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Design and Construction of a Remote Control Car Jack

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ABSTRACT: *A remote control car jack which will be affordable, simple to maintain and easy to operate was designed and fabricated with locally available materials. Results of the performance test of the car jack conducted with Toyota Camry of weight1359kg, BMW (5series) of 1685kg, Mercedes jeep of weight 2355kg and Toyota prado of weight 2555kg showed credible performance by lifting and sustaining the vehicles to heights of 14cm under 1.7mins; 13cm under 2mins; 11cm under 2.2mins and 10cm under 2.4mins respectively.*
Keywords: *Car jack, remote control, fabrication, affordable and performance.*

I. INTRODUCTION

There has been tremendous advancement and improvement all over the world practically due to science and technology. Technology can be said to be an art of applying science to develop equipment and services to ease any of man's numerous problems. This work is an example of using technology to ease up the former way of car jacking. A car jack is mechanical device that allows drivers and mechanics to get underneath a car, usually to change a tire, oil or some car parts like breaks. There are two kinds of jacks hydraulic and screw jack types. Most car jacks that are included with cars are crew types of screw type's mechanism. There are scissor jacks, common in newer cars and bumper jacks common in older cars.

The car jack is very important device all vehicle owner must have to help in servicing their car when the need arise. The need for the car jack is often necessitated by flat tires that need repair or replacement. Other cases include the repair that will require going under the vehicle and so to get access to such areas, the car jack is needed [3]. The type of car jack used will determine the amount of physical labour to operate them to raise the car to the required height and most time result in much exertion from the individuals and could be energy sapping.

[5] developed "Zenith Space Command", a wireless remote. It was mechanical and used ultrasound to change the channel and volume. When the user pushes a button on the remote control it clicked and struck a bar, hence the term "clicker". Each bar emitted a different frequency and circuits in the television detected this noise. The invention of the transistor made possible cheaper electronic remotes that contained a piezoelectric crystal that was fed by an oscillating electric current at a frequency near or above the upper threshold of human hearing, though still audible to dogs. The receiver contained a microphone attached to a circuit that was tuned to the same frequency. Some problems with this method were that the receiver could be triggered accidentally by naturally occurring noises, and some people, especially young women, could hear the piercing ultrasonic signals [2].

The impetus for a more complex type of television remote control came in the late 1970s with the development of the Ceefax teletext service by the BBC. Most commercial remote controls at that time had a limited number of functions, sometimes as few as three: next channel, previous channel, and volume/off. This type of control did not meet the needs of teletext sets where pages were identified with three-digit numbers [1]. A remote control to select teletext pages would need buttons for each number from zero to nine, as well as other control functions, such as switching from text to picture, and the normal television controls of volume, station, brightness, colour intensity and so on. Early teletext sets used wired remote controls to select pages but the continuous use of the remote control required for teletext quickly indicated the need for a wireless device. So BBC engineers began talks with one or two television manufacturers which led to early prototypes in around 1977-78 that could control a much larger number of functions. ITT was one of the companies and later gave its name to the ITT protocol of infrared communication [4]

In the 1950s remotes were extra upgrades options to TV sets. As previously mentioned, Zenith was ready to change the lives of "lazy" people for good.[5] The initial purpose to the TV remote was to turn off the TV set from afar, and to change the channels or mute commercials. People were told that the remote could turn

off the TV while they were still lying in their Laz Boy and thus could drift off to sleep without interruption. A common complaint was that people tripped on the cable that was attached to the first remotes. It was not until 1955 that Zenith created the "Flash-matic" or their first wireless remote. While it helped keep the flow of traffic without tripping people along the way, the "Flash-matic" was not flawless [5].

The objective of this work is to include electronic control with necessary mechanism that will make the work of jacking car for maintenance easier and friendly. The system will control the upward movement of the car jack through the remote control. This will help to conserve energy and save time. The jack is controlled downwards manually adjusting the valve for downward movement control of the jack.

II. MATERIALS AND METHODS

2.1 Component Description

In making up the construction of multi-channel infrared remote control there are few main components one is IR sensor TSOP 1738 and another is 89C51 micro-controller. The characteristic of IR sensor is that when it detects IR light of 38KHz it will give low output otherwise it will give high output. So the modulated output generated by IR remote control will be demodulated by this sensor and the pulses will be given to micro-controller.

2.1.1 Remote Control Transmitter

This block referred to the transmitter stage of the system. The function f this stage is to transmit a low frequency pulse to the receiver stage to control upward movement of the jack. It consists of two oscillator circuit that generate two different frequencies one is the modulator and the other the carrier. The control communication means is the infrared link.

2.1.2 Receiver and Driver Interface

This stage consist of the infrared receivers stage that picks up the transmitted infrared beam and converts it to electrical signals, simplify and shape the signal to pulse and the decode the frequency to switch power to jack for upward movement. This stage also consist of the jack mechanism and motor driver interface that helps connect the control circuit to the jack mechanism.

2.2 Stages in the Car Jack Assembly

The car jack is the hydraulic car jack. It requires less force for its operation. Stages involved in the assembly of the jack are as demonstrated in the diagrams below. Major Components for assembling the design include: Power supply, Micro controller, IR sensor, Crystal (oscillator) and DC motor.

2.2.1 Power supply unit

The micro based moving message display is being powered by 5volts using voltage regulator (7805) which allow the micro controller to work on its maximum capacity and perform the following acts:

i. Power supply connectors are connected to the power supply source and everything starts to happen at high speed! The control logic registers what is going on first. It enables only quartz oscillator to operate. While the first preparations are in progress and parasite capacities are being charged, the first milliseconds go by.
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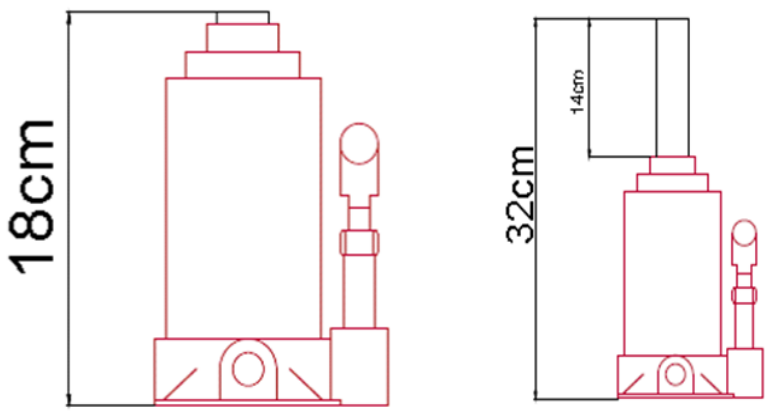

Fig.1 The car jack

2.2.2 Jack Control Motor Mechanism

This stage consists of mechanism that controls the car jack. This mechanism consist of the D.C motor and the gear and link mechanism for transmission of movement from the motor to the jack. This link mechanism function is to convert the rotary movement to linear movement.

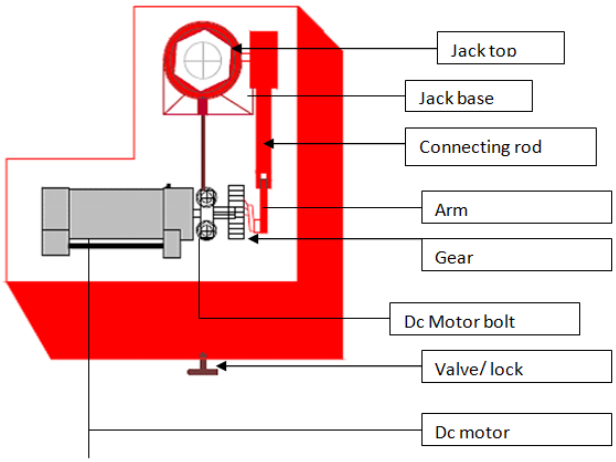

Fig. 2 The remote control car jack

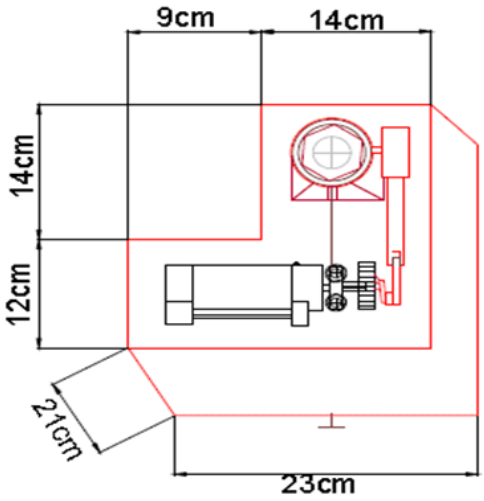

Fig. 3 External dimensions of the car jack

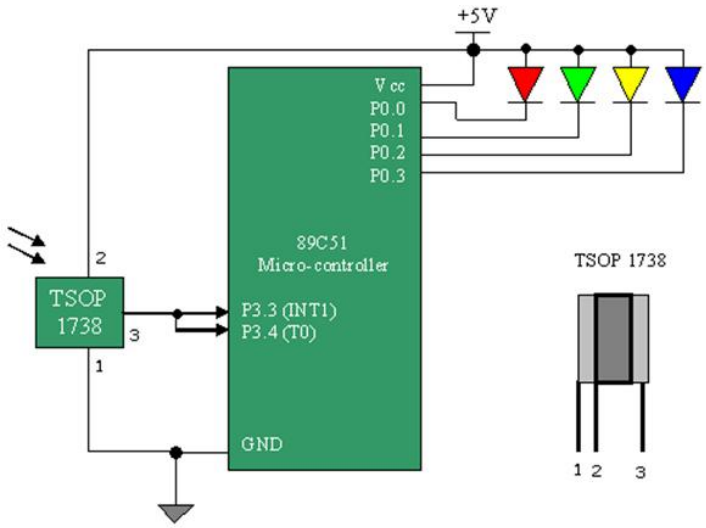

Figure 4 Basic control of a receiver circuit

2.4 Construction and Testing

The construction involves two parts namely, the control circuit and the mechanism. The construction started with mounting of the component on a project board, the project board circuit arrangement started with the power supply consisting of the limiting resistor and the voltage regulator since the other stages would need power for testing. An assembly language code that was developed for the microcontroller to the control circuit. The code was written for the microcontroller to the monitor the output of the infrared sensor and the decode it for the upwards movement of the jack.

The microcontroller and the other component where placed on the project board and wired together with jumper wires to realize the circuit. The next stage was the infrared receiver stage followed by the monitor drive control stage which was connected with the relay in place for power control to the mechanism.

The transmitter circuit was set up on a different project board . the transmitter consist of 555 timers , resistors, capacitors and infrared LED. A9V battery was used to power the transmitter circuit. The circuit was tested after the whole circuit component has been connected as indicated by the design and circuit schematics, stage by stage to ensure they are all working well. After the test, the component was transfer to the Vero board for permanent soldering. The soldering too was done stage by stage to ensure proper connection of parts and writing. IC's sockets where used for the IC's for protection of the IC from soldering iron heat

2.4.1 Hydraulic Jack Construction

The jack was mounted on a metal sheet and welded to it. The metal sheet measures 1foot SQ. the DC motor was weld with metal support to the point of jack.

2.4.2 Casing

After the complete construction work, the was tested the control circuit was housed in a small white panel casing.

2.4.3 Actuator/ Motor Drive Circuit

The motor or actuator controlled circuit is made up of transistor relay switch for controlling power to the DC motor that moves the car jack. The transistor relay switch will control power to move upwards direction

2.5 Operation principle of the jack

i. Place the Jack on a flat hard surface (concrete floor, hard metal sheet or plank) to avoid sinking while jacking up load.
ii. Set the Jack at the exert point to be pulled up.
iii. connect the circuit wires to 12v battery (could be the car battery and make sure it is properly fixed before pressing the remote to avoid partial connect, or may bring damage to either the microcontroller of the rely.
iv. When the Jack is properly fixed and placed, press the remote and then Jack will start pulling. Up, to a desired height, press the remote again, it will automatically stop.
v. Turning Down of the Jack: It is done manually once you unlock the hydraulic pressure valve (lock) of the jack the load mounted on it will press the jack down, Get the jack out and disconnect the wires from the battery

III. RESULTS AND DISCUSSION

3.1 Results

The result of the test presented are for the response of transmitter, receiver and the microcontroller response with the jack movement whenever the transmitter is pressed on and off.

Table.1 Test result of the remote car jack

S/No	Infrared Transmitter	Microcontroller response	Hydraulic jack response
1	Key press 1	Output voltage	Move up
2	Continuous press		Continuous movement

Table 2 Test result of Remote controlled jack on different vehicles

Vehicle type	Vehicle weight (Kg)	Hight of lift above ground (CM)	Maximum time of lift (minutes)
Toyota camry	1359	14	1.7
Bmw (5 series)	1685	13	2.0
Mercedes jeep	2355	11	2.2
Toyota prado	2555	10	2.4

3.2 Discussion

Table 1 presents the results of the constructed remote control car jack. According to the results of this table, there was appreciable movement of the jack when the infrared transmitter (key press 1) was operated. At continuous press of the key the movement continued which showed good operation.

Table 2 shows the results of the remote control jack when tested with different vehicles with different weights. According to the results, Toyota Camry of 1359kg weight was lifted to 14cm height above the ground under 1.7mins. BMW (5 series) of 1685kg was lifted to a height of 13cm under 2mins while Mercedes jeep of weight 2355kg and Toyota prado of weight 2555kg were lifted to heights of 11 and 1ocm under 2.2 and 2.4mins respectively.

IV. CONCLUSION

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).

V. RECOMMENDATION

For efficient function of the jack the researcher therefore made the following recommendations: use efficient code for better and faster response time; use more efficient mechanism for jack control and lifting of heavy loads. More researches should be made to make the project applicable for heavy duty vehicles; also to incorporate it into the car auto system (e.g cigarette lighter sockets or clipped to the 12volts battery); to increase lifting travel range from as low as 15cm to as high as 40cm and to make it more portable and user friendly.

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