

Electronics
coursework electronic
combination lock
essay



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* The aim of this project is to create a secure lock to protect a property from intruders. To do this I have researched how to construct an electronic combination lock. During this project I will create a lock that is a great deal more secure than a standard mechanical lock, the reasoning behind this is that an experienced locksmith can open a mechanical lock without any trouble. On the other hand an electronic lock will seem a lot more of an obstacle to open as you have to input 4 switches in the correct order to open the lock successfully increasing the security highly.

Research:

* I have researched some factory made electronic locks to compare with the design that I will make. Of course my project will be much simpler than some of the combination locks that I have found on the Internet.

* One of the factors of the circuits that I need to consider is what the input would be (for example a keypad or simply switches.) I have decided that a keypad as an input is too complicated to build effectively and fault finding will be very difficult, because of this I will include 4 switches as the input to make the circuit simpler and easier to build, and fault find if there are any problems after construction.

* The second factor that I will consider is the amount of active components that are involved in the circuit, as one of the things that need to be included is three active components. I have found circuits that use too many active components; this would make building it very complicated. This is why I have

chosen to construct the circuit below which includes 5 active components to minimise the complication of building the circuit.

Below is a photograph of the circuitry needed to operate an electronic combination lock the actual lock would use a solenoid to operate the lock mechanism.

* I have also researched the use of mechanical locks.

Specification:

* In this section I will explain what components I will be using to construct my circuit and how they work showing some calculations.

* To produce the memory needed to remember the combination that the switches have to be pressed in. I will be using 4013b CMOS chips these are D-type flip-flops. Below I will explain how a CMOS 4013b works and I will include a diagram of the pinout of the chip.

Each flip-flop may be used independently. There are two models, clocked and direct.

In the clocked mode, the direct set and reset inputs must remain at ground. The input to the D line decides what the flip-flop is going to do. The actual operation doesn't happen until the positive edge (ground-to-positive transition) of the clock.

If D is positive, clocking makes the Q output positive and Q dash grounded. If D is grounded, clocking makes the Q output grounded and Q dash positive.

In direct mode, a positive set input forces Q positive and Q dash to ground. A positive reset input forces Q to ground and Q dash positive. Should both reset simultaneously positive, both Q and Q dash will also go positive. This is usually a disallowed state. The last direct input to go to ground will determine the final state of the Q and Q dash outputs. The direct inputs override the clocked inputs.

Each flip-flop may be made to binary-divide by cross coupling the Q dash output to the D input.

The clock input must be noiseless and have only a single ground-to-positive edge transmission per desired clocking. Clock rise and fall times should be 5 microseconds or faster.

Maximum clock frequency is 10 megahertz at 10 volts and 4 megahertz at 5 volts. Total package current at 1 megahertz clock frequency is 0.8 milliamperes at 5 volts and 1.6 milliamperes at 10 volts.

Reference: taken from "CMOS Cookbook"

* In my circuit I am going to use momentary switches or push button switches. A push-button switch is considered to be "momentary"; it doesn't stay in place when you remove your finger. Your doorbell button is a "normally open" (N. O.) momentary switch. When you push it, the circuit is connected and so the bell rings. When you release it, it disconnects the <https://assignbuster.com/electronics-coursework-electronic-combination-lock-essay/>

circuit, and the bell stops ringing. A major part of my project is that I need to make sure that all the switches cannot be pressed at once to activate the unlocking sequence. To do this I will make it so the switches have to be pressed in a certain order. This will be achieved by using a series of latches as a form of memory making it impossible to open the lock without knowing the correct code. This will improve the security of the lock greatly.

* The transistor that is used to amplify the signal before it activates the relay is a BFY51 the pinout and an explanation of its functional properties are shown below.

Generation Of Possible Solutions:

Taking into consideration my research and the specification of the circuit I have found a compatible circuit diagram for the combination lock that I want to build. It includes the over three active components so it suits the brief and its not overly complicated because simplicity is important so I can realistically complete the construction, and fault find and test the circuit within the time limit that I have been assigned. The circuit had to be able to be linked to a relay in order to power a solenoid to actually open a lock mechanism, this was due to the voltage used for the circuitry which processed the switch entry only used an average of 5 volts which is very low compared with the mains voltage which would be used by the solenoid circuit. I also had another solution for my circuit which involved an almost totally different circuit. It contained more active components than the circuit I decided to use, plus it was a great deal more complicated so I decided it

would be wiser to use the less complicated circuit to ensure that I completed the project within the time limit.

Sub-System Development:

* The switches and the order that they have to be pressed in to open the lock can be determined by me. The switches that aren't being used are all wired together in parallel so if any of them are pressed they reset the circuit. The switches that are being used are wired to the 4013b CMOS chips so when they are pressed a signal is sent to the next chip telling it that one switch has been correctly pressed, activating the next chip allowing the next switch to be activated. This means switches can only be input in one correct order. If this combination is not entered correctly then the circuit is reset so the combination has to be input again.

* For the memory that I need to create to remember the order in which the switches have to be pressed, I am using 4013b CMOS chips.

Combination Lock Circuit Diagram

This circuit is relatively basic to build. To open the lock, which is connected to the K1 Load. You must press each momentary switch in the correct sequence. The sequence used in this circuit is S1, S2, S3, S4. If any of the other switches are pressed the circuit will reset and you will need to start over. Depending on

How you wire the switches, you can use any 4-switch combination. Obviously I will not use the simple combination of 1-> 2-> 3-> 4 I will change this code appropriately.

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