

AUTOMATED SYSTEM FOR OPENING A CAR'S TAILGATE

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Abstract: *The aim is to lock and unlock the car's door or tailgate by a press of a button on its remote control in order to give the driver a better comfort."OrCad" was used in the implementation of this project. First the "OrCAD" electrical diagram is designed, then the "Layout" for the integrated circuit (PCB) is created. The microcontroller used in this project is programmed in "PICkit 2" environment from "Microchip". In the following work the microcontroller is programmed in such a manner that it will open the car's doors and tailgate at the first button press and will lift the tailgate at the second button press. The controller will give the command further to a couple of transistors which will command the appropriate actuators' relays.*

Key words: *automatic systems for tailgate opening; microcomputers; tailgate open on the car key; open the tailgate when press of a button; blocks the action actuators (motors).*

1. Introduction

This work is splitted in the following manner. General description of the microcontroller "PIC12F675". This represents the centralized locking system with a remote-control key. Locking and unlocking the doors of a car including the luggage compartment (tailgate) will be done by the car's key.

In this article, the following actuators were shortly described: hydraulic, pneumatic, electrical, thermal or magnetic (shape memory alloys) and mechanically. In this project, a linear electric motor actuator was used.

The system structure includes two sub-categories: hardware description and software description. The hardware description presents the project's operation from the power source to the DC motor. The software description presents the C code for circuit itself, as well as general aspects of programming language and the PIC programmer. The general wiring diagram is presented and the designed system and aspects of the PCB to achieve "OrCAD Layout". All wiring diagrams are made in the "OrCAD Capture". The designed system meets the initial requirements, except the following aspect: DC motor, initially chosen, does not resist to open and to close the tailgate because of the insufficient power. The chosen actuator allows only the function of the whole designed system presentation. If the system will be mounted on the car, it must be equipped with a motor of appropriate power.

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2. Current Critical Stage

After carrying out a market study, there is a model system for automatically opening a tailgate car for better driver comfort.

For example, the new Opel Astra brand which has the same automatic tailgate opening but with little modifications. Opening the tailgate is achieved by motion sensors and reading the object (leg of a person) in one direction, from left to right. These sensors are placed in the rear bumper on a specific portion or size.

By comparing the two systems we can observe both advantages and disadvantages.

This system created has the main advantage upon entering the range of 3 meters, the distance between the person and car, while the person charged with luggage is moving towards the car, press twice on the button on the remote and open the tailgate.

The disadvantage of the system is a new car. The person being loaded with luggage must reach the car, then open the tailgate with the leg moving from left to right in place the sensors in the rear bumper of the car.

3. Microcontroller PIC12

Due to the RISC architecture, the microcontroller PIC12 has the lowest price. The microcontroller has a number of thirty-three instruction with highly orthogonal, most of which are executed in a single cycle and the jump in two cycles. These microcontrollers admit a frequency of up to 4MHz. PIC12 has a Harvard architecture, with different lines for data and instructions [1].

Central Unit is a unit that can achieve the eight-bit arithmetic and Boolean functions: addition, subtraction, shift and logical operations with data residing in the workbook (W) and any general purpose register. Set registry located in RAM contains special function registers and general purpose registers [1].

Input / Output lines can be programmed as inputs or outputs with GPIO special register. The pins can mean double. To ensure the safety program run correctly, the circuit is equipped with a watchdog, which can be reset by a special instruction by ensuring a delay of eighteen milliseconds to trigger a RESET. The microcontroller can be removed from aces way of working through a front applied to external pin or watchdog [1].

4. Methods

System description of the software and hardware used in designing and modelling the circuit in order to work properly.

4.1. Description hardware

By the hardware point of view first it's designed the electric diagram of a car tailgate opening system which can be actuated by a button or by the remote control car.

The assay plate is fed to the "12 V", for this purpose a source computer is used. The circuit power to "5 V" is obtained by the voltage stabilizer "LM7805" the change tension "12 V" to "5 V" because my microcontroller can feed only a maximum tension on "5 V".

The circuit board and I chose to use a push button that by operating or pressing will

send commands to each relay separately. The two relays will operate the DC motor once, in sense the first relay and the second time will change the meaning by the second relay.

The two commands will be signalled by three LEDs, two green and one yellow. A green LED is used to signal pulling lock hook tailgate, another LED all green is used to signal opening the tailgate with direct current motor continues and the three light yellow it is used to signal the closure of the tailgate with DC motor. The will be two commands that are written in the programmed language “C Compiler” and will be programme the “PICkit 2” microcontroller using the programmer from “Microchip”.

The commands will be operated from the button. These commands will be transmitted from the microcontroller via two pins: terminal six - that will send the commands to the first relay; terminal seven - which will send the order to the second relay. In Figure 1 were introduced from microcontroller to drive the DC motor.

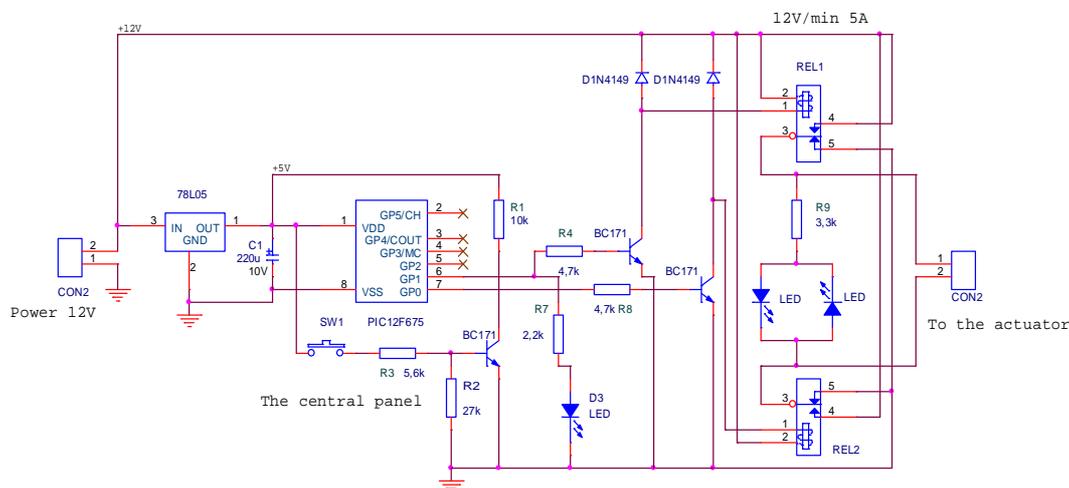


Fig. 1. Electrical schematic the opening and closing of a tailgate

Orders will be sent from the microcontroller to the two relays only when pressed. At the push of a button in a time interval will not produce anything. Two press actions in a row and in a short time the two commands will be send from microcontroller to two relays at a time.

The first order will be sent by terminal six microcontroller reaching the relay one and work continues to draw current motor lock hook tailgate and push the tailgate up. These two things, pulling the hook and tailgate release are indicated by two green LEDs. The second command will be sent via terminal seven of microcontroller reaching the relay two and will continue to operate the engine power tailgate close. This engine has the role of pulling back. The closing respectively tailgate is indicated by a yellow LED.

The relays were used in order to change the direction of engine twist. First comes the “+” and “-” the relay one and the second time has changed polarity “-” and “+” by relay two.

The circuit adapter is used to program the microcontroller shown in Figure 2. Supply voltage is indicated by an LED D1.

Significance of pin connector is: VPP (pin programing), VDD (+5 V input voltage), VSS (ground), ICSD (pin data), ICCLK (pin clock) and Aux is not used.

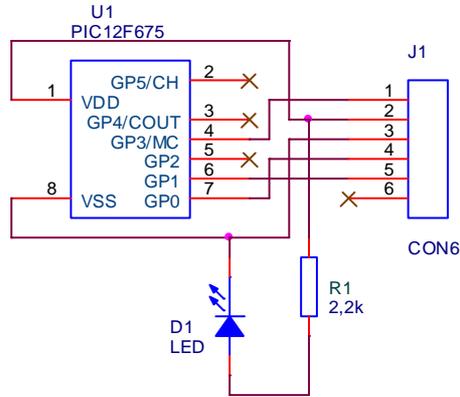


Fig. 2. *Electrical schematic programmer*

4.2. Description software

The “case zero” if a button was pressed once, check the make it “one” counter the “zero” and will be a short delay. In the “case one” if the counter is less than hundred pressing the check becomes “two”, counter makes him “counter + one” and if there is not pressed check becomes “zero” and will send jump to “case zero”. If the button is pressed twice it enters the “case two” and two commands will be sent from the microcontroller to the two relays and will act geared motor current continues to open and close the tailgate, then check becomes “zero”. This code is written in a “while” loop.

In Figure 3 is presented the chart after which the program was realized.

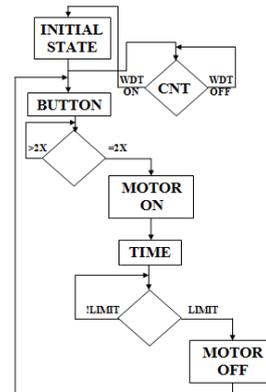


Fig. 3. *Chart*

5. Actuators

A first classification of actuators may consider two classes, based on the principle of operation: actuators classical / conventional; special actuators.

The systematic actuators are considered the first criterion on the principle of interaction and create movement illustrated in Figure 4.

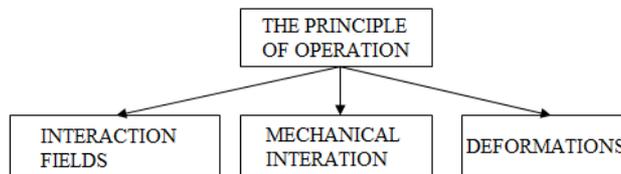


Fig. 4. *Systematization of actuators*

Actuators are devices that produce mechanical motion by converting various forms of linear or rotary mechanical energy. Integration of actuators is another form of integration hardware (components) in mechatronic systems [3].

An actuator initiates a movement or a process. If the linear actuator mechanical power moves in a straight line. Some actuators operating environments include vacuum and radiation, corrosive environment or underwater [3].

How to define the actuator as indispensable mechatronic system, extremely broad commonalities. In Figure 5 is presented schematic function of an actuator.

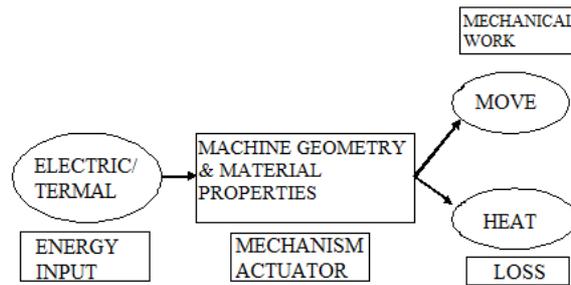


Fig. 5. Schematic function of an actuator

The actuators can be used for flow control valves, pumps, motors, switches. They usually belong to motion control systems and are controlled by a computer.

Servo actuators can also work to secure and transmit a fixed quantity of energy necessary for the operation of another mechanism. An actuator is the type of engine responsible of moving or controlling a mechanism or system. It is headed by an energy source, electricity typically fluid pressure hydraulic or pneumatic pressure and converts that energy in to motion [5].

5.1. Action block

Action block is responsible of ensuring power movements used to develop primary, secondary and auxiliary. The driver used are electric, pneumatic and hydraulic or in most cases mixed [3].

The structure of a driving unit show in Figure 6.

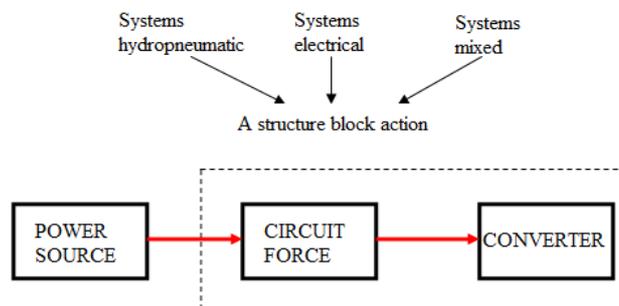


Fig. 6. Block action

5.2. Linear motors

Take hydrostatic energy generator element (pressure x flow) and converts it in to mechanical energy translational (force x speed) [4].

Based hydraulic cylinders/pneumatic are used to on opening and closing the car tailgate. In Figure 7 is presented cylinders.

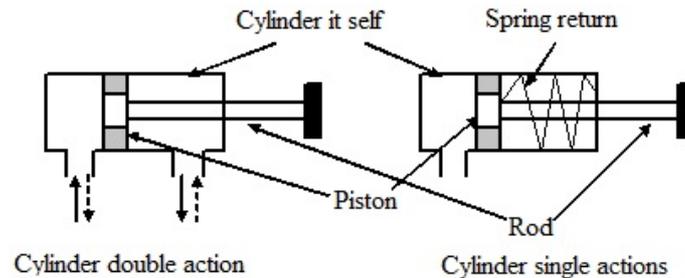


Fig. 7. *Cylinders hydraulic/pneumatic*

6. Conclusions

The designed system responds to the original requirements, it is adapted for any car even the oldest of, from 2005. It's helping the driver with the opening of the luggage compartment. When the person is in the area the detector from the car can read the key and open at an instant click the doors and the luggage compartment. For example, when the person is on his/her way to the car, he can press the key button within the range of the car's sensor, he is able to automatically open the doors and the luggage without any problems. He no longer has to stop at the car, drop down the luggage open the doors and put it into the tailgate.

It's not about a research centre.

The system is functional keeping in mind that tests were made as much as 30-40 times and it passed.

References

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