

A SAFETY VEHICLE JACK WITH A MICROCONTROLLER AND GYROSENSITIVITY

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ABSTRACT

It has become a well understood fact there are so many draw backs with the using of manual jack. The problems occurring mainly for the ladies and elder persons who are troubled with the tyre matter when traveling. Hence this is difficult to operate; this project suggested the solution of safe electronic jack with the features of gyro sensor and microcontroller, also the new design is powered by using internal car battery power from cigarette lighter adapter. The suitable and accurate gear wheel and motor is identified by calculating. The electronic circuit is designed by using ATmega8 Microcontroller, FS1003 RF Module (Signal transmitting and receiving module), Gyroscope Sensor (GY271), 16*2 LCD, HT12E, HT12D, and DC547 Transistor. Also the project is used “Proteus Software” and “MikroC AVR” Software to design the electronic circuit. Finally the implementation part is carried out as a prototype. This product is safer for both user and vehicle because electronic jack detected the hand break status. By using “gyroscope sensor” this device detect the movements in both jack and vehicle. Also do not required too much money to develop this product where the initial cost of product is an investment for the user. More research activities are required to enhance the performances and this can be further developed with more advanced features as future work.

Key Words: Gyroscope sensor, Microcontroller, Electronic jack, Scissor Jack, Radio Frequency Module

1. INTRODUCTION

Nowadays, most of the cars were equipped with the scissor car jack. We found that the scissor car jack were very difficult to be used especially by women and elder people, because this types of jack needed more strength and energy to operate this jack by turning the lead

screw. Also there are some safety issues such as if the hand break is forget to lift up or the jack is in a wrong angle, then the operator or the car driver is faced with accident while the tyre changing where the vehicle can be moved. This creates accidents to both vehicle and the user. To overcome this problem, a research has been conducted to find a solution of design a car jack for the car using the simplest and cheapest way while saving energy. Although there were many ways to solve this problem, but the design of electronic car jack system is the practical way when we considered all the factors and consequences especially about the analysis to develop this product.

Hence, this project has implemented to make user friendly electronic car jack that is user friendly and easier to operate. This product is safer for both user and vehicle because electronic jack detected the hand break status. By using “gyroscope sensor” this device detect the movements in both jack and vehicle. Also do not required too much money to develop this product where the initial cost of product is an investment for the user.

2. EXPERIMENTAL

In the experimental phase the existing jack is modified by using the components such as DC Motor, Gears, ATmega8 Microcontroller, Radio Frequency Module, HT12D/12E ICs, Gyroscope Sensor (GY271), I2C, Liquid Crystal Display [LCD], Cigarette Lighter Adapter and Push Button, as well as this project used tools such as PCB drill, multi meter, soldering iron and sucker pump. And the selection of type of gear wheel system is justified in the results and discussion section. This project used the Proteus software for microprocessor simulation, schematic capture, and printed circuit board (PCB) design also MikroC AVR software as programming language of the microcontroller¹.

2.1 Circuit Design

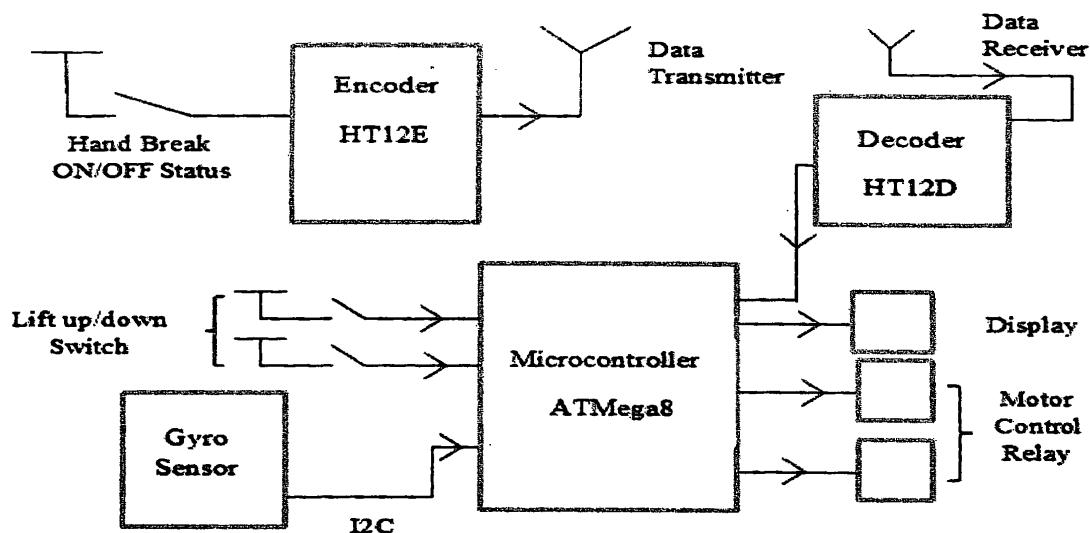


Figure 1: Electronic circuit design

Above figure no: 2.1 shows the components and the path for the designing of a project. The main of this project is to develop an existing scissor jack into a user friendly automated electrical jack which can be lift the vehicle more easier with low effort.

The pushbutton switch which used to lift the jack is directly connected to the microcontroller is functioning as the user requirement. If the user need to lift up the jack, need to press the up button continuously till the required level and when the user put his/hand away from button the jack is not lifting further. Similarly to lift down the jack need to press lift down button and vice versa. But there are two conditions need to be satisfied for this operation.

- Hand break status (lift up/not)

Role of the hand break of a vehicle is to lock the wheels without any movements. If the wheels are released at the time of jack is in use, there may occur accidents for user. Therefore it is essential to lifted up the hand break in standard level to lock the wheels for active the process of design and then one condition is satisfied to lift up the jack.

- Angle of the jack (Using Gyro sensor)

Tis jack is safe consideration product. If the jack angle is not at the suitable level, it may shift the jack or vehicle and caused accidents. So if the angle of the jack with respect to land is below 60° degrees, the gyro sensor gives I2C signal to microcontroller and the process is stopped. Therefore if the jack is operating on a flat surface or the angle with the land is not below than 60° degrees the other condition also satisfied.

2.3 Implementation of the project

The following figure shows the implemented circuit of the project with the used components.

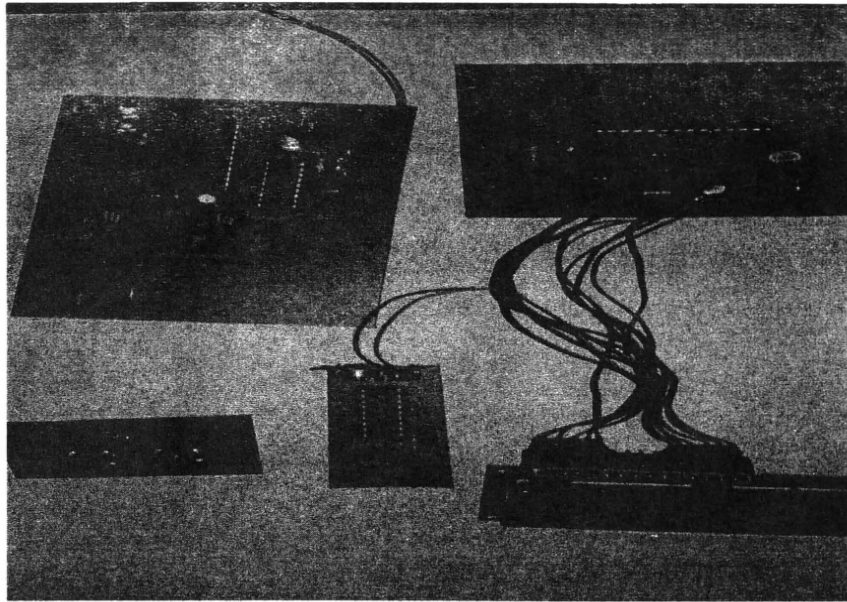


Figure 2: The implemented circuit of the project

3. RESULTS AND DISCUSSION

Overall result of this project is to design and manufactured an electrical car jack with the least amount of components at the least cost, designed and manufactured an electrical car jack that works in efficient way.

When selecting the equipments and components these steps and procedures are considered.

For the Jack Design, this research used the techniques of evaluating the force (F), torque (τ), and gears in order to modify the scissor jack. Firstly evaluate the Force analysis based on the axis of scissor jack.

The effort force for a screw jack when neglecting friction can be expressed as,

$$F = (Q p) / (2 \pi R l) \quad (1)$$

Where; F = effort force at the end of the arm or handle, Q = weight or load, p = pitch distance or lead of thread in one turn, r = pitch radius of screw and R = lever-arm radius

The torque of the scissor jack can be expressed as,

$$\tau_1 = (F * R) \quad (2)$$

And also Torque can be getting as with the terms of revolution per minute (rpm) and Horse Power (HP).

$$\tau_2 = 5252 * HP / rpm \quad (3)$$

τ_1 means the torque which need to provide to the axis of the jack to hold the load. τ_2 means the torque which provide by the electric motor's horse power. The jack can be lifted when the $\tau_1 < \tau_2$. Otherwise cannot lift the load by using jack.

Therefore as a solution, this project suggested using combined gear wheel system with the jack.

This project design is requires hand break status (lift up/not) as an essential requirement. Because this product is more reliable need to lift up the hand break before use the electronic jack. Otherwise the jack cannot be worked and the LCD displays the error message. By using Gyro sensor, this project concerns the angle of the jack before the operations. This also more safety concern both in vehicle and user. Because of if the jack angle is not at the suitable level (more than 60 degrees), it may shift the jack or vehicle and caused accidents. The LCD displays the status of the angle on the screen and the user can inform what the error is regarding with. To modify a scissor jack into an electronic device, it can be modified without spending more money; hence the cost of production is being an investment for the manufacturer or the user. Although this kind of automated jacks are currently available with the brand new cars and those are only allocate for rich people. But this product is for normal users; also this will be more convenient to the ladies and older people who are troubled with the tyre problem when traveling.

4. CONCLUSION

The project design was modified by introduction of an electric motor in the scissor jack, connecting gear with the pinion, the cigarette lighter adapter connected to the motor and plugged to the automobile 12V battery source to generate power for motor, in order to make load lifting easier. In this modified design, the power screw is rotated through its gear when electrical power flows through it.

The main advantages of the modified design over the existing design are that the modified designed motorized jack will save time, be faster and easier to operate and requires less human energy and additional work to operate. Also by using the gyroscope sensor this design have more safety considerations than existing products. Where the accident occurs because of the movements of a car or jack, this design can be easily identified. There by effectively curb the problems associated with Ergonomics - which is a fundamental concept of design process.

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