PROJECT NO -6

EMBEDDED SYSTEM FOR PASSWORD BASED DOOR LOCK SYSTEM

EE3401

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CONTENT

OBJECTIVES

Enhanced Security through Password Authentication:
Designed an embedded system that prioritizes security by implementing a robust password authentication mechanism, ensuring that only authorized individuals can gain access to the door lock.

User-Friendly Accessibility:
Designed an intuitive interface for seamless interaction, prioritizing ease of use to ensure effortless navigation and optimal user experience with the password-based door lock system.
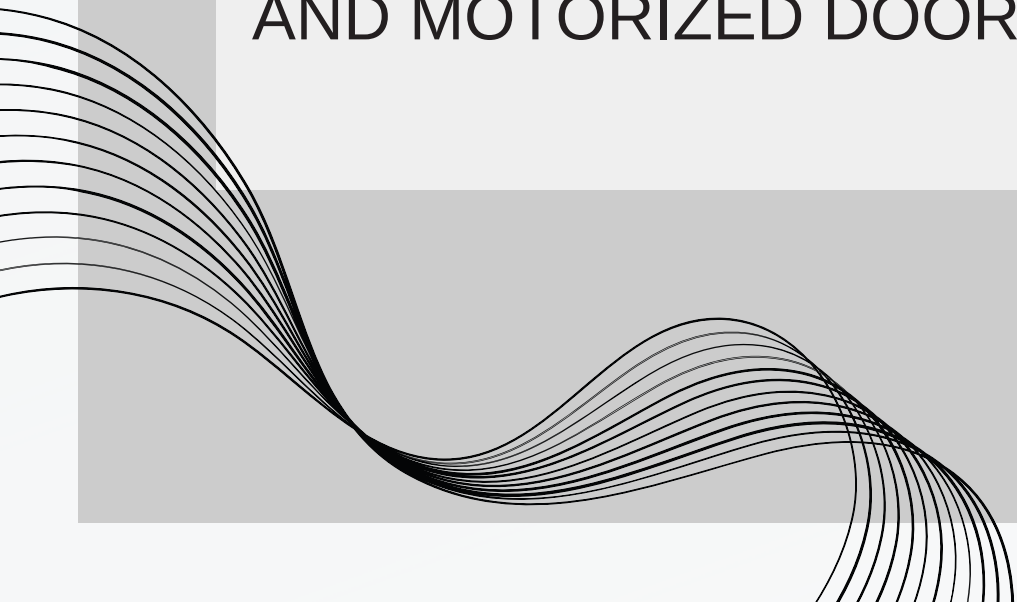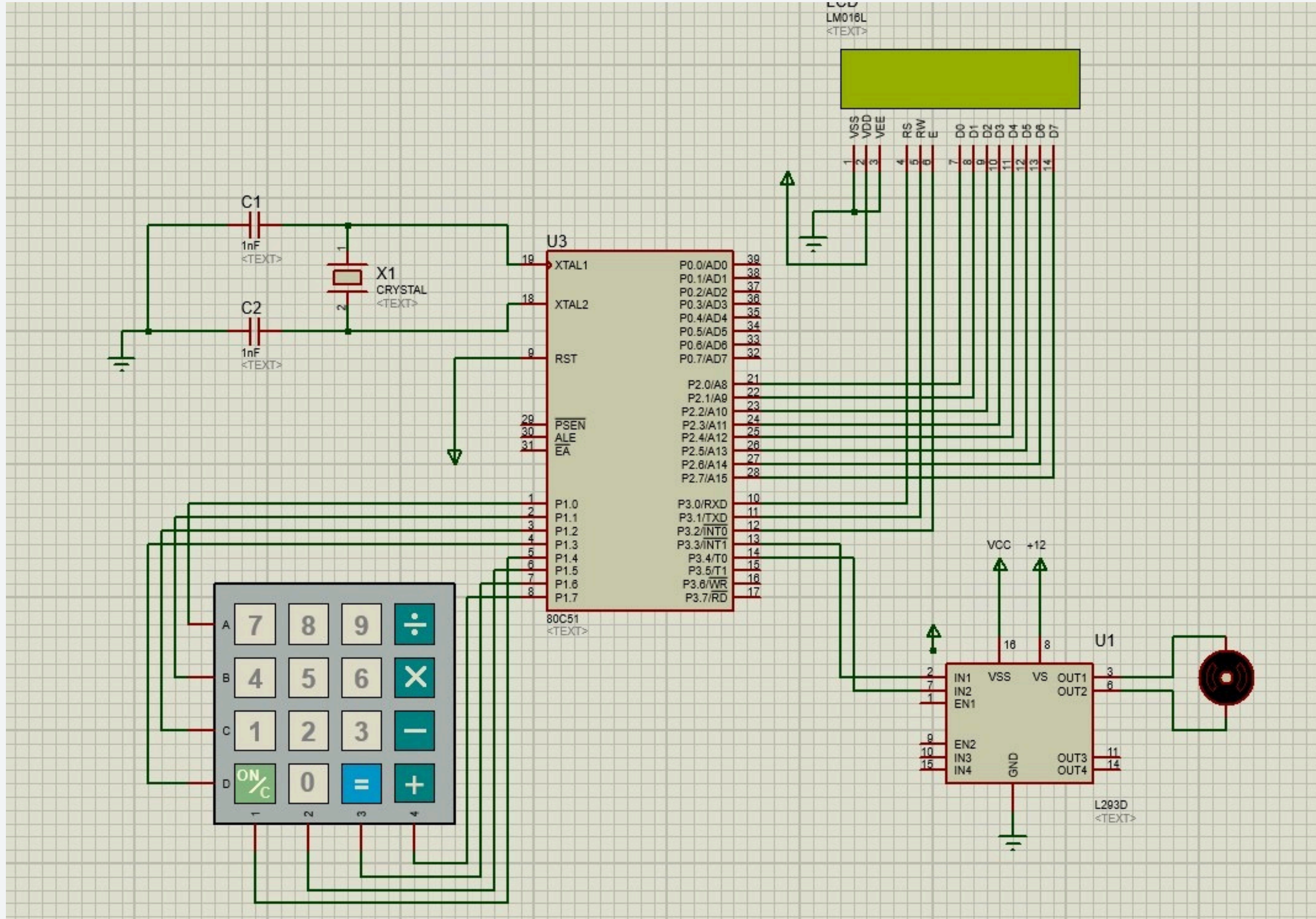
COMPONENTS USED

01 8051 MICROCONTROLLER(AT89S52)

02 8051 DEVELOPMENT BOARD

03 4 X 4 KEYPAD

04 16 * 2 LCD (1602A)

05 DC MOTOR(12V)

06 L293D MOTOR DRIVER

07 POWER SUPPLY

08 GROUND

CIRCUIT DESCRIPTION

THE EMBEDDED SYSTEM BEGINS ITS OPERATION BY INITIALIZING THE LCD AND KEYPAD INTERFACES. THE LCD DISPLAYS THE PROMPT "ENTER YOUR PASSWORD," SIGNALING USERS TO INPUT A 5-DIGIT PIN USING THE CONNECTED KEYPAD. AS EACH DIGIT IS ENTERED, IT APPEARS ON THE LCD IN REAL-TIME. ONCE THE FULL PASSWORD IS ENTERED, THE MICROCONTROLLER VERIFIES IT AGAINST A PRESET PASSWORD. IF THE ENTERED AND PRESET PASSWORDS MATCH, THE LCD DISPLAYS "ACCESS GRANTED," TRIGGERING THE MOTOR CONTROL CIRCUIT TO INITIATE DOOR OPENING. SIMULTANEOUSLY, THE LCD SHOWS "DOOR OPENING," AND THE MOTOR ROTATES FOR A PREDEFINED DURATION, FACILITATING THE DOOR'S MOVEMENT. IN THE EVENT OF AN INCORRECT PASSWORD ENTRY, THE LCD DISPLAYS "WRONG PASSWORD," PROMPTING THE USER TO RETRY. REGARDLESS OF THE OUTCOME, THE SYSTEM RESETS, AND THE LCD REVERTS TO DISPLAYING "ENTER YOUR PASSWORD," READY FOR THE NEXT USER INTERACTION. THIS CIRCUIT FLOW ENSURES A SEAMLESS AND SECURE DOOR ACCESS CONTROL EXPERIENCE WITH USER-FRIENDLY FEEDBACK AND MOTORIZED DOOR OPERATION UPON SUCCESSFUL AUTHENTICATION.

SCHEMATIC CAPTURE

COMPONENT DESCRIPTION

L.C.D:
Here we are using a 16x2 L.C.D which is a dot matrix Liquid Crystal Display. Data pins of LCD is connected to port P2 from P2.0-P2.7 describing the current status of system and three control pins RS, RW and E are connected to port P3 from P3.0-P3.2 respectively.

D.C Motor Drive:
It is a machine used to convert the electrical energy into mechanical energy. To interface this D.C motor drive with the Micro Controller we use an L293D I.C. Dc motor is connected to port P3 from P3.3-P3.4 via a relay circuitry.

4x4 Matrix Keyboard:
This keyboard contains a numbers of switches arranged in a matrix format. Each rows and each column are connected to the pins of micro controller. This keyboard contains numbers from 0 to 9, a '*' button ,a '#' button and Alphabets from 'A' to 'D'. These switches are generally a numbers of push buttons. With the help of this Keyboard an individual can enter the password to unlock the door. 4x4 keypad is connected to port P1 from P1.0–P1.7 allowing user to enter user id.

BLOCK DIAGRAM
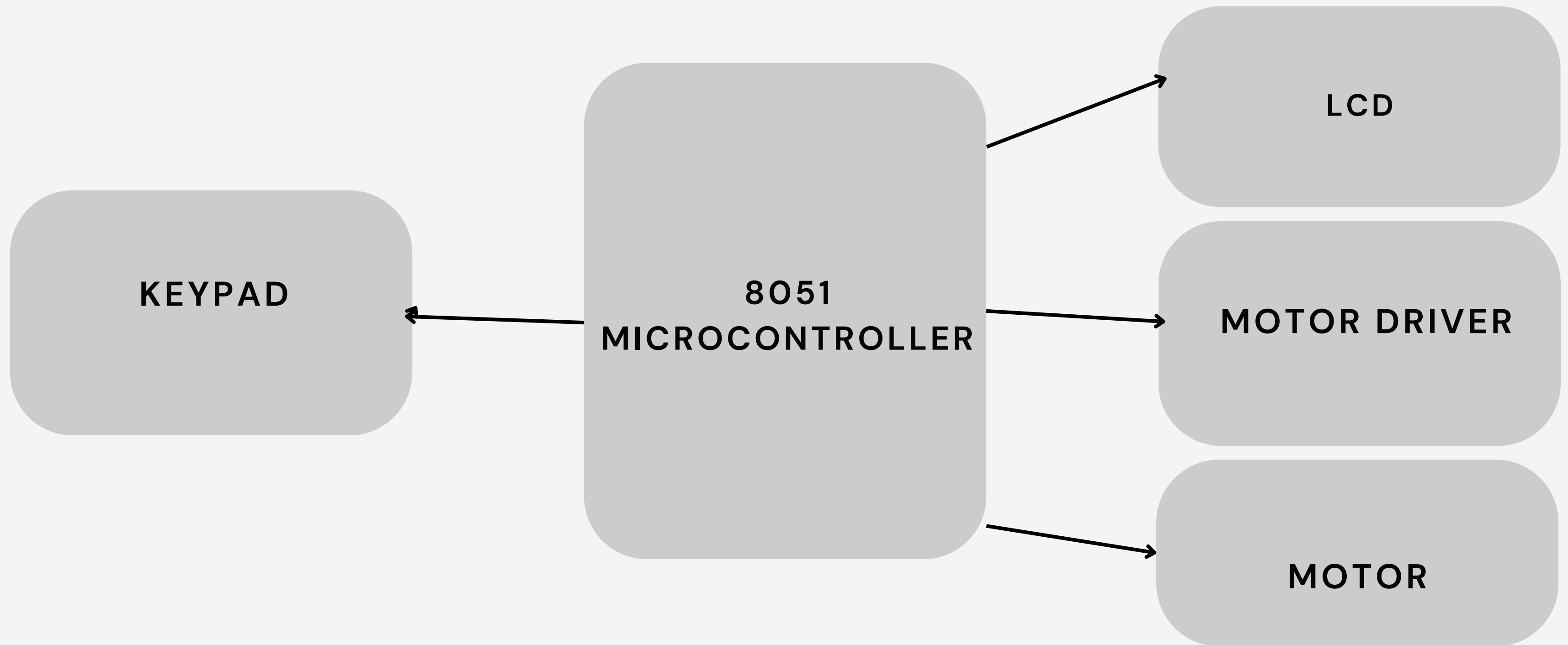
HARDWARE CIRCUIT
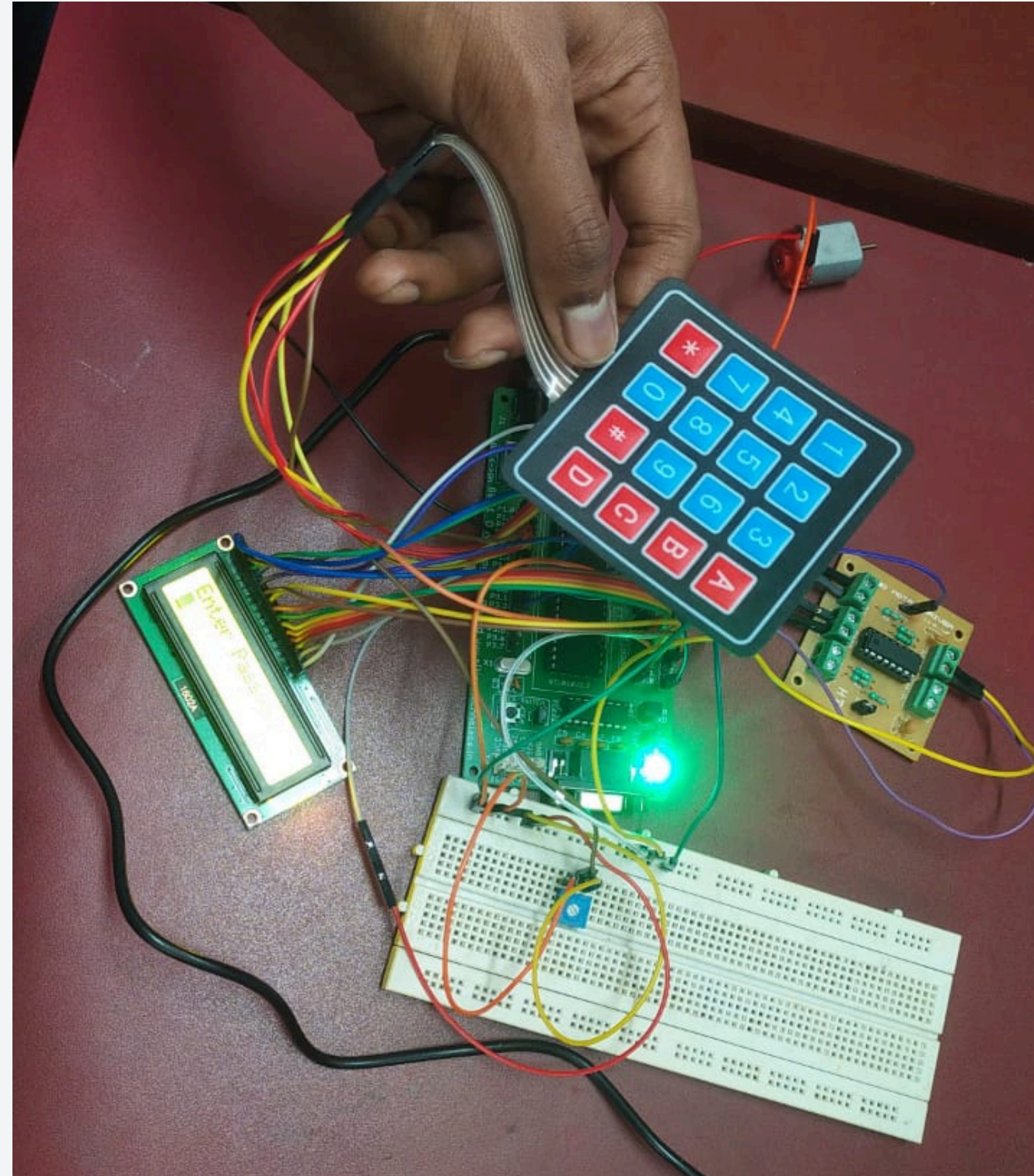
ASSEMBLY CODE

```
ORG 0000H
SJMP MAIN

MAIN: CLR P3.3
    CLR P3.4
    ACALL LCD_INITIALIZE   ;INITIALIZE LCD WITH INITIAL COMMANDS
    ACALL DELAY   ;DELAY FOR 0.036 SEC
    ACALL INITIAL_MSG  ;DISPLAYING INITIAL TEXT
    ACALL DELAY
    ACALL LINE2 ;MOVE THE CURSOR TO THWE BEGINNING OF 2ND LINE OF LCD
    ACALL DELAY
    ;TAKING INPUT FROM 4X4 KEYPAD
    ACALL READ_KEYS ;TAKING PASWORD FROM KEYPAD
    ACALL DELAY
    ACALL CLRSCR ; CLEAR THE SCREEN OF LCD
    ACALL DELAY
    ;ACALL PASS_CHECK  ;DISPLAYING TEXT
    ACALL DELAY2  ;DELAY FOR 0.271 SECOND

    ACALL CLRSCR
    ACALL CHECK_PASSWORD
    SJMP MAIN
```

ASSEMBLY CODE

```
;LCD INITIALIZATION SUBROUTINE
;COMMAND: DB 38H,0FH,01H,06H,80H
LCD_INITIALIZE:MOV DPTR,#COMMAND
C1:CLR A
MOVC A,@A+DPTR
JZ DAT
ACALL COMWRT
ACALL DELAY
INC DPTR
SJMP C1
DAT:RET

;INI_MSG: DB "ENTER 5-DIG. PASS",0
INITIAL_MSG:MOV DPTR,#INI_MSG
C2:CLR A
MOVC A,@A+DPTR
JZ RT
ACALL DATAWRT
ACALL DELAY
INC DPTR
SJMP C2
RT:RET
```

ASSEMBLY CODE

```
;SEND COMMAND TO INITILIZE THE LCD
COMWRT:MOV P2,A
CLR P3.0    ;REGISTER SELECT FOR COMMAND
CLR P3.1    ; WRITE OPERATION
SETB P3.2    ;ENABLE HIGH
ACALL DELAY
CLR P3.2     ;ENABLE LOW
RET

;SEND DATA TO LCD
DATAWRT:MOV P2,A
SETB P3.0     ;REGISTER SELECT FOR DATA
CLR P3.1
SETB P3.2
ACALL DELAY
CLR P3.2
RET

;MOVE TO SECOND LINE OF LCD
LINE2:MOV A,#0C0H
ACALL COMWRT
RET

CLRSCR:MOV A,#01H ;CLEAR THE LCD SCREEN
ACALL COMWRT
RET
```

ASSEMBLY CODE

```
READ_KEYS:MOV R0,#5 ;LENGTH OF PASSWORD
MOV R1,#2FH  ;MEMORY ADDRESS
ACALL DELAY
ROTATE:ACALL KEY_SCAN
MOV @R1,A  ;TAKE THE VALUE OF A AND STORE IN MEMORY LOACTION POINTED BY R1
ACALL DELAY2
ACALL DATAWRT  ;SHOW DATA IN LCD
ACALL DELAY2
INC R1   ; STORE THE NEXT DATA IN NEXT MEMORY LOCATION
DJNZ R0,ROTATE
RET
```

ASSEMBLY CODE

```
KEY_SCAN:
;SCANNING KEY PRESS FOR 1ST ROW
MOV P1,#0FFH
    CLR P1.0
    JB P1.4,NEXT1
    MOV A,#"1";MOVE 1 IN A
    RET
NEXT1:JB P1.5,NEXT2
    MOV A,#"2"
    RET
NEXT2:JB P1.6,NEXT3
    MOV A,#"3"
    RET
NEXT3:JB P1.7,NEXT4
    MOV A,#"A"
    RET
;SCANNING KEY PRESS FOR 2ND ROW
NEXT4:SETB P1.0
    CLR P1.1
    JB P1.4,NEXT5X
    MOV A,#"4"
    RET
NEXT5:JB P1.5,NEXT6
    MOV A,#"5"
    RET
NEXT6:JB P1.6,NEXT7
    MOV A,#"6"
    RET
NEXT7:JB P1.7,NEXT8
    MOV A,#"B"
    RET
```

ASSEMBLY CODE

```
;SCANNING KEY PRESS FOR 3RD ROW
NEXT8:SETB P1.1
    CLR P1.2
    JB P1.4,NEXT9
    MOV A,#"7"
    RET
NEXT9:JB P1.5,NEXT10
    MOV A,#"8"
    RET
NEXT10:JB P1.6,NEXT11
    MOV A,#"9"
    RET
NEXT11:JB P1.7,NEXT12
    MOV A,#"C"
    RET
;SCANNING KEY PRESS FOR 4TH ROW
NEXT12:SETB P1.2
    CLR P1.3
    JB P1.4,NEXT13
    MOV A,#"*"
    RET
NEXT13:JB P1.5,NEXT14
    MOV A,#"0"
    RET
NEXT14:JB P1.6,NEXT15
    MOV A,#"#"
    RET
NEXT15:JB P1.7,BACK
    MOV A,#"="
    RET
    BACK:LJMP KEY_SCAN
```

ASSEMBLY CODE

```
;PASSWORD: DB "A","O","B","C","*"
CHECK_PASSWORD:MOV R0,#5  ;LENGTH OF PASSWORD
MOV R1,#2FH    ;MEMORY ADDRESS
MOV DPTR,#PASSWORD
RPT:CLR A
MOVC A,@A+DPTR    ;MOVE THE CONTENT OF A+DPTR TO A AND CHECK FOR CORRECT
PASSWORD
XRL A,@R1  ;CHECKING FOR PASSWORD, IF 'A' AND CONTENT OF R1 IS SAME THE XOR OPERATION
RESULT IN 0 ELSE NOT ZERO
JNZ FAIL  ;JUMP TO FAIL IF A IS NOT ZERO
INC R1
INC DPTR
DJNZ R0,RPT
ACALL SUCCESS
RET

;TEXT_FAIL: DB "WRONG PASSWORD",0
FAIL:ACALL DELAY
MOV DPTR,#TEXT_FAIL
ACALL SEND_DATA  ;SEND TEXT TO DISPLAY ON LCD
ACALL DELAY2
LJMP MAIN
```

ASSEMBLY CODE

```
;SEND THE DATA TO BE DISPLAYED ON LCD
SEND_DATA:ACALL DELAY
CLR A
MOVC A,@A+DPTR
JZ AGAIN
ACALL DATAWRT
ACALL DELAY
INC DPTR
SJMP SEND_DATA
AGAIN:RET
```

ASSEMBLY CODE

```
;SUBROUTINE TO DISPLAY TEXT ON LCD AND TO TURN LED ON
SUCCESS:ACALL CLRSCR
ACALL DELAY2
;TEXT_S1: DB "ACCESS GRANTED",0
MOV DPTR,#TEXT_S1
ACALL SEND_DATA
ACALL DELAY2
ACALL LINE2
;TEXT_S2: DB "OPENING DOOR",0
MOV DPTR,#TEXT_S2
ACALL SEND_DATA
SETB P3.3
CLR P3.4
ACALL DELAY
ACALL CLRSCR
;TEXT_S3: DB "CLOSING DOOR",0
MOV DPTR,#TEXT_S3
ACALL SEND_DATA
CLR P3.3
SETB P3.4
ACALL DELAY3
RET
```

ASSEMBLY CODE

```
DELAY3:MOV TMOD,#10H  ;INITIALIZE TIMER 1 IN MODE 1
MOV R3,#42   ;THE 71.1 MS *42 = 3SEC DELAY
AGAIN1: MOV TL1,#00H   ; DELAY FOR 71.1065MSEC
MOV TH1,#00H
SETB TR1  ;START TIMER 1
BACK1: JNB TF1,BACK1   ;WAIT UNTIL OVERFLOW FLAG OF TIMER 1 BECOME 1
CLR TR1   ;STOP THE TIMER 1
CLR TF1   ;CLEAR THE OVERFLOW FLAG
DJNZ R3,AGAIN1 ;LOOP AGAIN
RET


DELAY2: MOV R3,#250D ; R3  = 250
 MOV TMOD,#01 ;INITIALIZE TIMER 0 IN MODE 1
BACK2:  MOV TH0,#0FCH
 MOV TL0,#018H  ;INITIAL COUNT VALUE = FC18 IS LOADED INTO TIMER
 SETB TR0 ;STARTING TIMER
HERE5:  JNB TF0,HERE5 ;MONITOR TIMER FLAG IF IT IS 1
 CLR TR0 ; STOP THE TIMER
 CLR TF0 ; RESET THE TIMER FLAG
 DJNZ R3,BACK2 ; REPEAT THIS PROCESS 250 TIMES
 RET
```

ASSEMBLY CODE

```
DELAY:MOV R3,#65
HERE:MOV R4,#255
HERE2:DJNZ R4,HERE2
DJNZ R3,HERE
RET


TEXT_S1: DB "ACCESS GRANTED",O
TEXT_S2: DB "DOOR OPENING",O
TEXT_FAIL: DB "WRONG PASSWORD",O
TEXT_S3: DB "DOOR CLOSING",O
COMMAND: DB 38H,OFH,O1H,O6H,8OH,O;INITIALIZE COMMAND OF LCD
INI_MSG: DB "ENTER PASSWORD",O
PASSWORD: DB "1","2","3","4","5"
END
```

PRACTICAL APPLICATIONS

HUMAN-MACHINE INTERFACE (HMI): THE LCD AND KEYPAD INTERFACES SERVE AS AN HMI, PROVIDING A USER-FRIENDLY INTERACTION PLATFORM. THE LCD DISPLAYS PROMPTS AND FEEDBACK, MAKING IT EASY FOR USERS TO INPUT THEIR PASSWORD AND UNDERSTAND THE SYSTEM'S STATUS.

DOOR ACCESS CONTROL SYSTEM: THE PRIMARY APPLICATION IS A SECURE DOOR ACCESS CONTROL SYSTEM. USERS ARE REQUIRED TO ENTER A CORRECT 5-DIGIT PIN TO GAIN ACCESS TO A SECURED AREA.

CONCLUSION

THE SUCCESSFUL INTEGRATION OF VARIOUS COMPONENTS, SUCH AS THE MICROCONTROLLER, LCD, KEYPAD, AND MOTOR CONTROL CIRCUIT, DEMONSTRATES THE FEASIBILITY OF CREATING A COMPREHENSIVE AND FUNCTIONAL EMBEDDED SYSTEM FOR DOOR ACCESS CONTROL.