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DESIGN AND FABRICATION OF MOBILE CONTROL SCREWJACK

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Abstract
In the present era an automobile has become the part and parcel of our life even after the Introduction of new range of tubeless tires a most common problem with us is the punctured wheel which is really a cumbersome &tedious task and the most tiring amongst the whole process is placing jack and lifting it. But what if this tiring task is done by the just one click. The titled design and fabrication of mobile controlled screw jack is the solution for the same in this we have primarily designed a screw jack and then by assembling motors and other components we have also simulated the design on the same which give the exact and virtual idea of our project. After successful design and procurement of the materials all the necessary components were manufactured and assembled. The entire assembly is controlled by an android mobile. The moment of the jack done by the assembly of an DC motors and lifting operation is obtained.

Keywords: Mobile Control Screw jack, DC motors, automobile and Motors.

1. Introduction

Everyday humans strive to develop the new and existing products to ease the operation and reduce the manual work. A jack is a device used for lifting heavy objects. Car jacks usually use mechanical advantage to allow a human to lift a vehicle by manual force alone. More powerful jacks use hydraulic power to provide more lift over the greater distance. The jack work on the principle of mechanical advantage and the mechanical advantage is the factor by which a mechanism multiplies the force or torque applied to it. A car jack is a device used to lift up the cars while changing the tires, under chassis works or during an emergency. Car jacks available in the markets has some disadvantages such as requiring more energy to operate, are not suitable for women. The purpose of this work is to modify the design of the existing car jack in terms of its functionality. In this ”Android-based advanced car lifting system using ” 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 translate to the engineering characteristic to obtain the concepts that need to be modified and fabricated.

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From the house of quality, the best concept will be valued, based on the weighted rating method. Then the configuration design was analyzed according to the function factor and critical issue that the design that had been implementing was according to the specification. In this paper, we employed a reduction gearbox to transmit the motor power to the lead screw to facilitate the motion of Jack. The power supply to the motor which is derived from the car battery is monitored and directed using a circuit built to serve the purpose. An automotive jack is a device used to raise all or part of a vehicle into the air in order to facilitate repairs. Most of the people are familiar with the basic auto jack that was still included as standard equipment with most new cars. In the US Patent 6237953, the author mentions that at least one inverted jack driven by an electric motor permanently attached to the vehicle . The system may employ a jack disposed between the front and rear wheel on each side of the vehicle, or it may be equipped with a jack at each of the four wheels. The system also features a novel wheel and hub axle assembly featuring a split axle whose length may be adjusted by operation of an electric motor. Both the motor for raising the jack and the motor for adjusting the length of the axle may be operated by remote control.

Only rivet joints are induced by in the place of welded joints to avoid distortion. Many improvements have been made in this field. Shraddha et al. developed automatic hydraulic lifting system using a hydraulic cylinder. M.M.Noor et al. proposed a new automated jack system controlled by a wired remote which derives power from the car battery. Ivan Sunit Rout et. al. proposed a motorized jack system built using a screw jack deriving power from an external battery. Manoj Patil et al. developed a new automated jack system which is controlled by a wired remote control to operate the jack. In many situations, jacks fail and cause a serious accident. Asonye et al. built hydraulic jack systems which consist of a base, gearing system, and crank mechanism. This derives power from the car battery through the lighter adapter. A new method of manufacturing was introduced by using different materials for different parts of the jack to attain the maximum efficiency . The rest of the paper is structured with the preliminary concept of proposed design in Section II. The Proposed methodology is explained briefly in Section III and finally, the paper concludes in Section IV. 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. 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

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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 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.

Design of machine elements by V.B.Bhandari [1] Screw type mechanical jacks were very common for jeeps and trucks of World War II vintage. For example, the World War II jeeps (Willys MB and Ford GPW) were issued the "Jack, Automobile, Screw type, Capacity 1 1/2 ton", Ordnance part number 41-J-66. This jacks, and similar jacks for trucks, were activated by using the lug wrench as a handle for the jack's ratchet action to of the jack. The 41-J-66 jack was carried in the jeep's tool compartment. Screw type jack's continued in use for small capacity requirements due to low cost of production raise or lower it. RAJENDRA KARWA [2] A control tab is marked up/down and its position determines the direction of movement and almost no maintenance. The virtues of using a screw as a machine, essentially an inclined plane wound round a cylinder, was first demonstrated by Archimedes in 200BC with his device used for pumping water. There is evidence of the use of screws in the Ancient Roman world but it was the great Leonardo da Vinci, in the late 1400s, who first demonstrated the use of a screw jack for lifting loads. design used a threaded worm gear, supported on bearings, that rotated by the turning of a worm shaft to drive a lifting screw to move the load - instantly recognizable as the principle we use today. We can t be sure of the intended application of his invention, but it seems to have been relegated to the history books, along with the helicopter and tank, for almost four centuries. It is not until the late 1800s that we have evidence of the product being developed further. With the industrial revolution of the late 18th and 19th centuries came the first use of screws in machine tools, via English inventors such as John Wilkinson and Henry Maudsley The most notable inventor in mechanical engineering from the early 1800s was undoubtedly the mechanical genius Joseph Whitworth, who recognised the need for precision had become as important in industry as the provision of power. While he would eventually have over 50 British patents with titles ranging from knitting machines to rifles, it was Whitworth on screw cutting machines, accurate measuring instruments and standards covering the angle and pitch of screw threads that would most influence our industry today. Whitworth s tools had become internationally famous for their precision and quality and dominated the market from the 1850s. Inspired young engineers began to put Whitworth s machine tools to new

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2. Existing Work

2.1 Motorized Screw Jack.

This Project," Motorized Screw" is a device used to fully or partially lift, lower or position an object. Screw jacks are often found in machine shops, auto repair facilities and in the automotive racing industry. Many vehicles also have a screw jack included with the spare tire kit, so drivers can repair a tire easily. Very large screw jack systems are even used to lift houses for foundation repair or replacement with this model, we have designed and developed a working prototype of a motorized screw jack. The construction mainly consists of an aluminum framework and a wooden base to provide low weight. To activate the lead screw, a high torque motor is used which is connected to the screw with the help of a coupler. To control DC Motor, we have used DPDT switches which in turn control the overall motion of the jack.

Fig.1 Motor Operated Screw Jack

2.2 Features and Benefits

Safety Features;- Screw Jacks are inherently safe and comply with a number of ISO EN standards for machinery, lifting tables and platform. Some of the main safety features are:-

- Safety Nuts- Secondary follow Nuts can allow monitoring of wear and secondary redundancy if Nut fails in service. Sensors can be fitted to detect failure/max wear reached.
- Self-Locking- Gearbox: All screw jacks ratios are self-locking and will not backwind when power off. Standard ratio with trapezoidal spindles will remain self-locking when static (comes to rest), Low ratio worm gearbox will offer a dynamic self-lock and will slow and lock the moving load when powered off.
- Secondary Safety- For lift systems for personnel; redundancy or secondary safety is required. Screw jacks can be offered with Self-locking jacks, Safety Nuts, Brake, motors, and even linear braking elements so a secondary safety measure is always in place.

3. Implementation

After successful designing and simulation of the model, all the necessary parts were procured, manufactured and assembled. Manufacturing was done using various machines such as Milling for slot cutting, drilling machine or making holes and Cutter Grinder for various cutting and grinding operations. After the fabrication and assembly of the entire assembly, the app and coding was done. to control the entire assembly using app, a proper circuitry and coding is needed, the brain of the entire assembly is Arduino Uno which is used to drive and control both the motors using app. The coding on Arduino UNO was done with the help of Arduino IDE software. After coding the Arduino, the required app was made on MIT

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app maker. After making the app the Arduino was patched up with the app to command the Arduino using the app. To control the motors using app wirelessly a device known as HC-05 Bluetooth module was connected to Arduino.

FIG 2: Blynk Application

3.1 Blynk application:

Blynk supports hardware platforms such as Arduino, Raspberry Pi, and similar microcontroller boards to build hardware for your projects. The following is a list of some microcontroller boards that can be coupled with Blynk: Espressif (ESP8266, ESP32, NodeMCU, WeMos D1, Adafruit HUZZAH, SparkFun Blynk
Board, SparkFun ESP8266 Thing)
Linux (C++) (Raspberry Pi, Ubuntu)
Arduino (Arduino UNO, Arduino MKR1000, Arduino MKRZero, Arduino Yun, Arduino 101, Arduino Zero, Arduino M0, Arduino M0 Pro, Arduino Nano, Arduino Leonardo, Arduino Due, Arduino Mega 2560, Arduino Mega 1280, Arduino Mega ADK, Arduino Micro, Arduino Pro Micro, Arduino Mini, Arduino Pro Mini, Arduino Fio, Arduino Decimilia, Arduino Duemilanove, Arduino Pro, Arduino Ethernet, Arduino Leonardo ETH, Arduino Industrial 101)
Particle (particle core, particle photon, particle electron)

3.2 Connection types

Blynk supports the following connection types to connect your microcontroller board (hardware) with the Blynk Cloud and Blynk's personal server:
internet
Wi-Fi
Bluetooth
Cellular
Serial
However, throughout this book, you will only focus on Wi-Fi and Ethernet connection types to connect with Blynk Cloud and Blynk's personal server. Blynk architecture
The Blynk platform includes the following components:
Blynk app builder: Allows to you build apps for your projects using various widgets. It is available for Android and iOS platforms. Blynk server: Responsible for all the communications between your mobile device that's running the Blynk app and the hardware. You can use the Blynk Cloud or run your private Blynk server locally. It's open source, could easily handle thousands of devices, and can even be launched on a Raspberry Pi.Blynk libraries: Enables communication with the server and processes all the incoming and outcoming commands from your Blynk app and the hardware. They are available for all the popular hard platforms.

All the aforementioned components communicate with each other to build a fully

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functional IoT application that can be controlled from anywhere through a preconfigured connectivity type. You can control your hardware from the Blynk app running on your mobile device through the Blynk Cloud or Blynk's personal server. It works the same in the opposite direction by sending rows of processed data from hardware to your Blynk app.

3.3 Applications

Arduboy, a handheld game console based on Arduino
Arduinome, a MIDI controller device that mimics the Monome
Ardupilot, drone software and hardware
ArduSat, a cubesat based on Arduino.
C-STEM Studio, a platform for hands-on integrated learning of computing, science, technology, engineering, and mathematics (C-STEM) with robotics.
Data loggers for scientific research.
OBDuino, a trip computer that uses the on-board diagnostics interface found in most modern cars
OpenEVSE an open-source electric vehicle charger
XOD, a visual programming language for Arduino

3.4 Blynk ecosystem

The Blynk ecosystem consists of the following partners. They can cover anything from electronic components, to manufacturing and data plans:
Intel IoT Solutions Alliance
SparkFun Electronics
Espressif
littleBits
Hologram
ThingSpeak.com
Electric Imp
Punch Through
Codebender
RedBearLab
Wicked device
TinyCircuits
Arduino
Texas Instruments
Proximus
Deutshe Telekom
Particle
Samsung

3.5 IOT circuit Nodemcu

NodeMCU is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. Later, support for the ESP32 32-bit MCU was added.

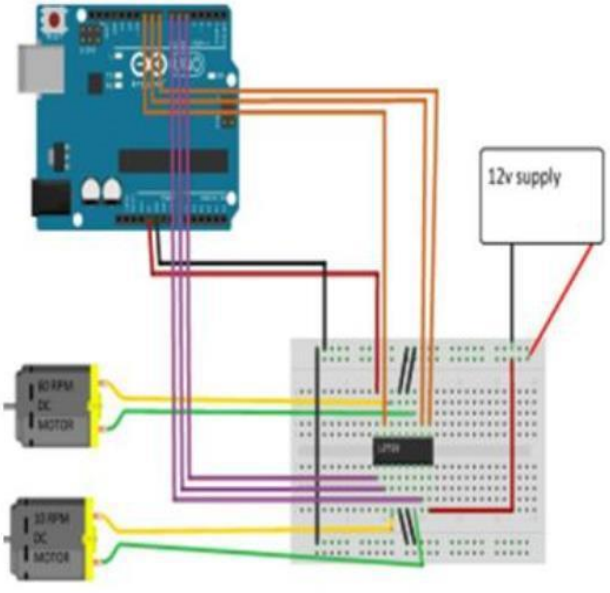

Fig 3: Circuit Diagram

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Both the firmware and prototyping board designs are open source.

The firmware uses the Lua scripting language. The firmware is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as luacjsonand SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented. The prototyping hardware typically used is a circuit board functioning as a dual in-line package (DIP) which integrates a USB controller with a smaller surface-mounted board containing the MCU and antenna. The choice of the DIP format allows for easy prototyping on breadboards. The design was initially based on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC integrated with a Tensilica Xtensa LX106 core, widely used in IoT applications (see related projects). As Arduino.cc began developing new MCU boards based on non-AVR processors like the ARM/SAM MCU and used in the Arduino Due, they needed to modify the Arduino IDE so that it would be relatively easy to change the IDE to support alternate toolchains to allow Arduino C/C++ to be compiled for these new processors. They did this with the introduction of the Board Manager and the SAM Core. A "core" is the collection of software components required by the Board Manager and the Arduino IDE to compile an Arduino C/C++ source file for the target MCU's machine language. Some ESP8266 enthusiasts developed an Arduino core for the ESP8266 WiFi SoC, popularly called the "ESP8266 Core for the Arduino IDE". This has become aleading software development platform for the various ESP8266-based modules and development boards, including NodeMCUs.

3.6 Arduino

Arduino is an open-source hardware and software company, project and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices. Its hardware products are licensed under a CC-BY-SA license, while software is licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1] permitting the manufacture of Arduino boards

3.7 History

The Arduino project was started at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy.

At that time, the students used a BASIC Stamp microcontroller at a cost of $50. In 2003 Hernando Barragán created the development platform Wiring as a Master's thesis project at IDII, under the supervision of Massimo Banzi and Casey Reas. Casey Reas is known for co-creating, with Ben Fry, the Processing development platform. The project goal was to create simple, low cost tools for creating digital projects by non-engineers. The Wiring platform consisted of a printed circuit board (PCB) with an ATmega168 microcontroller, an IDE based on Processing and library functions to easily program the microcontroller. In 2005, Massimo Banzi, with David Mellis, another IDII student, and David Cuartielles, extended Wiring by adding support for the cheaper ATmega8 microcontroller. The new project, forked from Wiring, was called Arduino. The initial Arduino

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core team consisted of Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis. Following the completion of the platform, lighter and less expensive versions were distributed in the open-source community. It was estimated in mid-2011 that over 300,000 official Arduinos had been commercially produced, and in 2013 that 700,000 official boards were in users' hands.

3.8 Trademark dispute

In early 2008, the five co-founders of the Arduino project created a company, Arduino LLC, to hold the trademarks associated with Arduino. The manufacture and sale of the boards was to be done by external companies, and Arduino LLC would get a royalty from them. The founding bylaws of Arduino LLC specified that each of the five founders transfer ownership of the Arduino brand to the newly formed company.[citation needed] At the end of 2008, Gianluca Martino's company, Smart Projects, registered the Arduino trademark in Italy and kept this a secret from the other co-founders for about two years. This was revealed when the Arduino company tried to register the trademark in other areas of the world (they originally registered only in the US), and discovered that it was already registered in Italy. Negotiations with Martino and his firm to bring the trademark under control of the original Arduino company failed. In 2014, Smart Projects began refusing to pay royalties.

They then appointed a new CEO, Federico Musto, who renamed the company Arduino SRL and created the website arduino.org, copying the graphics and layout of the original arduino.cc. This resulted in a rift in the Arduino development team. In January 2015, Arduino LLC filed a lawsuit against Arduino SRL. In May 2015, Arduino LLC created the worldwide trademark Genuino, used as brand name outside the United States.

At the World Maker Faire in New York on 1 October 2016, Arduino LLC co-founder and CEO Massimo Banzi and Arduino SRL CEO Federico Musto announced the merger of the two companies. Around that same time, Massimo Banzi announced that in addition to the company a new Arduino Foundation would be launched as "a new beginning for Arduino.", but this decision was withdrawn later.

3.9 Hardware

Arduino is open-source hardware. The hardware reference designs are distributed under a Creative Commons Attribution Share-Alike 2.5 license and are available on the Arduino website. Layout and production files for some versions of the hardware are also available. Although the hardware and software designs are freely available under copy left licenses, the developers have requested the name Arduino to be exclusive to the official product and not be used for derived works without permission. The official policy document on use of the Arduino name emphasizes that the project is open to incorporating work by others into the official product. Several Arduino-compatible products commercially released have avoided the project name by using various names ending in -Arduino.

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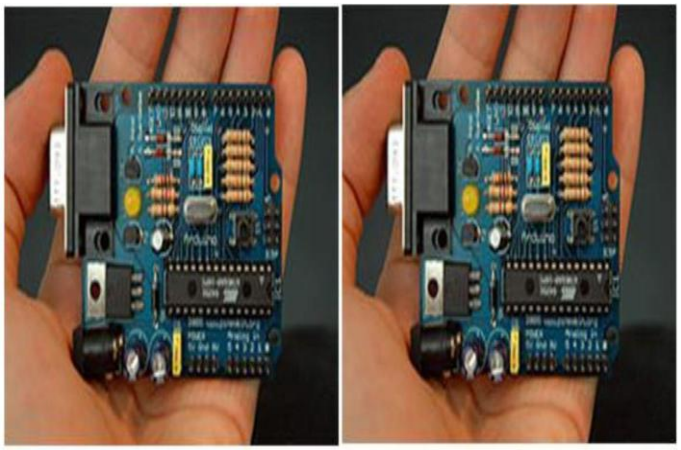

FIG 4. Controller Boards

Arduino microcontrollers are pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory. The default bootloader of the Arduino Uno is the Optiboot bootloader.[31] Boards are loaded with program code via a serial connection to another computer. Some serial Arduino boards contain a level shifter circuit to convert between RS-232 logic levels and transistor transistor logic (TTL) level signals. Current Arduino boards are programmed via Universal Serial Bus (USB), implemented using USB- to-serial adapter chips such as the FTDI FT232. Some boards, such as later-model Uno boards, substitute the FTDI chip with a separate AVR chip containing USB-to-serial firmware, which is reprogrammable via its own ICSP header. Other variants, such as the Arduino Mini and the unofficial Boarduino, use a detachable USB-to-serial adapter board or cable, Bluetooth or other methods. When used with traditional microcontroller tools, instead of the Arduino IDE, standard AVR in-system programming (ISP) programming is used.

Many Arduino-compatible and Arduino-derived boards exist. Some are functionally equivalent to an Arduino and can be used interchangeably. Many enhance the basic Arduino by adding output drivers, often for use in school-level education, to simplify making buggies and small robots. Others are electrically equivalent, but change the form factor, sometimes retaining compatibility with shields, sometimes not. Some variants use different processors, of varying compatibility.

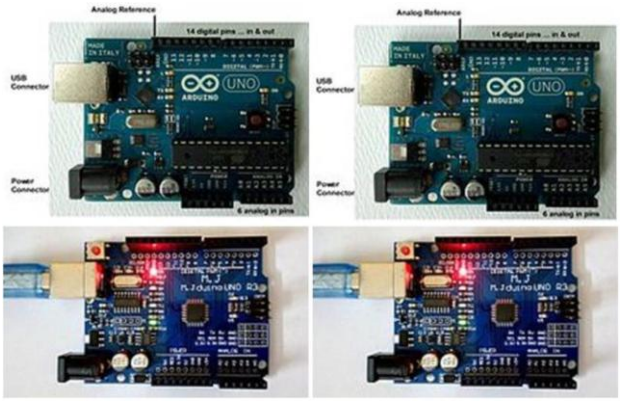

FIG5. BOARD PARTS and BLINK EXAMPLE

Table .1 Test Cases

MaHS	24pin	MiHS	78pin	pve	nve
0V	0V	5V	0V	0V	0V
0V	0V	5V	5V	0V	12V
0V	5V	5V	0V	0V	0V
5V	0V	0V	0V	0V	0V
5V	0V	0V	5V	0V	0V
5V	0V	5V	0V	0V	0V
5V	0V	5V	5V	0V	12V
5V	5V	0V	0V	12V	0V
5V	5V	5V	0V	12V	0V
	all other cases not possible				

TABLE 1: TEST CASES

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4. Results and Discussions

Fig 6. Various Stages of Vehicle Position

5. Conclusion and Future Scope of Work

We make this project entirely different from other projects .since concept involved in our project entirely differently that a single unit is used to various purposes, which is not developed by any of the other team members. By doing this project work, we understood the working principle and uses of relay screw jack and dc motors

- ❖ The proposed model is to reduce the manual work greatly. It uses least manual work for the lifting of the jack. The proposed electric circuit is built using relays, Bluetooth module, and an Arduino. The interface between the mobile phone and circuit is achieved through Bluetooth module and that of between Jack and electronic circuit is gained by a reduction gear box. All that needs to be done is to just tap on the mobile phone.
- ❖ The proposed work can be extended to a single jack that can be fitted to the car and can be moved according to the need. Screw 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 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 4-5 ton 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 motorized screw jack will prove to be beneficial in lifting and lowering of loads.

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