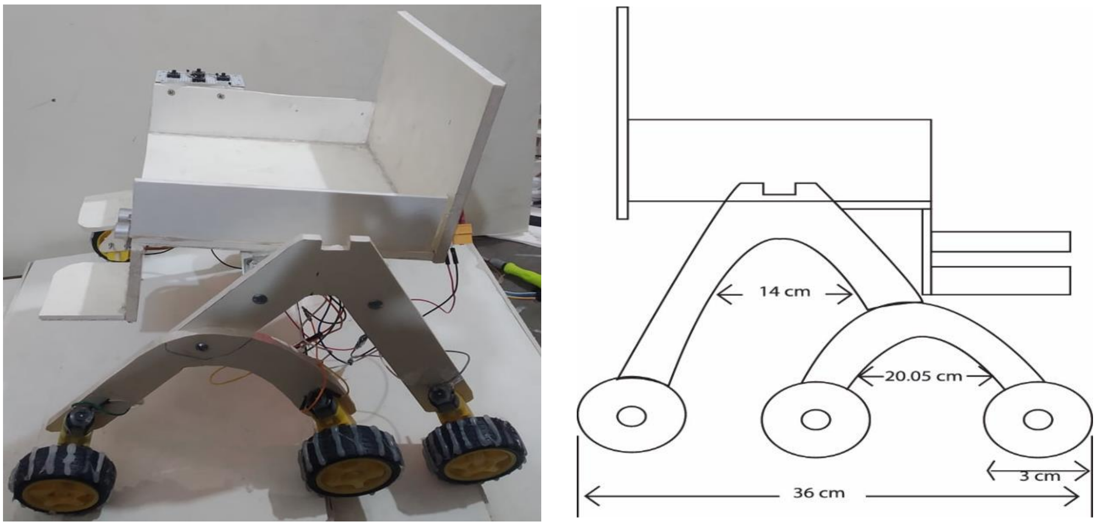

Fig. 4.4: Side view of final outcome.

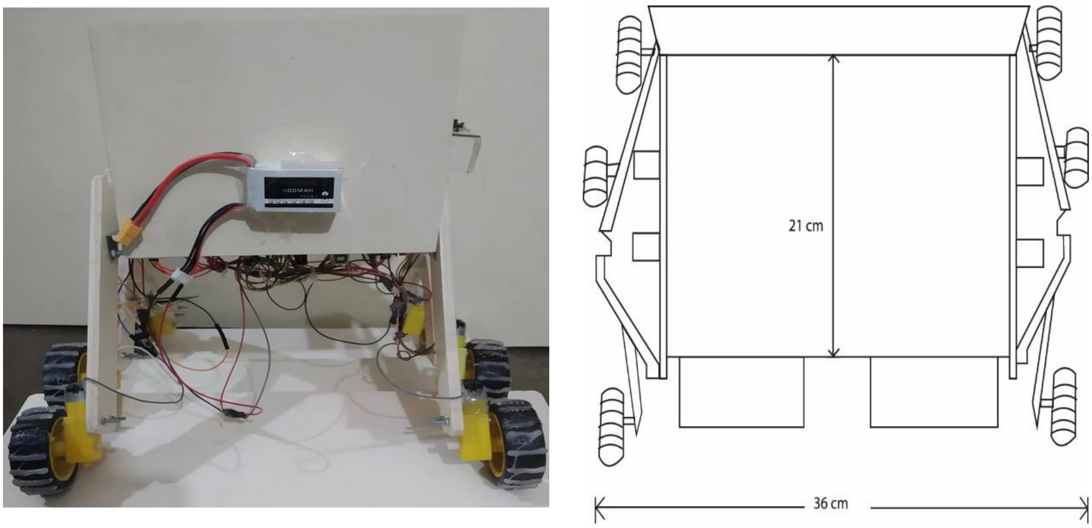

Fig 4.5: Back side view of final outcome.

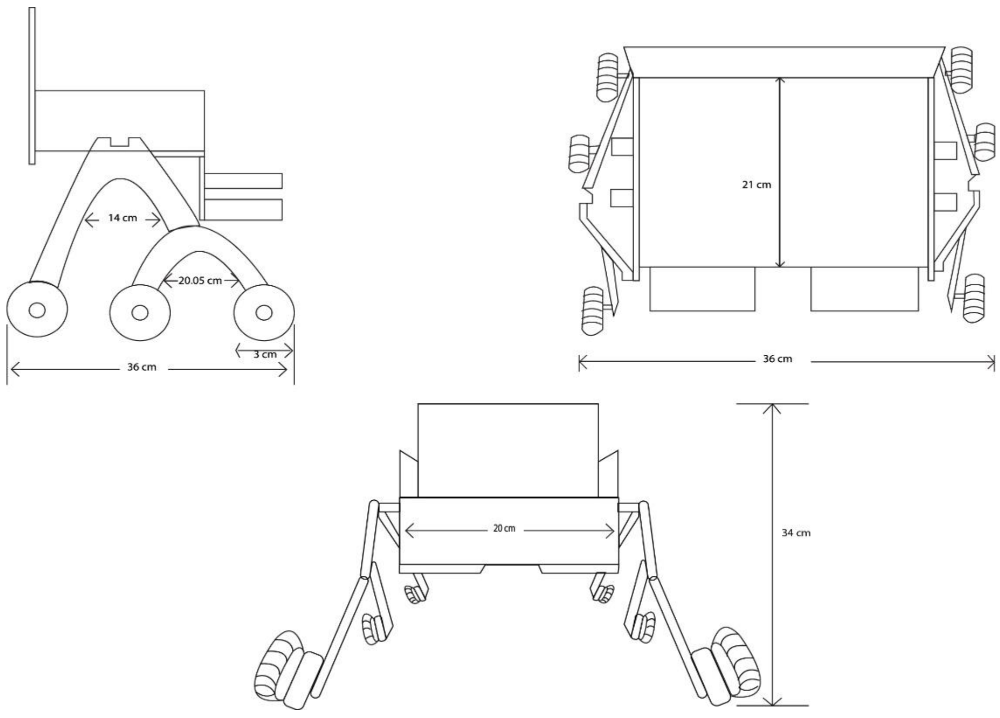

Fig 4.6: All side view of final outcome.

4.8 Measurements of structure

The overall body structure measurements are given below

For seat measurements

- Backrest – height : 34cm
  Width : 21cm
- Base - Length : 36cm
  Width : 21cm
- Armrest –length : 14cm
  Angle - Width : 20.5cm
  Wheel : 3cm
- Thickness of chair : 21cm

CHAPTER 5
LOAD ANALYSIS

5.1 Analysis of load

The load analysis with different performance parameter of smart wheelchair are given below

5.2 Reasons to Determine Motor Loading

Most electric motors are designed to run at 50% to 100% of rated load. Maximum efficiency is usually near 75% of rated load. Thus, a 10-horsepower (hp) motor has an acceptable load range of 5 to 10 hp; peak efficiency is at 7.5 hp. A motor's efficiency tends to decrease dramatically below about 50% load. However, the range of good efficiency varies with individual motors and tends to extend over a broader range for larger motors, as shown in Figure 1. A motor is considered underloaded when it is in the range where efficiency drops significantly with decreasing load. Figure 2 shows that power factor tends to drop off sooner, but less steeply than efficiency, as load decreases.Overloaded motors can overheat and lose efficiency.

5.3 Input Power Measurements

When "direct-read" power measurements are available, use them to estimate motor part-load. With measured parameters taken from hand-held instruments, you can use Equation 1 to calculate the three-phase input power to the loaded motor. You can then quantify the motor's part-load by comparing the measured input power under load to the power required when the motor operates at rated capacity. The relationship is shown in Equation 3.

Equation 1

$$Pi = \frac{V \times I \times PF \times \sqrt{3}}{1000}$$

Where:

Pi = Three-phase power in kW

V = RMS voltage, mean line-to-line of 3 phases

I = RMS current, mean of 3 phases

PF = Power factor as a decimal

Equation 2

$$Pir = hp \times \frac{0.7457}{\eta fl}$$

Where:

Pir = Input power at full-rated load in kW

hp = Nameplate rated horsepower

ηfl = Efficiency at full-rated load

Equation 2

$$Load = \frac{Pi}{Pir} \times 100\%$$

Where:

Load = Output power as a % of rated power

Pi = Measured three-phase power in kW

Pir = Input power at full-rated load in kW

Example: Input Power Calculation

An existing motor is identified as a 40-hp, 1800 rpm unit with an open drip-proof enclosure. The motor is 12-years old and has not been rewound.

The electrician makes the following measurements:

Measured Values:

V ab = 467V	I a = 36 amps	PF a = 0.75
V bc = 473V	I b = 38 amps	PF b = 0.78

V ca = 469V I a = 37 amps PF c = 0.76

V = (467+473+469)/3 = 469.7 volts

I = (36+38+37)/3 = 37 amps

PF = (0.75+0.78+0.76)/3 = 0.763

Equation 1 reveals:

$$Pi = \frac{469.7\ x\ 37\ x\ 0.763\ x\ \sqrt{3}}{1000} = 22.9\ kW$$

5.4 Line Current Measurements

The current load estimation method is recommended when only amperage measurements are available. The amperage draw of a motor varies approximately linearly with respect to load, down to about 50% of full load. (See Figure 3.) Below the 50% load point, due to reactive magnetizing current requirements, power factor degrades and the amperage curve becomes increasingly non-linear. In the low load region, current measurements are not a useful indicator of load.Nameplate full-load current value applies only at the rated motor voltage. Thus, root mean square (RMS) current measurements should always be corrected for voltage. If the supply voltage is below that indicated on the motor nameplate, the measured amperage value is correspondingly higher than expected under rated conditions and must be adjusted downwards. The converse holds true if the supply voltage at the motor terminals is above the motor rating.

CHAPTER 6
RESULTS AND DISCUSSION

6.1 Results

- After assembly of the wheelchair, from above calculation different types of resulting values found that with respect to the performance parameters (Such as Torque, Revolution, Velocity and Mass) of it on a normally flat surface.
- The maximum possible mass to successfully overcome 105 kg in a normally flat surface.
- The maximum possible mass to successfully overcome 31kg in the inclined surface at an angle $15^o$and 30^o

6.2 Discussion

During this project develop it's quite difficult to form the required degree of freedom and sometimes the circuit will fail and get heated with excise current supply, that's why there use some extra safety device like buck converter and voltage regulator IC. The circuit design will be developed by a board and the power system has gained a 12V/8.2Amp. lipo battery. For the controlling system, we used Arduino AT mega 328 with program language. The better its design can gain with a complicated degree of freedom it can be transformed.

CHAPTER 7
CONCLUSION AND RECOMMENDATION

7.1 Conclusion

From the above calculation of load analysis, it has been found that the motions controlled smart wheelchair proves to be an effective solution for paralysis patients who could not move their hands and legs for driving a manual wheelchair. This system proves better than the automatic Push button as well as android mobile apps to control a motorized wheelchair.

That is implemented motors with reduction gears and chain drive trains, in order to change the motor speed to a slower speed and increase the available torque to wheels. The virtual model of the wheelchair is designed in Solid Works and upon this model is developed the experimental model. The proposed solution used Six DC gear motors, controlled by a push-button module.

Also, the project comes out to be economical as compared to other available wheelchairs in the market. The micro controlling device of a smart wheelchair is controlled by using Bluetooth. The Bluetooth is controlled by the android mobile apps with the maximum range 10m from the surrounding region of a wheelchair. The project explains that automated smart wheelchair can be used to help handicapped people, especially those who are not able to move. This project was the complete edition of the electronic circuits, the hardware designing & software knowledge. The system was successfully implemented to move the wheelchair forward and backward as well as forward right turn and backward left turn in the movement of forwarding direction.

7.2 Recommendation

The parameters and the systems of our project of a smart wheelchair have been observed to be properly running. However, some important features can be incorporated to improve our project. The following can be treated as the recommendation of the future modification of this project.

- The frame weight can be reduced by using high strength lightweight materials such as composites, carbon fiber.
- The project can move with a gyroscopic sensor and can attach the camera to inspect outside to disable a person.
- The motorized wheelchair can stop at the contact of any obstacle in the movement of forwarding and backward direction when the use of the sonar sensor.
- The project can also be improved when the use of eye sensor manipulation.
- The motorized wheelchair can also be improved, in case of people suffering from certain paralysis by using either voice or head movement as per requirement.

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