DISABLED FRIENDLY FOUR WHEELED E-VEHICLE

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

Each and every person in this world has an expectation to live a normal human life but road accidents, syndromes, antiquities make their expectations crumble due to their disabilities. Physically handicapped people are a permanent part of our society. The disabled people are dependent on others for their transportation from one location to another with a wheelchair. Also, they need somebody's assistance for their regular day-to-day activities. In order to facilitate ease of mobility for the disabled people, we implemented an idea by using a four wheeled electric vehicle that can be controlled wirelessly using a bluetooth connection through mobile phones. The proposed idea allows the person to travel around with his wheelchair without being shifted from one seat to another.

The proposed and fabricated model consists of a plywood frame. It is operated by a microcontroller which drives the motor and helps in turning the vehicle left and right and a path-planning algorithm is fed into the microcontroller to identify the correct path to be followed.

The established system provides an eco-friendly disabled car, through which the disabled can explore various places independently. And it has a pi-camera using which the surrounding obstacles can be detected and the shortest path can be identified by path-planning algorithm for easy traversal of the vehicle around the location.

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INTRODUCTION

1.1 OVERVIEW

Four wheeled electric vehicles for disabled people is one of a kind as this is a new prototype to be established in the present industry. As the present world is moving towards Industry 4.0, it is necessary to implement a disabled friendly electric vehicle for the disabled for ease of transportation from one place to another.

A few designs for a manually operated Electric Wheelchair was first published by an American Inventor, named as George Westinghouse in 1914 . However, a group of engineers led by George Klein are considered as the inventor of the first electric powered wheelchair. Then in1956, a company named as Everest & Jennings started the commercial production of electric wheelchair. From the invention of the power wheelchair, many researchers proposed different methods to control the wheelchair. One of the most popular of them is the use of joystick or toggle switches. Another common alternative is voice control method, where a particular spoken word was recognized by an application called **'AMR VOICE**' speech which generates a specific corresponding signal on a microcontroller board. In addition, a compact form of marketable electronic power-driven wheelchair which is organized by a speech recognition method established on grammar and laptop along with six Peripheral Interface Controller (PIC) was suggested by Akira Murai. But the system was not user friendly in the case of easiness and cost.

Disabled Population in India as per census 2011. In India out of the 121 Cr population, 2.68 Cr persons are disabled which is 2.21% of the total population. Among the disabled population 56% (1.5 Cr) are males and 44% (1.18 Cr) are females. In the total population, the male and female population are 51% and 49% respectively. In an era where Inclusive Development is being emphasised as the right path towards sustainable development, focussed initiatives, for the welfare of disabled persons are essential. One such way of promoting lives of disabled persons in our nation from our side is to implement

a four wheeled electric vehicle which helps the wheelchaired people to travel from one place to another without getting up from the wheelchair.

The proposal also paves way for independence of a disabled person. Since, it allows them to be independent without any assistance from others for lifting them and guiding them inside a vehicle. Also, the current scenario worldwide is to control pollution and save the environment. Keeping this in mind, to save the future of our planet, we have designed this vehicle, which uses electricity as fuel.

1.2 PROBLEM STATEMENT

The disabled people are physically and mentally vulnerable in this society, as a result it increases their dependency on others for their day-to-day activities and most importantly they depend on others for their mobility.

In India, there is a limited number of vehicles for disabled.

Usage of IC(Internal Combustion) engine in vehicles cause environmental degradation .

And also fuel sources are limited to our country , this makes India to depend on foreign countries for crude oil.

According to British Petroleum (BP) census in 2013, it is estimated that crude oil present, lasts for about 53.3 years at current rate of extraction.

1.3 OBJECTIVES

- To locate the physically challenged population of our country in a way by providing ease of mobility.
- To implement environment friendly electric vehicle for the transportation.
- To provide an autonomous nature for the vehicle instead of manual control.

1.4 EXISTING MODEL

_____ The current model available is not designed to allow disabled people to get inside the vehicle with their wheelchair .

Instead , the driver seat is modified as shown in the fig.no.1.3 to help disabled person to get inside the car .

Here , the person depend on others as he must be lifted from his wheel chair and then be placed at the seat.

fig.no.1.3

1.4 PROPOSED MODEL

_____ The proposed model is designed in such a way that the disabled person can get inside the vehicle along with his wheelchair as shown in the fig.no.1.4 and not necessary to depend on others.

Keeping in mind the future of our planet, we have decided to operate the vehicle using electricity as a fuel.

The vehicle is automated through wireless connection and can be controlled using mobile phones.

The driving can be completely controlled using mobile phones instead of steering wheel, and thus providing a better driving comfort.

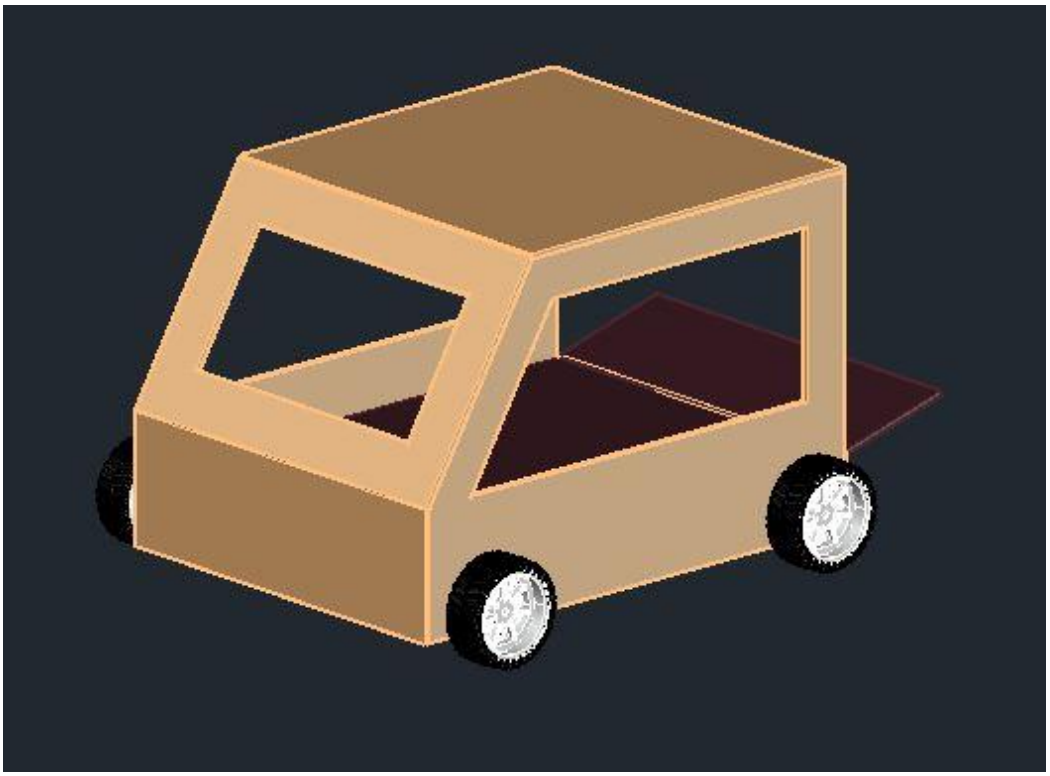

fig.no.1.4(a)

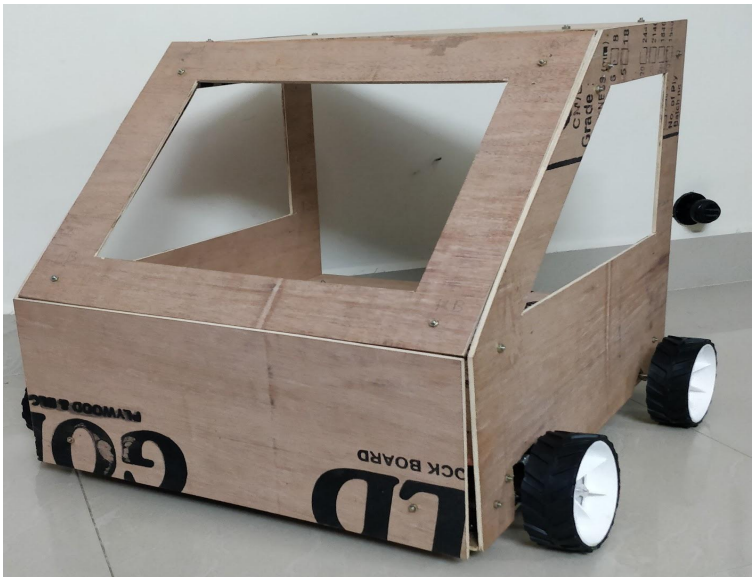

fig.no.1.4(b)

CHAPTER - 02

LITERATURE REVIEW

2.1 PREVIOUS WORKS

1. TITLE : Smart Cars for Physically Disabled Based on Artificial Intelligence.

PUBLICATIONS : IJARBEST

AUTHORS : K.V.Leelambika, Lenny Arul Jegan, Sindhu, Yuvashree.

METHODOLOGY:

This prototype promotes the development of SMART CARS controlled by human brain which could assist the physically challenged people to drive these special cars at their own. As these cars incorporates the trending technology of ARTIFICIAL INTELLIGENCE, it synchronizes and integrates the signals from various sensors and thus these cars rely only on what the person thinks, which does not involve any physical interaction with the car, who drives. Henceforth, these special cars help to transform the disabled into able people who can independently travel across places.

The main idea behind these smart cars is that the impulse of the brain can be monitored and can be decoded. In the brain, there are motor neurons present inorder to help with our motions. When a person wants to move, he/she sends an impulse which is detected by these motor neurons present in the brain. These motor neurons are responsible for carrying the signals to the corresponding physical components such as hands/legs. Thus maximum efficiency can be achieved if these motor neurons are tracked. For monitoring the eye movement of the driver sensor neurons are observed by the computer. The electroencephalograms of the driver decides upon if

the driver is capable of continuing his drive. That is the EEG of the driver is noted continuously. And if it drops less than 4HZ then it can be inferred that the driver is in an unstable state. If this situation arises then a warning message is given to the driver and a reply is awaited before continuing the drive. If the reply is received then automatic driving mode is set on.in case the reply is not received then the destination is known by means of prompting the driver before the drive.

The special interfaces provides facility to synchronize with highly sophisticated technological system such as autonomous vehicles. As these cars are integrated by smart system of artificial intelligence which facilitates the disabled driver to acquire control of the car's major feature of driving using involving any physical interaction. Even if it is not assured to be deployed for public usage, this proposal can enable the disabled people to effectively drive these cars at their own without indulging any physical movement and to command the vehicle in relatively small and closed areas.

CONCLUSION:

The proposal gives a glimpse of existing feature of brain-interface. With the increase in advancements of the BCI, numerous advantages can be claimed. They are (i)more accurate car control (ii)more effective velocity control and steering control. When all these above mentioned constraints gets satisfied and if the estimation of the cost becomes effective, then a massive revolution in the society of disabled people occurs which extinct the differences between the abler and the disables. Thus the integration of bioelectronics with Artificial intelligence, smart automotive is important to deploy efficient and futuristic cars, which shall be developed soon helping the disabled in every aspect in the field of transportation.

2. **TITLE : Hands Free Electric Vehicle for Disabled People**

PUBLICATIONS : IRJET

AUTHORS : Sankat Londhe, Rahul Ghate, Udit Paradkar, Praful Nighot, Manuja Pandey

METHODOLOGY:

The aim of this project is to develop a vehicle for people with disability in their upper limbs and provide vehicle users with improved levels of mobility, facilitating freedom in travel and contribution to the community. The most important part of the design is the incorporation of the steering mechanism which will be fully operated by legs without any discomfort and to make life more comfortable for the physically challenged persons. The system is entirely dependent on sprocket chain mechanism for its steering purpose. A battery powered engine was chosen for this design and consideration was also given to the weight of the user in which a maximum weight of 70kg was used.

The steering mechanism consists of a steering rod which is nothing but the vehicle handle and an operative rod which is mounted in two bearings attached to an 'L' shaped connecting rod. Also it consists of two sprockets and a chain to transmit the motion from the operative rod to the steering rod. The two sprockets are attached at the upper ends of these rods in such a way that, the rotation of one will lead to the rotation of other. A pedal mechanism is provided at the bottom of the operative. The operative rod which mounted in two bearings is connected with the steering rod with the help of an 'L' shaped connecting rod which is welded at its two ends respectively.

The seat frame of the vehicle was initially designed on solidworks. Further the CAD model of the seat frame was tested keeping in mind the ergonomics of the vehicle. The seat of the vehicle was supposed to provide support and comfort to the driver at the same time it was necessary that the seat was satisfying the

safety requirements for the timely evacuation in case of an emergency. The frame was fabricated with the help of L-angled bars composed of mild steel. Two 90degree angles were made with the help of these bars which were attached to each other with the help of a horizontal bar. The lower and upper ends of this frame were bolted to the body of the vehicle whereas the middle section was covered with the help of a rectangular wooden plank on which the driver was supposed to sit. Further two inclined bars were bolted to the vehicle body and a rectangular wooden plank was attached to its upper section which acted as the back rest of the seat.

CONCLUSION :

Hands-free electric vehicle with suspension has been designed and fabricated. Turning mechanism different than other handicap vehicles has been successfully designed and fabricated. Our vehicle causes zero pollution as compared to other handicap vehicles. Our vehicle runs on a motor driven by four 12 V batteries connected in series. Our vehicle has a better balance as compared to other handicap vehicles.

3. **TITLE : Design And Construction of Electric Drive.**

PUBLICATIONS : IRJET

AUTHORS : Sania Sheikh, Abhishek Waghmare, Ankit Yadav, Shubham Boyar, Chetana Dolase.

METHODOLOGY :

The main objective of this project is to design a micro controller-based (ATmega328/P) wheelchair, the speed and direction of wheelchair can be controlled from a controller board that contains controlling of motor driver and controlling of joystick. The wheelchair moves by means of a Geared Dc motor.

The enforce work is quite exceptional in the sense that it provides a combination of controlling part and therapy part. Therapy parts give some therapy facilities to the disabled person to overcome their debility.Again, the other part includes two types of controlling method which are joystick and voice control method.The joysticks are Arduino interfaced and can be easily organized by fingers movement. Voice command system is done by the use of Bluetooth module which eliminates the necessity of personal computer.Therefore it is cost effective. Here using Arduino environment, reduce the circuit complexities. Moreover, obstacle detection provides additional safety in case of any sudden hurdle. Arduino shield and therapy facilities provided a new revolution on wheelchair history and improvised the previous work. Moreover, to help a paralyzed person to move freely was not only our main concern but also help him to recover his strain as well as he can easily go back to his normal life, which we considered as the special feature of this effort.

CONCLUSION :

The controls are dependent on the environment also, voice operated control system cannot used in noisy environment. Multiple control system implemented in a wheelchair is quite suitable to overcome this disadvantage. But as control system increases the cost also increases a lot so there is also limitation on implementation number of control system. There is no any system which makes physical disabled people fully independent. Different control system should be used for different type of physical disability. This paper presents a summary of current state-of-the-art smart wheelchairs. Various techniques are available to operate and control the wheel mechanism of wheelchair. Some of operating techniques of wheelchairs have been explained here. This information is gathered to promote awareness of the status of existing types of smart powered wheelchair so that the improvement can be incorporated into it.

2.2 RESEARCH GAP

- There is no specially designed vehicle in usage for the mobility of disabled people which can provide drivability at ease.
- The present day research aims only at developing a special feature in the existing vehicles which can be used to provide them comfortable seating and travelling alone.
- But, this upgrade on an existing vehicle doesn't provide them the independence to travel alone without the need of any help from other people.

CHAPTER - 03

METHODOLOGY

3.1 DESCRIPTION

Initially, the vehicle is controlled by a joystick controller via bluetooth module. The vehicle is placed in its initial position and the destination is set. Using the path-planning algorithm provided, the vehicle reaches the destination. If the scanned path is reachable the vehicle moves or it stops. The motor driver is provided to give power supply to the four DC motor.

The presence of arduino mega is to provide flexibility with working with the ultrasonic sensor which detects the obstacles around the vehicle and power consumption. If any object is detected along its path, the vehicle takes the data from the sensor and takes left or right turn accordingly and rejoins the path. And when the desired path is detected, the vehicle stops.

3.2 BLOCK DIAGRAM

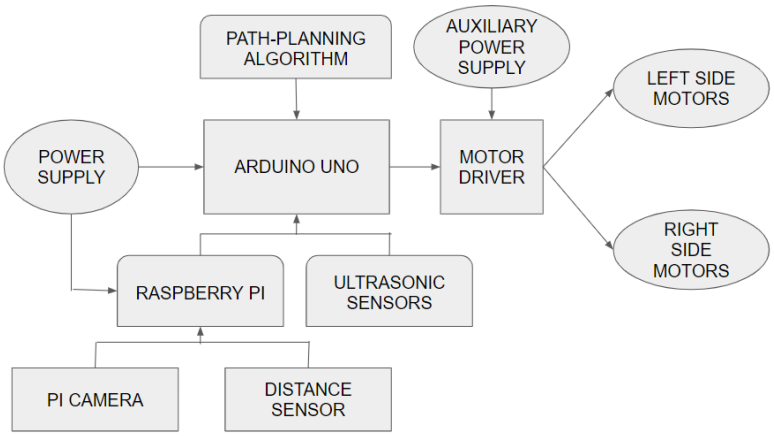

fig.no.3.2(a)

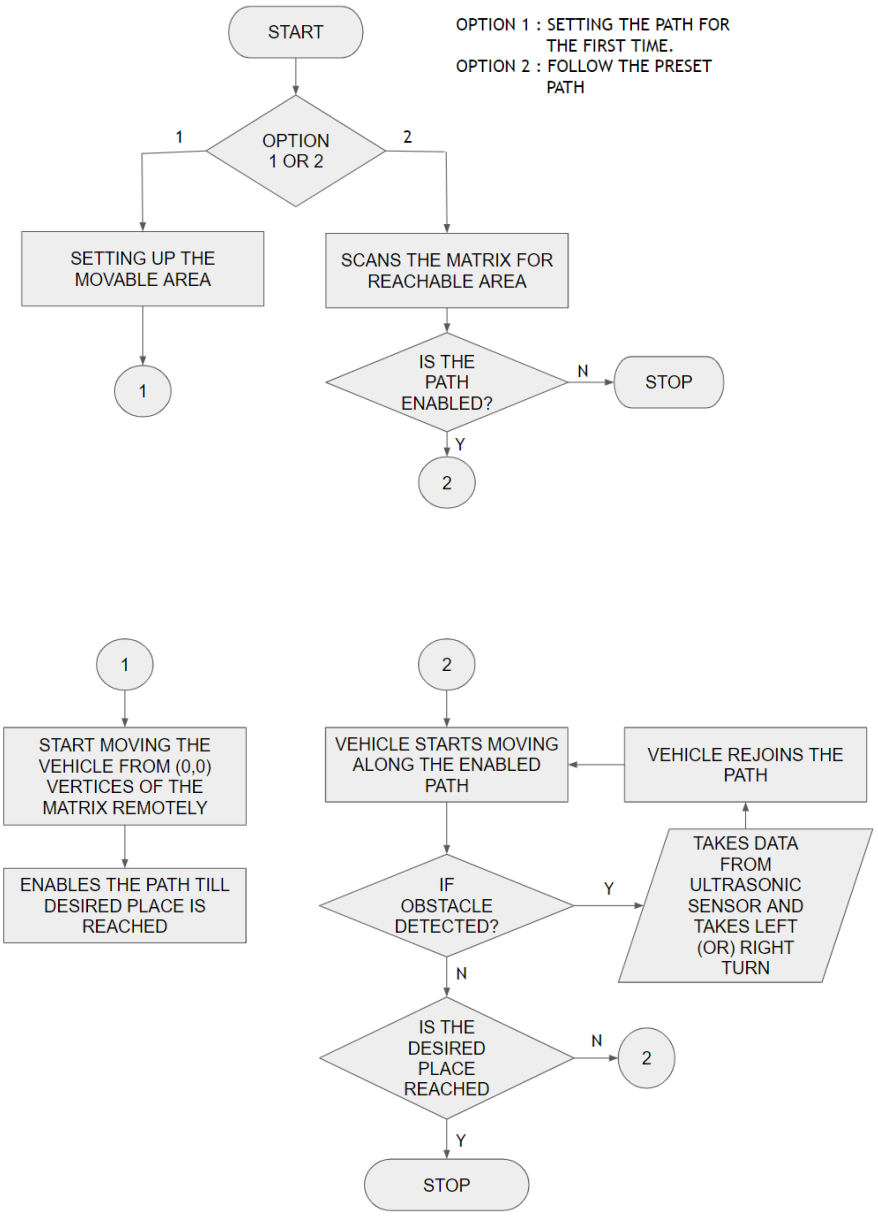
START
OPTION 1 : SETTING THE PATH FOR THE FIRST TIME.
OPTION 2 : FOLLOW THE PRESET PATH
OPTION 1 OR 2
1
2
SETTING UP THE MOVABLE AREA
SCANS THE MATRIX FOR REACHABLE AREA
1
IS THE PATH ENABLED?
N
STOP
Y
2
1
START MOVING THE VEHICLE FROM (0,0) VERTICES OF THE MATRIX REMOTELY
ENABLES THE PATH TILL DESIRED PLACE IS REACHED
2
VEHICLE STARTS MOVING ALONG THE ENABLED PATH
VEHICLE REJOINS THE PATH
IF OBSTACLE DETECTED?
Y
TAKES DATA FROM ULTRASONIC SENSOR AND TAKES LEFT (OR) RIGHT TURN
N
IS THE DESIRED PLACE REACHED
N
2
Y
STOP

fig.no.3.2(b)

ELECTRICAL CIRCUIT

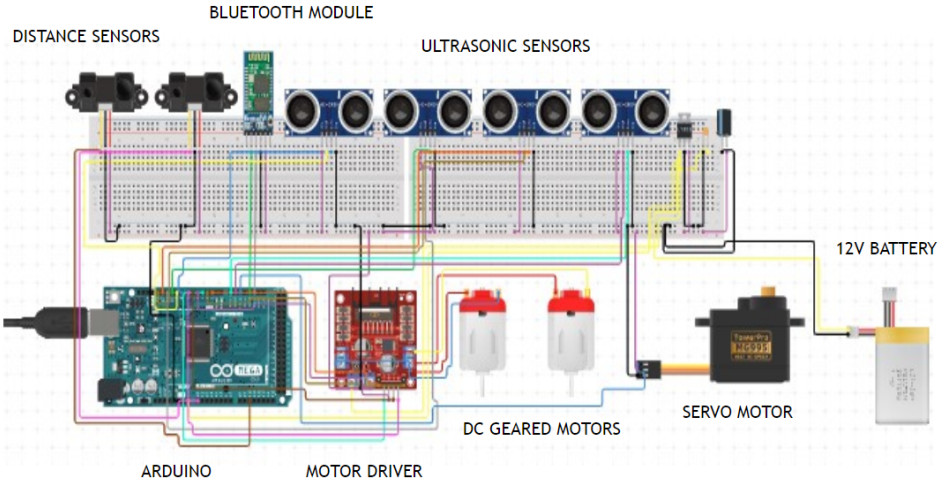

fig.no.3.2(c)

3.3 HARDWARE DESCRIPTION

3.3.1 ARDUINO MEGA 2560

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

The Arduino Mega is the addition to the Arduino family.This board is physically larger than all the other boards and offers significantly more digital and analog pins. The MEGA uses a different processor allowing greater program size and more.The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip.Instead, it features the ATmega16U2 programmed as a USB-to-serial converter.The Mega has four hardware serial ports, which means maximum speed if you need a second or third (or fourth) port.The Arduino Mega works in the same way the Arduino

Uno does but the difference is that it uses ATmega2560 microcontroller and has more number of digital pins,analog pins.

The Arduino Mega can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The Mega2560 differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the ATmega16U2 programmed as a USB-to-serial converter.

fig.no.3.3.1

3.3.2 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 angles or distance, then you use servo motor. It is just made up of simple motor which runs through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor. We can get a very high torque servo motor in a small and lightweight packages.

Doe to these features they are being used in many applications like toy cars, RC helicopters and planes, Robotics, Machine etc.

Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity. The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly and a controlling circuit. First of all we use gear assembly to reduce RPM and to increase torque of motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now difference between these two signals, one comes from potentiometer and another comes from other source, will be processed in feedback mechanism and output will be provided in term of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with potentiometer and as motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

fig.no.3.3.2

3.3.3 BRUSHLESS DC MOTOR

A brushless DC electric motor (BLDC motor or BL motor), also known as electronically commutated motor (ECM or EC motor) and synchronous DC motors are synchronous motors powered by direct current (DC) electricity via an inverter or switching power supply which produces an alternating current (AC) electric current to drive each phase of the motor via a closed loop controller. The controller provides pulses of current to the motor windings that control the speed and torque of the motor.

The construction of a brushless motor system is typically similar to a permanent magnet synchronous motors (PMSM), but can also be switched reluctance motor, or an induction (asynchronous) motors.

The advantages of a brushless motor over brushed motors are high power-to-weight ratio, high speed, electronic control, and low maintenance. Brushless motors find applications in places such as computer peripherals (disk drives, printers), hand-held power tools, and vehicles ranging from model aircraft to automobiles.

Brushless motors offer several advantages over brushed DC motors, including high torque to weight ratio, more torque per watt (increased efficiency), increased reliability, reduced noise, longer lifetime (no brush and commutator erosion), elimination of ionizing sparks from the commutator, and overall reduction of electromagnetic interface(EMI). With no windings on the rotor, they are not subjected to centrifugal forces, and because the windings are supported by the housing, they can be cooled by conduction, requiring no airflow inside the motor for cooling. This in turn means that the motor's internals can be entirely enclosed and protected from dirt or other foreign matter.

Brushless motor commutation can be implemented in software using a microcontroller or microprocessor computer, or may alternatively be implemented in analogue hardware, or in digital firmware using a field-programmable gate array (FPGA). Commutation with electronics instead of brushes allows for greater flexibility and capabilities not available with

brushed DC motors, including speed limiting, "micro stepped" operation for slow and/or fine motion control, and a holding torque when stationary. Controller software can be customized to the specific motor being used in the application, resulting in greater commutation efficiency.

fig.no.3.3.3

3.3.4 MOTOR CONTROLLER

A motor controller is a device or group of devices that serves to govern in some predetermined manner the performance of an electric motor. A motor controller might include a manual or automatic means for starting and stopping the motor, selecting forward or reverse rotation, selecting and regulating the speed, regulating or limiting the torque, and protecting against overloads and faults.

Every electric motor has to have some sort of controller. The motor controller will have differing features and complexity depending on the task that the motor will be performing.

The simplest case is a switch to connect a motor to a power source, such as in small appliances or power tools. The switch may be manually operated or may be a relay or contactor connected to some form of sensor to automatically start and stop the motor. The switch may have several positions to select different connections of the motor. This may allow reduced-voltage starting of the motor, reversing control or selection of multiple speeds. Overload and overcurrent protection may be omitted in very small motor controllers, which rely on the supplying circuit to have overcurrent protection. Small motors may have built-in overload devices to automatically open the circuit on overload. Larger motors have a protective overload relay or temperature sensing relay included in the controller and fuses or circuit breaker for overcurrent protection. An automatic

motor controller may also include limit switches or other devices to protect the driven machinery.

More complex motor controllers may be used to accurately control the speed and torque of the connected motor (or motors) and may be part of closed loop control systems for precise positioning of a driven machine. For example, a numerically controlled lathe will accurately position the cutting tool according to a preprogrammed profile and compensate for varying load conditions and perturbing forces to maintain tool position.

fig.no.3.3.4

3.3.5 BATTERY

A battery is a device consisting of one or more electrochemicals cells with external connections provided to power electrical devices such as flashlights, mobile phones, and electric cars. When a battery is supplying electric power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free energy difference is delivered to the

external circuit as electrical energy. Historically the term "battery" specifically referred to a device composed of multiple cells, however the usage has evolved to include devices composed of a single cell.

Primary batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable electronic devices. Secondary batteries can be discharged and recharged multiple times using an applied electric current; the original composition of the electrodes can be restored by reverse current. Examples include the lead acid batteries used in vehicles and lithium batteries used for portable electronics such as laptops and mobile phones.

Batteries come in many shapes and sizes, from miniature cells used to power hearing aids and wristwatches to small, thin cells used in smartphones, to large lead acid batteries or lithium-ion batteries in vehicles, and at the largest extreme, huge battery banks the size of rooms that provide standby or emergency power for telephone batteries and computer data centers. Batteries have much lower specific energy (energy per unit mass) than common fuels such as gasoline. In automobiles, this is somewhat offset by the higher efficiency of electric motors in converting chemical energy to mechanical work, compared to combustion engines.

fig.no.3.3.5

3.3.6 PLYWOOD

Plywood is a material manufactured from thin layers or "plies" of wood veneer that are glued together with adjacent layers having their wood grain rotated up to 90 degrees to one another. It is an engineered wood from the family of manufactured boards which includes medium-density fibreboard (MDF) and particle board (chipboard).

All plywoods bind resin and wood fibre sheets (cellulose cells are long, strong and thin) to form a composite material. This alternation of the grain is called cross graining and has several important benefits: it reduces the tendency of wood to split when nailed at the edges; it reduces expansion and shrinkage, providing improved dimensional stability; and it makes the strength of the panel consistent across all directions. There is usually an odd number of plies, so that the sheet is balanced—this reduces warping. Because plywood is bonded with grains running against one another and with an odd number of composite parts, it has high stiffness perpendicular to the grain direction of the surface ply.

Smaller, thinner, and lower quality plywoods may only have their plies (layers) arranged at right angles to each other. Some better-quality plywood products will by design have five plies in steps of 45 degrees (0, 45, 90, 135, and 180 degrees), giving strength in multiple axes.

A typical plywood panel has face veneers of a higher grade than the core veneers. The principal function of the core layers is to increase the separation between the outer layers where the bending stresses are highest, thus increasing the panel's resistance to bending. As a result, thicker panels can span greater distances under the same loads. In bending, the maximum stress occurs in the outermost layers, one in tension, the other in compression. Bending stress decreases from the maximum at the face layers to nearly zero at the central

layer. Shear stress, by contrast, is higher in the center of the panel, and at the outer fibres.

fig.no.3.3.6

3.4 SOFTWARE DESCRIPTION

3.4.1 AUTOCAD

AutoCAD is a commercial computer aided design (CAD) and drafting software application. Developed and marketed by Autodesk, AutoCAD was first released in December 1989 as a desktop app running on a microcontroller with an internal graphic controller. Before AutoCAD was introduced, most commercial CAD programs run on mainframe computers or minicomputers, with each CAD

operator (user) working at a separate graphic terminal. Since 2010, AutoCAD has been released as a mobile- and web app as well, marketed as AutoCAD 360.

AutoCAD is used in the industry, by architects, project managers, engineers, graphic designers, city planners and other professionals. It was supported by 750 training centers worldwide in 1994.

fig.no.3.4.1

FEATURES

1. Compatibility with other software

ESRI ArcMap 10 permits export as AutoCAD drawing files. Civil 3D permits export as AutoCAD objects and as landXML. Third-party file converters exist for specific formats such as Bentley MX GENIO

Extension, PISTE Extension (France), ISYBAU (Germany), OKSTRA and Microdrainage (UK); also, conversion of .pdf files is feasible, however, the accuracy of the results may be unpredictable or distorted. For example, jagged edges may appear. Several vendors provide online conversions for free such as Cometdocs.autoCAD commonly use in all purposes.

2. Language

Auto CAD and AutoCAD LT are available for English, German, French, Italian, Spanish, Korean, Chinese Simplified, Chinese Traditional, Brazilian Portuguese, Russian, Czech, Polish and Hungarian, Albanian (also through additional language packs). The extent of localization varies from full translation of the product to documentation only. The AutoCAD command set is localized as a part of the software localization.

3. Extensions

AutoCAD supports a number of APIs for customization and automation. These include AutoLISP, VisualLISP, VBA, .NET and ObjectARX. ObjectARX is a C++ class library, which was also the base for:

- products extending AutoCAD functionality to specific fields
- creating products such as AutoCAD Architecture, AutoCAD Electrical, AutoCAD Civil 3D
- third-party AutoCAD-based application

There are a large number of AutoCAD plugins (add-on applications) available on the application store Autodesk Exchange Apps. AutoCAD's DXF, drawing exchange format, allows importing and exporting drawing information.

4. Vertical integration

Autodesk has also developed a few vertical programs for discipline-specific enhancements such as:

- AutoCAD Advance Steel
- AutoCAD Architecture
- AutoCAD CIVIL 3D
- AutoCAD Electrical
- AutoCAD ecscad
- AutoCAD Map 3D
- AutoCAD Mech
- AutoCAD MEP
- AutoCAD Structural Detailing
- AutoCAD Utility Design
- AutoCAD P&ID
- AutoCAD Plant 3D

Since AutoCAD 2019 several verticals are included with AutoCAD subscription as Industry-Specific Toolset.

For example, AutoCad Architecture (formerly Architectural Desktop) permits architectural designers to draw 3D objects, such as walls, doors, and windows, with more intelligent data associated with them rather than simple objects, such as lines and circles. The data can be programmed to represent specific architectural products sold in the construction industry, or extracted into a data file for pricing, materials estimation, and other values related to the objects represented.

Additional tools generate standard 2D drawings, such as elevations and sections, from a 3D architectural model. Similarly, Civil Design, Civil Design 3D, and Civil Design Professional support data-specific objects facilitating easy standard civil engineering calculations and representations.

Softdesk Civil was developed as an AutoCAD add-on by a company in New Hampshire called Softdesk (originally DCA). Softdesk was acquired by Autodesk, and Civil became Land Development Desktop (LDD), later renamed Land Desktop. Civil 3D was later developed and Land Desktop was retired.

3.4.2 ARDUINO IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows,macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino compatible boards, but also, with the help of 3rd party cores, other vendor development boards.

The source code for the IDE is released under the GNU General Public Licence, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution. The Arduino IDE employs the program *avrdude* to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

fig.no.3.4.2

CHAPTER - 04

STEERING MECHANISM

The steering system is required to control the direction of motion of the vehicle. This is done through a series of links used to convert the rotations of the steering wheel into change of angle of the axis of the steering wheels. Another function of the steering system is to provide directional stability. The motion of the vehicle being steered needs to become straight ahead when the force on the steering wheel is removed. The design of the steering system should be such that it should cause minimum wear of the tyres of the wheels.

4.1 PITMAN STEERING

The Pitman arm is a steering component in an automobile or truck. As a linkage attached to the steering box sector shaft, it converts the angular motion of the sector shaft into the linear motion needed to steer the wheels. The arm is supported by the sector shaft and supports the drag link or center link with a ball joint. It transmits the motion it receives from the steering box into the drag (or center) link, causing it to move left or right to turn the wheels in the appropriate direction. The idler arm is attached between the opposite side of the center link from the Pitman arm and the vehicle's frame to hold the center or drag link at the proper height. A worn ball joint can cause play in the steering, and may get worse over time.

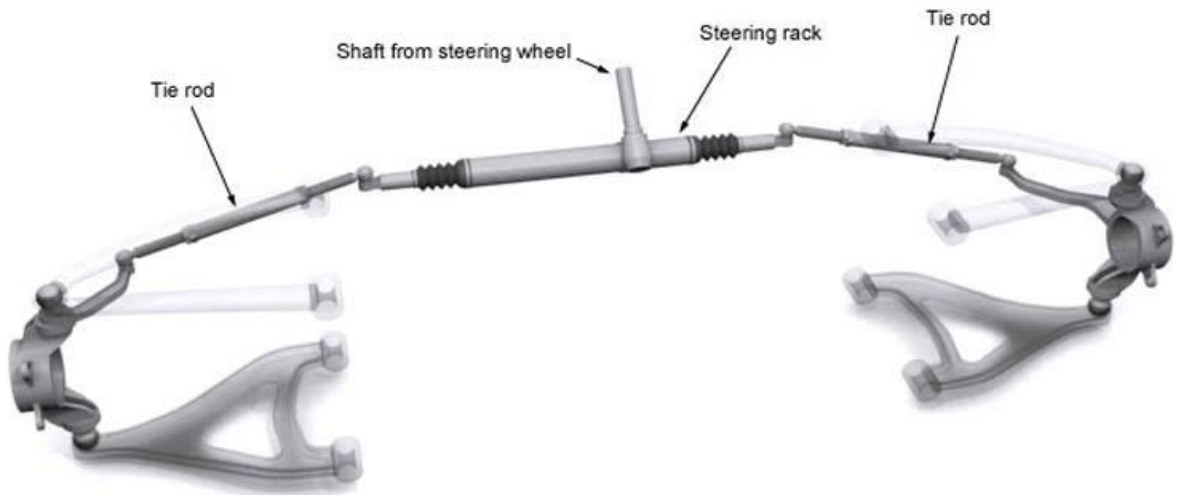

fig .no.4.1

4.2 TIE ROD

The tie rod is that part of the steering system wherein power or force coming from steering gear is transmitted towards the steering knuckle located at each wheel. The effective transfer of this power what makes the wheel turn. The tie rod's length can also be adjusted to allow for the more accurate setting of the car's alignment angle.

4.3 ADVANTAGE OF USING PITMAN STEERING THAN RACK AND PINION :

There are very few advantages to the pitman arm style over the rack and pinion style. The rack and pinion style has less moving parts and, therefore, less causes of failure. The rack and pinion system is also lighter in general which helps the vehicle's weight.

The pitman arm style steering system is normally referred to as parallelogram steering. This type of steering system is typically used on large heavy-duty trucks and on older vehicles with boxy bodies. This is an older style steering system that has been phased out by most manufacturers.

4.4 CAD MODEL

Fig.no.4.4(a) WHEEL

Fig.no.4.4(b) BASE

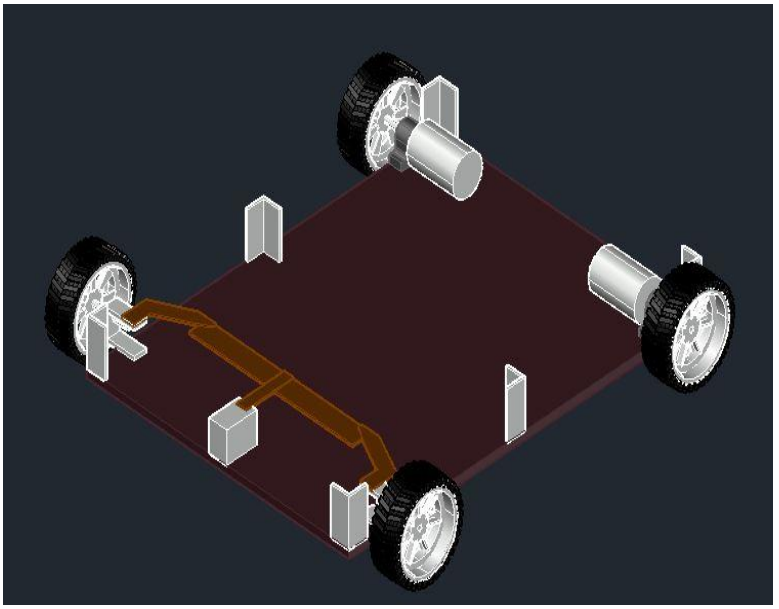

fig.no.4.4(c) BASE WITH COVER

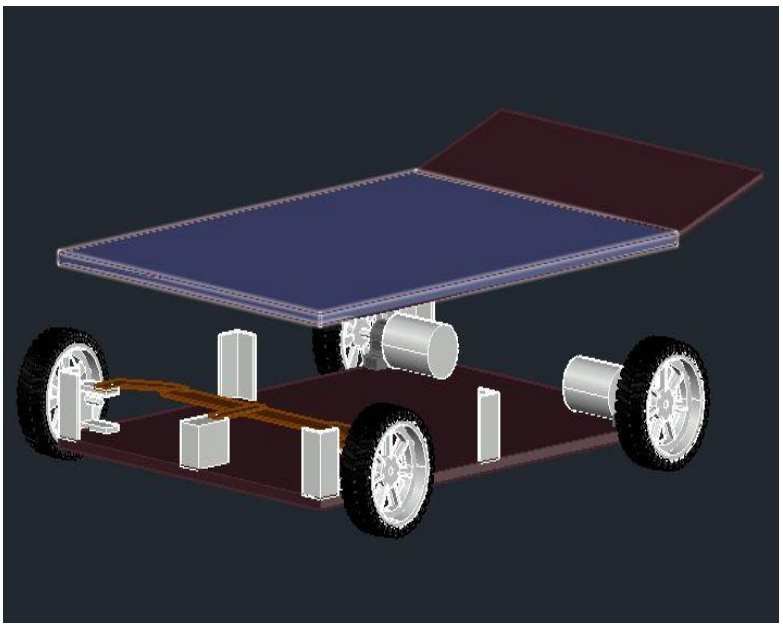

Fig.no.4.4(d) CHASSIS

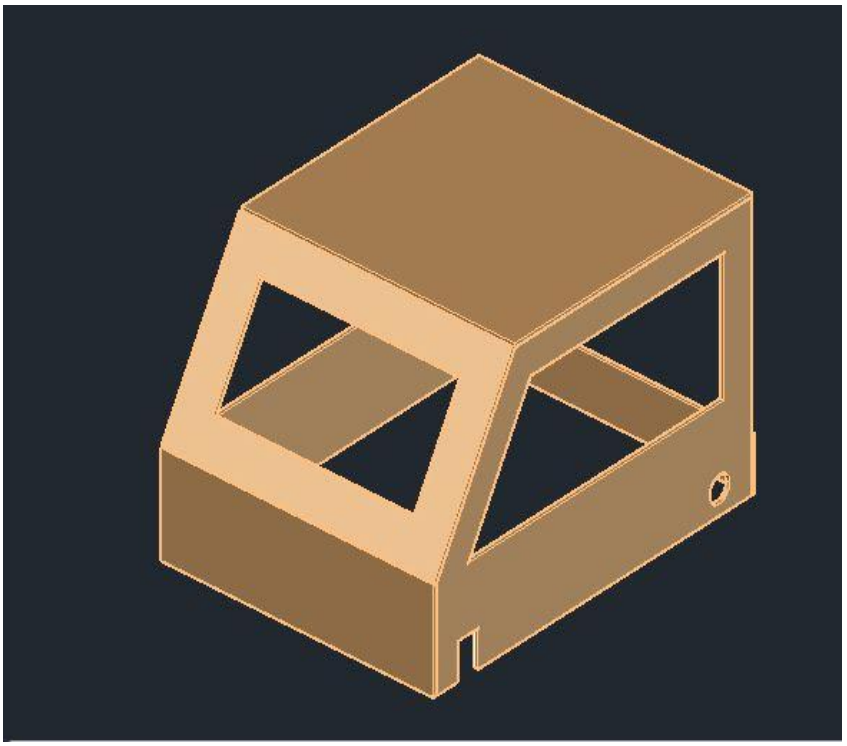

Fig.no.4.4(e) STEERING

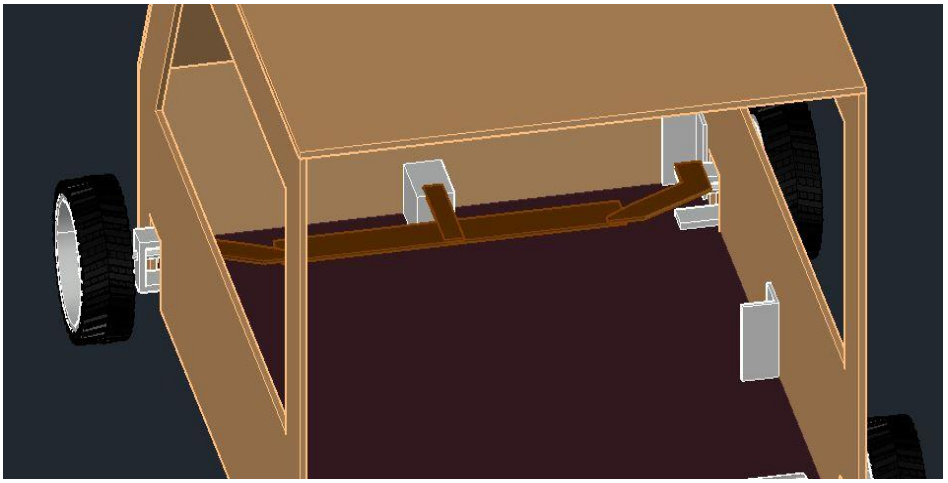

Fig.no.4.4(f-1) ASSEMBLY

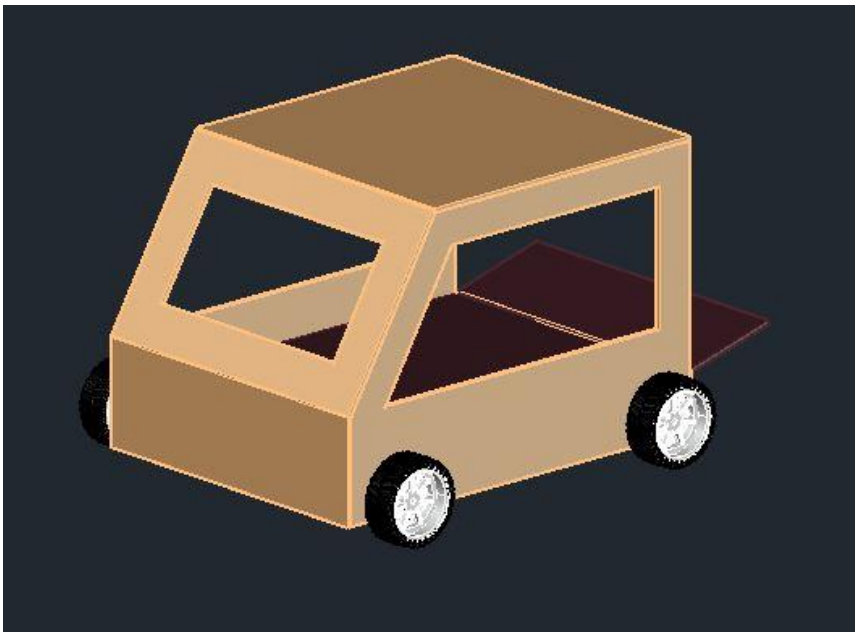

Fig.no.4.4(f-2)

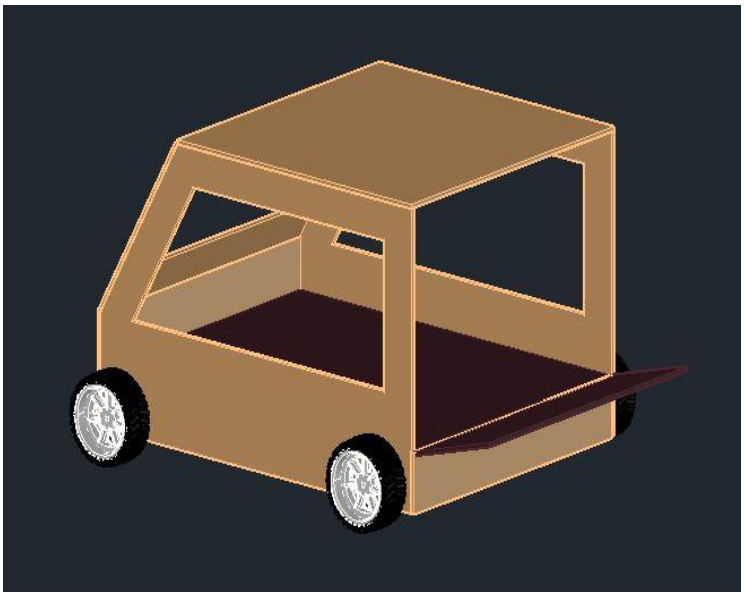

Fig.no.4.4(g) FRONT VIEW

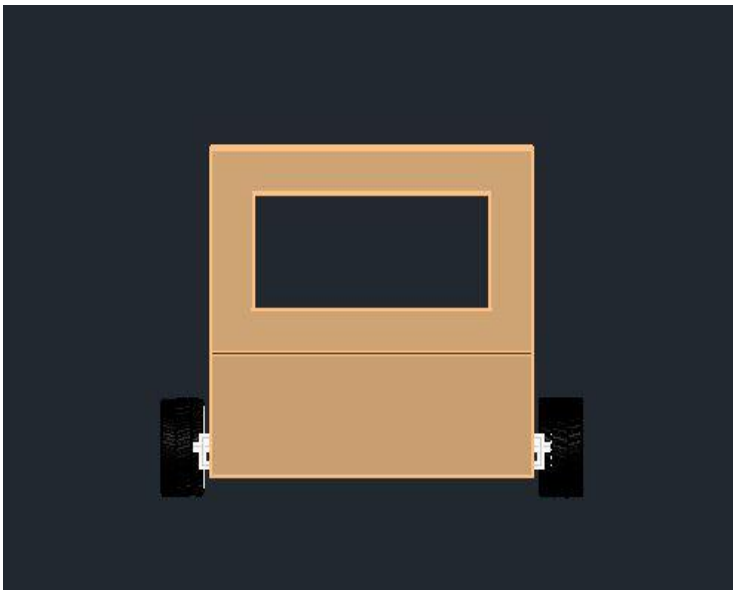

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Fig.no.4.4(h) TOP VIEW

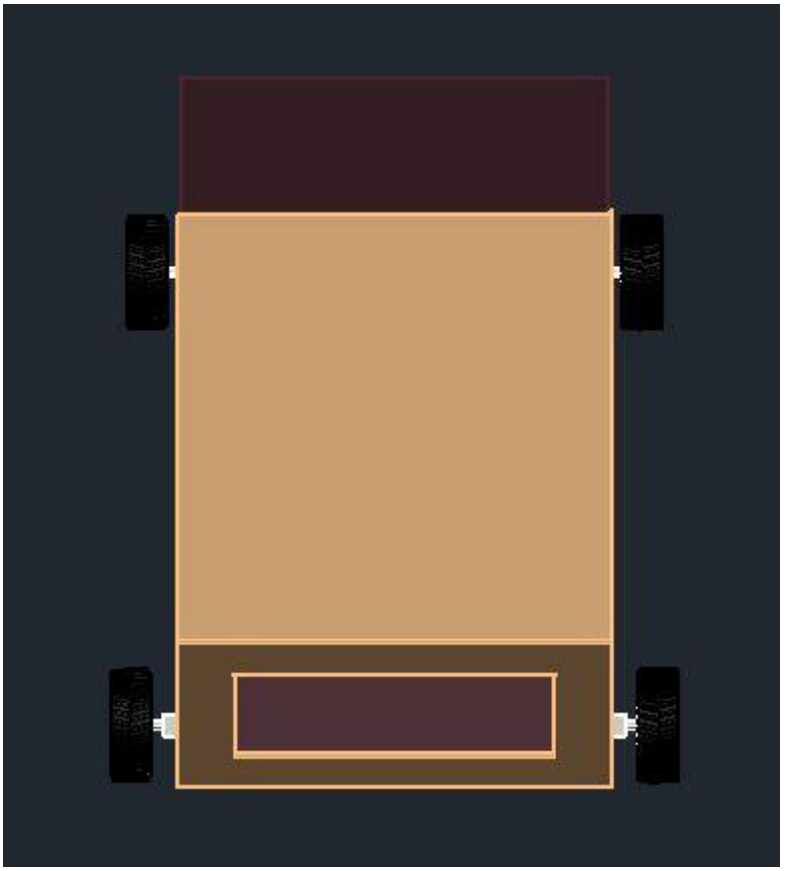
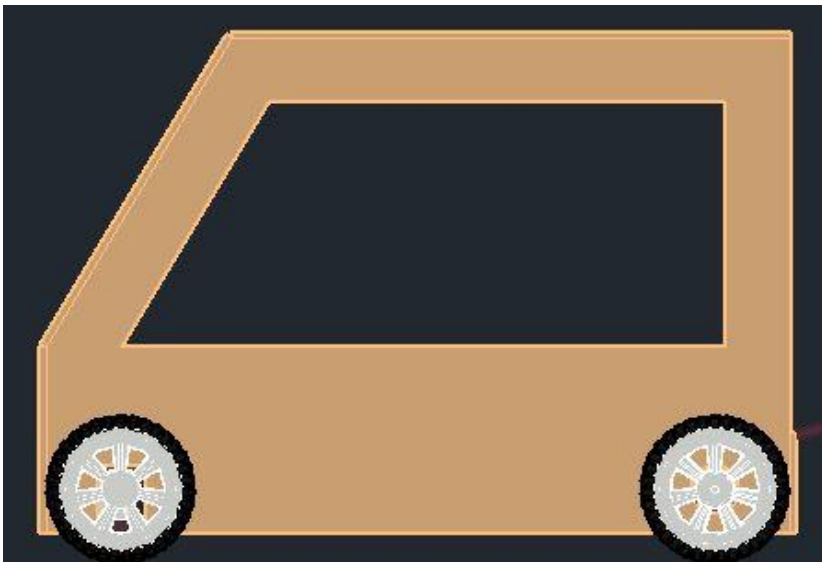


Fig.no.4.4(i) SIDE VIEW



4.5ACTUAL MODEL

Fig.no.4.5(a) WHEEL

Fig.no.4.5(b) BASE

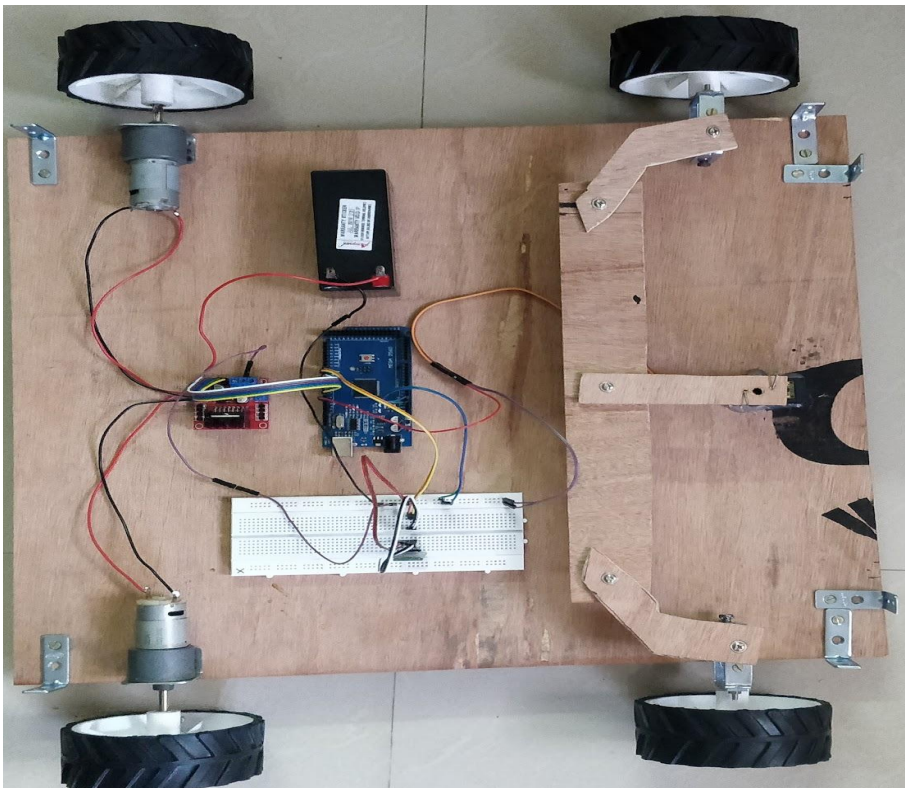


Fig.no.4.5(c) STEERING

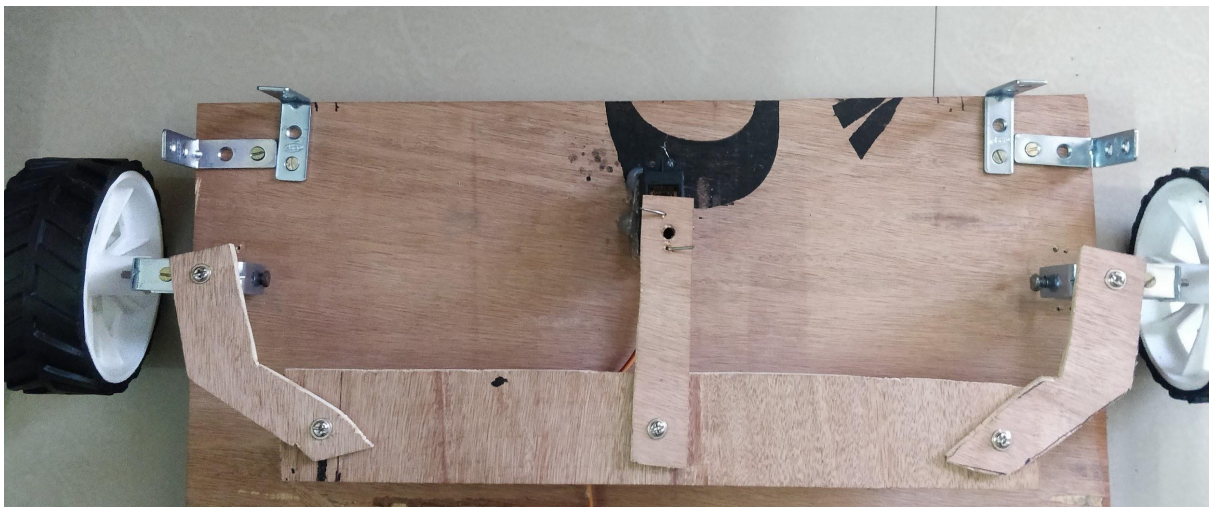
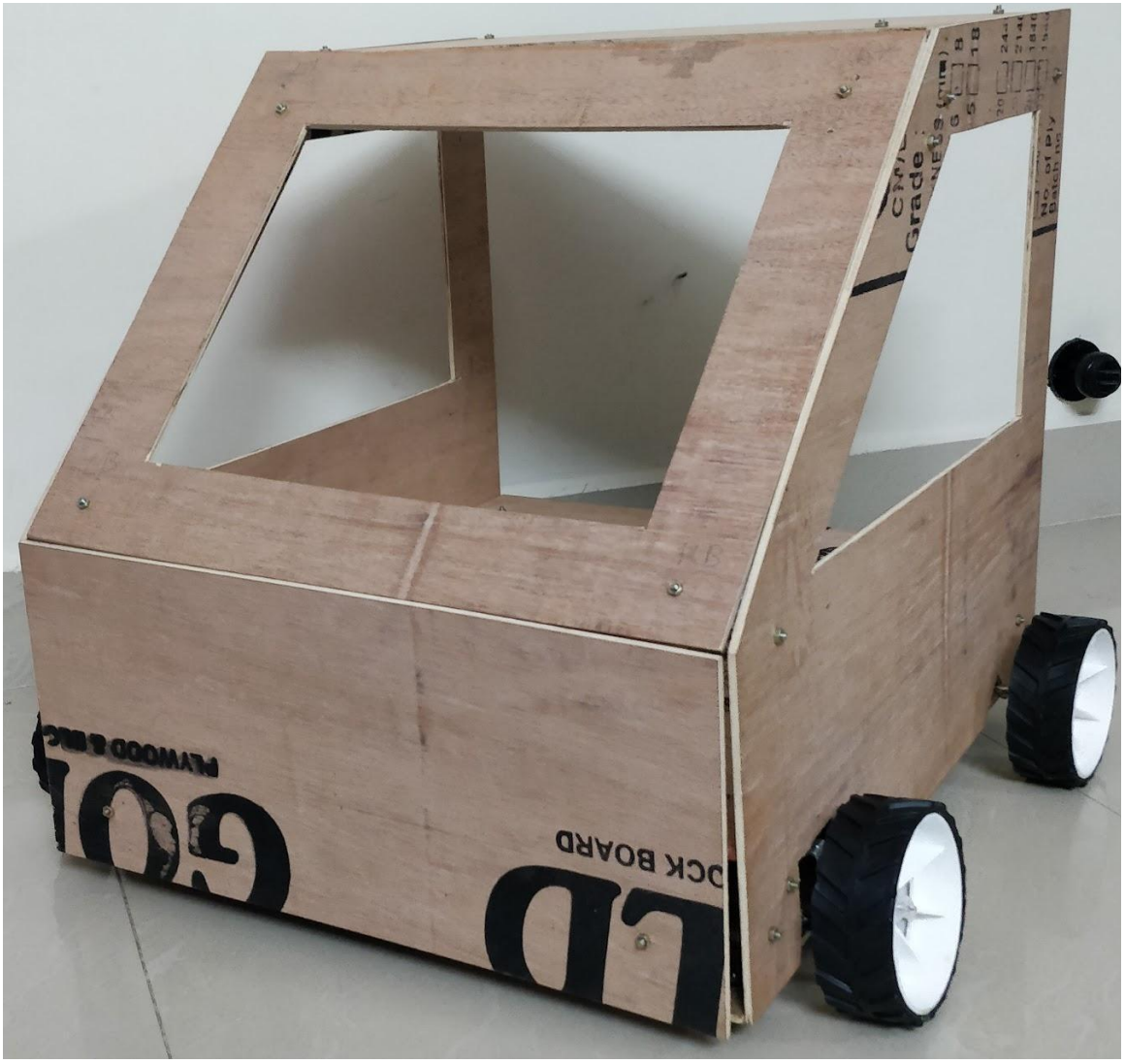


Fig.no.4.5(d) ASSEMBLY



CHAPTER - 05

CALCULATION

7.1 REQUIREMENTS

Gross weight of vehicle = 250 kg

Required speed = 50 kmph

Wheel size = 10 inches

= 0.254 m

Wheel Radius = 0.127 m

Efficiency of motor = 85%

Rolling Resistance = 0.02

Coefficient of Drag = 0.2

Area of vehicle = 3.3 m^2

Density of air = 1.216 kg/m^3

7.2 ASSUMPTIONS

Total weight = 300 Kg = 2940 N

Maximum Speed = 50 Km/h = 14 m/s

Wheel Diameter = 0.445 m ; Radius = 0.2225 m

Coefficient of Rolling Resistance = 0.02

Coefficient of Aerodynamics Drag = 0.2

Density of Air = 1.225 Kg/m^3 = 12 N/m^3

Vehicle Dimensions:

Wheel base = 1.5 m

Total Length = 2.5 m

Breadth = 1.2 m

Height = 1.6 m

Linear Distance Travelled = $2*\pi*r$ = 1.4 m

RPM_{wheel} = Total distance travelled in an hour / Linear distance Travelled

= 600 rpm

Power required = $[(M*g*R_r) + (\text{Air Density}*C_d*\text{Frontal Area}*0.5*V_{max}^2)]*V_{max}$

= 1600 W

= 1.6 KW

Torque = 26 Nm

7.3 FEASIBILITY:

1. The model is made feasible as a project by scaling it down with a ratio of 1:4 and made the design to be compact in manner.
2. All the derived calculations and values are reduced to the decided ratio respectively.

7.4 DIMENSIONS:

Length	=	50 cm
Breadth	=	45 cm
Height	=	45 cm
Wheel diameter	=	11 cm

7.5 BATTERY CAPACITY

Power	=	V*I
Energy stored, E	=	V*I*T
	=	Q*V
Battery capacity, Q	=	26.4/12
Q	=	2.2 Ah

7.6 BLDC MOTOR SPECIFICATIONS

Voltage	=	48v
Rated Speed	=	3000±100 rpm
Rated Torque	=	7.6 Nm
Rated Current	=	45 A
Maximum Output Torque	=	22 Nm
Rated Power	=	2000 W
Maximum Power Output	=	3000 W
Efficiency	=	>83%
Number of Poles	=	8
Motor Diameter	=	145 mm
Peak Protection Current	=	60 A

CHAPTER - 06

CONCLUSION AND FUTURE SCOPE

6.1 CONCLUSION

6.2 FUTURE SCOPE

1. Our idea is not only to make arrangements for the disabled to travel independently but also to provide an autonomous nature to the vehicle so that it would be easy, independent and comfortable for them to travel from one place to another.
2. The way forward is to provide an autonomous electric vehicle for the disabled which also concentrates on the aspect of sustainable development by using electricity as fuel instead of conventional fuels.

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11. Saurabh Chauhan, “Motor Torque Calculations For Electric Vehicle” International Journal of Scientific and Research Volume 4, Issue 08,August 2015.

APPENDIX 1

ARDUINO MEGA

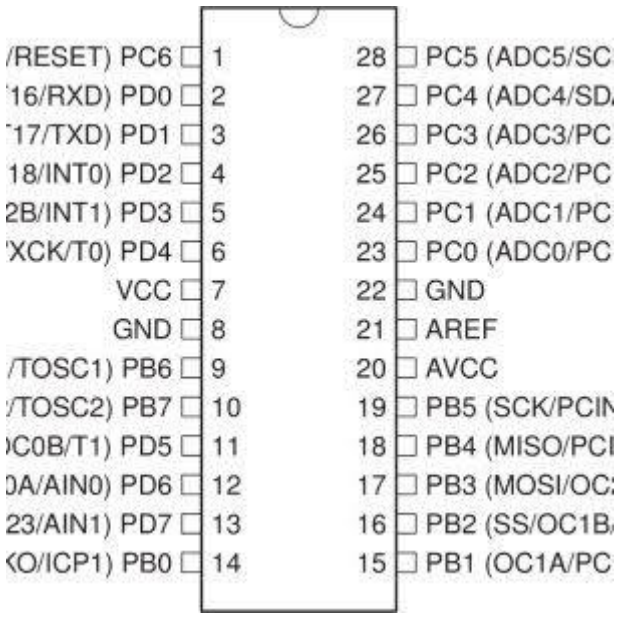

fig.no.A1

MOTOR DRIVER

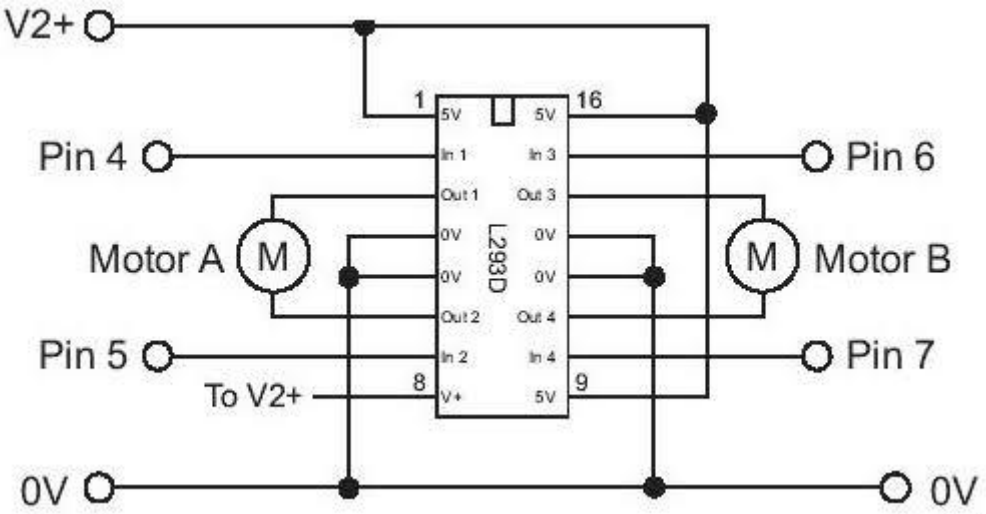

fig.no.A2

BLUETOOTH MODULE

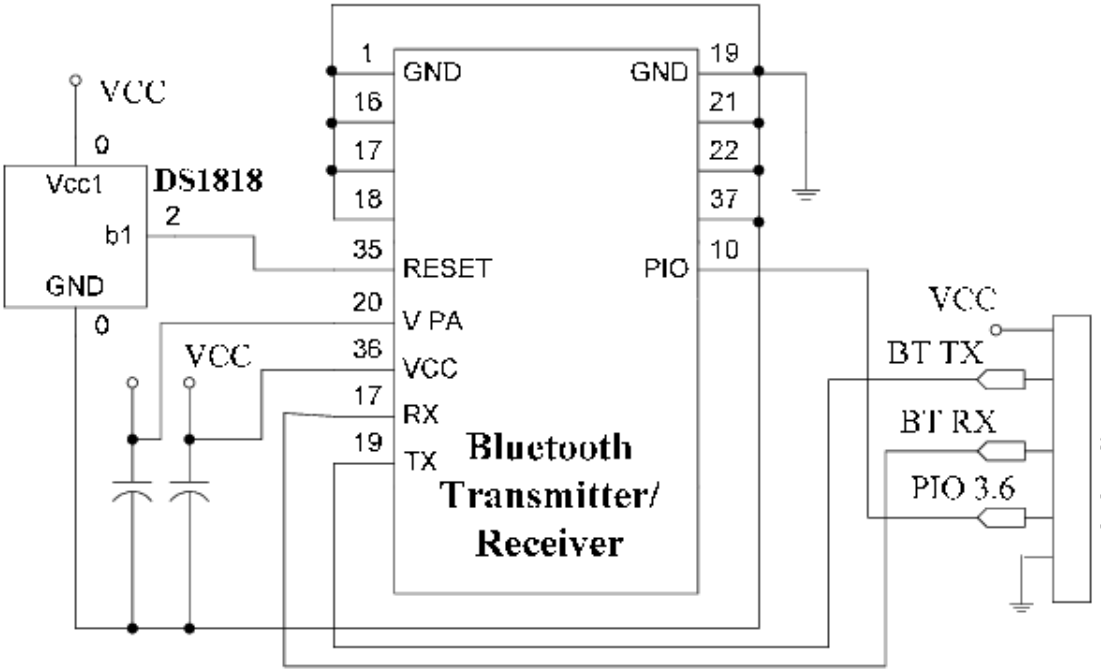

fig.no.A3

APPENDIX 2

```
#include<Servo.h>
int pos=0;
int opt=0;
int flag=0;
unsigned long pcnt=0;
unsigned long ccnt=0;
unsigned long tt=0;
unsigned long sttime[100]={0};
unsigned long stmove[100];
int nos=0;
int rt=0;
int lt=0;
const int ena=2;
const int enb=7;
const int int1=3;
const int int2=4;
const int int3=5;
const int int4=6;
Servo myservo;


void setup()
{
 Serial.begin(9600);
 myservo.attach(9);
 pinMode(ena,OUTPUT);
 pinMode(enb,OUTPUT);
 pinMode(int1,OUTPUT);
 pinMode(int2,OUTPUT);
 pinMode(int3,OUTPUT);
 pinMode(int4,OUTPUT);
 digitalWrite(ena,HIGH);
 digitalWrite(enb,HIGH);
 digitalWrite(int1,LOW);
 digitalWrite(int2,LOW);
 digitalWrite(int3,LOW);
 digitalWrite(int4,LOW);
 Serial.setTimeout(10);
 for(int i=0;i<100;i++)
 {
  sttime[i]=0;
 }
}
void loop()
{
 Serial.println("Enter your option:");
 while(Serial.available()==0){}
 opt=Serial.parseInt();
 if(opt==7)
 {
  teach();
 }
 else if(opt==8)
 {
```

```
   repeat();
}
}
void teach()
{
 for(int i=0;i<100;i++)
 {
  sttime[i]=0;
 }
 nos=0;
 ccnt=millis();
 while(pos!=6)
 {
  while(Serial.available()>0 )
  {
   pos=Serial.parseInt();
   if(pos==6)
   {
    return;
   }
   if(pos!=0)
   {
    ccnt=millis();
    tt=(ccnt-pcnt);
    pcnt=ccnt;
    Serial.print("Time taken : ");
    Serial.println(tt);
    display();
    sttime[nos]=tt;
    stmove[nos]=pos;
    nos=nos+1;
   }
  }
 }
}
void repeat()
{
 if(nos==0)
 {
  Serial.println("No data found");
 }
 else
 {
  nos=0;
  pos=stmove[nos];
  while(pos!=6)
  {
   pos=stmove[nos];
   Serial.println(pos);
   display();
   delay(sttime[nos+1]);
   nos=nos+1;
   if(pos==0)
   {
    return;
   }
  }
 }
}
void display()
{
 if(pos==1)
 {
  if(flag==2)
```

```
    {
     digitalWrite(int1,LOW);
     digitalWrite(int2,LOW);
     digitalWrite(int3,LOW);
     digitalWrite(int4,LOW);
     Serial.println("Motor stops");
     if(rt==1)
     {
      rt=0;
      myservo.write(100);
      delay(500);
      myservo.write(90);
     }
     if(lt==1)
     {
      lt=0;
      myservo.write(70);
      delay(500);
      myservo.write(90);
     }
     Serial.println("Straight");
     flag=0;
    }
    else
    {
     flag=1;
     Serial.println("Motor runs
forward");
     digitalWrite(int1,HIGH);
    digitalWrite(int2,LOW);
     digitalWrite(int3,HIGH);
     digitalWrite(int4,LOW);
     if(rt==1)
     {
      rt=0;
      myservo.write(100);
      delay(500);
      myservo.write(90);
     }
     if(lt==1)
     {
      lt=0;
      myservo.write(80);
      delay(500);
      myservo.write(90);
     }
     Serial.println("Straight");
   }
  }
  else if(pos==4)
  {
   if(flag==1)
   {
    digitalWrite(int1,LOW);
    digitalWrite(int2,LOW);
    digitalWrite(int3,LOW);
    digitalWrite(int4,LOW);
    Serial.println("Motor stops");
    if(rt==1)
    {
     rt=0;
     myservo.write(100);
     delay(500);
     myservo.write(90);
```

```
    }
    if(lt==1)
    {
     lt=0;
     myservo.write(80);
     delay(500);
     myservo.write(90);
    }
    Serial.println("Straight");
    flag=0;
   }
   else
   {
    flag=2;
    Serial.println("Motor runs
backward");
    digitalWrite(int1,LOW);
    digitalWrite(int2,HIGH);
    digitalWrite(int3,LOW);
    digitalWrite(int4,HIGH);
    if(rt==1)
    {
     rt=0;
     myservo.write(100);
     delay(500);
     myservo.write(90);
    }
    if(lt==1)
    {
     lt=0;
     myservo.write(80);
     delay(500);
     myservo.write(90);
    }
    Serial.println("Straight");
   }
  }
  else if(pos==2)
  {
   lt=1;
   rt=0;
   myservo.write(110);
   Serial.println("Left");
  }
  else if(pos==3)
  {
   rt=1;
   lt=0;
   myservo.write(70);
   Serial.println("Right");
  }
  else if(pos==5)
  {
   digitalWrite(int1,LOW);
   digitalWrite(int2,LOW);
   digitalWrite(int3,LOW);
   digitalWrite(int4,LOW);
   Serial.println("Motor stops");
   if(rt==1)
   {
    rt=0;
    myservo.write(100);
    delay(500);
    myservo.write(90);
```

```
  }
  if(lt==1)
  {
    lt=0;
    myservo.write(80);
    delay(500);
    myservo.write(90);
  }
  Serial.println("Straight");
}
else if(pos==6)
{
    digitalWrite(int1,LOW);
    digitalWrite(int2,LOW);
    digitalWrite(int3,LOW);
    digitalWrite(int4,LOW);
    Serial.println("Motor stops");
    if(rt==1)
    {
     rt=0;
      myservo.write(100);
      delay(500);
      myservo.write(90);
    }
    if(lt==1)
    {
      lt=0;
     myservo.write(80);
      delay(500);
      myservo.write(90);
    }
    Serial.println("Straight");
    return;
  }
}
```

RAJALAKSHMI ENGINEERING COLLEGE

DEPARTMENT OF MECHATRONICS ENGINEERING

VISION:

To attain excellence in academics, research and technological advancement in Mechatronics Engineering with a concern for society.

MISSION:

To impart high quality professional education and produce Mechatronics Engineers with all round knowledge of multi-disciplinary branches of engineering and technology. To foster skill sets required to be a global professional in the areas of automation, intelligent systems, robotics, research for technology management and to fulfill the expectations of industry and needs of the society. To inculcate entrepreneurial qualities for creating, developing and managing global engineering ventures.

PROGRAMME EDUCATIONAL OBJECTIVE(PEO)

PEO1 :
Graduates will have a comprehensive knowledge in the analytical, scientific and engineering fundamentals necessary to model, analyse and solve engineering problems and to prepare them for graduate studies and for successful careers in industry.

PEO2 :

Graduates will effectively design and develop products in areas such as manufacturing, motion control, machine vision, system simulation, intelligent systems, automotive systems and robotics.

PEO3 :

Graduates will acquire Technical expertise, Leadership skills, Ethical practices and Team spirit with a concern towards greener society.

PROGRAMME OUTCOMES(PO)

Engineering Graduates will be able to:

- **Engineering knowledge:** Apply knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

- **Problem analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

- **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations.

- **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

- **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

- **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

- **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

- **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

- **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

- **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES(PSO)

PSO1 : To innovate a Mechatronics system to meet the requirements and specifications.

PSO2 : To analyse and improve the performance of a Mechatronics system and enhance the intellectual capabilities of the system.

PSO3 : To lead professional career in industries or an entrepreneur by applying Engineering and Management principles and practices.