

Android Controlled Automatic Jack System for Vehicle

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ABSTRACT: The concept of this work is to design and develop the automatic jack system using an android app. An automotive jack is a device used to raise all or part of a vehicle into the air in order to facilitate repairs. With the manually operated car jack most people are familiar with, that is still included as standard equipment with most new cars. Changing flat tire is not a very pleasant experience. Operating the manual car jack is quite difficult job. This purpose is to mainly encounter this problem. This paper presents the development of the car jack which is controlled by android app. A vehicle frame, also known as its chassis, is the supporting structure of a motor vehicle to which all the components are attached, comparable to the skeleton of an organism. Where the jack is placed in the middle of the chassis, to which the movement of the jack is control through the app. A car jack works on the 12V power supply which is obtained from the car battery itself. Operator only needs to press a button from the app without working in a bent or squatting position for a long period of time to change a tire. In order to fulfill the present car jack problem, some improvement in the present technology has to be made.

KEYWORDS: Easy to operate, flat tires, improvements in jack, Android App .

I. INTRODUCTION

Jack can be stated as the device for lifting of the heavy objects. Particularly to raise the automobile or any vehicle off the ground so that the defective wheel can be fixed or replaced. There are various types of jack they are:-

1) Jackscrew:

These are the jacks similar to that of the scissor jacks and also it is the simplest kinds of still being used for cars. We can also find electrically operated car scissors which are operated by 12v dc directly from the car.

2) House jack:

It is mainly used for the repair of the buildings by lifting the foundation of the buildings.

3) Hydraulic jack:

This jack uses hydraulic power to lift heavy objects. It is basically used by shop work. Hydraulic jacks can find applications in lift elevators in medium and low rise buildings.

4) Pneumatic jack:

Pneumatic jack is similar to that of the hydraulic jack except that it is operated by a compressed air without any need for the human intervention. This eliminates user to operate hydraulic mechanism.

5) Strand jack:

It is specialized hydraulic jack which is specially used to grip steel cables. It is frequently used in strand in concerts which is capable of lifting hundreds of tons mainly used in construction and engineering

Automatic Jack system is used to jack the car during road side emergency i.e. tire puncher. A device which is mechanical jack is used to lift heavy equipments, all the part of the vehicle which in order to facilitate vehicle maintenances or breakdown repairs [6]. Experience of changing a flat tire is not pleasant. Variety of car jacks have been developed for lifting up the vehicles been produced nowadays. With the manual work of changing the flat tire has been difficult for the elderly and handicapped. It requires physical work such as squatting position or prolonged bent to operate the jack. During this work which is squatting position or bent where in it gives a back ache problem in due of

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time. A toggle Jack is operated by turning a lead screw. With this case of jack, a little force is applied in the horizontal plane which uses to raise or lower large load [7]. A thread which is more often used is acme, as this thread can resist the large loads and very strong imposed on the jackscrews and by wear it is not being weakened over many rotations [8]. A normal jack purposed to hold up to 1000 kilograms, when test is conducted by consumer affairs has revealed that it stops to work after reaching 250 kilograms and physical damage takes place when it has a weight close to its 1000 kilograms capacity [9]. As the test conducted jack has capacity to buckle under the weight to subject to withstand [10]. The purpose of this project is to develop an automatic car jack system which is easy to install and operate, which is also able to lift and lower the car without involving much physical effort. Our paper gives detailed of the design and analysis of modified automatic car jack.

II. RELATED WORK

In paper [1], 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 [2], 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.

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 madhusudhan, B.P.Mahesh, Prabhushankar, explains about the developments of the electro-mechanical jack for auto levelling of the vehicles. Automation plays a significant role in reducing manual involvement especially RADAR Borne vehicles plays significant role. With this methodology there are five phases which are problem definition, conceptual development, system level design, fabrication and testing as a new product development.

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The main system of radar borne vehicles is provided an effective and simplified levelling device for use in levelling. This system uses electro mechanical principle facilities to function effectively.

III. IMPLEMENTATION

The movement of jack is controlled by the android app called “My JACK” which is downloaded / available in the Google app called ‘play store’. This is built by using “TheAppBuilder” software. The procedure to SIGN IN where this procedure helps for the user security, users will have the separate password where only the car owners can operate. And to log in there are two steps which are I) create my account II) Sign in, as two steps are completed the next pop ups with the system which is connected to the arduino board. During the time of puncher where in the user have two options which are front and back, by pressing the front button the jack is being place in the between part of the front two tires, similarly with the back alignment. As the user press on front and back, there is an option called ‘complete’, as user press on complete jack will be placed in that position where the user is required. With the option OPEN and CLOSE the jack movement is controlled. With the option OPEN the jack lift the vehicle, and with CLOSE the jack is placed in the vertical direction.

App is mounted in the dash board of the car or can carry away in the mobile, IP address of the Wi-Fi module

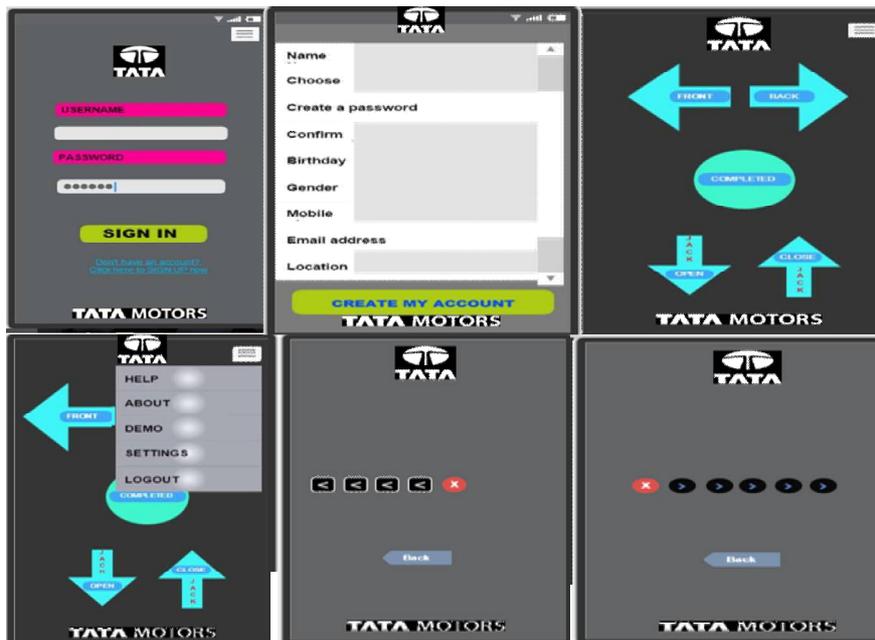


Fig.1 App Design

i. Functional Requirements:

A functional requirement defines a function of a system and its components. A function is described as a set of inputs, the behaviour, and outputs.

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Table 1: Functional Requirements

| Sl.No | Requirements | Specification |
|-------|--------------|---------------|
| 1 | Arduino UNO | 5V |
| 2 | Wi-Fi module | ESP8266 |
| 3 | DC motor | DC |
| 4 | Motor driver | L298N |
| 5 | Wires | BC 547 |
| 6 | Battery | 9V |

i. Wi-Fi module ESP8266:

ESP8266 has 8 pins, 4 in the row of 2. The rst(reset) pin on the top left is GND. The two pins right from the GND are GPIO 2 and 0. The pin on the top right side is the RX pin and the pin on the lower left is TX. These are the pins for communication. The middle pins on the bottom are CH-PD (chip power-down) and RST (reset). The main thing to remember is this device works with 3.3V, even the RX and TX pins. Arduino or many USB to serial converters work with 5V. The solution for this project is in the next step.



Fig 2 Wi-Fi Module

ii. DC Motor:

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. A direct current, or DC, motor is the most common type of motor. DC motors normally have just two leads, one positive and one negative. If you connect these two leads directly to a battery, the motor will rotate. If you switch the leads, the motor will rotate in the opposite direction. To control the direction of the spin of DC motor, without changing the way that leads are connected, you can use a circuit called an H-Bridge.



Fig.3 DC Motor

iii. Non-Functional Requirements:

In systems engineering and requirements engineering, a non-functional requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviours. They are contrasted with functional requirements that define specific behaviour or functions. The plan for implementing functional requirements is detailed in the system design. The plan for implementing non-functional requirements is detailed in the system architecture.

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Table 2: Non-Functional Requirements

| Equipments | Yes/Optional |
|------------|--------------|
| LED | Optional |
| Switch | Yes |
| Alarm | Optional |
| Battery | Optional |
| casing | Yes |

iv. Objective Tree:

Objective tree analysis is central to many forms of project planning and is well developed among development agencies. Objective Tree Analysis helps find solutions by mapping out the anatomy of the problem. It looks upstream at causes and determinants and downstream at consequences and effects

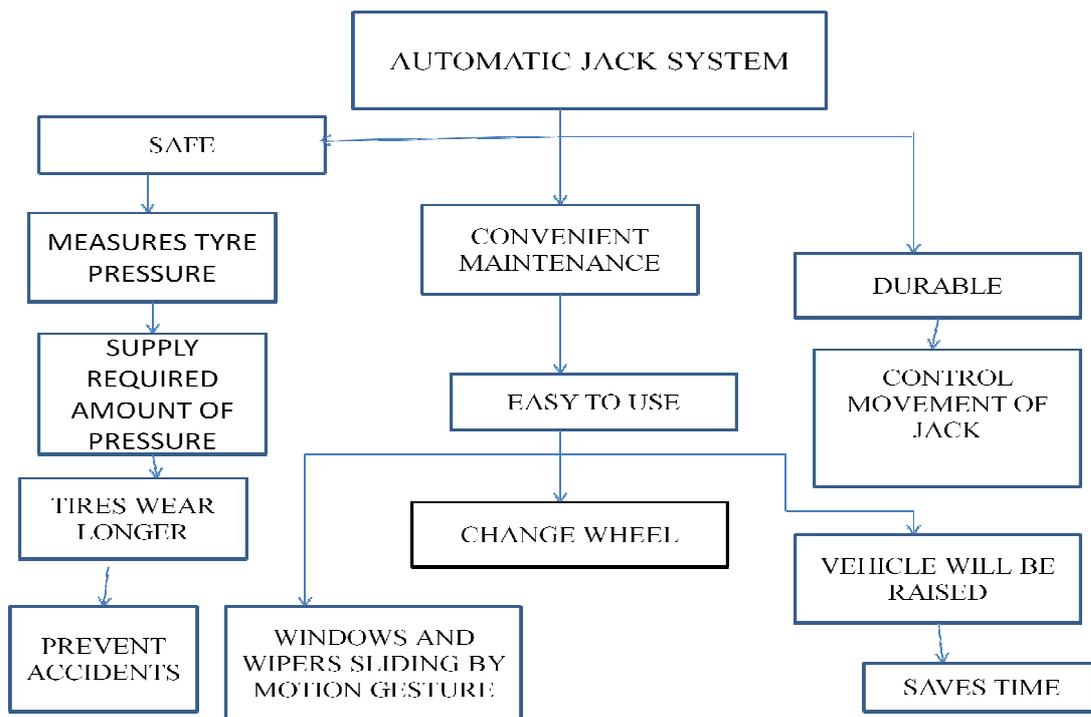


Fig.4 Objective Tree

The power supply is of 12V where in it is acquired from the car power source. The power source helps the motor to rotate with the 30Rpm.

During the process, the message from the android app is sent to the Wi-Fi module (model ESP8266) the receiver receives the message from the module and further it is proceed to the arduino board where the information are obtained from the codes. From the arduino the signal is passed to the motor, the rotation per minute makes the jack to move with the help of pulley. This process is controlled by the "Control Unit" as it controls the motor, pulley and jack movement. The power supply / source make the motor to work. Hence, the jack movement makes the lift in the air by the "UP" control from the App. With the "DOWN" control the jack comes to the initial place and then it is place in the horizontal position and place in the central part of the vehicle. Fig.2 gives out the detailed block diagram representation of the process involved in this system.

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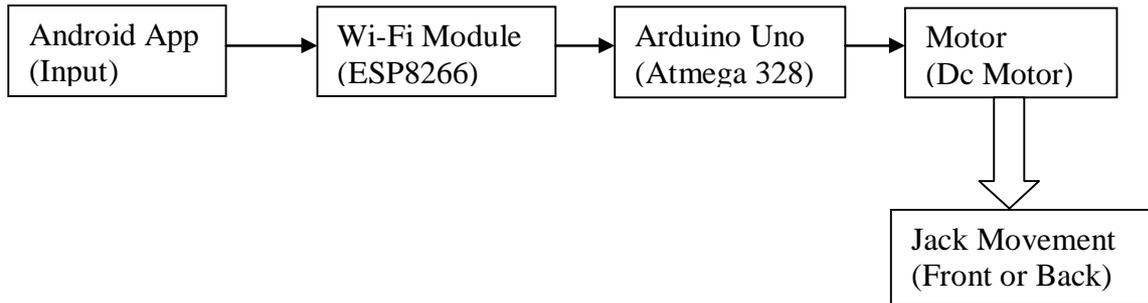


Fig.5 Block Diagram Representation of the Automated Jack System

v. Detailed Block Diagram:

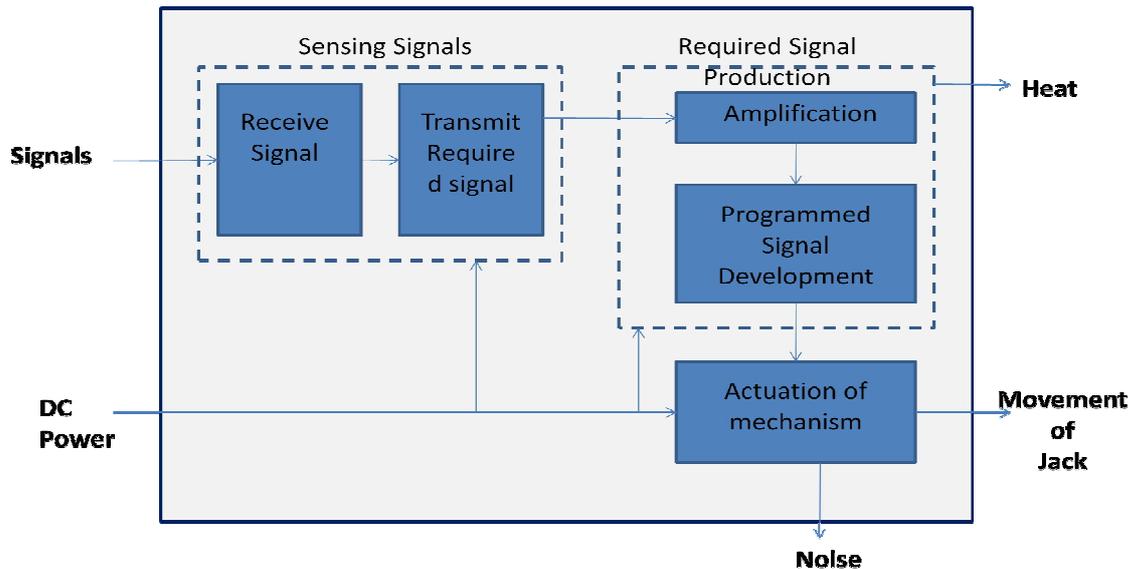


Fig.6 Detailed Block Diagram Representation.

Application:

- Small / mini cars
- Heavy vehicles like buses and trucks.
- Heavy Utility vehicles (HUV) like crane and harvester.

Advantages:

- Easily operated.
- Maintenance cost will be less.
- Parts are easily available in the market.
- This type of system is useful mainly for ladies and old peoples, during the time of puncher they can easily operate and change the wheel

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IV. RESULTS AND DISCUSSION

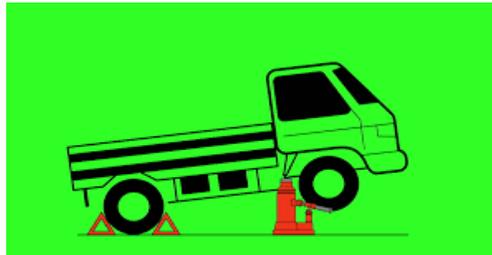


Fig.7 Vehicle lift

Automatic Jack system for a motor vehicle will allow the individual to quickly and safely raise and lower the vehicle thereby facilitating the efficient process of changing a vehicle tire. It will be easy for elderly or handicapped individual to jack up the motor vehicle completely eliminated the messy process of manually jacking up a vehicle.

V. CONCLUSION

An inbuilt automatic jack system can be easily attached to all currently manufacture chassis and frames. By the android app the movement of jack from front suspension is mounted centrally to the front suspension of an automobile between its front wheels. According to the topological conditions jack will be sufficient enough in achieving the horizontal levelling. With the help of car battery which is of 12v battery source the movement of the jack from front to back 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 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 and automated with the android app.

Considering some specification based on testing and from analysis, it is considered safe to use automated jack system. By the torque supplied on the system is more enough to lift the cars which are having up to 2500 Kg.

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