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Android App Controlled Automobile Screw Jack for Light and Heavy Transport

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Abstract: ***This project is designed with Driver circuit with relay, BLUETOOTH APP (remote), Dc motor and jack model. Either the battery power or direct power supply is used to control the jack motor. The Bluetooth keypad is used to control the direction of the motor which is coupled with the spur gear.***
Relay is directly connected with the DC motor. When the start key is pressed the motor is operated in forward direction and the when the stop key is pressed the motor is stops automatically. The forward and reverse button in the remote is used to operate the motor is required directions. Bluetooth app Using To Control All Operation Using Wireless Communication.
Keywords: NodeMCU, Screw jack, Motorized screw jack, Android application

I. INTRODUCTION

When we are traveling in the road for a particular work, if suppose tyre gets puncture it will be a big headache to remove the tyre and fixing up the stepney also it is not easy to lift the jack manually in the workshop. This makes the worker to get tired. It's all a tedious work for the worker. In order to overcome this problem we have designed and developed a system called motorized jack operating through keypad by having full control of the jack, we can easily lift it up and down by using the on/off. This helps to reduce the burden of the worker. 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 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 aeroplanes. 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. 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. 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 are oil lubricants intended to enhance the equipment's capabilities. Apart from proper maintenance, to 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.

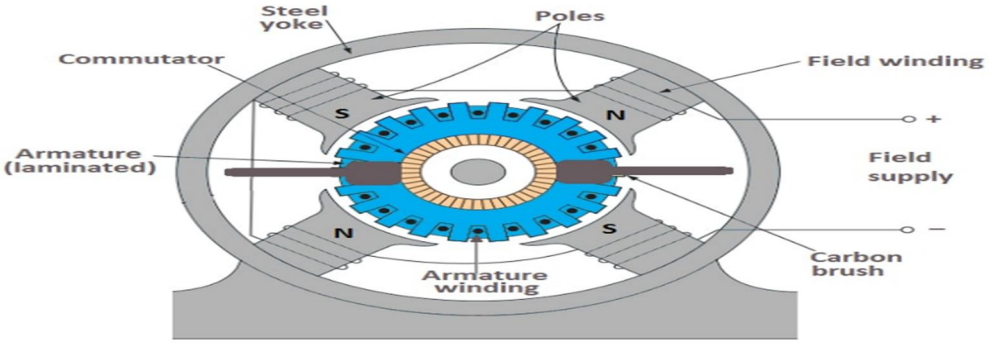
II. DESIGN OF EQUIPMENT

The DESIGN AND FABRICATION OF ANDROID APP CONTROLLED AUTOMOBILE SCREW JACK machine consists of the following components to full fill the requirements of complete operation of the machine.

1) DC motor
2) Screw jack
3) ESP8266 WIFI MODULE
4) Relay
5) Micro controller
6) Transformer
7) Rechargeable Battery

A. DC Motor

In any electric motor, operation is based on simple electromagnetism. 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.Every DC motor has six basic parts -- axle, rotor (armature), stator, commutator, field magnet(s), and brushes. In most common DC motors, the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor. The rotor (together with the axle and attached commutator) rotate with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator. The geometry of the brushes, commutator contacts, and rotor windings are such that when power is applied, the polarities of the energized winding and the stator magnet(s) are misaligned, and the rotor will rotate until it is almost aligned with the stator's field magnets.



B. Screw Jack

A jack screwjack or jackscrew is a mechanical device used as a lifting device to lift heavy loads by applying minimal forces. A hydraulic jack uses hydraulic power. The most common form is a car jack floor jack or garagejack which lifts vehicles so that maintenance can be performed

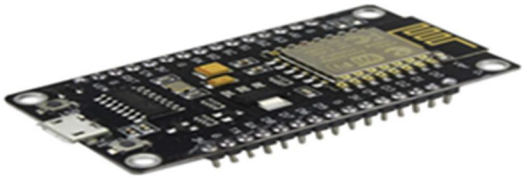
C. ESP8266 WIFI Module

The ESP8266 WIFI Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WIFI network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WIFI-ability as a WIFI Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community. This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other applications. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. In the Documents section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IoT (Internet of Things) solution!

Note: The ESP8266 Module is not capable of 5-3V logic shifting and will require an external Logic Level Converter. Please do not power it directly from your 5V dev board.
Note: This new version of the ESP8266 WIFI Module has increased the flash disk size from 512k to 1MB.

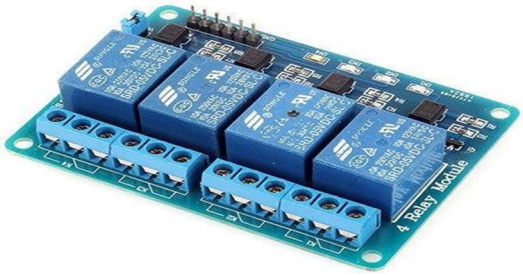
D. Relay

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off. So relays have two switch positions and they are double throw (changeover) switches.
Relays allow one circuit to switch a second circuit which can be completely separate from the first. The link is magnetic and mechanical. The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification. Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. The animated picture shows a working relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts. There is one set of contacts (SPDT) in the foreground and another behind them, making the relay DPDT



E. Micro Controller

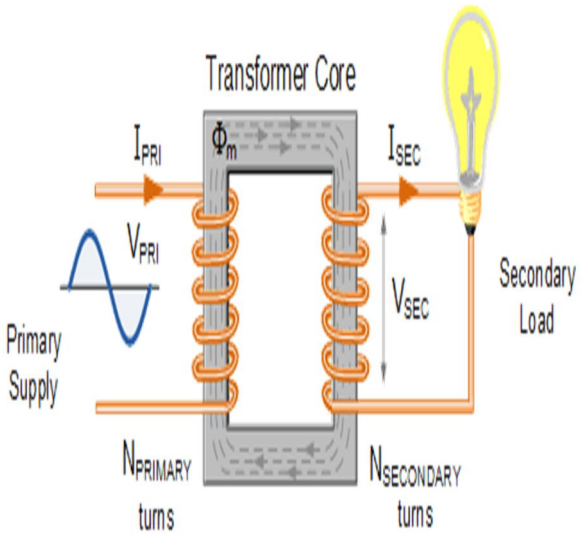
Microcontrollers are destined to play an increasingly important role in revolutionizing various industries and influencing our day to day life more strongly than one can imagine. Since its emergence in the early 1980's the microcontroller has been recognized as a general purpose building block for intelligent digital systems. It is finding using diverse area, starting from simple children's toys to highly complex spacecraft. Because of its versatility and many advantages, the application domain has spread in all conceivable directions, making it ubiquitous As a consequence, it has generate a great deal of interest and enthusiasm among students, teachers and practicing engineers, creating an acute education need for imparting the knowledge of microcontroller based system design and acute education need for imparting the knowledge of microcontroller-based system design and development. It identifies the vital features responsible for their tremendous impact; the acute educational need created by them and provides a glimpse of the major application area.



F. Transformer

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors—the transformer's coils. A varying current in the first or primary winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic field through the secondary winding. This varying magnetic field induces a varying electromotive force (EMF), or "voltage", in the secondary winding. This effect is called inductive coupling. If a load is connected to the secondary, current will flow in the secondary winding, and electrical energy will be transferred from the primary circuit through the transformer to the load. In an ideal transformer, the induced voltage in the secondary winding (Vs) is in proportion to the primary voltage (Vp) and is given by the ratio of the number of turns in the secondary (Ns) to the number of turns in the primary (Np) as follows

$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$



By appropriate selection of the ratio of turns, a transformer thus enables an alternating current (AC) voltage to be "stepped up" by making Ns greater than Np, or "stepped down" by making Ns less than Np.

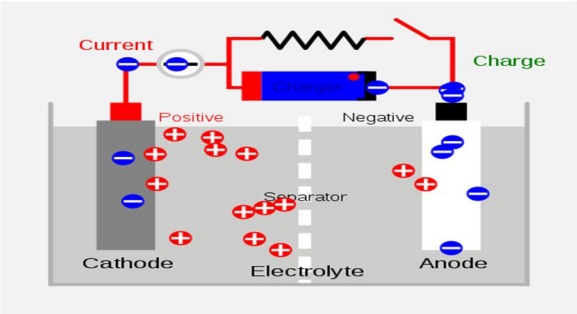
In the vast majority of transformers, the windings are coils wound around a ferromagnetic core, air-core transformers being a notable exception.

Transformers range in size from a thumbnail-sized coupling transformer hidden inside a stage microphone to huge units weighing hundreds of tons used to interconnect portions of power grids. All operate on the same basic principles, although the range of designs is wide. While new technologies have eliminated the need for transformers in some electronic circuits, transformers are still found in nearly all electronic devices designed for household ("mains") voltage. Transformers are essential for high-voltage electric power transmission, which makes long-distance transmission economically practical.

G. Rechargeable Battery

A Rechargeable battery, storage battery, or secondary cell (formally a type of Energy Accumulator), is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells. The term "accumulator" is used as it accumulates and stores energy through a reversible electrochemical reactions.

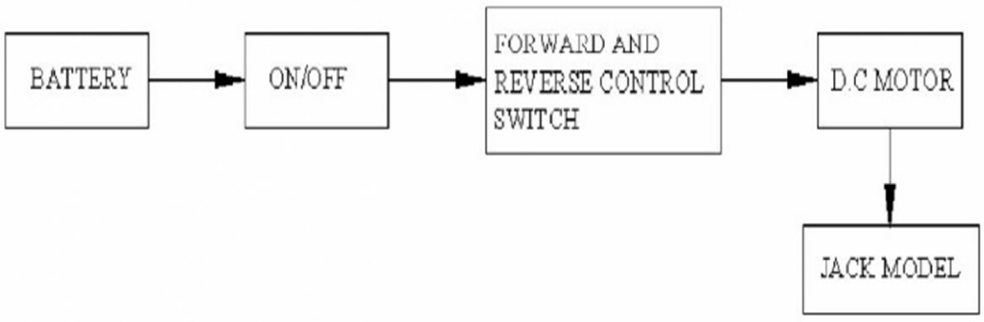
Rechargeable batteries are produced in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network Several different combinations of electrode materials and electrolytes are used, including lead–acid, zinc–air, nickel–cadmium (NiCd),nickel–metal hydride (NiMH), lithium-ion (Li-ion), lithium iron phosphate (LiFePO4), and lithium-ion polymer (Li-ion polymer).



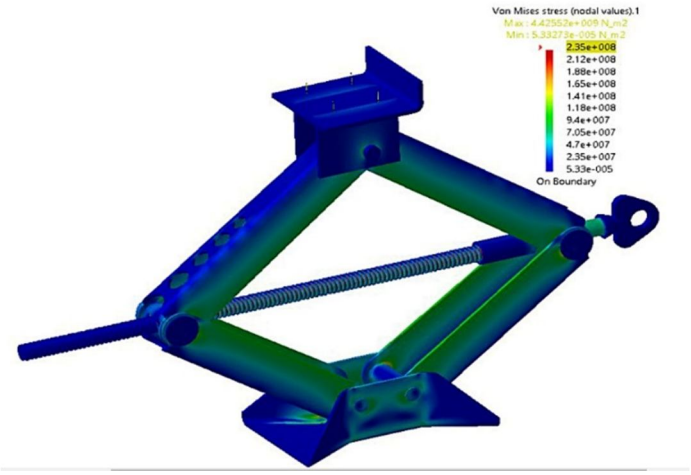
III. WORKING PRINCIPLE

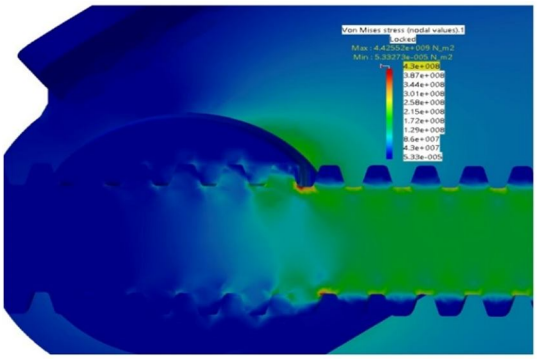
This project is designed with Driver circuit with relay, IOT APP (remote), Dc motor and jack model. direct power supply is used to control the jack motor. The IOT app is used to control the direction of the motor which is coupled with the dc motor. Relay is directly connected with the DC motor. When the start key is pressed the motor is operated in forward direction and the when the stop key is pressed the motor is stops automatically. The forward and reverse button in the remote is used to operate the motor is required directions. IOT app Using To Control All Operation Using Wireless Communication.

IV. WORKING IMAGE



V. ANALYSIS OF SCREW JACK





VI. CALCULATIONS

LIFITING CAPACITY OF JACK

Let's assume we have a 12V motor with a power rating of 100 watts and a maximum speed of 500 RPM. The screw has a pitch of 5 mm and a diameter of 10 mm.

Calculate the mechanical advantage:

Mechanical advantage =

(2 x pi x diameter) / pitch

Mechanical advantage = (2 x 3.14 x 10) / 5

Mechanical advantage = 12.56

Determine the load capacity:

Load capacity =

Mechanical advantage x Force

Assuming a force of 1000 N:

Load capacity = 12.56 x 1000

Load capacity = 12560 N

Determine the required power of the motor:

Motor power =

Load capacity x Screw speed

Assuming a screw speed of 10 mm/s:

Motor power = 12560 x 0.01

Motor power = 125.6 W

VII. MERITS AND DEMERITS

A. Merits

1) Low cost
2) Easy to operate
3) Reduce the manpower
4) Portable device
5) Low power consumption

B. Demerits

1) Jack cannot be operated without electric power.
2) Cost of the equipment is high when compared to ordinary hand jack.
3) Taking care of handling the equipments like proper wiring connection, battery charging checkup,etc.

VIII. CONCLUSION

The project carried out by us made an impressing task in the field of automobile and automobile workshops. It is very usefully for the workers to work in the automobile workshop are in the service station.

This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also been provided.

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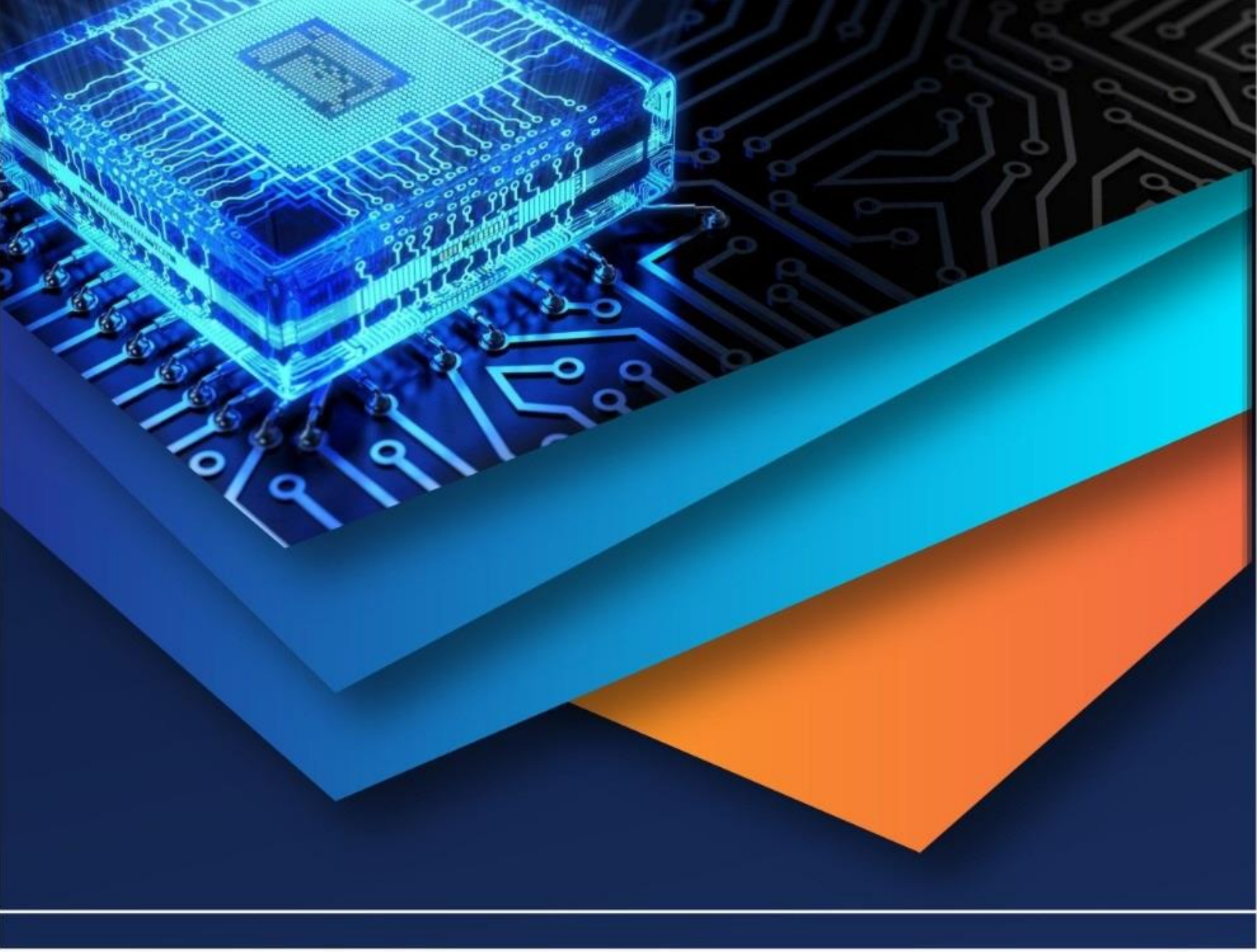

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