Android based advanced car lifting system

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CHAPTER 1
INTRODUCTION

Introduction to the project:

Car jack is a device used to lift up the cars while changing the tyres during an emergency. Car jacks are available at the market has some disadvantages such as requiring more energy to operate, are not suitable for women and cannot be used on the uneven surface. The purpose of this project is to modify the design of the existing car jack in terms of its functionality and also human factors considerations. In this "**Android based advanced car lifting system**", the scopes of research were on developing an integrated system to the car that can be used through wireless remote control. In the process of obtaining a suitable design, the customer needs will be translate to the engineering characteristic to obtain the concepts that need to be modified and fabricated. From the house of quality, the best concept will be valued based on the weighted rating method. Then the configuration design was analyzed according the function factor and critical issue so that the design that had been implementing was according to the specification. The last step for this project was to build up prototype.

Problem faced during these days:

Nowadays in our country, most of the cars were equipped with the scissor car jack. We found that the scissor car jack were very difficult to be used especially by women because this types of jack needed more strength and energy to operate this jack by turning the lead screw. Thus, we want to develop a product based from the problem faced by the users who drive a car regarding this issue. To overcome this problem, a research has been conducted to find the solution on how to design a car jack for the car using the simplest and cheapest way while it is energy saving. Although there were many ways to solve this problem, we recommend that the design this car jack system is the practical way when we considered all the factors and consequences especially about the analysis to develop this product. During the research, we have found that most of the car user has difficulties in maintaining their vehicles breakdown especially cars in the scope of changing tires. The normal car jack we have in the market is operated using bare hands and it is time consuming. It also requires much energy from the person to rotate the jack. Hence, this

report had been prepared to recommend the design of the car jack that is user friendly and easier to operate as do not required too much money to develop this product to integrate into our vehicle.

Objective of the project:

Design improvement the existing car jack in terms of its functionality and human factor consideration by installing a system inside the car which can be easily operated and maintained.

Principle of Operation:

We are taking the instruction of moving the jack up or down through an app controlling by the user. Then this information is going to arduino board via a bluetooth module. Then according to the instructions loaded in the controller of the arduino, motor is rotating clockwise or anticlockwise . Then after that, we have provided a sufficient gear ratio to move the screw of the jack in the respective direction.

Conclusion:

This chapter mainly deals with the introduction to objectives and methodologies of the project.

CHAPTER 2

DESCRIPTION ABOUT THE PROJECT

Arduino:

Like every complex system, it is modular. There is the power system, that chooses between the power jack and the USB power and produces 5v and 3v for the rest of the system. There is a USB to serial controller that contains the bootloader which is used to load programs into the ATMEGA328P.If there is a power supply connected to the power jack. The power supply should be between 9v and 15v. The USB controller is implemented with the ATMEGA8U2-MU. It is used to load the code unto the ATMEGA328P.

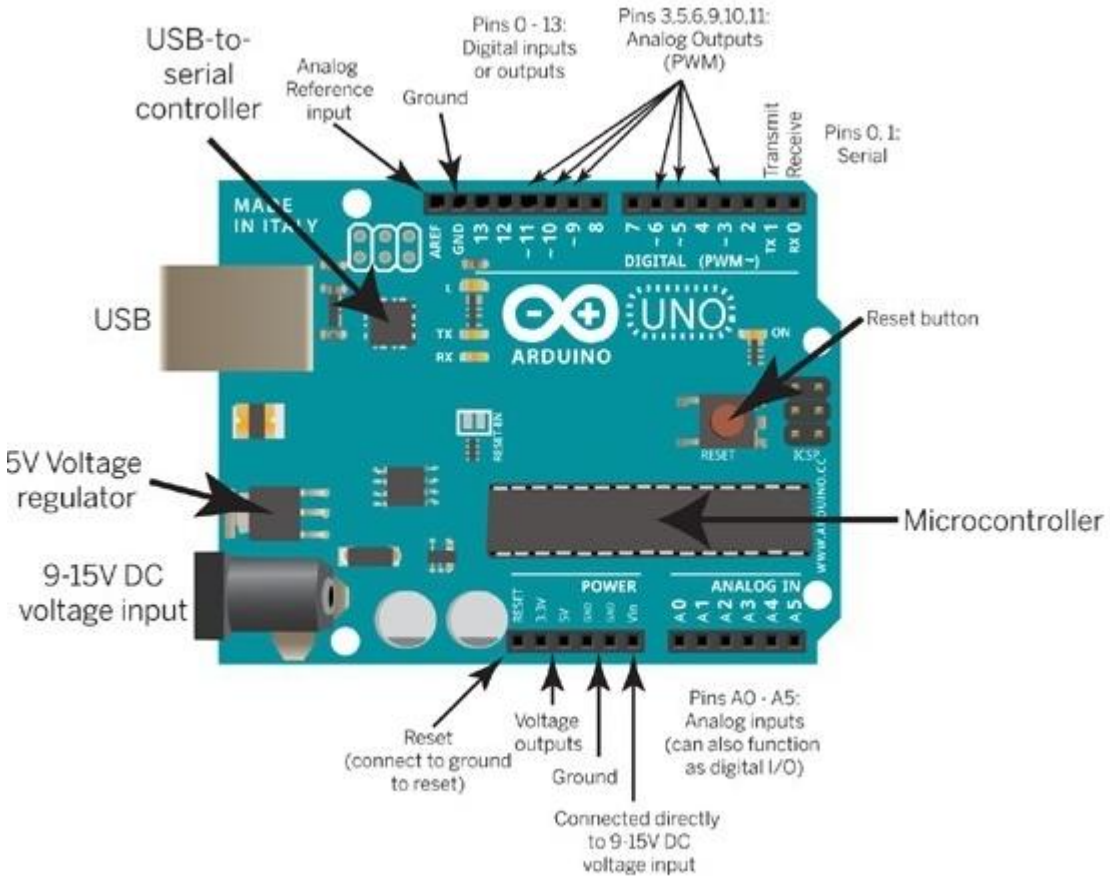


Figure 1 : Arduino- Uno

Relays :

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a low-power signal or where several circuits must be controlled by one signal.

Figure 2 : Relay - SPST

When an electric current is passed through the coil it generates a magnetic field that activates the armature, and the consequent movement of the movable contact(s) either makes or breaks (depending upon construction) a connection with a fixed contact. If the set of contacts was closed when the relay was de-energized, then the movement opens the contacts and breaks the connection, and vice versa if the contacts were open. When the current to the coil is switched off, the armature is returned by a force, approximately half as strong as the magnetic force, to its relaxed position. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor starters. When the coil is energized with direct current, a diode is often placed across the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a voltage spike dangerous to semiconductor circuit components. Some automotive relays include a diode inside the relay case. Alternatively, a contact protection network consisting of a capacitor and resistor in series (snubber circuit) may absorb the surge. If the coil is designed to be energized with alternating current (AC), a small copper "shading ring" can be crimped to the end of the solenoid, creating a small out-of-phase current which increases the minimum pull on the armature during the AC cycle.

Motorized Jacks:

DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. Motion and controls cover a wide range of components that in some way are

used to generate and/or control motion. Areas within this category include bearings and bushings, clutches and brakes, controls and drives, drive components, encoders and resolves, Integrated motion control, limit switches, linear actuators, linear and rotary motion components, linear position sensing, motors (both AC and DC motors), orientation position sensing, pneumatics and pneumatic components, positioning stages, slides and guides, power transmission (mechanical).Motors are the devices that provide the actual speed and torque in a drive system.

Figure 3: Motorized jack

A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion

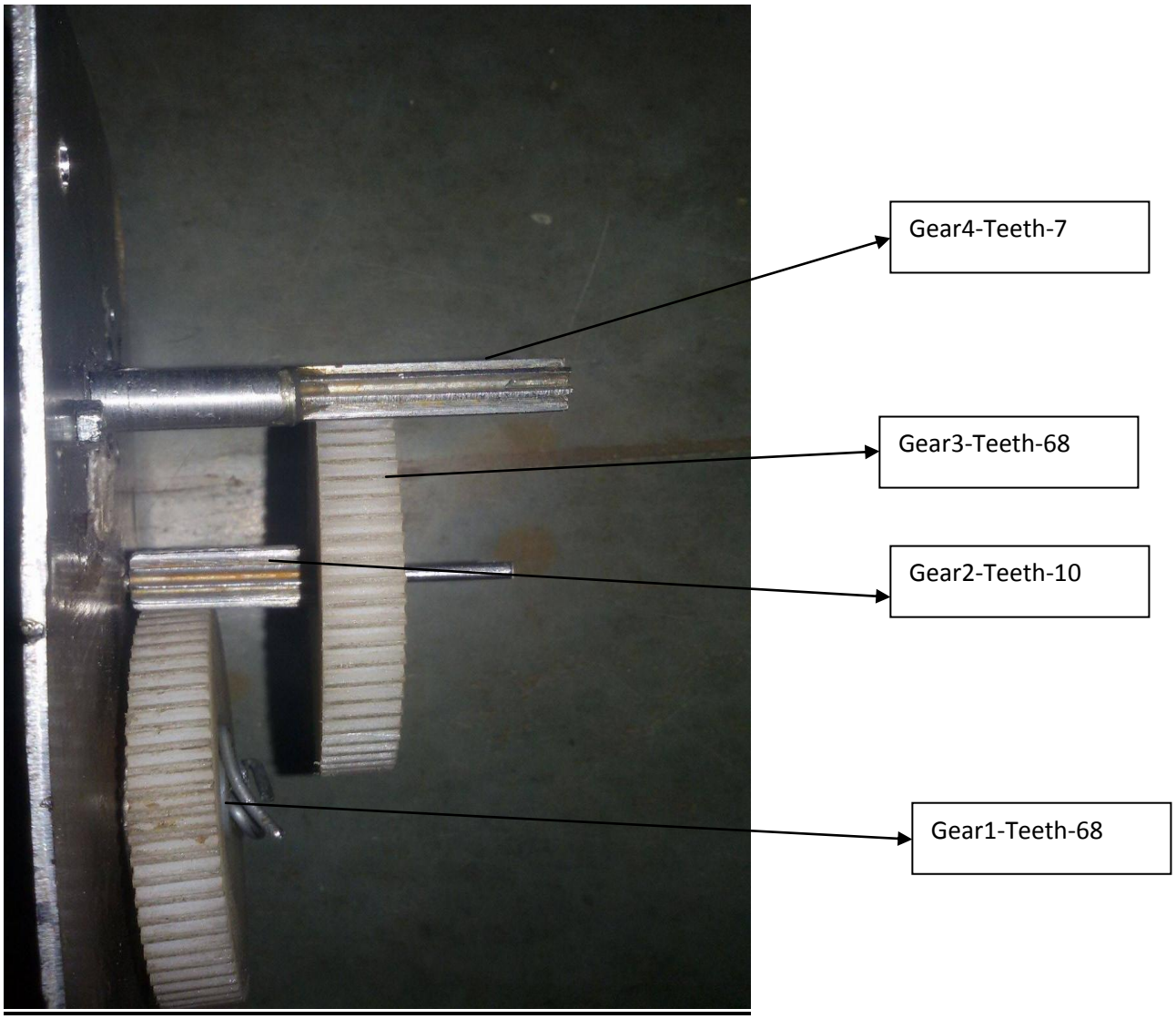
Android based advanced car jack

Manual jack is converted to automatic one by assembling the app, electronic circuit and motor and the gearbox. When signals are received by the arduino the relay passes the 12 V D.C. to the motor which drives the gear train which in turn rotates the lead screw of the jack. When the lead screw turns clockwise the arms of the jack lift up i.e., the carrier plate lifts up. And similarly when the lead screw rotates anti clockwise the carrier plate comes down. Since the jack is automatic so it should stop at the topmost and the bottom most position by itself. To achieve this attribute we have put two contact breaker switches on the arms of the jack. As the jack reaches the topmost position ,the switches by the virtue of the position are pressed and the contact with the power supply breaks. Similar is the case when the jack reaches lowest position. Jack we have used is scissor jack which is

easily available in the market at reasonable prices according to our requirements of amount of load to be lifted.The task left is to make the jack automatic. Firstly we have to use a high RPM motor and not high torque motor since .It's less bulky than the high torque motor.It's cost is lower. It can efficiently run the gear train.Since we need to reduce the motor rpm from 1500 to 22 rpm. So we need a Reduction Gear Box.

GEAR BOX

Our gearbox involves 4 gears :



Coding :

```
char input;

String inputString="";
```

```
int enable = 11;
int sta = 13;
int in1 = 2;
int in2 = 4;
int in3 = 7;
int in4 = 8;
boolean rev = HIGH;
void setup()
{
Serial.begin(9600);
pinMode(enable,OUTPUT);
pinMode(sta,OUTPUT);
pinMode(in1,OUTPUT);
pinMode(in2,OUTPUT);
pinMode(in3,OUTPUT);
pinMode(in4,OUTPUT);
}
void setMotor(boolean rev)
{
digitalWrite(in1,rev);
digitalWrite(in2,rev);
digitalWrite(in3,!rev);
digitalWrite(in4,!rev);
digitalWrite(sta,rev);
}
```

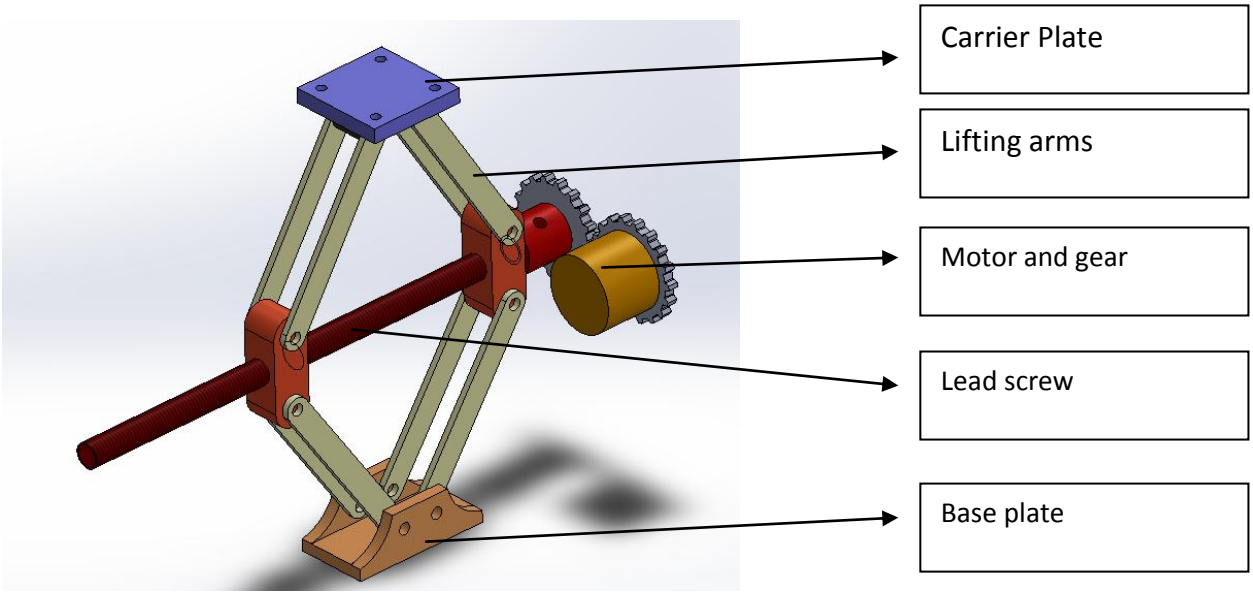
```
void brake(boolean rev){
digitalWrite(in1,rev);
digitalWrite(in2,rev);
digitalWrite(in3,rev);
digitalWrite(in4,rev);
digitalWrite(sta,LOW);
}
void loop()
{
if(Serial.available()){
while(Serial.available())
{
input = (char)Serial.read();
inputString += input;
}
Serial.println(inputString);
while (Serial.available() > 0)
{char junk = Serial.read() ; }
if(inputString == "a"){
setMotor(rev);
}else if(inputString == "b"){
setMotor(!rev);
}else if(inputString == "c"){
brake(rev);
}
```

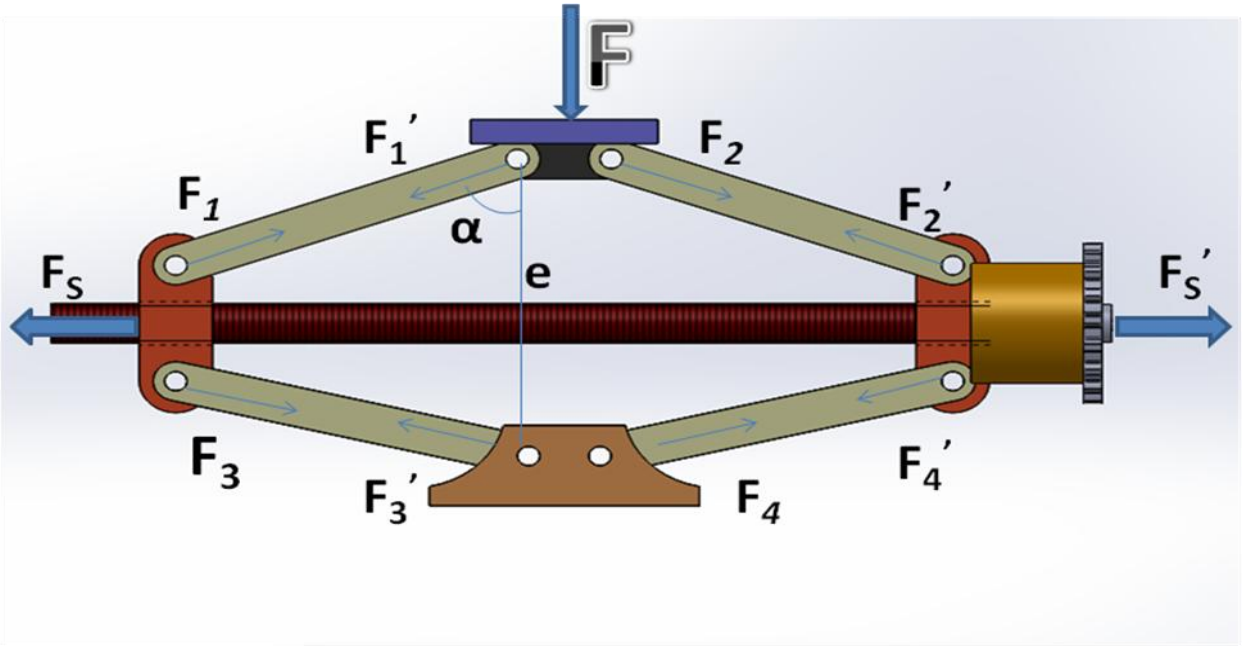
inputString = "";

}

}

Force Analysis :





The maximum capacity for the scissor jack : 1000 kg

Maximum load = 1000 kg

F = 1000*9.81 $^{m}/_{s^2}$= 9810 N

L= 200 mm , length of the arms(From hole center to hole center)

e = 180 mm, minimum raising height of the jack

Cos α =($^{e}/_{2}$)/L= 0.45

α = 63.26

Since the maximum loading force will act at the minimum rising height of the jack , the design stresses will be analysed at that point.

∑ Fy=0

F1.cos α-F3.cos α=0

F1.cos α = F3.cos α

F1=F3

∑ Fx=0

F1.sin α+F3.sin α-Fs=0

Fs=2.F1.sin α =4477.031N

Now , because of symmetry we can write the following equation:

|F1|=|F2|=|F3|=|F4|=|F1'|=|F2'|=|F3'|=|F4'|

Stress Analysis

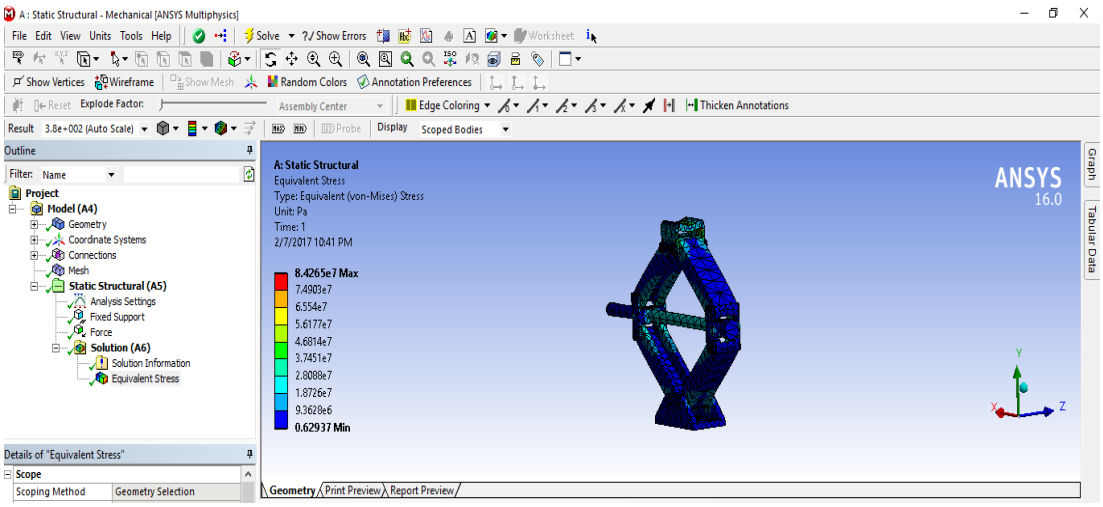


Figure: Deformation of jack for load below 6000N

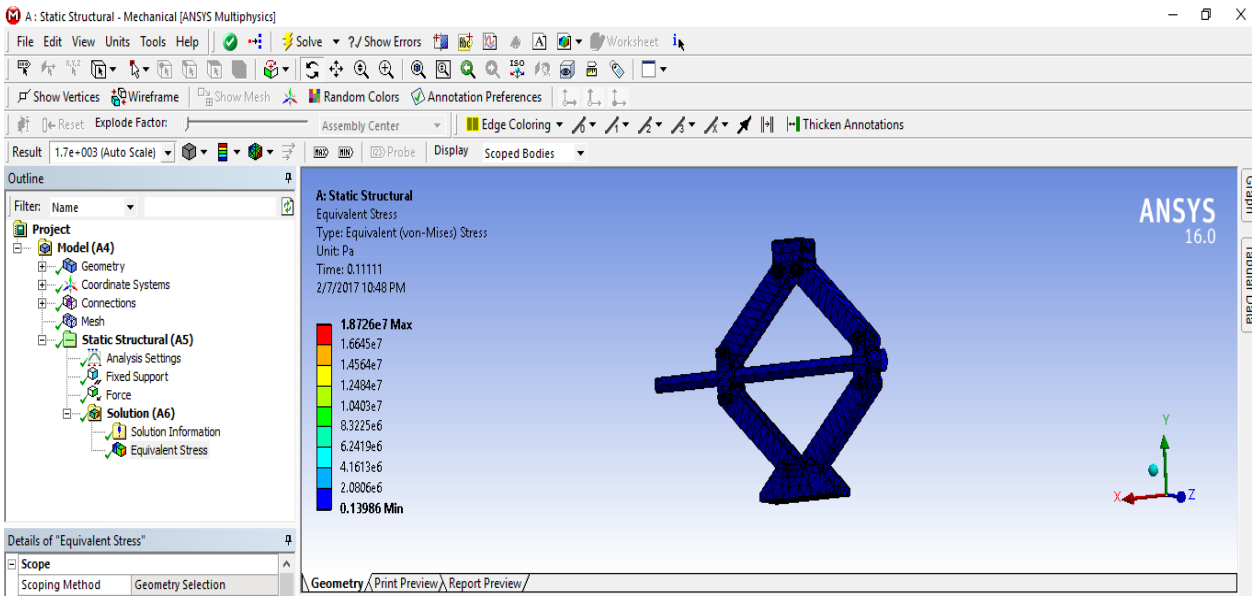
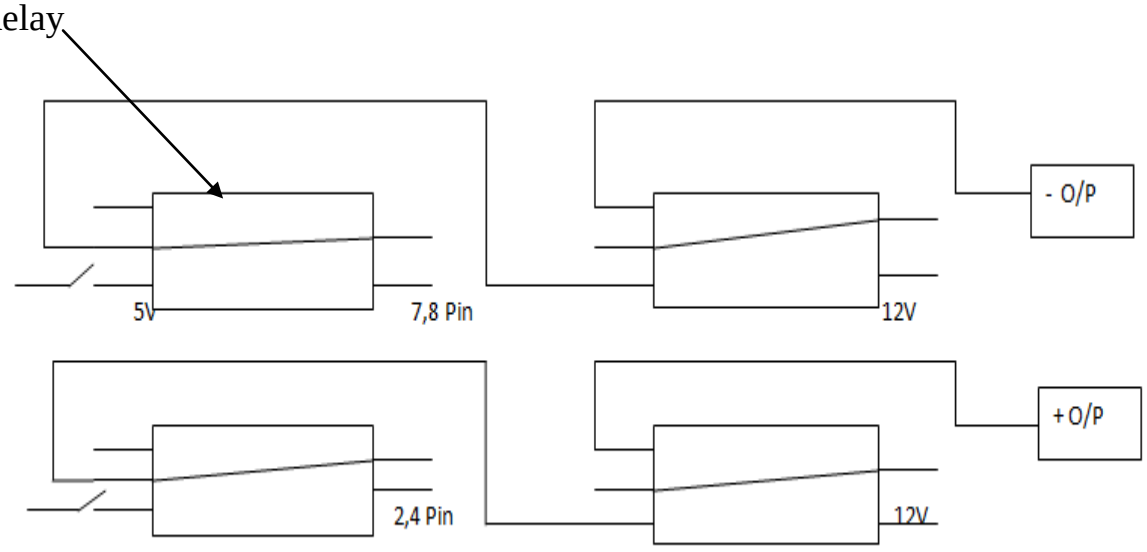


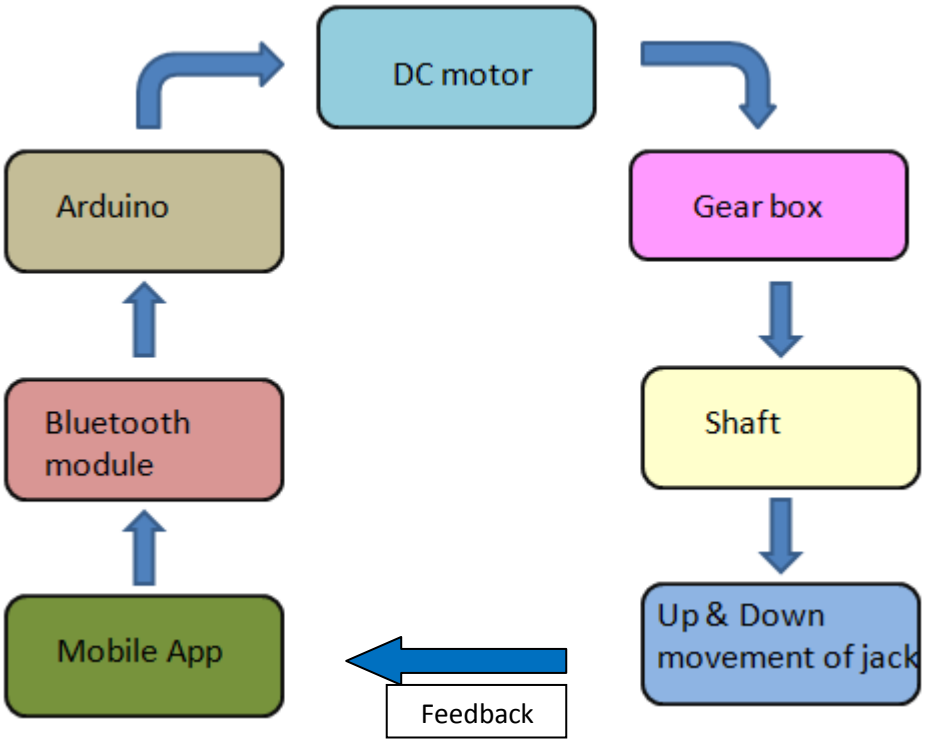
Figure 4 : Deformation of jack for load above 6000N

Circuit Diagrams :

Relay



Block Diagram :



Conclusion :

This chapter deals with major components such as relays, bluetooth module , arduino and also the block diagram of the entire prototype.

CHAPTER 3
SOFTWARE TOOLS

Since to make a durable jack we need force and stress analysis of the jack with the materials of the jack. This rigorous analysis was done on

1. SOLID WORKS –Force Analysis
2. ANSYS-Stress Analysis
3. Android Studio

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CHAPTER 4
ADVANTAGES

ADVANTAGES :

- Easy changing and replacing of tires & Easy car wash.
- During floods we can the lift the car above the water level and save the car from damage.
- It becomes easy to do work under cars for simple and even for major repairs.
- Moreover, when the car is not used for many days the air inside the tire is reduced but with this system we can lift the car because of which the tires loose contact with the ground and thus it maintains pressure inside the tire.
- Completely operated with switches which be fitted near the driver and easily operated.
- The system can bear 6-8 tons of weight, so there is no risk of working under for long hours together, because we often come across cases where people have been crushed to death when vehicles that were improperly secured fell on them.
- It becomes easy to find if there are any leakages too & also it does not effect the ground clearance of the vehicle

CHAPTER 5

RESULTS

The outcomes of the jack assembly ,app and the electronics circuit has been shown below.

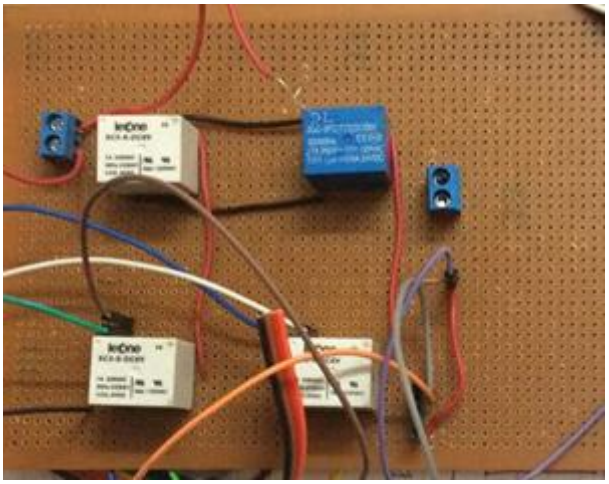

Figure 5: Circuit diagram

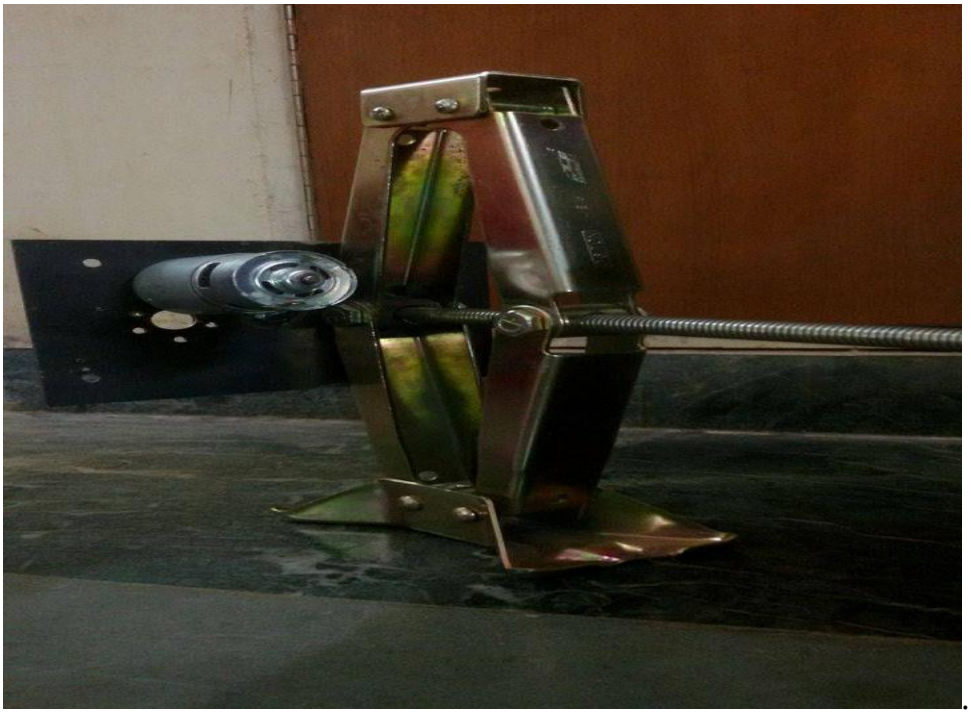

Figure 6: Proposed Jack

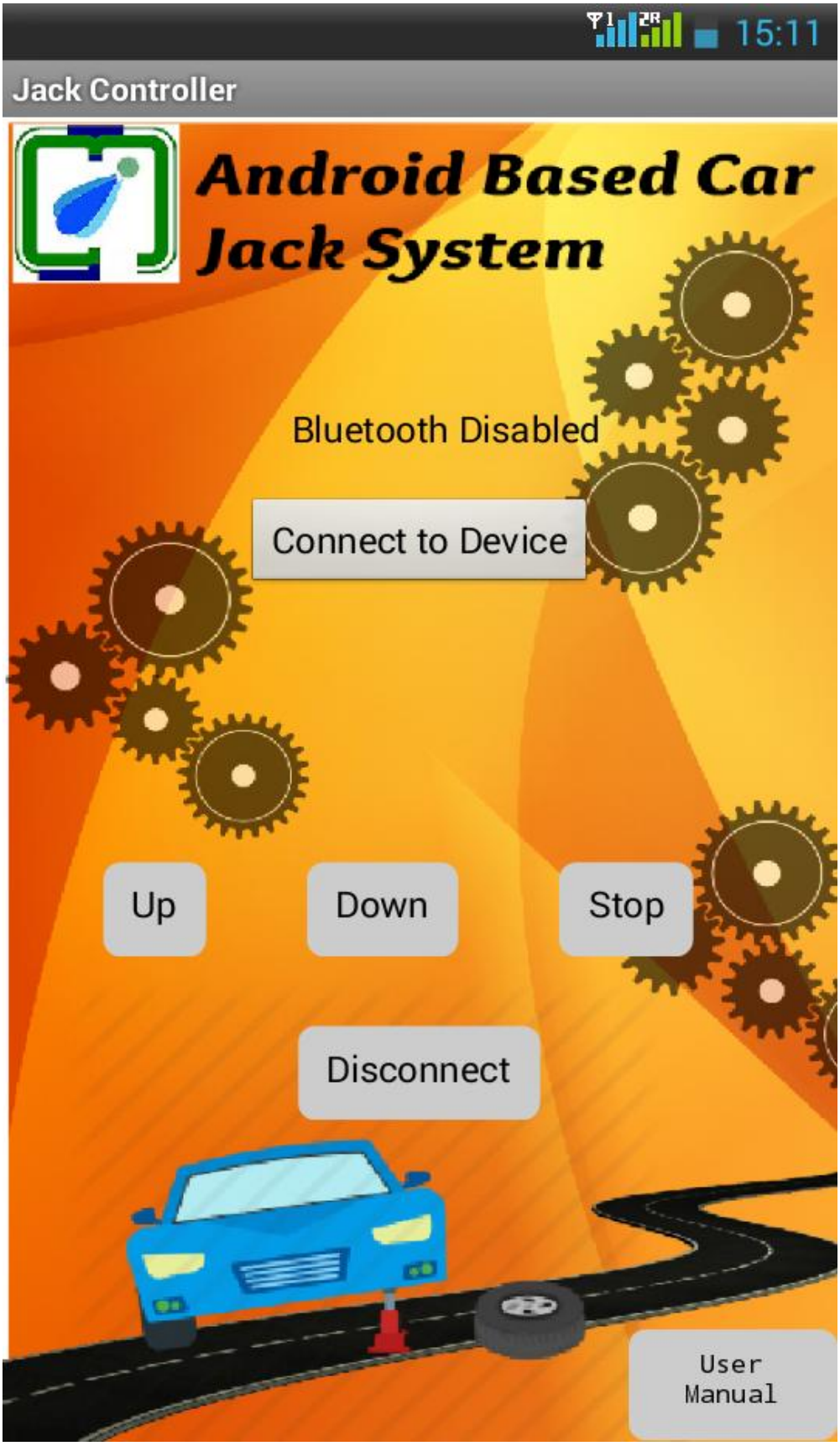
15:11
Jack Controller
Android Based Car
Jack System
Bluetooth Disabled
Connect to Device
Up
Down
Stop
Disconnect
User
Manual

Figure 7: App

CHAPTER 6

CONCLUSION AND FUTURE SCOPE

Conclusion:

Through this project I could implement my idea through a real time prototype. Hands on experience from the researching work till developing the prototype gave me a chance to develop my skills.

Future Scope :

Presently since it is a prototype we are using motorized jacks but later we would replace this with hydraulic system, and add a wheel(nylon) which can bare upto 2 tons will be added to the base of the jack and thus when a particular tire is punctured the nylon wheel attached to the jack will bolster and hence it acts as a spare wheel.

References:

1.Manoj Patil,Gaurav Udgirkar,Rajesh Patil and Nilesh“Automated Car Jack International Journal of Current Engineering and Technology E-ISSN 2277 4106, P-ISSN 2347 –5161.