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PERFORMANCE OF ANDROID OPERATED SCREW JACK

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Abstract— Screw jack is one of the important device while lifting the load it is available in conventional this project deals with the screw jack is operated by using the android application 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 [1] in which a small force applied in a horizontal plane is used to raise or lower a large load. The principle on which it works is similar to that of an inclined plane. The mechanical advantage of a screw jack is the ratio of the load applied to the effort applied. The screw jack is operated by turning a lead screw. The height of the jack is adjusted by turning a lead screw and this adjustment can be done either manually or by integrating an electric motor. In this project, an electric motor will be integrated with the screw jack and the electricity needed for the operation will be taken from the battery of the vehicle and thereby the mechanical advantage will be increased. An Android device is used to Control the DC Motor by using a Printed Circuit Board.

Keywords—**Toggle switches, DC motor, Armature, Electromagnets etc**

I. INTRODUCTION

A screw jack is a portable device consisting of a screw mechanism used to raise or lower the load. The principle on which the screw jack works is similar to that of an inclined plane. There are mainly two types of jacks-hydraulic and mechanical. A hydraulic jack consists of a cylinder and piston mechanism. The movement of the piston rod [2] is used to raise or lower the load. Mechanical jacks can be either hand operated or power driven. Jacks are used frequently in raising cars so that a tire can be changed. A screw jack is commonly used with cars but is also used in many other ways, including industrial machinery and even airplanes. They can be short, tall, fat, or thin depending on the amount of pressure they will be under and the space that they need to fit into. The jack is made out of various types of metal, but the screw itself is generally made out of lead. While screw jacks are designed purposely for raising and lowering loads, they are not ideal for side loads, although some can withstand side loads depending on the diameter and size of the lifting screw. Shock loads should also be avoided or minimized. Some screw jacks are built with anti-backlash. The anti-backlash device moderates the axial backlash in the lifting screw and nut assembly to a regulated minimum. A large amount of heat is generated in the screw jack and long lifts can cause serious overheating. To retain the efficiency of the screw jack, it must be used under ambient temperatures, otherwise lubricants must be applied. There is oil lubricants intended to enhance the equipment's capabilities. Apart from proper maintenance, to

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optimize the capability and usefulness of a screw jack it is imperative to employ it according to its design and manufacturer's instruction. Ensure that you follow the speed, load capacity, temperature recommendation and other relevant factors for application.

1.1Loads and Stresses in Screw

The load on the screw is the load which is to be lifted W, twisting moment M, between the screw threads and force F at the handle to rotate the screw. The load W is compressive in nature and induces the compressive stress in the screw. It may also lead the screw to buckle. The load F produces bending and it is maximum, when the screw is at its maximum lift. The screw also experiences twisting moment[5] due to F. the shear stress is also induced in the screw due to the twisting moment between the threads of screw and nut.

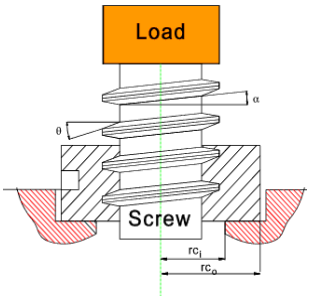

Fig. 1 shear stress induced in the screw

Step I Problem Specification:

It is required to design a screw jack for supporting the machine parts during their repair and maintenance. It should be a general purpose jack with a load carrying capacity of 50KN and a maximum lifting height of 0.3m. The jack is to be operated by means of a DC motor.

Step II Selection of Materials:

The frame of the screw jack has complex shape. It is subjected to compressive stress. Grey cast iron is selected as the material for the frame. Cast iron is cheap and it can be given any complex shape without involving costly machining operations. Cast iron has higher compressive strength compared with steel. Therefore, it is technically and economically advantageous to use cast iron for the frame. The screw is subjected to torsional moment, compressive force[4] and bending moment. From strength consideration, EN8 is selected as material for screw.There is a relative motion between the screw and the nut, which results in friction. The friction causes wear at the contacting surfaces. When the same material is used for these two components, the surfaces of both components get worn out, requiring replacement. This is undesirable. The size and shape of the screw make it costly compared with the nut. The material used for the nut is stainless steel.

Step III Design of Screw:

The screw jack is an intermittently used device and wear of threads is not an important consideration. Therefore, instead of trapezoidal threads, the screw is provided with square threads. Square threads have higher efficiency and provision can be made for self-locking[3] arrangement. When the condition of self-locking is fulfilled, the load itself will not turn the screw and descend down, unless an effort in the reverse direction is applied.

II.Android operated screw jack

II.1Motorized Screw Jack

Our survey in the regard in several automobile garages, revealed the facts that mostly some difficult methods were adopted in lifting the vehicles for reconditioning. Now the paper has mainly concentrated on this difficulty, and hence a suitable device has been designed, such that the vehicle can be lifted from the floor land without application of any impact force. The fabrication part of it has been considered with almost case for its simplicity and economy, such that this can be accommodated as one of the essential tools on automobile[3] garages. The motorized screw jack has been developed to cater to the needs of small and medium automobile garages, which are

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normally man powered with minimum skilled labour. In most of the garages the vehicles are lifted by using screw jack. This needs high man power and skilled labour. In order to avoid all such disadvantages, the Motorized Screw 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 DC motor is coupled with the screw jack by gear arrangement. The screw jack shaft's rotation depends upon the rotation of DC motor. This is a simple type of automation project.

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains to be an essential part of the system although with changing demands on physical input, the degree of mechanization is increased.

Fig. 2 the Motorized screw Jack

II.2 Parts of Motorized Screw Jack

The main parts of the motorized screw jack are as follows:

Screw Jack

The screw jack used in this project is a 5 tone bottle (cylindrical) jack. It mainly consists of the body, screw, nut and thrust bearings. In this type of a jack, the nut remains stationary while the screw rotates and helps in lifting or lowering of the load.

Capacity	:	2Ton
Min height	:	160MM
Max height	:	280MM
Net Weight	:	8KG
Lifting heigh	:	120 mm

Spur Gear

The spur gears, which are designed to transmit motion and power between parallel shafts, are the most economical gears in the power transmission industry.

Design considerations for a gear drive

Speeds In Gear Box:

Measured Specifications:

N1/N2 = D2/D1

N1 = Motor speed in RPM---40RPM

N2 = Output speed

D2 = Diameter of the roller gear wheel

= 100 mm

D1 = Diameter of the motor gear wheel

= 60 mm

$\therefore$ N2 = (D1/D2) x N1

= (60/ 100) X40

= 24 Rpm

Description of dc motor

An electric motor is a machine which converts electrical energy to mechanical energy. Its action is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a magnetic force whose direction is given by Fleming's left hand rule. When a motor is in operation, it develops torque. This torque can produce mechanical rotation. DC motors are also like generators classified into shunt wound or series wound or compound wound motors.

Electromagnets and Motors

An electromagnet is the basis of an electric motor. You can understand how things work in the motor by imagining the following scenario. Say that you created a simple electromagnet by wrapping 100 loops of wire around a nail and connecting it to a battery. The nail would become

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a magnet and have a North and South Pole[6] while the battery is connected. Now say that you take your nail electromagnet, run an axle through the middle of it, and you suspended it in the middle of a horseshoe magnet as shown in the figure below. If you were to attach a battery to the electromagnet so that the North end of the nail appeared as shown, the basic law of magnetism tells you what would happen The North end of the electromagnet would be repelled from the north end of the horseshoe magnet and attracted to the south end of the horseshoe magnet.The South end of the electromagnet would be repelled in a similar way. The nail would move about half a turn and then stop in the position shown.

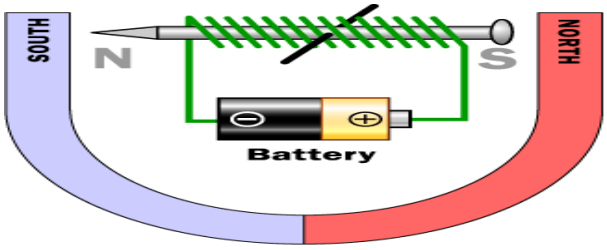

Fig. 2 The nail would become a magnet and have a North and South Pole

You can see that this half-turn of motion is simple and obvious because of the way magnets naturally attract and repel one another. The key to an electric motor is to then go one step further so that, at the moment that this half-turn of motion completes, the field of the electromagnet flips. The flip causes the electromagnet to complete another half-turn of motion. You flip the magnetic field simply by changing the direction of the electrons flowing in the wire (you do that by flipping the battery over). If the field of the electromagnet flipped at just the right moment at the end of each half-turn of motion, the electric motor would spin freely.

The Armature

The armature takes the place of the nail in an electric motor. The armature is an electromagnet made by coiling thin wire around two or more poles of a metal core. The armature has an axle, and the commutator is attached to the axle. In the diagram above you can see three different views of the same armature: front, side and end-on. In the end-on view the winding is eliminated to make the commutator more obvious. The commutator is simply a pair of plates attached to the axle. These plates provide the two connections for the coil of the electromagnet.

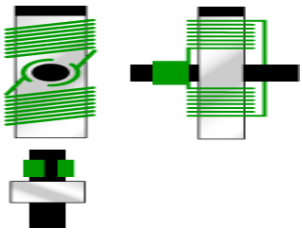

Fig. 4 The current flow through the electromagnet the armature winding has been left out so that it is easier to see the commutator in action. The key thing to notice is that as the armature passes through the horizontal position, the poles of the electromagnet flip. Because of the flip, the North pole of the electromagnet is always above the axle so it can repel the field magnet's North pole and attract the field magnet's South pole. If you ever take apart an electric motor you will find that it contains the same pieces described above: two small permanent magnets, a commutator, two brushes and an electromagnet made by winding wire around a piece of metal. Almost always, however, the rotor will have three poles rather than the two poles as shown in this article. There are two good reasons for a motor to have three poles:

- It causes the motor to have better dynamics. In a two-pole motor, if the electromagnet is at the balance point, perfectly horizontal between the two poles of the field magnet when the motor starts; you can

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imagine the armature getting "stuck" there. That never happens in a three-pole motor.

- Each time the commutator hits the point where it flips the field in a two-pole motor, the commutator shorts out the battery (directly connects the positive and negative terminals) for a moment. This shorting wastes energy and drains the battery needlessly. A three-pole motor solves this problem as well.
- It is possible to have any number of poles, depending on the size of the motor and the specific application it is being used in.

II.3Working Principle

- An Android application Called Bluetooth controller is used to control the screw jack, The App gives signals to the Micro controller through a Bluetooth device. Then the microcontroller controls the relay switches in which direction the power has to pass. The lead-acid battery is connected to the circuit board. And then the circuit board is connected to the DC Motor. The DC motor shaft is connected to the spur gear [8]. If power is given to the DC motor, it will run so that the spur gear also runs to slow down the speed of the DC motor. The screw jack moves the screw upward, so that the vehicle lifts from ground. The vehicle is lifted by using the lifting platform at the top of the screw jack. The motor draws power supply from the battery. The rising and lowering is done by changing the battery supply to the motor.

The following steps involved in connecting Device

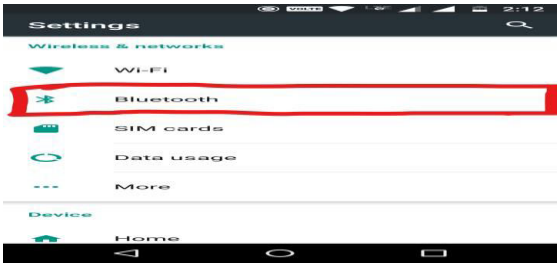

Fig. 5 step1 connect the Bluetooth using android

2. Secondly, Click on the available Bluetooth device to pair.

Fig. 6 step 2 pair the device

3. In the Password section enter ‘‘1234’’ as password and click OK.

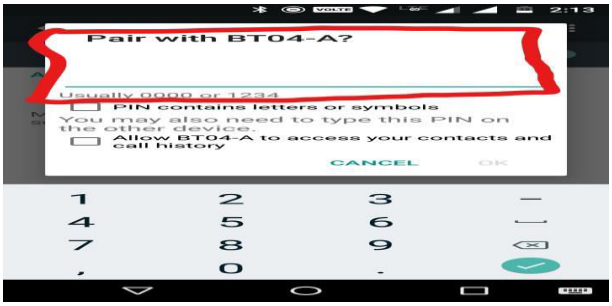

Fig. 6 step 3 Enter the password

4. Open the Installed Application in mobile and click on the screen as shown in Fig. below.

Fig. 7 step 4 Installed Application by using the mobile

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5. Click on the Bluetooth address available on the screen to connect with application. After clicking this, The App will be connected.

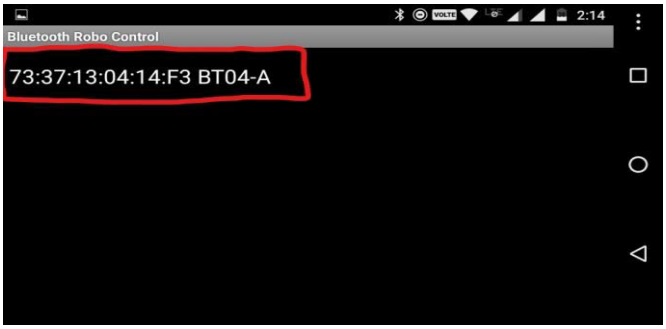

Fig. 8 step 5 Find the Bluetooth

6. Click on the upper arrow for lifting and down arrow for lowering the Load as shown in Fig. and Click the marked area for disconnect the application.

Fig. 9 step 6 Click on the upper arrow for lifting and down arrow for lowering the Load

II.4 Design calculations to check the safety of LEAD SCREW

Maximum Load to be lifted = 5 Ton

= 50 x 103 N

= 50KN

For a 5 Ton capacity screw jack, the suitable screw is the one whose nominal (major) diameter is 36mm

III.Conclusions

Screw Jacks are the ideal product to push, pull, lift, lower and position the 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 desirably 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 4,000-5,000 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 the Android Operated motorized screw jack will prove to be beneficial in lifting and lowering of loads.

TABLE I. **NOMINAL DIAMETER, D (MM)**	TABLE II. **PITCH, P (MM)**
TABLE III. 22, 24, 26, 28	TABLE IV. 5
TABLE V. 30, 32, 36	TABLE VI. 6
TABLE VII. 40, 44	TABLE VIII. 7
TABLE IX. 48, 50, 52	TABLE X. 8
TABLE XI. 55, 60	TABLE XII. 9
TABLE XIII. 65, 70, 75, 80	TABLE XIV. 10
TABLE XV. 85, 90, 95, 100	TABLE XVI. 12

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