PROJECT WORK: MICROPROCESSORS AND MICROCONTROLLERS (ECC-256)

On topic

DIGITAL DOOR LOCK USING 8051 MICROCONTROLLER

Electronics and Communication Engineering

Maharaja Surajmal Institute of Technology

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CERTIFICATE OF ACKNOWLEDGEMENT

This is to certify that the project work for software *construction of a digital door lock using 8051 microcontroller*, has been successfully completed and submitted by **Ashmit Negi**, **Mukul Kankheria** and **Yashika**, students of **2nd Year B.Tech (ECE)**, under the supervision of **Dr. Vishakha Tomar**, as a part of the coursework for the subject **Microprocessor and Microcontroller**.

The work presented in this project is a result of sincere effort and dedication, and it fulfills the requirements for the partial completion of the academic curriculum of B.Tech in Electronics and Communication Engineering at **Maharaja Surajmal Institute of Technology**.

We extend our acknowledgment to all those who provided valuable insights and guidance throughout the course of this project.

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ACKNOWLEDGEMENT

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We would like to express gratitude to Dr. Vishakha Tomar for her guidance and valuable feedback throughout the development of this report. Additionally, we would like to extend our appreciation to MSIT for providing us with the valuable opportunity to work on this report. Their continued support throughout this process has been very beneficial in the successful completion of this report.

It is important to note that the views and opinions expressed in this report are solely mine and do not necessarily reflect the official policies or positions of MSIT, Janakpuri or any other organisation mentioned herein.

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DIGITAL DOOR LOCK
USING 8051 MICROCONTROLLER

INTRODUCTION:

Today people are facing more problems about security all over the world, nowadays security is the most essential issue everywhere in the world; so, security of everything gains higher and higher importance in recent years. In the past days, the research has gone on various door lock security systems like traditional security systems which provide indications using alarm. Due to the advancement in recent techniques, some door lock security systems are based on microcontrollers, GSM, GPS, many sensors, software like MATLAB, PROTEUS, biometrics like face recognition, Iris scanner, RFID, Smart Card and password etc. As security becomes a major problem nowadays, the security monitoring systems today need to make use of the latest technology. Also, the enhanced security systems are available based on android platform, wireless techniques and embedded systems. A lot of modification takes place in various Door lock security from the last few years; in the next coming years many changes will take place.

The digital code lock system with LCD using 8051 microcontrollers is a password-based system. This project can be used as a security checking system to stop access to a room only for unauthorized persons with the password. So, this project can be named with a wide range of names such as a digital combination lock, a digital security code lock, a password security system, an electronic code lock, a digital code lock. In this proposed system, we have discussed a simple Digital code lock using LCD and 8051 Microcontroller, which can only be not closed by a predefined code. Main concept behind this project is a door-latch opening using a password entered through a keypad. Today people are facing more problems about security all over the world, nowadays security is the most essential issue everywhere in the world so security of everything gains higher and higher importance in recent years. The main component in the circuit is an 8051 microcontroller.

PRINCIPLE:

The digital door lock system described in the project report works on the principle of **password-based electronic access control** using an **8051 microcontroller**. The system consists of a **4x4 keypad** for user input, a **16x2 LCD** for feedback display, and a **DC motor** to operate the lock. The core idea is simple: a user must enter a predefined password (e.g., "1234") via the keypad. The microcontroller compares the input with the stored password. If the input is correct, the microcontroller activates the motor (via the L293D driver IC), unlocking the door; if incorrect, it denies access and optionally displays an error message on the LCD.

The system is powered by embedded C code compiled into a HEX file, which runs on the microcontroller. Components like a crystal oscillator (for clock timing) and capacitors support stable operation. This setup provides a basic, cost-effective, and customizable security solution without the need for physical keys, offering ease of use and minimal maintenance.

AIM :

To Build a Digital Door Lock using 8051 Microcontroller

COMPONENTS REQUIRED:

1. 8051 Microcontroller – AT89C51
2. 4×4 Matrix Keypad
3. 16x2 LCD – LM016L
4. IC L293D
5. 10kΩ Potentiometer
6. 22pF Capacitor [2]
7. Crystal Oscillators
8. Motor
9. 12V and 5V Battery

CIRCUIT DIAGRAM:

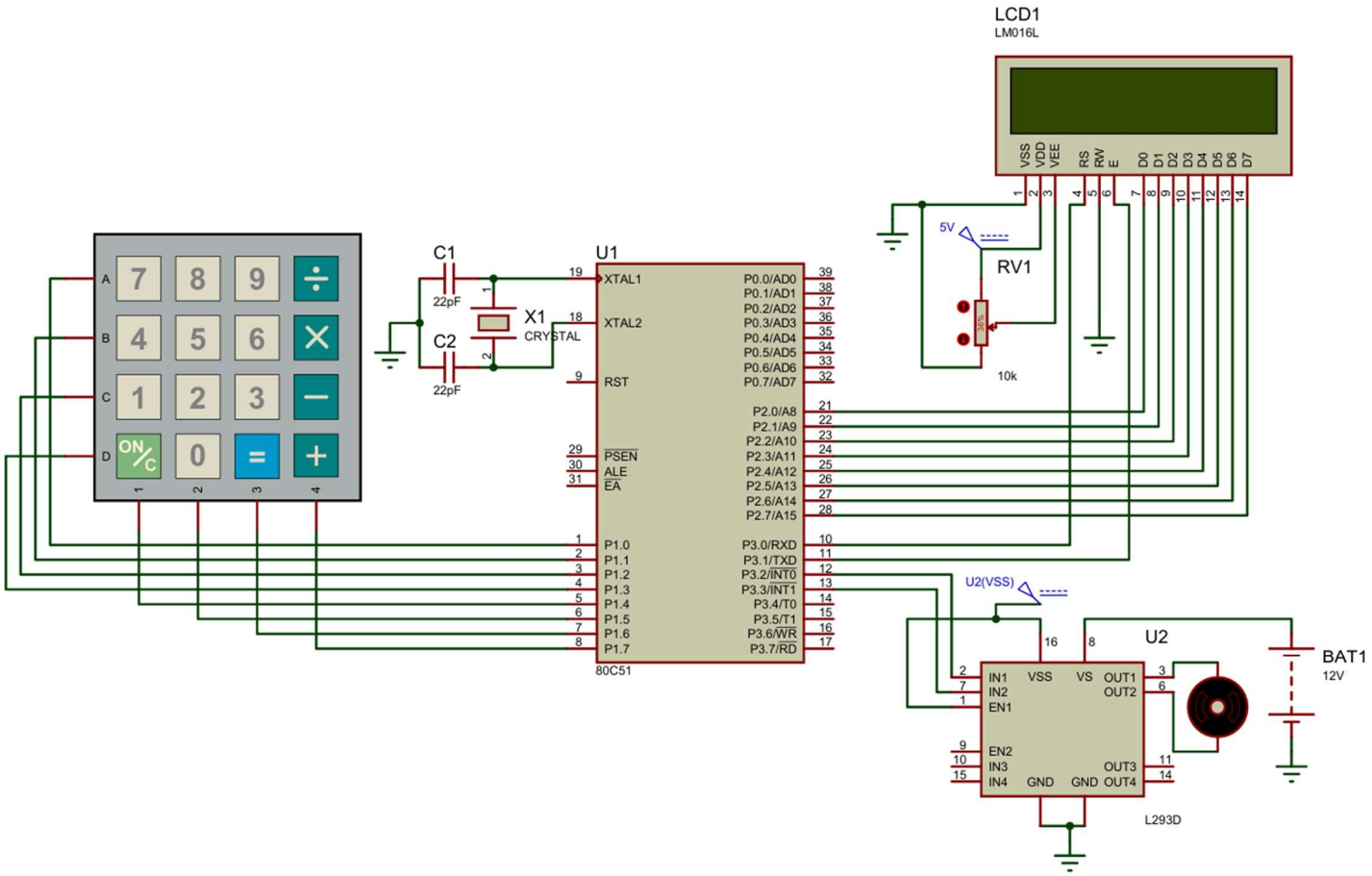


Figure 1. Schematic Diagram

WORKING:

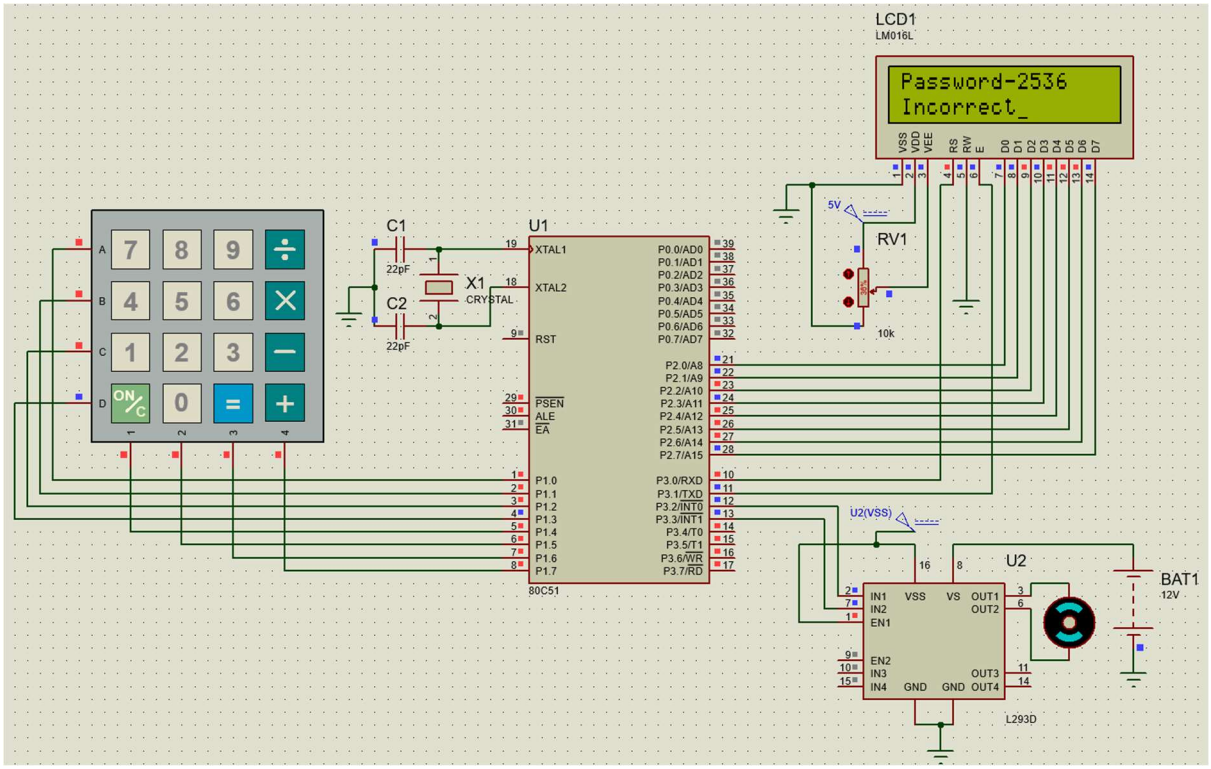


Figure 2. When the password is incorrect

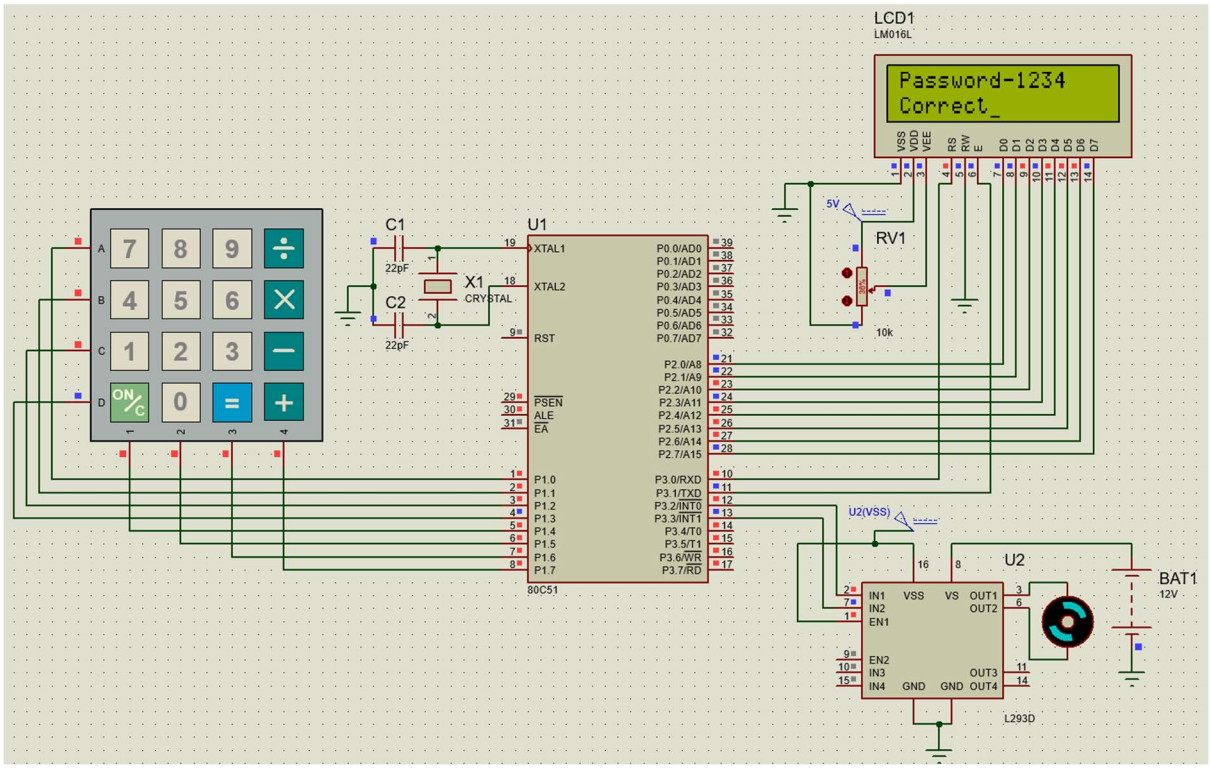


Figure 3. When the password is correct

THEORY:

8051 Microcontroller

The 8051 microcontroller is an 8-bit microcontroller developed by Intel in 1980 and widely used in embedded systems. It features a CPU with 8-bit data processing capabilities, 4 KB of ROM, 128 bytes of RAM, 32 I/O lines, two 16-bit timers, and a full duplex serial port. The 8051 is known for its simplicity, reliability, and ease of interfacing with peripheral devices, making it ideal for control-based applications like digital locks, robotics, and automation systems. It operates using a crystal oscillator, typically at 11.0592 MHz, to maintain precise timing for instructions and operations.

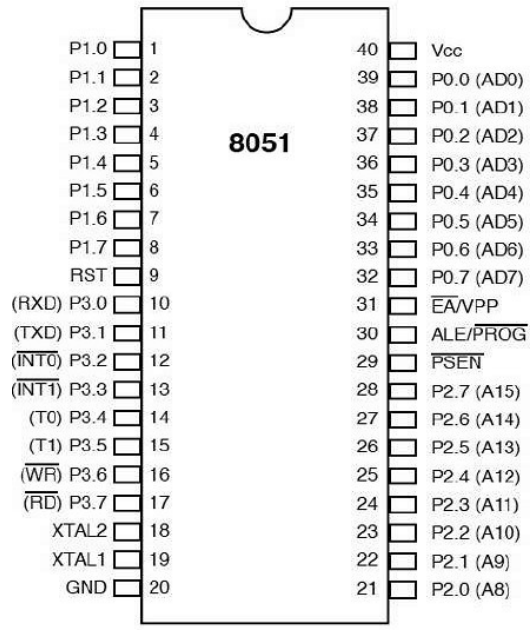


Figure 4. Pin Diagram of 8051 Microcontroller

FUNCTION OF DIFFERENT PINS:

1. **Power Supply and Clock Pins**
    a. **Vcc (Pin 40):** +5V power supply.
    b. **GND (Pin 20):** Ground.

c. **XTAL1 (Pin 19) & XTAL2 (Pin 18):** Connected to a crystal oscillator for the clock signal.

2. **Reset and Control Pins**

   a. **RST (Pin 9):** Resets the microcontroller when held high for at least two machine cycles.

   b. **EA (Pin 31):** External Access. When low, it fetches code from external memory.

   c. **ALE (Pin 30):** Address Latch Enable. Used to demultiplex address/data bus.

   d. **PSEN (Pin 29):** Program Store Enable. Reads external program memory.

3. **Port Pins (I/O)**

   a. **Port 0 (Pins 32–39):** P0.0 to P0.7 — multiplexed address/data bus, or general- purpose I/O.

   b. **Port 1 (Pins 1–8):** P1.0 to P1.7 — dedicated I/O lines.

   c. **Port 2 (Pins 21–28):** P2.0 to P2.7 — higher address bus or I/O.

   d. **Port 3 (Pins 10–17):** P3.0 to P3.7 — I/O and special functions like:

      i. **P3.0 (RXD):** Serial input

      ii. **P3.1 (TXD):** Serial output

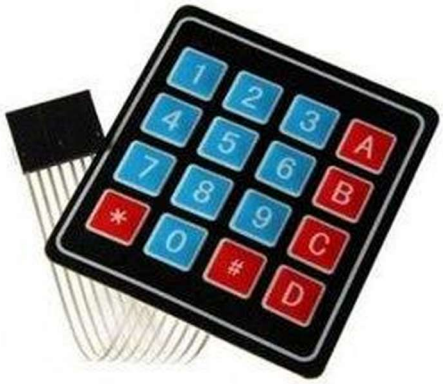
      iii. **P3.2 (INT0) & P3.3 (INT1):** External interrupts

      iv. **P3.4 (T0) & P3.5 (T1):** Timer inputs

      v. **P3.6 (WR) & P3.7 (RD):** External memory write/read control

4×4 Matrix Keypad

These Keypad modules are made of thin, flexible membrane material. The 4 x4 keypad module consists of 16 keys.



16x2 LCD

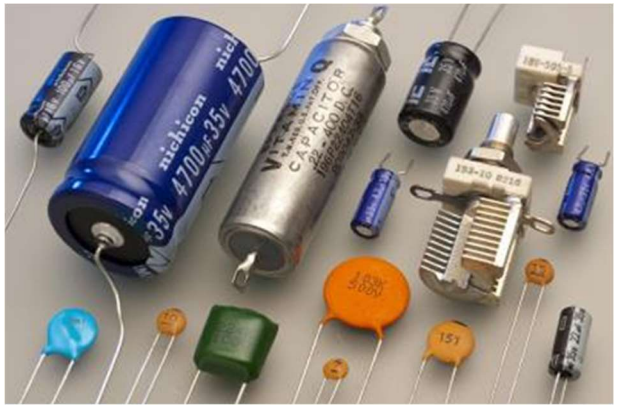
16x2 LCD modules are very commonly used in most embedded projects, the reason being its cheap price, availability, programmer friendly and available educational resources.

Potentiometer

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

Capacitor

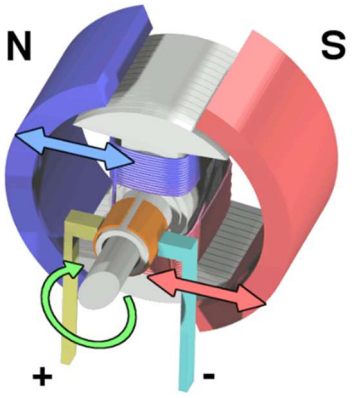
A capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals.



Crystal Oscillators

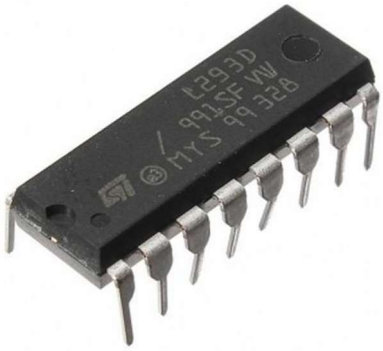
Oscillators provide the basic timing and control for a microcontroller and its peripherals. Commonly used oscillators are of crystal because of its well-known stability and durability. It produces stable output for prolonged time.

Motor



A DC motor is an electrical machine that converts electrical energy into mechanical energy. In a DC motor, the input electrical energy is the direct current which is transformed into the mechanical rotation.

L293D IC



The L293D IC receives signals from the microprocessor and transmits the relative signal to the motors.

WORKING:

1. **System Initialisation**

   The microcontroller initialises all connected components, including the keypad, LCD display, and motor driver. The clock frequency is set using a crystal oscillator (11.0592 MHz) for stable operation.

2. **Password Entry**

   The user is prompted to enter a 4-digit password using the 4x4 keypad. Each keypress is detected and displayed on the 16x2 LCD.

3. **Password Verification**

   The entered password is compared with a predefined password (e.g., "1234") stored in the microcontroller's program memory.

4. **Access Granted**

   If the entered password matches the stored password:

   a. A “Correct Password” message is shown on the LCD.
   b. The microcontroller activates the motor via the L293D driver.
   c. The motor rotates to unlock the door.

5. **Access Denied**

   If the password is incorrect:

   a. A “Incorrect Password” message is displayed on the LCD.
   b. The motor remains inactive and the door stays locked.

6. **Program Execution**

   The entire process is controlled through functions defined in embedded C. The compiled HEX code runs continuously, monitoring keypad input and managing output actions.

7. **Simulation and Testing**

   The system was tested and simulated using Proteus and Keil software to verify logic and performance before deployment.

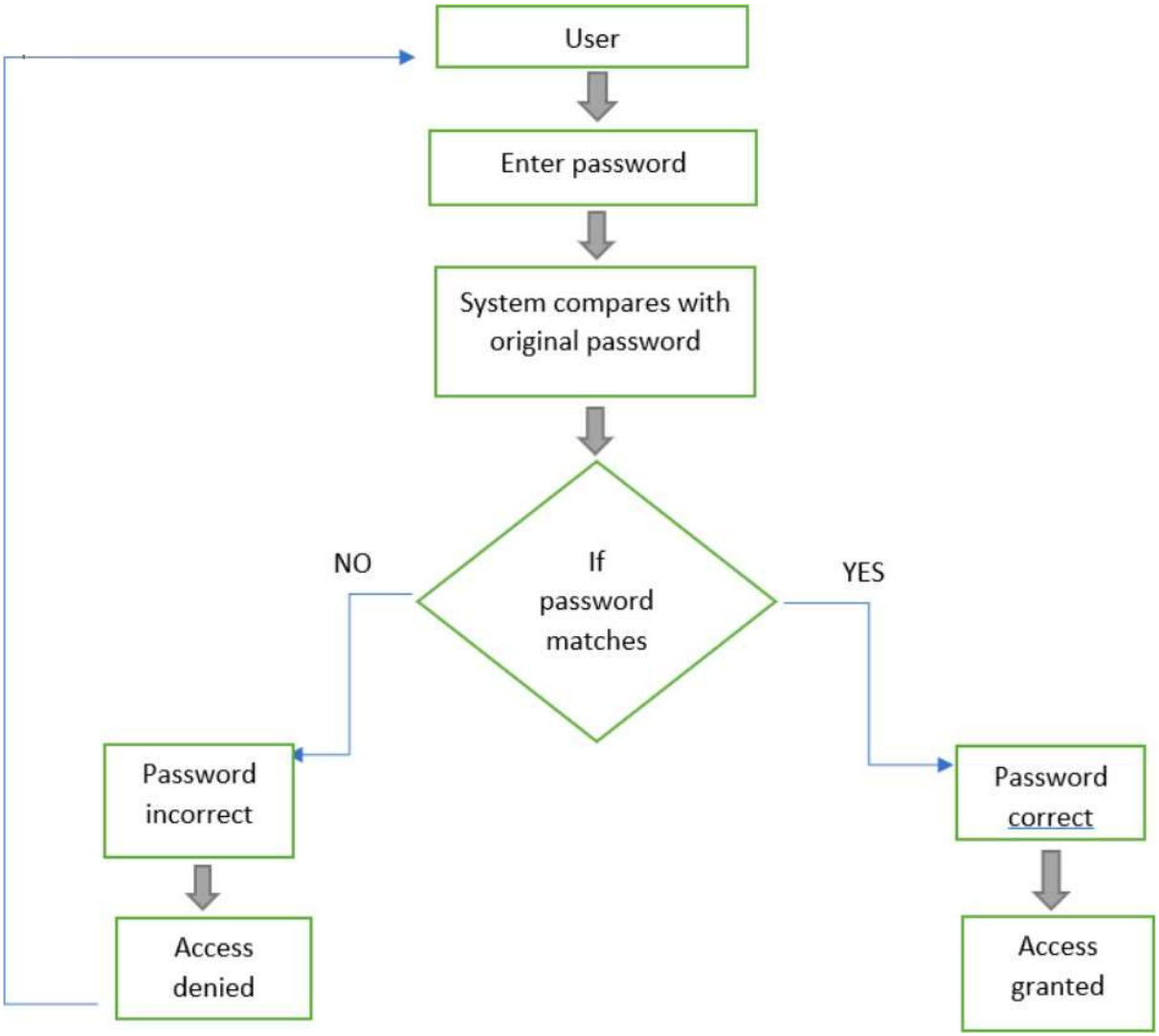


Figure 5. Flowchart

OBSERVATION:

- The microcontroller successfully detects and processes keypad inputs.
- The LCD correctly displays messages based on password input.
- The door lock motor activates only when the correct password is entered.
- Incorrect password entries do not trigger the motor, maintaining security.
- The system is stable and functions consistently during repeated tests.
- Power supply fluctuations can affect performance if not properly regulated.

RESULT:

The digital door lock system using the 8051 microcontroller was successfully implemented and tested. It performs accurate password verification and activates the locking mechanism only when the correct code is entered. The system is efficient, reliable, and demonstrates effective integration of hardware and embedded programming for access control.

PRECAUTIONS:

- Ensure the power supply is stable and within the required voltage range (typically +5V).
- Avoid pressing multiple keypad buttons simultaneously to prevent input errors.
- Use a proper delay between key presses for accurate detection.
- Secure connections to all components to prevent loose contacts during operation.
- The password should be kept confidential to maintain system security.
- Always handle the microcontroller and other ICs with proper ESD protection.

APPLICATIONS:

1. This basic circuit can be used to improve safety in residential areas.
2. It can be used in businesses to ensure that only authorized people have access to extremely guarded areas.
3. With a little tweaking, this project may be used to control load switching through password.
4. Can be used in banks for locker purposes
5. Can be used in Hotel Door room locks, office buildings .

CONCLUSION

This project can be used in the places where security is a major concern. It can be used to secure our precious keepings, lockers etc.

This system consists of a number keypad which is connected to the 8-bit microcontroller 8051.The microcontroller monitors whether the user enters correct passkey or not. This system will allow the person who knows the password and it will not allow who don't know the password We found that this digital code lock is very marketable because it is easy to use, comparatively inexpensive due to low power consumption, and highly reliable.

The digital code lock ensures this is reduced significantly. It is useful as it requires less Power and has minimal cost and hence can be used as door locks and equipment locks.

ANNEXURE

C program for 8051 Microcontroller

```
#include<reg51.h>
#include<string.h>
sbit RS = P3^0;
sbit EN = P3^1;
sbit IN1 =P3^2;
sbit IN2 = P3^3;
void delay(int a)
{
int i,j;
for(i=0;i<a;i++)
for(j=0;j<255;j++);
}
void cmd(char cm)
{
P2 = cm;
RS = 0;
EN = 1;
delay(1);
EN = 0;
}
void dat(char dt)
{
P2 = dt;
RS = 1;
EN = 1;
delay(1);
EN = 0;
}
void display(char *lcd)
{
while(*lcd != '\0')
{
dat(*lcd);
lcd++;
}
}
void lcdint()
{
cmd(0x01);
cmd(0x38);
cmd(0x0E);
cmd(0x80);
}
void main()
{
char pass[5] = "1234";
char pass2[5];
int i=0;
char *ptr;
ptr = pass2;
lcdint();
display("Password-");
pass2[4]='\0';
while(1)
{
while(i<4)
{
P1=0xFE;
if(P1==0xEE)
{
*(ptr+i)='7';
dat('7');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0xDE)
{
*(ptr+i)='8';
dat('8');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0xBE)
{
*(ptr+i)='9';
dat('9');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0x7E)
{
*(ptr+i)='/';
dat('/');
delay(200);
cmd(0x06);
i++;
}
P1=0xFD;
if(P1==0xED)
{
*(ptr+i)='4';
dat('4');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0xDD)
{
*(ptr+i)='5';
dat('5');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0xBD)
{
*(ptr+i)='6';
dat('6');
delay(200);
cmd(0x06);
i++;
}
else if (P1==0x7D)
{
*(ptr+i)='*';
dat('*');
delay(200);
cmd(0x06);
i++;
}
P1=0xFB;
if(P1==0xEB)
{
*(ptr+i)='1';
dat('1');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0xDB)
{
*(ptr+i)='2';
dat('2');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0xBB)
{
*(ptr+i)='3';
dat('3');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0x7B)
{
*(ptr+i)='-';
dat('-');
delay(200);
cmd(0x06);
i++;
}
P1=0xF7;
if(P1==0xE7)
{
*(ptr+i)='C';
dat('C');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0xD7)
{
*(ptr+i)='0';
dat('0');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0xB7)
{
*(ptr+i)='=';
dat('=');
delay(200);
cmd(0x06);
i++;
}
else if(P1==0x77)
{
*(ptr+i)='+';
dat('+');
delay(200);
cmd(0x06);
i++;
}
}
while(i==4)
{
if ((strcmp(pass,
pass2)) == 0)
{
cmd(0xC0);
display("Correct");
IN1 = 1;
IN2 = 0;
delay(100);
}
else
{
cmd(0xC0);
display("Incorrect");
IN1 = 0;
IN2 = 0;
delay(100);
}
i = 0;
cmd(0x01);          //
Clear display
cmd(0x80);      // Set
cursor to start
display("Password-");
}
}
```