Password Based Door Lock System using 8051 Microcontroller

**Principle Behind the Circuit:**

This circuit operates on the principle of microcontroller interfacing. A keypad interfaced to the microcontroller is used to enter the password and store it. A LCD is interfaced to the microcontroller to display the status and a motor is interfaced to the microcontroller via the motor driver. The motor is rotated forward or backward, depending on the authenticity of the entered password.

**Circuit Diagram of Password Based Door Lock System using 8051 Microcontroller:**

![Circuit Diagram](image)

**Circuit Components:** Circuit components and their corresponding values are given below.

- R1 – 10k
- R2 – 5k
- C1 – 0uF, electrolyte
- C2, C3 – 15pF
Electronic Code Lock System Circuit Design:

The circuit involves using five major components – a Microcontroller, a Motor driver, a Motor, a 4 by 3 Matrix keypad and a LCD. The microcontroller used in this case is AT89C51, an 8 bit microcontroller; the motor driver used is L293D - an H-bridge based motor driver.

The power supply to the microcontroller consists of a 5V battery providing DC power to the microcontroller.

Reset Circuit Design: The reset pin of the microcontroller is kept active till the power supply is in the specified range and a minimum oscillation level is maintained. In other words to ensure the supply voltage doesn’t falls below the threshold level of 1.2V and the reset pulse width is greater than 100ms (recommended for 89C51), we select the values of resistor and capacitor such that $RC \geq 100ms$. Here we select a 10K resistor and a 10uF electrolyte capacitor.

Oscillator Circuit Design: A crystal oscillator is used to provide external clock signal of 24MHz to the microcontroller. To ensure smooth operation, we connect two ceramic capacitors, each 30pF. This crystal oscillator is connected between pin 18 and 19 of the microcontroller.

Microcontroller Interfacing Design: A 4 by 3 keypad is interfaced to the microcontroller port P0 and a motor driver L293D is interfaced to microcontroller port pins P2.3, P2.4 and P2.5. An LCD is interfaced to microcontroller such that the register select, read/write and enable pins are connected to port pins P2.0, P2.1 and P2.2 respectively, whereas the data pins are connected to port P1.

Compilation of Microcontroller Code: Once the circuit is designed and drawn on a piece of paper, the next step is to write and compile the code. Here we select the Kiel uVision software to write the program in C language.

Prior to writing the code, general steps needs to be followed like creating a new project and selecting the target device or the required microcontroller. Once the code is written, we saved it with .c extension and then added it to the source file group under the target folder. The code is then compiled by pressing F7 key.

Once the code is compiled, a hex file is created. In the next step, we use Proteus software to draw the circuit. The code is dumped into the microcontroller by right clicking on the IC and then adding the hex file. The microcontroller oscillating frequency is selected here to be 24MHz.
**Password Based Door Lock System Circuit Operation:**

Once the circuit is powered, microcontroller sends commands to the LCD such that it is ready to accept the data. This data is entered using the keypad. Once the data is entered, it is displayed on the LCD. This data denotes the password. According to the program, the microcontroller again sends commands to clear the LCD and then sends the data to be displayed on the LCD. The password is entered using the keypad and it is checked with the set password. If the passwords match, the microcontroller sends signals to the motor driver such that pin P2.3 is at high level and pin P2.4 is at low level (while the enable pin of L293D is at high level) and the motor rotates in forward direction. After a certain time delay, the enable pin is grounded by sending a low logic signal from the microcontroller and the motor stops. Again after some certain time delay, the microcontroller sends signals to the motor driver such that P2.3 is at logic low level, P2.4 is at logic high level and the enable pin is at logic high level. The motor now rotates in backward direction. Now if the passwords do not match, the microcontroller sends a logic low signal to the enable pin of the microcontroller, thus disabling the motor driver and the motor does not runs at all.

**Applications of Password Based Door Lock System Circuit:**

1. This simple circuit can be used at residential places to ensure better safety.
2. It can be used at organizations to ensure authorized access to highly secured places.
3. With a slight modification by replacing the motor driver with a relay driver, this circuit can be used to control the switching of loads through code.
4. This circuit can be also modified by using EEPROM chip interfaced to the microcontroller and store the entered password in the chip.

**Limitations of Password Based Door Lock System:**

1. The microcontroller used is a CMOS device and is highly static and hence cannot be touched by bare hands.
2. It is a low range circuit, i.e. it is not possible to operate the circuit remotely.
3. It is a battery operated circuit and can easily run out of power once the battery life time ends.