

# Design And Fabrication Of Mobile Operated Screwjack

<sup>1</sup>Prof. Bhavik Soneji, <sup>2</sup> Paumil Khatri|Karan Shah|Parth Shah|Dipti Trikamani

<sup>1</sup> Assistant Professor, <sup>2</sup> UG Students

<sup>1</sup> Department of Mechanical Engineering,

<sup>1</sup> Indus Institute of Technology and Engineering, Rancharda, via Thaltej, Ahmedabad 382115, Gujarat, India

**Abstract :** With the increasing levels of technology, the efforts being put to produce any kind of work has been continuously decreasing. The efforts required in achieving the desired output can be effectively and economically be decreased by the implementation of better designs. Power screws are used to convert rotary motion into translator motion. A screw jack is an example of a power screw in which a small force applied in a horizontal plane is used to raise or lower a large load. The mechanical advantage of a screw jack is the ratio of the load applied to the effort applied. The height of the jack is adjusted by moving a lead screw and this adjustment can be done either manually or by integrating an electric motor, which is controlled by mobile with the help of arduino. In this work, an electric motor will be integrated with the screw jack and the electricity needed for the operation will be taken from the battery and thereby the mechanical advantage will be increased. And the motor will be controlled via mobile from a short distance. The significance and purpose of this work is to modify the existing car jack in order to make the operation easier, safer and more reliable in order to reduce health risks especially back ache problems associated with doing work in a bent or squatting position for a long period of time. The designed mobile operated jack will also save time and requires less human energy to operate.

**Index Terms -** Screw Jack , Bevel Gears , Mobile Operated , Bluetooth , Wi-Fi, Arduino-UNO

## I. INTRODUCTION

Car jacks usually use mechanical advantage to allow human being to lift a vehicle. Screws Application is used in the elevation of vehicles or objects. The operation of the screw jack is such that it comprises a handle for driving a bolt element (Lead Screw) manually so as to adjust the height of the Jack to elevate a vehicle or the object. Doing work in a bent or squatting position for a period of time is not ergonomic to human body. These presently available jacks further require the operator to remain in prolonged bent or squatting position to operate the jack. It gives back ache problem in due of time. A mechanical jack is a device which lifts heavy equipment and vehicles so that maintenance can be carried out underneath. The operation of the jack manually makes it difficult for most women and the elderly to operate since much effort is needed to drive the screw jack which results in low linear speed and time consuming. In most of the garages the vehicles are lifted by using screw jack. This needs high man power and skilled labour. In the world, the fact is that necessity is the mother of invention and the necessary condition is that, large effort is required for the manual operation of jacks, so for that reason, it is the need of invention. The general purpose of the project is to minimize the human effort while operating the jack. The objective of the project is to modify the existing design of car jack by incorporating an electric motor into the existing screw jack to make the operation easier safer faster and more reliable. In order to avoid all such disadvantages, the mobile operated jack has been designed in such a way that it can be used to lift the vehicle very smoothly without any impact force. The operation is made simple so that even unskilled labour can use it with ease. The D.C motor is coupled with the screw jack. The screw jack shafts rotation depends the rotation of D.C motor and it works on arduino circuit which is connected to mobile via Bluetooth or Wi-Fi.

### 1.1 Need for automation :-

- ✓ To reduce human effort.
- ✓ To increase the efficiency of the jack.
- ✓ To reduce the work load.
- ✓ To reduce the cost.
- ✓ To reduce the time.

## II. Literature Survey:

In paper [1], the authors J.M. Gere, Thomson explains about Object lifting jacks are the ideal product to push, pull, lift, lower and position loads of anything from a couple of kilograms to hundreds of tonnes. The need has long existed for an improved portable jack for automotive vehicles. it is highly desirable that a jack become available that can be operated alternatively from inside the vehicle or from a location of safety off the road on which the vehicle is located. Such a jack should be light enough and be compact enough so that it can be stored in an automobile trunk, can be lifted up and carried by most adults to its position of use,

and yet be capable of lifting a wheel of a 4000-5000 pound vehicle off the ground. Further, it should be stable and easily controllable by a switch so that jacking can be done from a position of safety. It should be easily movable either to a position underneath the axle of the vehicle or some other reinforced support surface designed to be engaged by a jack. Thus, the product has been developed considering all the above requirements. This particular design of motorized automated object lifting jack will prove to be beneficial in lifting and lowering of heavy loads.

In paper [2], the authors C.S Agu and J.E Igwe explains about The system was design with a DC motor actuator to control the hydraulic Jack up as controlled by an infrared transmitter. The work consist of an infrared transmitter that transmits a modulated infrared beam towards the receiver. The receiver reception of the weak signals and then the microcontroller receives the signal for the upwards movement of jack. The circuit when tested worked satisfactorily as it was able to carry loads up to three tons (3tons).

In paper [3], the authors M.M.Noor, K.Kadiragama, M.M.Rarehman, M.S.M.Sani, M.R.M.Rejab gives information on development of auto car jack using internal car power. By the manual force car jack is a mechanical advantage to allow a human to lift a vehicle. The internal cigarette lighter power (12volts) in order to ensure the power is adequate, gear was used. In this paper they have used two relays where it is connected to the motor with the 12V power supply has been used for switch circuit. And implementation the prototype for the modification on the features and design, it was implemented on PERODOA Kancil, with the higher torque such as Proton Wira® and Proton Iswara® car.

In paper [4], the authors Mohammed Abuzaid, Mohammed Hasnain, Sahab Alam, Sohail khan, prof.surendra agarwal explains about 'Inbuilt jack in Automobile vehicles. On front and rear part of the chassis of the automobile, hydraulic jack system is attached. It can be easily attached to all kinds of automobile chassis and frames. There is a front and rear suspension hydraulic jack that is centrally mounted to front and rear suspension of automobiles between wheels respectively. It is operated by 12v dc current and works on the principle of hydraulic power. It becomes easy for the maintenance of automobiles especially heavy vehicles by implementing this system. Pascal's principle is involved in the working of the hydraulic jack system. It states that at all points in the closed container or the cylinder pressures remain same at all the points. If there are two cylinders connected small and large. Force exerted by the large cylinder is more as the area is more, provided that pressure applied remains constant. It is represented by the equation  $P=F/A$  to  $F=PA$ . Oil pressure is used by hydraulic jack to displace vehicles up and down by moving the handler. Hydraulic fluids act as a motive medium in hydraulic machinery. Hydraulic cylinders are powered by hydraulic fluids. In this system energy supplied is not absorbed by the Hydraulic fluid.

In paper [5], the authors P.S.Rana, P.H.Belge, N.A.Nagrare, C.A.Padwad, P.R.Daga, K.B.Deshbhratar explains about the integrated automated jack for 4 wheelers, i.e. by the single push button provided an automobile jack can be operated. The system consists of three main parts that is hydraulic pump, driven by an electric motor, hydraulic cylinder for vehicle lift. During the breakdown condition hydraulic jacks actuate separately for either side of car. By the oil incompressible of the hydraulic jack the lifting capacity is more compared with the pneumatic system where it operates on air which is compressible. With the single acting cylinders which are controlled by the control valves and the relief valve the circuit has been done.

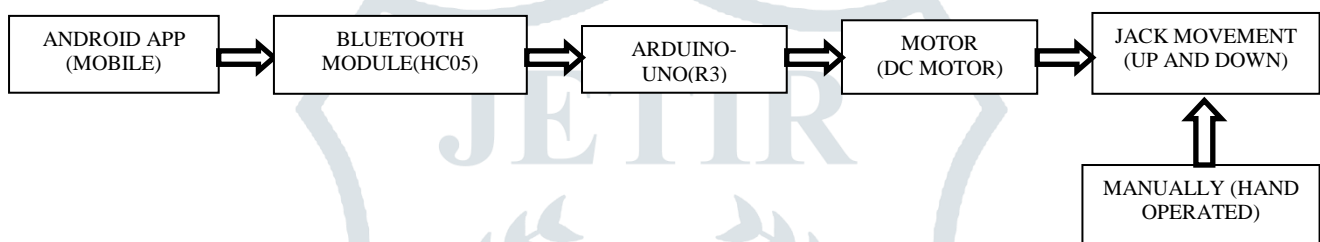
In paper [6], the authors Manoj Patil, Gaurav Udigikar, Rajesh Patil and Nilesh overcome the problem of automated car jack. In order to facilitate repairs a device used to raise all or part of vehicle into the air done by an automotive jack. In this work, electric car jack has been used by the current supply from the car battery which makes easy to operate. For the polarity of motor a switch is provided. As the required torque is applied at the screw the gear ratio provided the torque. The jack is plugged in where 12V Power supply is used to gear up.

### III. METHODOLOGY

In operation, the jack will lift a load in contact with the load platform when the power screw's movement through its connecting gear with the bevel gear mechanism when electrical power flows through the pinion gear lighter connected to the motor, plugged to the 12V battery source to generate power for the prime mover (motor), which transmits its rotating speed to the pinion gear meshing with the bigger gear connected to the power screw to be rotated with required speed reduction and increased torque to drive the power screw. The power screw movement within the threaded bore of its connecting members in the clockwise direction that will cause a typical load-raising process and anticlockwise direction that will cause the lowering process. During the typical load-raising process, the jack will first be positioned beneath the load to be lifted such that at least a small clearance space will exist between the platform and the object to be raised. Next, power screw will be moved so that the load platform makes contact with the object and the clearance space is eliminated. As contact is made, load from the object will be increasingly shifted to the load platform and cause forces to be developed in and transmitted through lifting members and connecting members. The force transmitted through the connecting members will be transferred at the threaded bore to the square threads, there within. An Arduino circuit is connected to the motor is used to regulate the lifting and lowering process with the use of the mobile which is connected via bluetooth module.



Another side of the of the motor will provide the handle for the manual operation



#### IV. PROGRAMMING OF ARDUINO

```

#define enA 10
#define in1 4
#define in2 7
// #define button 4

int state;
int flag=0; //makes sure that the serial only prints once the state

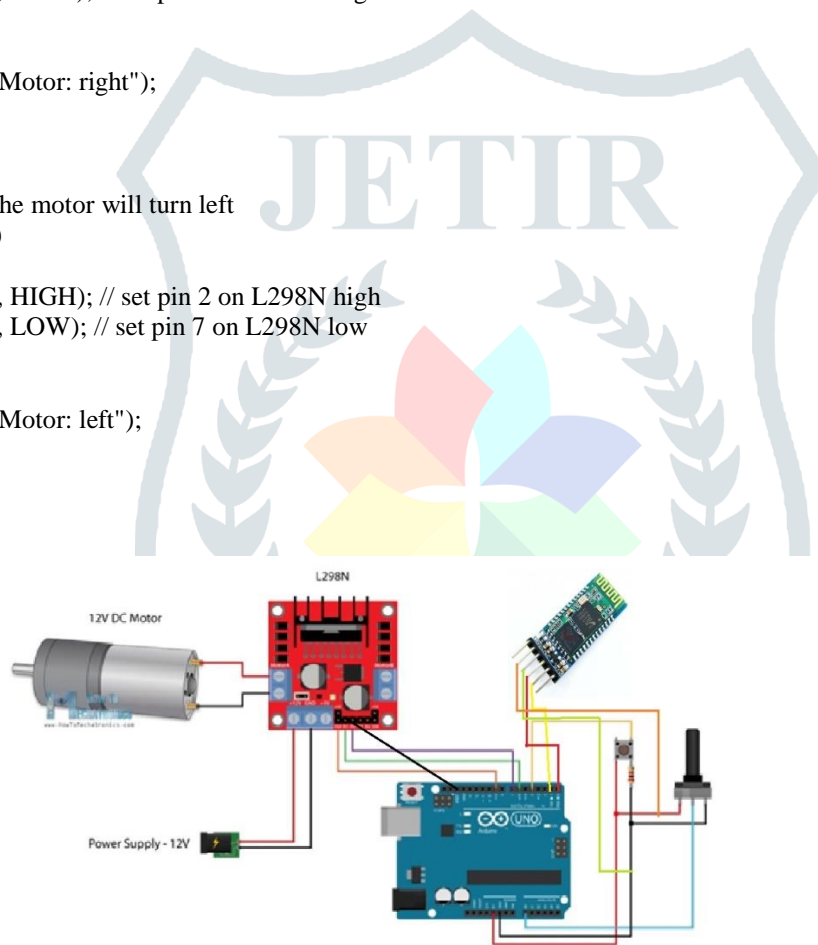
int rotDirection = 0;
//int pressed = false;
void setup() {
  Serial.begin(9600);
  pinMode(enA, OUTPUT);
  pinMode(in1, OUTPUT);
  pinMode(in2, OUTPUT);
  // pinMode(button, INPUT);
  // Set initial rotation direction
  digitalWrite(in1, LOW);
  digitalWrite(in2, LOW);
}
void loop()
{
  if(Serial.available() > 0)
  {
    state = Serial.read();
    flag=0;
  }

  int potValue = analogRead(A0); // Read potentiometer value
  int pwmOutput = map(potValue, 0, 1023, 0, 255); // Map the potentiometer value from 0 to 255
  analogWrite(enA,pwmOutput); // Send PWM signal to L298N Enable pin
  // Serial.println(enA);
  delay(1000);
  
```

```

// if the state is '0' the DC motor will turn off
if (state == '0')
{
digitalWrite(in1, LOW); // set pin 2 on L298N low
digitalWrite(in2, LOW); // set pin 7 on L298N low
if(flag == 0)
{
Serial.println("Motor: off");
flag=1;
}
}
// if the state is '1' the motor will turn right
else if (state == '1')
{
digitalWrite(in1, LOW); // set pin 2 on L298N low
digitalWrite(in2, HIGH); // set pin 7 on L298N high
if(flag == 0)
{
Serial.println("Motor: right");
flag=1;
}
}
// if the state is '2' the motor will turn left
else if (state == '2')
{
digitalWrite(in1, HIGH); // set pin 2 on L298N high
digitalWrite(in2, LOW); // set pin 7 on L298N low
if(flag == 0)
{
Serial.println("Motor: left");
flag=1;
}
}
}
}

```



**IV. RESULTS AND DISCUSSION**

**4.1 Results Of Car Lifting By Using Mobile**

Table 4.1: Result Of Different Cars

Type of Car	Weight of the car(kg)	Time (seconds) required to lift a car
ECCO	908	49
GRAND I10	961	43
SWIFT DEZIRE	985	45

The design was focused on all the processes of conception, invention, visualisation, calculation, refinement and specification of details that determine the form of the practical experiments. Hence, the said Mobile Operated Screw Jack for Vehicles, specifically the Scissors type has require more efforts and body ache problems. The main physical parameters of the design are determined through the appropriate calculations and practical considerations with reasonable assumptions.(like Maximum Weight of the car ).From the search it was discovered that at the minimum height from the ground to car wheel shaft is 175 mm. So we designed it height upto 170 mm. Aluminium is used as the materials for all three supportive plates of gears and steel for power screw due to its high strength, toughness and its economical effects. (bronze is more costlier). As shown in to the table for the different types of car we used our jack and the time require to lift up the wheel is shown below.

## 4.2 CONCLUSIONS

By the android app the movement of the jack from front suspension is mounted centrally to the front suspension of an automobile between its front wheels. With the help of car battery which is of 12v battery source the movement of the jack from down to up and vice-versa is possible. Android app can be installed / mounted in the dash board for displaying the movement of jack. With all the car jacks available in the markets, this model is improvised on the features, mechanism and design. The main objective of this design is safety, reliable and able to raise and lower the level, which is powered by internal car battery, external battery and automated with the android app. Considering some specification based on testing and from analysis, it is considered safe to use manual jack system. By the torque supplied on the system is more enough to lift the cars which are having up to 4000 Kg. The proposed mechanism is capable of increasing capacity; reducing input effort; saving cost of operation and requires simple maintenance compared to conventional lever lift mechanisms of lifting jacks. Conclusively, the modified design provides a good alternative to the lever lift mechanism as other existing conventional lifting jacks require more effort, capacity, power generating sources and maintenance cost.

## V. ACKNOWLEDGMENT

Foremost, I would like to express my sincere gratitude to my guide Prof. Bhavik Soneji for the continuous support of my Project study and research, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped me in all the time of research and writing of this report. I could not have imagined having a better advisor and mentor for my Project study.

Besides my advisor, I would like to thank to **Prof. Mitesh J. Mungla, HOD**, Mechanical Engineering department, who gives guidance for the Project work and their insistence for meeting deadlines we can do such excellent work. I offer my special gratitude to all the **faculty members**, Mechanical Engineering Department, Indus University for their help and support. I thank to my **friends** for providing me such a warm atmosphere to make my study more delightful and memorable.

I would like to express endless gratitude to "**My Parents**" who gave me everything they could to enable me to reach the highest possible education level. I only hope that they know how their love, support and patience encouraged me to fulfill their dream.I would like to thank all people who have helped and inspired me during my Report study.

## REFERENCES

- [1] J.M. Gere, Mechanics of materials, Thomson, 6th Edition, 2006. DESIGN AND FABRICATION OF MOTORIZED AUTOMATED OBJECT LIFTING JACK.
- [2] C.S Agu and J.E Igwe American Journal of Engineering Research (AJER) e-ISSN: 2320-0847 p-ISSN : 2320-0936 Volume-5, Issue-8, pp-76-80
- [3] M.M.Noor, K.Kadirgama, M.M.Rahman, M.S.M.Sani, M.R.M.Rejab "Development of Auto Car Jack Using Internal Car Power", Malaysian Science and Technology Congress, MSTC08, 16~17 Dec, KLCC, Malaysia, 2008
- [4] Mohammed Abuzaid, Mohammad Hasnain, Shabaj Alam Sohail khan, Prof. Surendra Agarwal "Inbuilt Hydraulic Jack in Automobile Vehicles", International journal on innovation in engineering and technology (IJJET).
- [5] P.S. Rana, P.H. Belge, N.A. Nagrare, C.A. Padwad1, P.R. Daga, K.B. Deshbhratar N.K. Mandavgade "Integrated Automated Jacks for 4 wheelers", European Journal of Applied Engineering and Scientific Research, 2012, 1 (4):167-172.
- [6] 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.