DESIGN AND FABRICATION OF AUTOMATIC GROUND CLEARANCE ADJUSTMENT CAR

A DESIGN PROJECT REPORT

Submitted by

K. SHARAN KUMAR (18127060)

B. RAGHULMANIKANDAN (18127046)

ALLENS JOHN (18127062)

A. PRAVEEN KUMAR (18127031)

In partial fulfilment for the award of the degree

Of

Bachelor of Technology

In

MECHANICAL ENGINEERING

SCHOOL OF MECHANICAL SCIENCE

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BONAFIDE CERTIFICATE

Certified that this Project Report titled "**DESIGN AND FABRICATION OF AUTOMATIC GROUND CLEARANCE ADJUSTMENT CAR**" is the Bonafide work of **B. RAGHUL MANIKANDAN (18127046), ALENS JOHN (18127062), K. SHARAN KUMAR (18127060), A. PRAVEEN KUMAR (18127031)** who carried out the project work under my supervision during the academic year 2021-2022

29/4

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ACKNOWLEDGEMENT

First and foremost, I would like to thank the Lord Almighty for His presence and immense blessings throughout the project work.

I would like to thank my internal guide Mr. Elvin Roy, Assistant professor, Department of Mechanical Engineering for continually guiding and actively participating in my project, giving valuable suggestions to complete the Project work.

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I would like to thank all the technical and teaching staffs of the Mechanical Engineering Department, who extended directly or indirectly all support.

Last, but not least, I am deeply indebted to my parents who have been the greatest.

SHARAN KUMAR K

B RAGHULMANIKANDAN

ALENS JOHN

PRAVEEN KUMAR A

ABSTRACT

The handling of vehicle depends upon the various parameters center of gravity of the vehicle is one of them. For better handling of the vehicle, we need to keep center of gravity as low as possible. Whereas a sedan car or hatchback has to run on smooth roads as well as on rough terrains sometime with its fixed lower ground clearance which tends to create dents on the bottom portion the car. In both cases we need an adjustable ground clearance system in the vehicle to have optimum performance. Most commercial vehicles currently on the market are still equipped with a passive suspension system, while some luxury brands may already use an adaptive suspension. Active suspension systems on the other hand are rarely found, however, they offer great opportunities to close the gap of the well-known trade-off between ride comfort and handling. Besides that, they can also be used to mitigate single event disturbances, an objective of the USA army as announced in a solicitation which initiated and motivated this research. In addition to that, several studies were found stating the impact and danger of potholes and their impact on the vehicle and passenger. “Pneumatic jack” fabricated model consists of a pneumatic control valve which regulates the air flow and double acting cylinder used as a jack which performs lifting. Thus, the car is lifted using jack and the problem related to tires such as puncture types, tire replacement and wheel balancing can be resolved with less effort and time.

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HINDUSTAN
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CHENNAI

Department of Mechanical Engineering

MEB4441 – PROJECT – VIVA VOCE (8th MECH)

Project Batch No. **:** 11

Title of the Project **:** DESIGN AND FABRICATION OF AUTOMATIC GROUND CLEARANCE ADJUSTMENT CAR

No of students in the Batch **:** 4

I. *Students' Individual contribution*

Name of the student : SHARAN KUMAR. K

Register No. : 18127060

Myself, Sharan Kumar k contributed to my utmost level for the present project by selecting literature papers and took all the necessary information about the modelling of Automatic Ground Clearance Adjustment Car. Then I contributed by design this project and also did some parts of the machine using CATIA v5. Then my role in this project is to collect the chapters related to Modelling and completed the same MS Word. I extended my support in the final alignment and all other necessary were done as per the UG Project Guidelines in our report work.

Name and Signature of Student

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MEB4441 – PROJECT – VIVA VOCE (8th MECH)

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No of students in the Batch **:** 4

Students' Individual contribution

Name of the student : B RAGHULMANIKANDAN

Register No. : 18127046

Myself, B Raghul Manikandan contributed to my utmost level for the present project by selecting literature papers and took all the necessary information about the modelling of Automatic Ground clearance Adjustment Car. Then I contributed by doing the fabrication works as well as assembling the parts. Then my role in this project is to create a code for the Arduino which helps to perform the required process. I extended my support in the final alignment and all other necessary were done as per the UG Project Guidelines in our report work.

Name and Signature of Student

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MEB4441 – PROJECT – VIVA VOCE (8th MECH)

Project Batch No. : 11

Title of the Project : DESIGN AND FABRICATION OF AUTOMATIC GROUND CLEARANCE ADJUSTMENT CAR

No of students in the Batch : 4

Students' Individual contribution

Name of the student : ALENS JOHN

Register No. : 18127062

Myself, Alens john contributed to my utmost level for the present project by selecting literature papers and took all the necessary information about the modelling of Automatic Ground Clearance Adjustment Car. Then I contributed by doing the design for this project and also collected Literature survey. Then my role in this project is to collect the chapters related to Modelling and completed the same in MS Word. I extended my support in the final alignment and all other necessary were done as per the UG Project Guidelines in our report work.

Name and Signature of Student

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INSTITUTE OF TECHNOLOGY & SCIENCE
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CHENNAI

Department of Mechanical Engineering

MEB4441 – PROJECT – VIVA VOCE (8th MECH)

Project Batch No : 9

Title of the Project : DESIGN AND FABRICATION OF AUTOMATIC GROUND CLEARANCE ADJUSTMENT CAR

No of students in the Batch : 4

Students' Individual contribution

Name of the student : A. PRAVEEN KUMAR

Register No. : 18127031

Myself, Praveen kumar. A contributed to my utmost level for the present project by selecting literature papers and took all the necessary information about the Automatic Ground Clearance Adjustment Car. Then I contributed by suggesting the selection of materials for our project model. Then my role in this project is to collect the chapters related to Fabrication of the project, circuit designing and completed the same in MS Word. I extended my support in the final alignment and all other necessary were done as per the UG Project Guidelines in our report work.

Name and Signature of Student

CHAPTER 1

1.1 INTRODUCTION

Road conditions are not similar at all places, it changes with application, environment and climate. In city at different sectors like school, hospital there are speed breakers of different dimensions. At certain condition road goes straight without any pits else we found irregularity. Most of the people buy only one four wheeler which they use that at all this condition. Hence, it's necessary to give some standard ground clearance to the vehicle. But still there are some obstructions while driving the car on highway and in city. It is not possible for the off-road vehicle to run at high speed on its standard ground clearance provided considering the city obstacles and on-road cars to run over the rough terrain with its lower ground clearance. To obtain the good performance at high speed and low speed it is necessary to build one system which can vary the ground clearance. This can be achieved by changing the suspension height so that the chassis height can be adjusted with respect to the speed and the quality of roads. Suspension systems plays vital role while designing the car for good stability and road holding ability. It is very difficult to achieve this ability at all road condition with passive suspension system only. This problem can be solved by active suspension system but this is not widely used because it required more external energy and additional controlling system which affects the cost of the vehicle. With a view to reduce the complexity and the cost while improving ride, handling and performance we can use the combination of active and passive

suspension system. In this paper various parameters are discussed which are related to the ground clearance and suspension system and its control. This gives the idea about the vehicle characteristics like ride control, height control, roll control, road holding etc. and its effect on vehicle performance. Ground clearance is the position of the vehicle body (sprung mass) above the basic ground level. It is an important parameter in off-road vehicle. For a certain car's weight, there is a certain amount of mechanical down force which act on tires, and therefore the grip of tires is constantly changing during running condition. The whole weight of vehicle is concentrated at a point known as center of gravity. At the lower ground clearance, we get the location of center of gravity near the ground level. This reduces weight transfer during cornering, accelerating, and braking and increase the vehicle performance. Also, by lowering the front end and raising the rear end, we can improve high speed stability. Since the center of gravity has an influence on most of the parameters during running of the vehicle. We need a location of center of gravity at a high level as well as at lower level according to road conditions. We have designed a simple pneumatic linkage mechanism for ground clearance adjustment. The adjustment is possible with the help of an active and a passive suspension which are linked together in series. Active suspension is placed below the passive suspension. With the help of this system, we can vary ground clearance of the vehicle up to 200mm. Pneumatic cylinders are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Like in hydraulic cylinders, something forces a piston to move in the desired direction. Thus, it produces a lift in desired direction. Air compressor is

utilized to produce a pneumatic lift to increase the ground clearance whenever required otherwise it brings the chassis down to its position to have standard ground clearance by acting as an active suspension system

1.2 PROBLEM STATEMENT

Higher ground freedom quite often implies the vehicle has a generally higher focal point of gravity. As a rule, this will in general inadequately influence taking care of, on the grounds that it makes a bigger second about a hub on the ground plane. In the event that their ground freedoms high, at that point it impacts on motor productivity causes less efficiency. For lower ground freedom vehicle, it's passed from on any snag then it effortlessly scratched.

1.3 PRINCIPLE

The main principle of the project is Our entire framework is mounted on outline which is move with the assistance of wheels. Toward the front of the framework there is sensor. We take ultrasonic sensor here. These sensors sense the article before outline. Ultrasonic sensor utilizes transducer and beneficiary to send and get single. When there is an item before the framework, our framework is lift. This lift happens with the assistance of pneumatic chamber. Ultrasonic sensor offers single to pneumatic chamber and casing lift upward way. As the article die pneumatic chamber goes down.

1.4 OBJECTIVE

1. The automatic in-built pneumatic system is used to lift the chassis from the ground without human efforts and time.
2. Pneumatic lifting technique system is used to provide higher ground clearance at the time of rough roads and speed bumps.
3. To cope up the shortage of most commonly used fuel and go for compressed air or liquid fuel as a working medium.
4. While driving four wheelers, we faced a problem related to tyres. A hydraulic operated jack is placed in a supportable position where transitional motion to lift vehicle.
5. In several automobile garages, revealed the facts that mostly some difficult methods were adopted in lifting the vehicles for reconditioning.
6. Hence a suitable Design has been designed such that the vehicle can be lifted from the floor land without application of any impact force.
7. In order to avoid all such disadvantages, the automatic jack has been designed in such a way that it can be used to lift the vehicle very smoothly without any impact force.
8. In order to fulfil the needs of present car jack, some improvement must be made base on the problems statement:
    i. To design and develop efficient jack system.
    ii. To minimize human effort.

CHAPTER 2

LITERATURE REVIEW

2.1 PRIOR SURVEY

Hrishikesh V Deo& Nam P Suh Et.al introduced that how the comfort and handling are interrelated with center of gravity of the vehicle. They designed the suspension system which varies its height and stiffness according to speed. The researchers used short long arm suspension system which is widely used in front wheel suspension. For controlling the height and stiffness, it can be achieved by making the lower spring pivot movable along the lower control arm. For moving the pivoted point and achieve desired position electric motor is used to actuate the actuator. But there are some limitations which we come across, that is about less quick response. In this paper they also described about active and semi-active suspensions limitations and how it can be overcome with adaptive control with variable height.

P Uys, P.S. Els, M. ThoressonEt.al. E. presented the suspension settings for optimal ride comfort of offroad vehicles travelling on roads with different roughness and speeds. In this they vary the suspension settings for different roads roughness and vehicle speeds and results achieved for comfort level. Simulation is performed on a Land Rover Defender 110 model in MSC.ADAMS software for speeds ranging from 10 to 50 km/hr. Tests were

performed on 100m Belgian paving and also ISO 2631-1, BS 6841 and VDI 2057 at different speeds. Correlation between measured and simulated results is very good, especially with respect to vertical acceleration. There are number of applications related to ground clearance and their consideration is designer need. To give the information about vital role of ground clearance.

DebojyotiMitra Et.al presented design optimization of ground clearance of domestic cars. Stability and performance is also parameter of ground clearance. If we allow the vehicle for the low ground clearance then it helps to give less drag force simultaneously it consumes less fuel resulting less pollution. The experiment is carried out in wind tunnel with the help of notch back car model. The result shows that the positive lift force reduces with increasing height of ground clearance. Hence the optimized value of h/b ratio has to be taken in to consideration of clearance design. With the help of spoiler, the lift force problem can be solved. The active suspension system is very essential for handling and giving comfort. These days this system is used in different type of vehicles like hybrid vehicles

Morteza and Mahdi Et.al presented active suspension system in parallel hybrid electric vehicles. In this they compare the conventional and hybrid vehicle with active suspension. For conventional the power is taken from the IC engine hence gives little lag in actuation while in hybrid electric vehicle it is direct, resulting less fuel consumption and less emission.

Guangqiang Wu, Guodong Fan, and JianboGuo Et.al presented ride comfort evaluation for road vehicle based on rigid-flexible coupling multibody dynamics. Spectrum of vibrations occurs in the vehicle due to various speeds. There are different road profiles and roughness therefore occupants are subjected to accelerations in different directions, which caused discomfort. With the help of ADAMS-CAR they built rigid and rigid flexible coupling multibody vehicle models. As speed increases the relative difference goes increases, at 80 km/hr it becomes 8%. It is better to build the variable suspension with rigid flexible coupling.

Mohammad, Mahir and IyadEt.al gives new control strategy for active suspension using modified fuzzy and PID controllers. In this they proposed controlled strategy to control the suspension system by means of electrohydraulic actuator. The passive suspension is replaced by low frequency active suspension. The quarter car model tested under rolling effect, cornering and pitching effect at different speeds and road profiles. The reduction in body acceleration by 60% gives better road holding and car stability. There are two types of active suspensions which are commonly recognized that are low bandwidth and high bandwidth. Non-linear controllers are more capable to handle high bandwidth active suspension because they show good capability at worst road condition. Researchers give the linear controller over active suspension of low bandwidth new PID with fuzzy switch which improve the performance of suspension. The design of suspension is concern with three main parameters; car body acceleration for

ride comfort, the tire deflection for road holding and the suspension travel. The ideal suspension system would minimize these three quantities for any road and operating condition, which is not achievable for suspension having constant spring stiffness and damping. This can be achieved by active suspension system. But this needed high external energy. Hence it is not widely used. The alternative solution is to use of semi-active suspension. It reduces car body resonance without compromising road holding. But this solution gives disturbance like jerk, rattling noise etc.

CHAPTER 3

3.1 METHODOLOGY

We started the work of this project with literature survey. We gathered many research papers which are relevant to this topic. After going through these papers, we learnt about Fatigue Testing Machine. After that the components which are required for our project are decided. After deciding the components, the 3 D Model and drafting will be done with the help of CATIA software. The components will be manufactured and then assembled together. The experimental observations will be taken, calculations will be done and then the result will be concluded

3.2 AUTOMATIC GROUND CLEARANCE

The components consist of essential of Chassis, D.C Motors, Ultrasonic Sensors, indicators, and Batteries. These components are used to Design and Fabrication of Automatic Ground Clearance Adjustment System. The working mechanism of in this system is Ultra Sonic Sensors are placed under the bumper and at middle and rare parts of the chassis. Ultrasonic Sensors detects the clearance height of the vehicle continuously. The Ultrasonic sensors detect the obstacles (speed breakers, slopes etc.) and sends signals to the relay board circuit. By using relay switch, the relay board sends power supply to the solenoid valve. The pneumatic cylinder lifts the chassis

there by increasing the ground clearance. When the ultrasonic sensors detect no obstacles, they send signals to the relay unit, and then the solenoid valve acts and it to the pneumatic cylinder lowers the chassis thus by maintaining the normal ground clearance. Working mechanism Torque, moment, or moment of force is the tendency of a force to rotate an object about an axis, fulcrum, or pivot. Just as a force is a push or a pull, a torque can be thought of as a twist to an object. Mathematically, torque is defined as the cross product of the position vector of the point where the force is applied (distance vector) and the force vector, which tends to produce rotation. The magnitude of torque depends on three quantities: the force applied, the length of the lever arm connecting the axis to the point of force application, and the angle between the force vector and the lever arm.

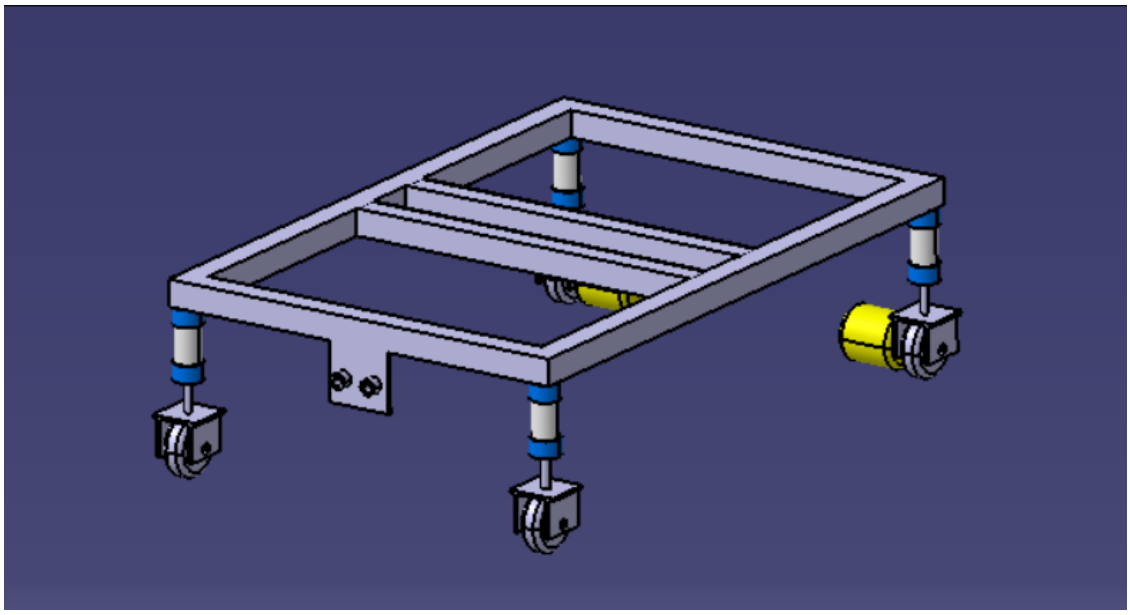


FIG 3.1- Frame

3.3 WORKING PRINCIPLE

Our entire framework is mounted on outline which is move with the assistance of wheels. Toward the front of the framework there is sensor. We take ultrasonic sensor here. These sensors sense the article before outline. Ultrasonic sensor utilizes transducer and beneficiary to send and get single. When there is an item before the framework, our framework is lift. This lift happens with the assistance of pneumatic chamber. Ultrasonic sensor offers single to pneumatic chamber and casing lift upward way. As the article die pneumatic chamber goes down.

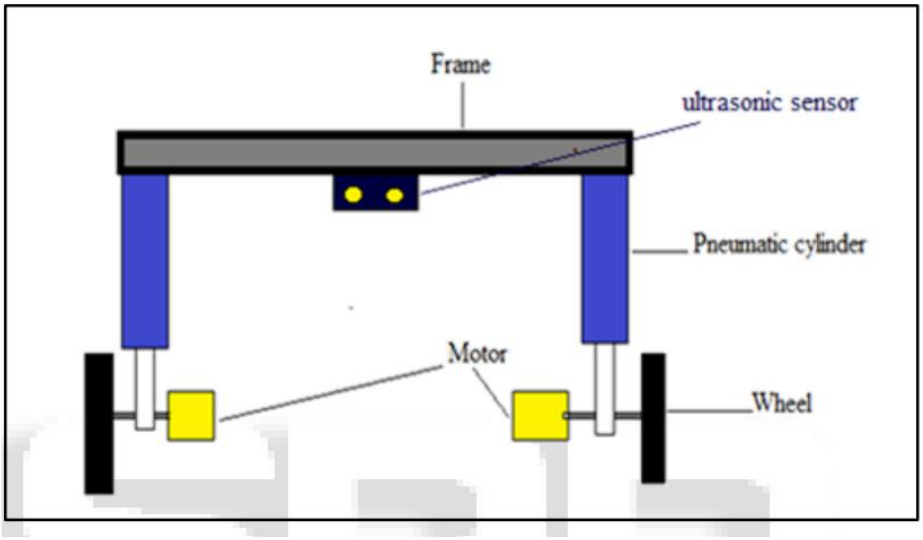


FIG 3.2: Component

3.4 PROPOSED METHOD

Pneumatic lift in a vehicle can be achieved by pneumatic cylinder employing a reciprocating compressor. Compressor compresses the gas to a high pressure. This high pressurized gas then sends to pneumatic cylinders to exert force against the piston head inside it to have the piston movement to create a linear motion outward. By lowering the pressure of gas, the piston movement can be reversed. And with this mechanism ground clearance of the vehicle can be increased or decreased the whole lifting mechanism act as active suspension system consisting of four pneumatic cylinders which are mounted between each wheel assembly and passive suspension system in such a way so that the outer dead center of cylinder faces upwards and inner dead center faces downwards. The inlet of each cylinder is connected to the accumulator via air tubes. Accumulator is attached to the outlet of reciprocating compressor through air tubes which is mounted over the chassis at the fixed position. An electric motor drives the reciprocating compressor using the battery power which is charged by the engine. There are two button system on the dashboard, one to turn on the motor and one to open the outlet of pneumatic cylinders to release the high pressurized gas. A person driving a car on a smooth road when sees rough bumpy road or rough terrain in front of the vehicle, he can choose to increase the ground clearance just by pressing the button which is assigned to start the motor by connecting it with the battery. And as the rough terrain ends driver of vehicle can decrease the chassis height by pressing another button assigned to open the exhaust valve of the pneumatic cylinders to release the high pressurized air to the

atmosphere which makes all the lifted pistons of pneumatic cylinders to get down to the position of inner dead center. Releasing the pressed button ensures the closing of outlet valve of pneumatic cylinders. And again, driver can have the standard ground clearance of the car to have a proper center of gravity so to utilize the full potential of acceleration Prototype of this project consists of one chassis with four wheels with their axle shafts attached to it, one reciprocating compressor, four motors, a DPDT controller and rest of the design accessories. The prototype vehicle runs by the electric motors and compressor which runs on the battery power is employed to produce the pneumatic lift at each vehicle to increase the ground clearance of the vehicle. A controller is used to operate the compressor and motors to run the mechanism.

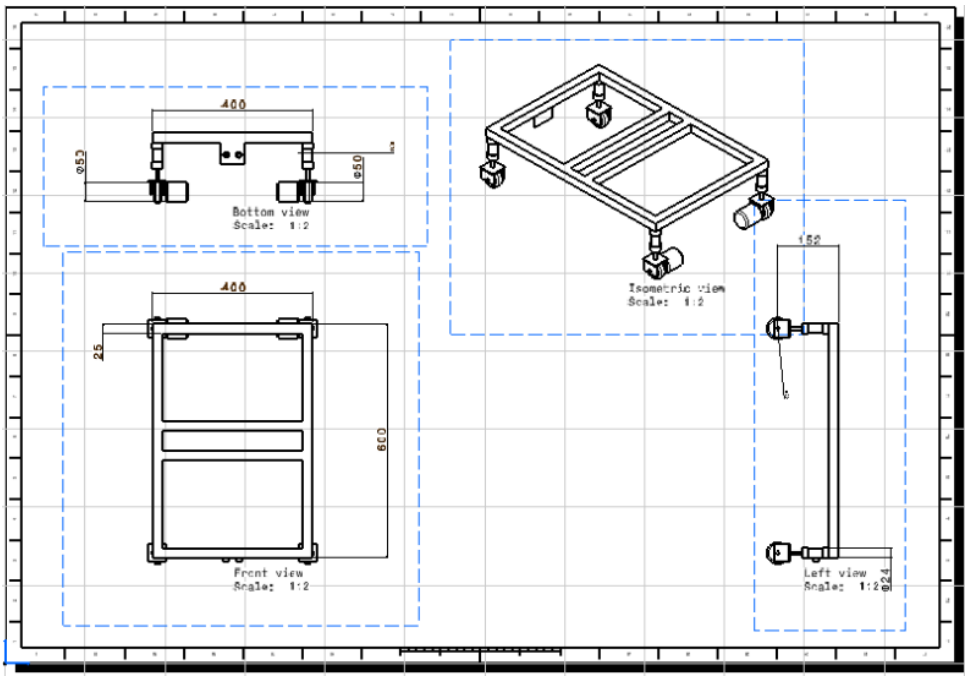


Figure 3.3-prototype design

3.5 ULTRASONIC SENSOR

Ultrasonic sensors like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse. The working principle of this module is simple. It sends an ultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated.

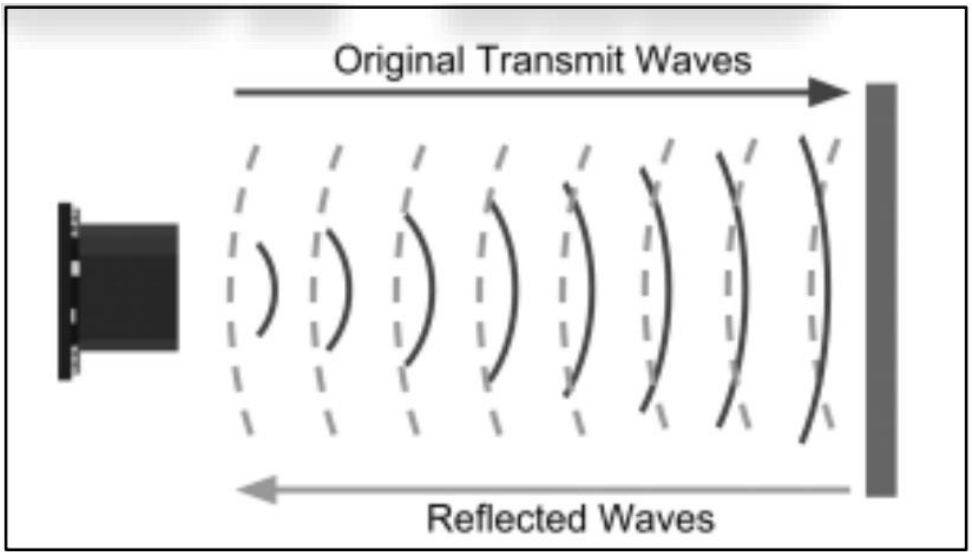


FIG 3.4: Ultrasonic sensor

3.6 PNEUMATIC CYLINDER

Pneumatic cylinder is mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Like hydraulic cylinders, something forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved. Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage. Because the operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement.

FIG 3.5 - Pneumatic cylinder

3.7 MOTOR

A motor is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire winding to generate force in the form of rotation of a shaft. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, (inverters or electrical generators). An electric generator is mechanically identical to an electric motor, but operates in the reverse direction, converting mechanical energy into electrical energy.

FIG 3.6 – Motor

3.8 COMPRESSOR

Horse Power	5 HP
Brand	Atlas Copco
Compressor Technology	Screw Compressor
Model Name/Number	GX5
Discharge Pressure	4 bars
Air Tank Capacity	200 litters

FIG 3.7 - Compressor

CHAPTER 4

MODELLING

4.1 DESIGN CACULATION

Given data:

Cylinder: 20×150

Bore diameter= 20mm

Stroke length= 150mm

Volume of air exhaust =stroke × area of piston =150× $\frac{\pi}{4}$ = $47123.88mm^3$

Area of piston = $\frac{\pi}{4}\times\ 20^2$= 314.15 mm^2

Outstroke force (F) = pressure × Area of cylinder =0.6×314.15 =188.49 N

Piston rod area = $\frac{\pi}{4}\times d^2 = \frac{\pi}{4}\times 7^2$ =38.48 mm^2

Effective area= piston area- piston rod area =314.15-38.48 =275.66 mm^2

The force applied to lift the crane in this problem is the in-stroke force. In-stroke force for various pressures,

1. P =0.4Mpa In-stroke force= P×A = 0.4×275.66 = 110.264N

2. P =0.6MPa In-stroke force= P×A =0.6×275.66 =165.39N

3. P =0.85MPa In-stroke force= P×A = 0.85×275.66 = 234.311N

4. Frame

We have considered frame size as, Length of frame=762 mm Breadth of frame=610 mm Now in our design as on the length part of the frame overall weight of the system is placed so the length part is considered as beam, and design is done accordingly. While designing the beam is considered as overhang beam as two motors are placed between the ends of beam, with uniformly distributed loading, Hence UDL=100 N/m Considering total mass of the prototype as 10kg. Now to calculate reactions we need to simplify the load diagram. Considering equilibrium conditions, now to find the reactions at A and B,

1.Moment about A is considered as 0. So, Rb=37.54 N

2.Forces in Y direction=0. So, Ra=38.56 N

Now we are doing calculations for shear force diagram, Sc=0 Sc=0 SFal=-15.2 N SFar=23.36 N SFbl=-22.34 N SFbr=15.2 N SFdl=0 Sfdr=0 Now we are doing calculations for bending moment diagram, BMc=0 BMa=-1.15 N-m BMb=0.23 N-m Bmd=0 Now we know that a point at which shear force is zero maximum bending moment occurs. X is the point at which maximum bending moment occurs. BMx=4.30 N-m=0.0043 N-mm Now we are using the square cross sectional pipe with thickness as 2 mm. So according to flexure formula for bending stress, (M/I)=(σ/Y) Now we know that, M=0.0043 N-mm Y=18.85 mm---------(distance of neutral axis) By using the

parallel axes theorem we can calculate the moment of inertia (I) I=IXX1-IXX2 I=(616.03-529.40)*10^3 =86.62*10^3 mm4 So from above data we can calculate, (0.004)/(86.62*10^3)=(σ/18.85) Hence σ =0.858 N/m2 This is the maximum permissible stress acting on frame.

4.2 MODELLING

4.2.1 CATIA V5

Computer Aided Design (CAD) is the use of computer software to design a product or an object. Computer Aided Manufacturing (CAM) is the use of computer software and hardware to plan, manage and control the operations of a manufacturing plant. Computer Aided Engineering is the use of computer software to solve engineering problems and analyze products created using CAD.

CATIA is an acronym for Computer Aided Three-Dimensional Interactive Application. It is the most proficient, powerful and highly popular CAD i.e., computer aided design software. It is created, developed and owned by Dassault Systems of France. IBM was the leading marketer of CATIA till 2010. Because of its high usability, CATIA certification is one of the most popular and sought-after certification in market

4.2.2 APPLICATIONS OF CATIA

CATIA is among the very few software which has its application in about every industrial sector. It is mostly used by the designer team. The designer team of any organization needs to create a digital copy of any object which has to be manufactured. This digital copy can be created with much ease by using CATIA. It is mostly found in companies who are associated with design and manufacturing of products.

4.2.3 IMPORTANCE OF CATIA

The two recent versions of CATIA that is CATIA V5 & V6 are renowned as the world's leading design product suite. This was possible because of two important factors; one was the industrial usability and other was the huge and constant investment made for product development and innovation. CATIA has wide range of application in the industry and because of this the demand for the product is also increasing.

CATIA was initially used in Automotive and Aerospace engineering for designing of the various parts and designs of the overall structure. With the advance in technology and CATIA's divers use, it can be used for many more things than just parts and structure designing. This has increased the areas of applications for CATIA. With mass production and usability, CATIA has also become affordable to the industry. Many big brands use CATIA as the basic engineering design platform.

4.3 MODELLING OF GROUND CLEARANCE ADJUSTMENT CAR

Pneumatics working fluid is also widely available and most factories are pre-plumbed for compressed air distribution, hence pneumatic equipment is easier to set-up then hydraulics. To control the system, only ON and OFF are used and the system consists only of standard cylinders and other components, making it simpler than hydraulics. The working fluid of the pneumatic system absorbs excessive force, leading to less frequent damage to equipment. We can lift the weight of 40 kg at pressure of 4-5bar.

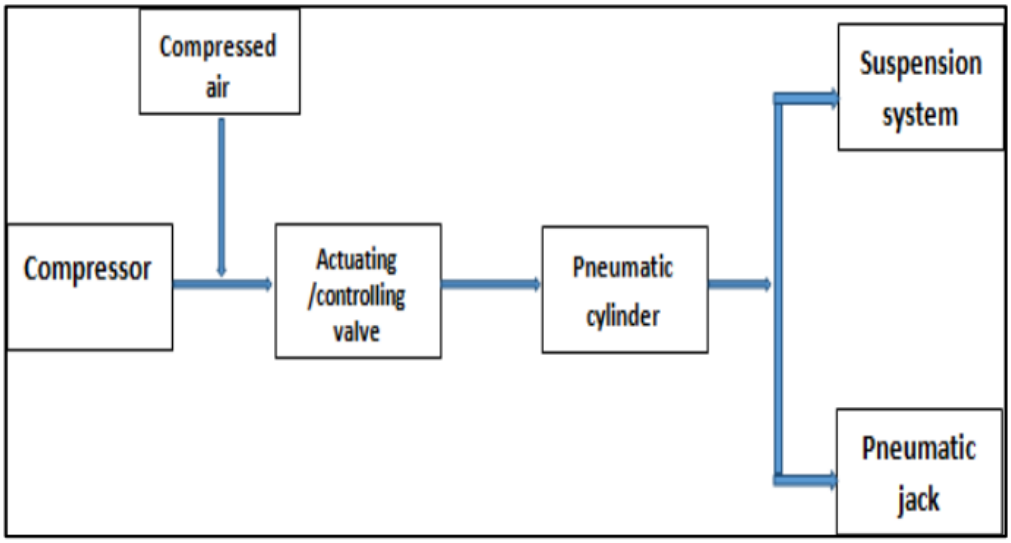


FIG 4.1-Working operation of pneumatic pump

4.4 PARTS MODEL OF AUTOMATIC GROUND CLEARANCE ADJUSTMENT CAR

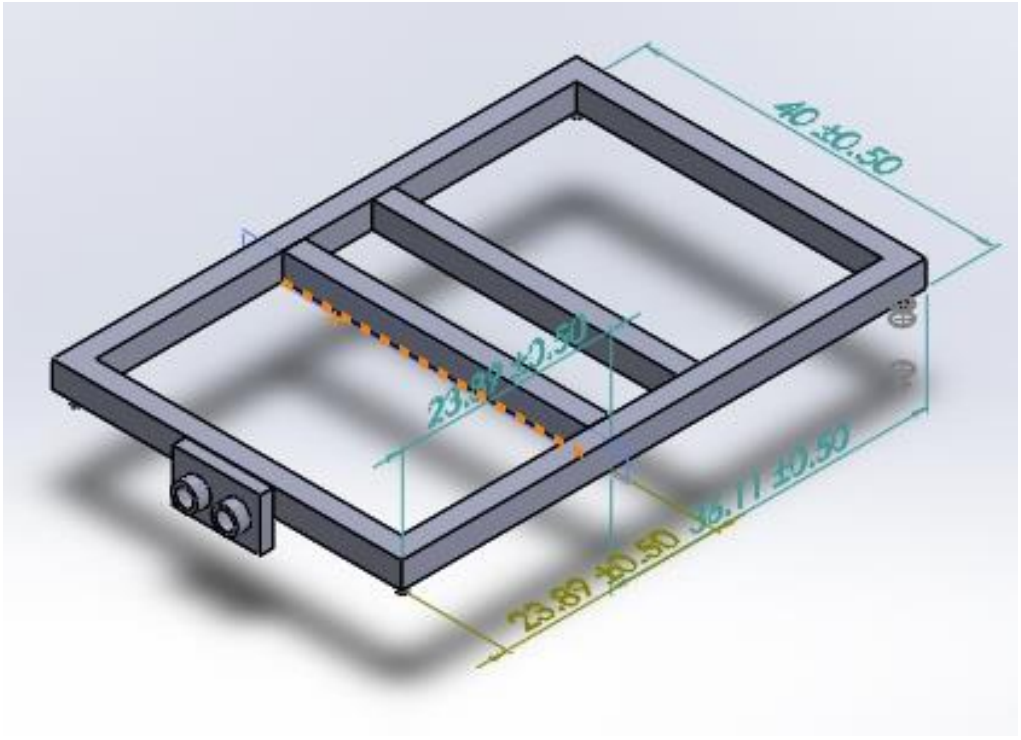


FIG 4.2 – Frame

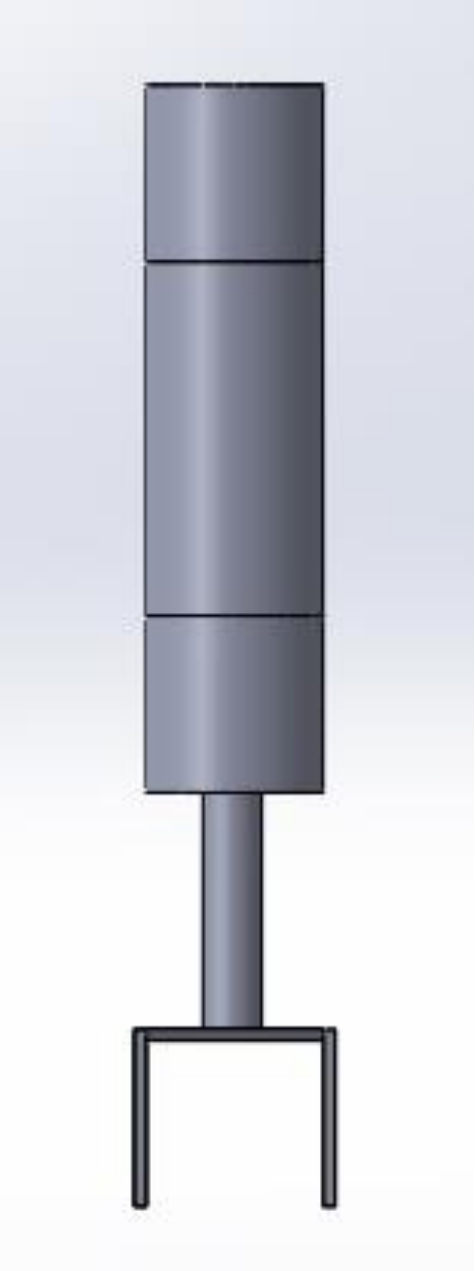


FIG 4.3 – Pneumatic pump

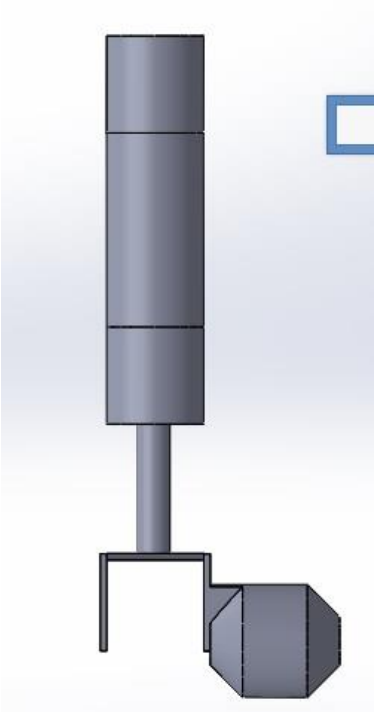


FIG 4.4- Pneumatic pump with motor

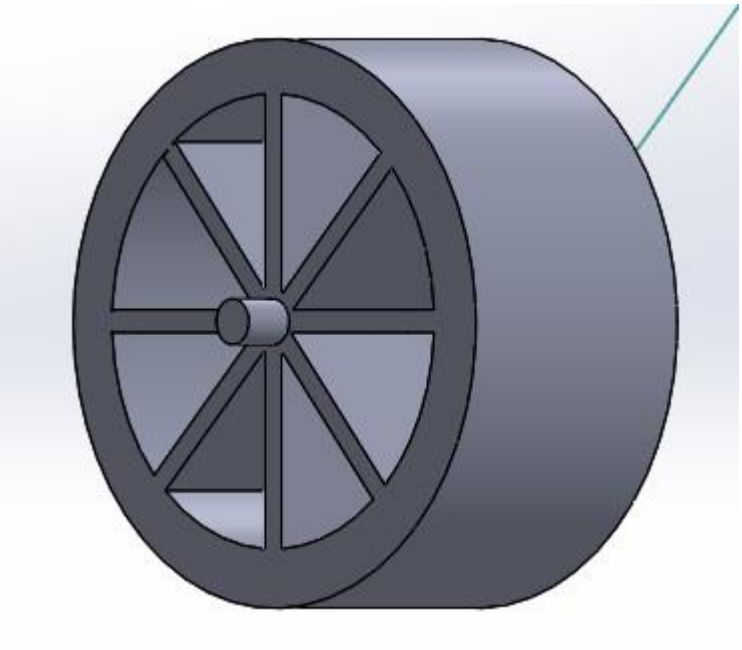
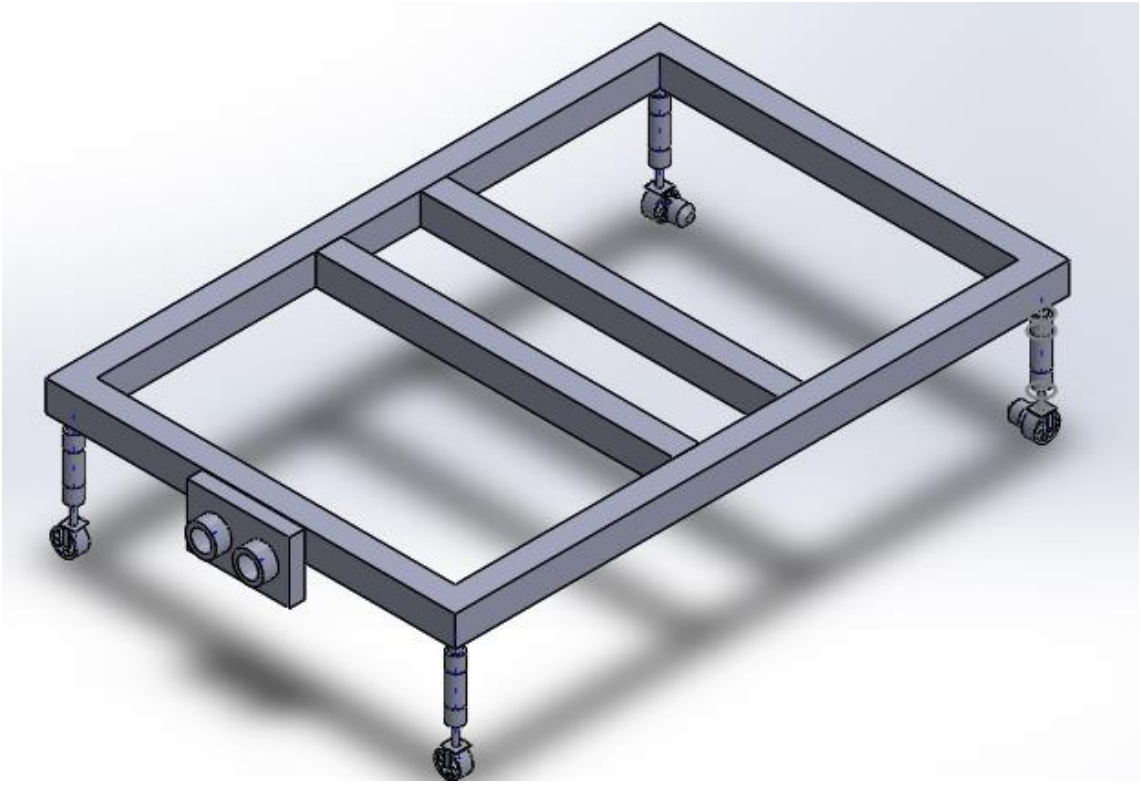


FIG 4.5 – Wheel

4.5 COMPLETE DESIGN OF GROUND CLEARANCE ADJUSTMENT CAR



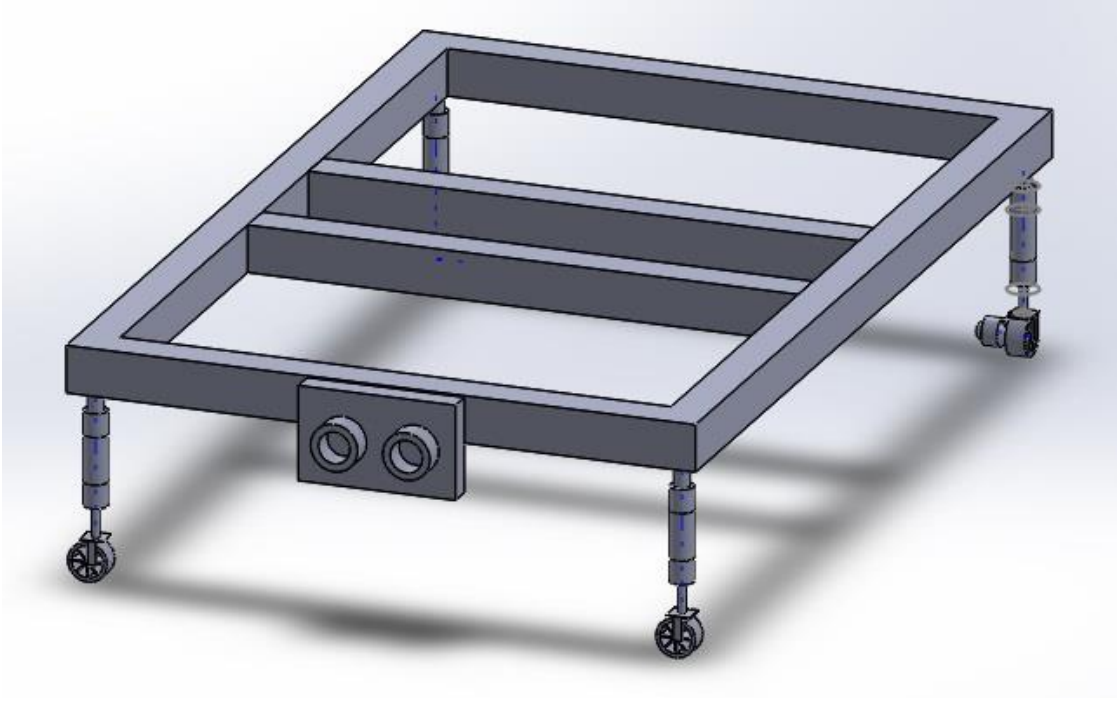


FIG 4.6 – Complete design

4.6 FOUR VIEW DESIGN OF THE MODEL

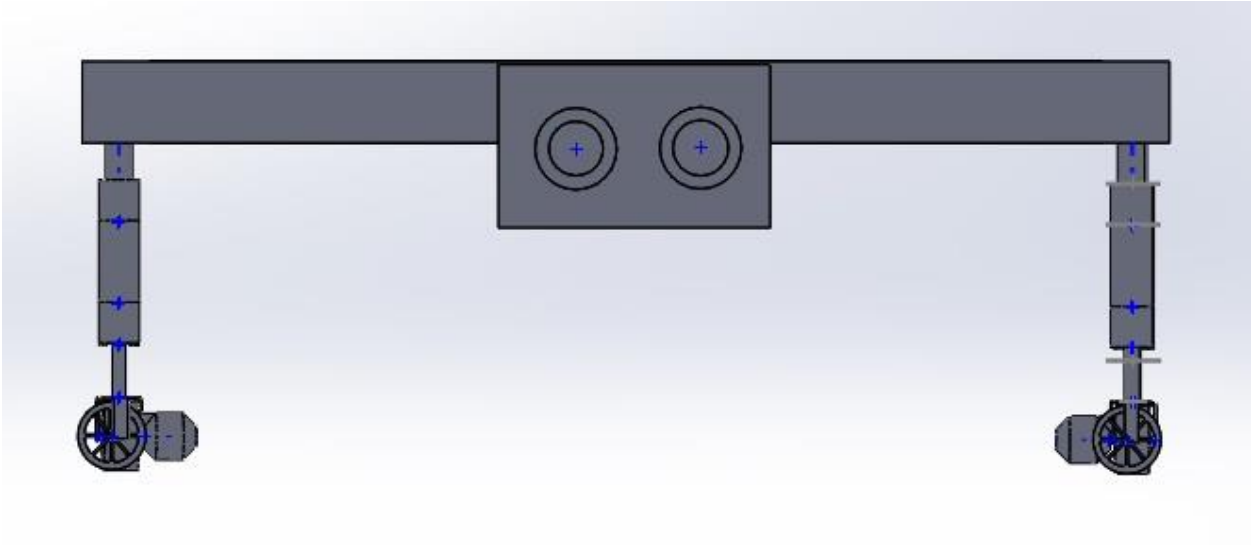


FIG 4.6.1- Front view

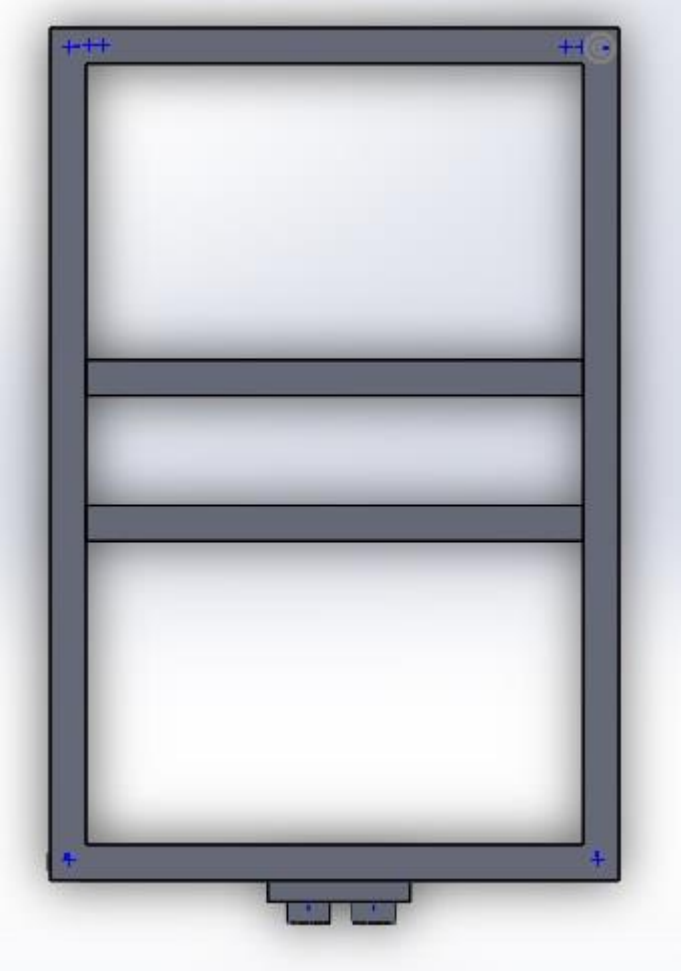


FIG 4.6.2- Top view

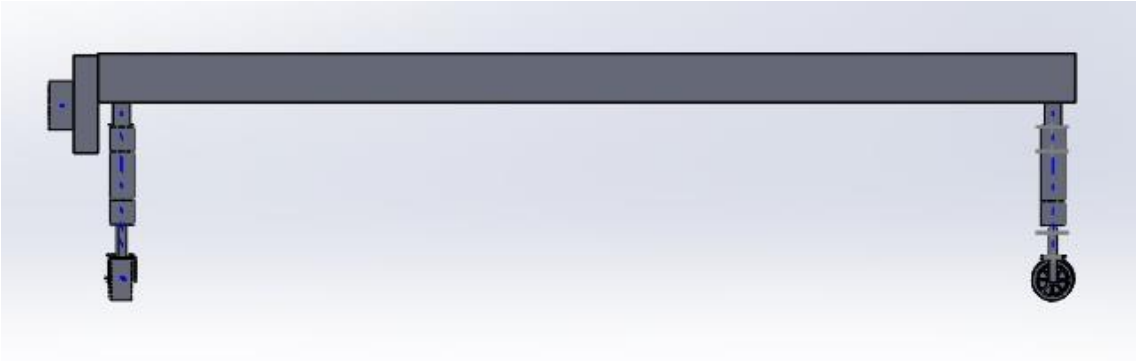


FIG 4.6.3- Side view

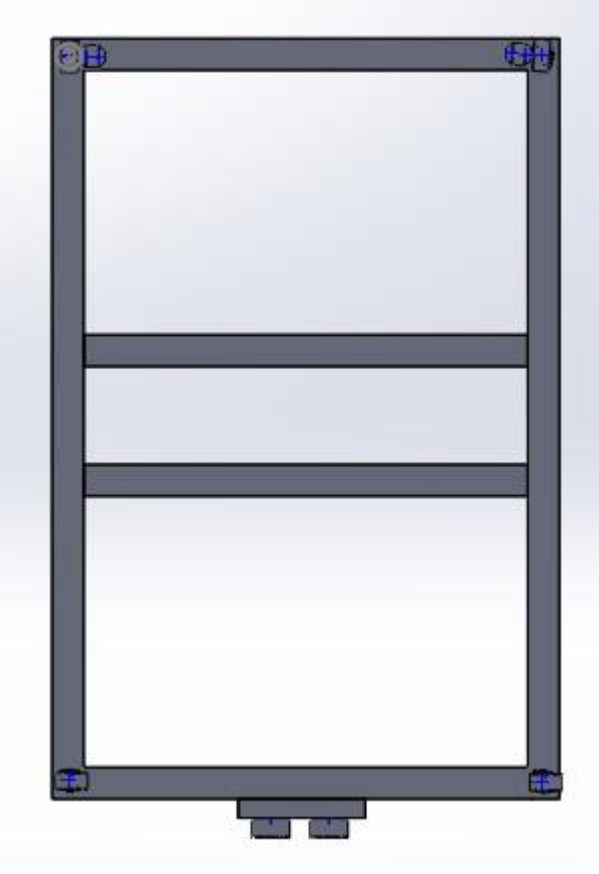
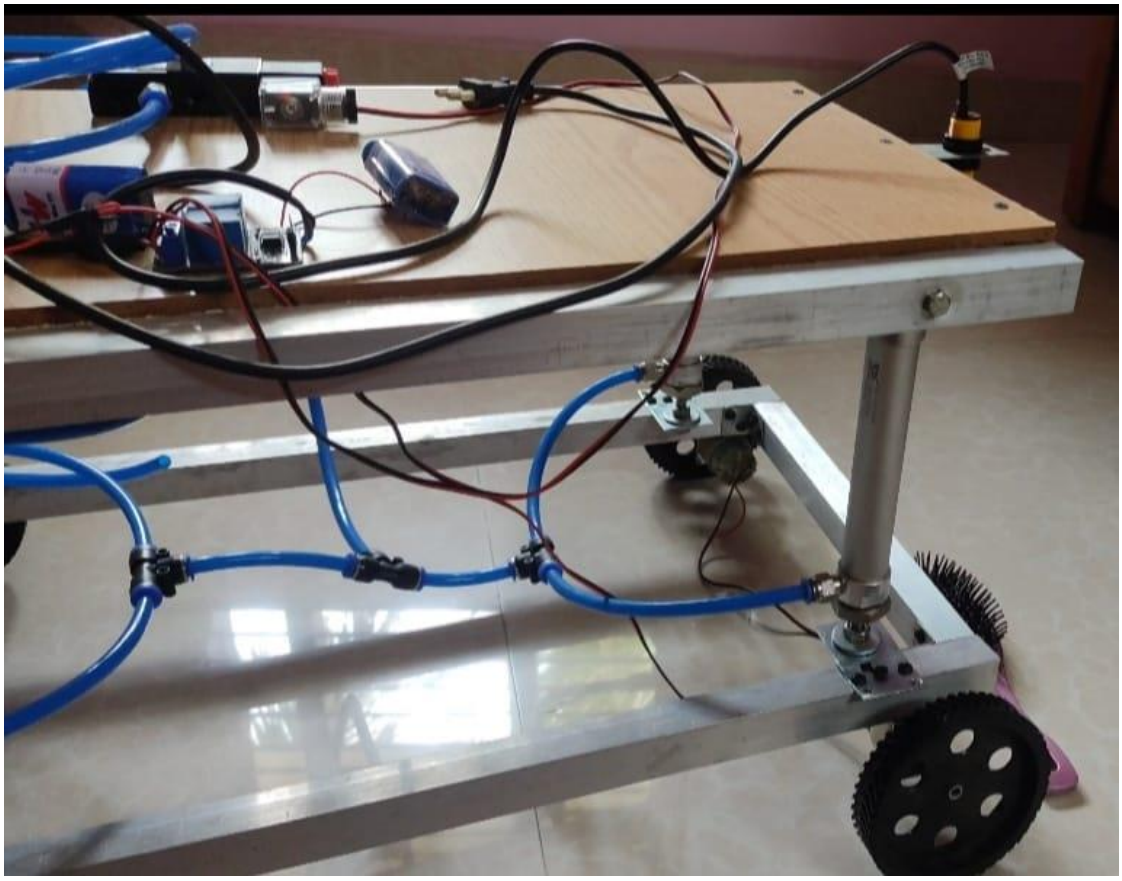
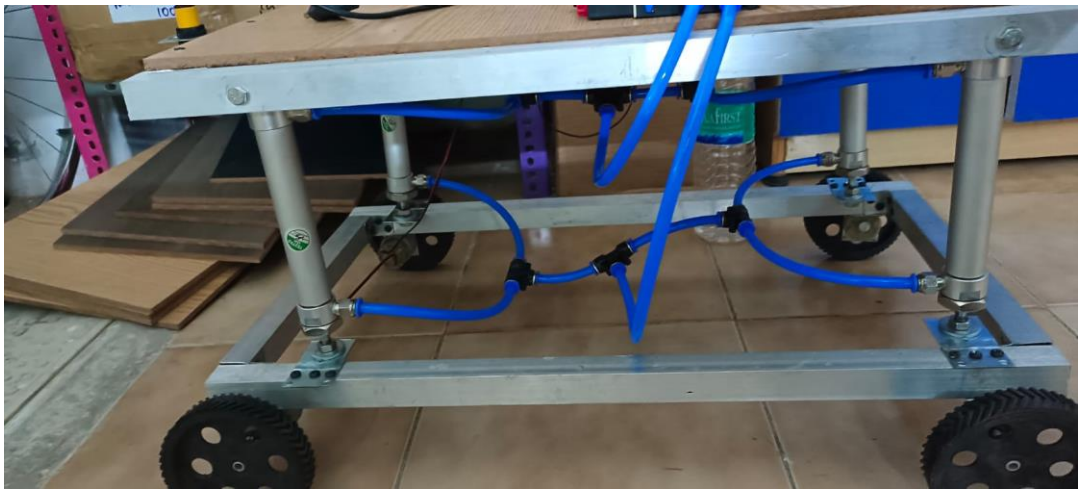


FIG 4.6.4- Bottom view

4.7 GROUND CLEARANCE ADJUSTMENT CAR PROTOTYPE





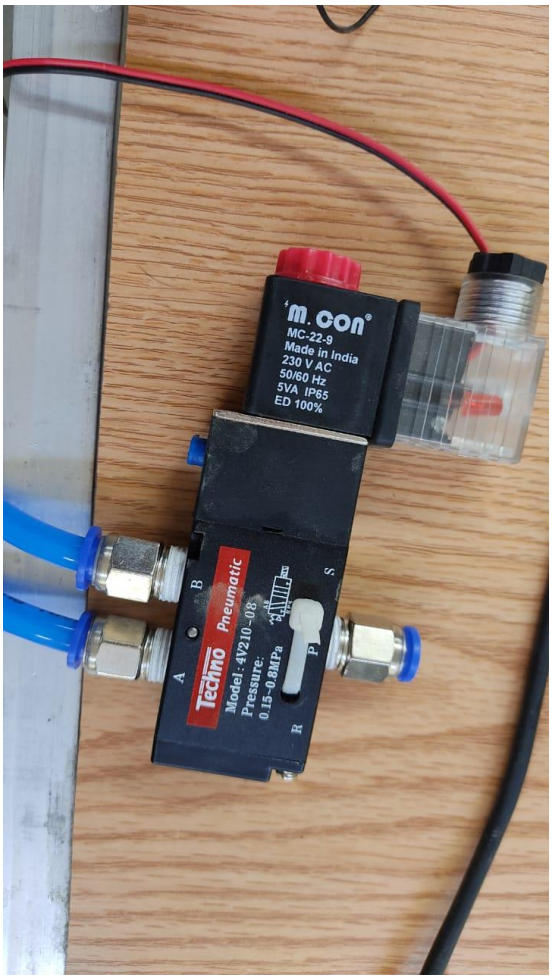

M. CON
MC-22-9
Made in India
230 V AC
50/60 Hz
5VA IP65
ED 100%
Techno Pneumatic
Model : 4V210 -08
Pressure:
0.15-0.8MPa
A
B
P
R
S

FIG 4.7 – Model

CHAPTER 5
FUTURE ENHANCEMENT AND RESULT

5.1 FUTURE SCOPE

We have concluded that this project model can be heavily commercialized in various industries. We can use this model in accident prevention of private and commercial vehicles basically in four wheelers. This type of mechanism is very essential in current scenarios where the. road is heavily following the mixed traffic. This mechanism can be useful for off road vehicles for better obstacles prevention.

5.2 EXPERIMENTAL RESULT

The pneumatic lift mechanism applied in prototype to increase the ground clearance works successfully. It is able to lift the weight of chassis up to 30-40kg with a compressor of capacity 5bar, which is good enough for a lower scale work. The mechanisms take maximum 5 seconds to lift the chassis after providing input to the controller and then can have a fixed higher ground clearance up to required period of time to protect the chassis of prototype. And later can lower the chassis using controller to have fixed lower ground clearance within 5 second. And the performance can be optimized.

5.3 CONSIDERATION OF FUTURE WORK

No project is ever complete with respect to the technology it uses. There is constant improvement in the technology that drives it. So, we have to consider an aspect which needs to be considered to accommodate future probabilities in our project.

1)We can integrate this system in military vehicles that need to travel on off roads quite often.

2)We integrate this system with medical vehicles that need to follow social distancing in the current Covid-19 Pandemic.

3)This system traces its use in various construction vehicles which are peculiarly subjected to rough roads and cause many accidents due to obstacle hitting.

4)The low ground clearance vehicles can have this system to counter bumpers or speed breaker to ensure that vehicle does not get damaged on the chassis. 5)This system can briefly be used on rovers that are sent on other planets like mars rover so that it can operate on clingy roads.

5.4 ENHANCEMENT

The results can be arranged as: Automatic Ground Clearance Adjustment System

The average time required by the system to vary the ground clearance of the vehicle is 5 seconds. The ground clearance of the vehicle is increased by 3cm along the obstacles. Car chassis is prevented from being damaged. The system can withstand a weight of 3 to 4 kg with the compressor of 350psi capacity. The project works well in case of prototype but there might be a

chance that the result can vary with the Realtime application of the pneumatic system. But with proper design and mechanism with having accurate measurement in real time application the performance can be optimized.

As a result of this automatic braking system, the function of each part is working well and the whole system is successfully accomplished. The safety distance is determined then the vehicle system is broken when the obstacle is detected. The ranging accuracy of ultrasonic sensor in this prototype is about 2cm to 1m and works effectively within the prescribed limit. Final Overview of Project In this project, we have checked the working of our project, we connected it with a battery and whose braking system is controlled by a DC gear motor and servomotor. This technique is eco-friendly and this work is an attempt to reduce accidents while in critical driving conditions. We have tested the working of the system by placing various objects ahead as obstacles. The system responded by reducing the speed of the vehicle when the obstacle is placed at various distances from it. Also, the system stopped automatically in restricted areas. It gave very accurate measurement according to limit of values interpreted.

5.5 CONCLUSION

The pneumatics jacks can act in the place of hydraulic jacks efficiently. The air required for the operating of the jack is easily available in the nature. Cost of the project is not high compared with other jacks. As our jack is in built the fatigue is less. If made in the lot the cost could be less.

1) It serves better than hydraulic jacks which is used for lifting.

2) Such that distraction driving is a major contributor to accident death, thus by implementing this System we can reduced the close impact potential accident.

3) This innovation would help the women elders and other fellow folks to easily change the tires.

4) It would save time of installing a manual jack and washing of the lower body of the car as it would raise the car by about 2 feet.

5) To minimize human effort.

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