Experiment - 1

Aim :- Introduction to KEIL and 8051 microcontroller.

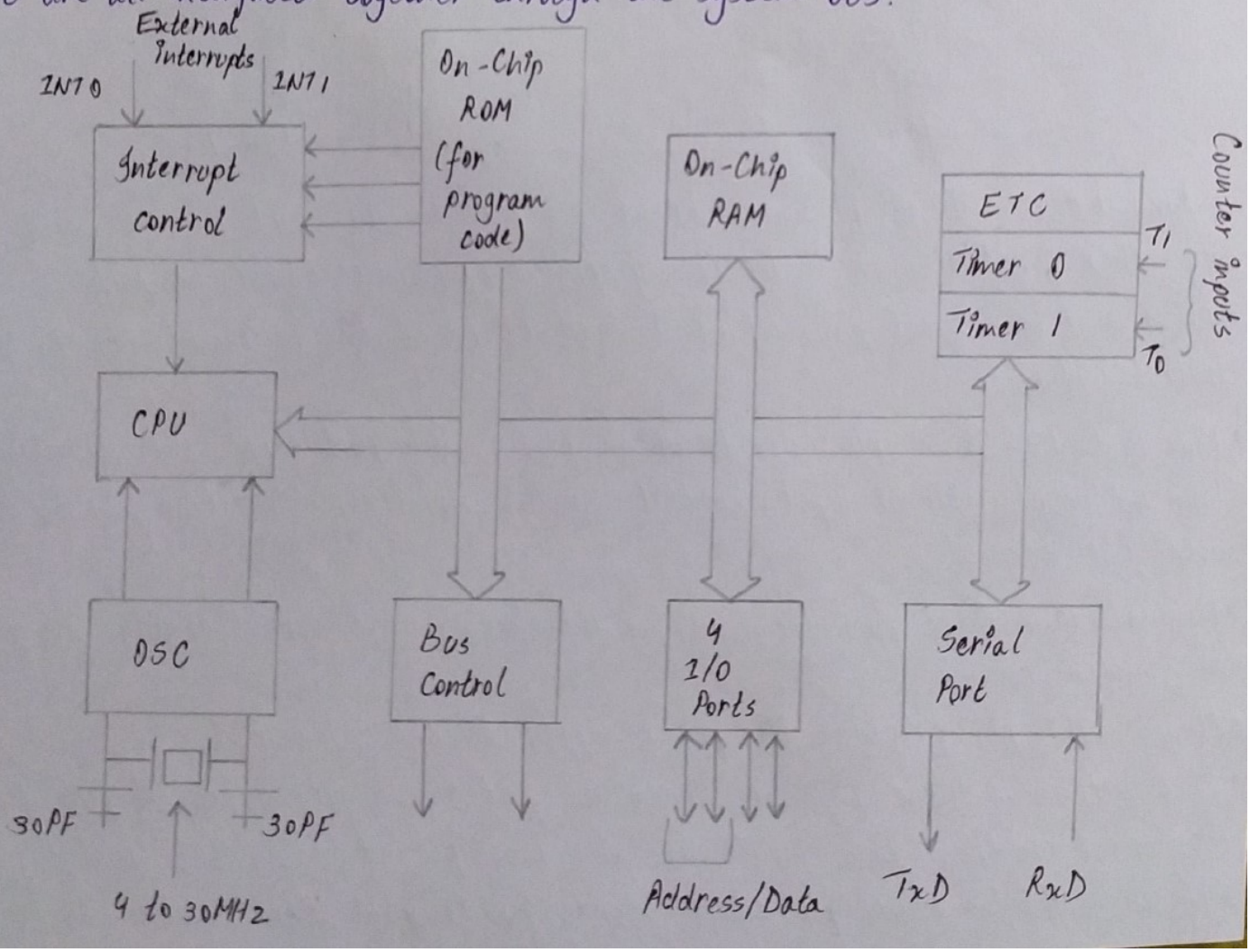
Theory :-

8051 Microcontroller

8051 microcontroller is designed by intel in 1981. It is an 8-bit microcontr -oller. It is built with 40 pins DIP (Dual Inline Package), 4kb of ROM storage and 128 bytes of RAM storage, two 16 bit timers. It consists of four parallel 8 bit ports, which are programmable as well as addressable as per the requirement. An on chip crystal oscillator is integrated in the microcontroller having crystal frequency of 12 MHz.

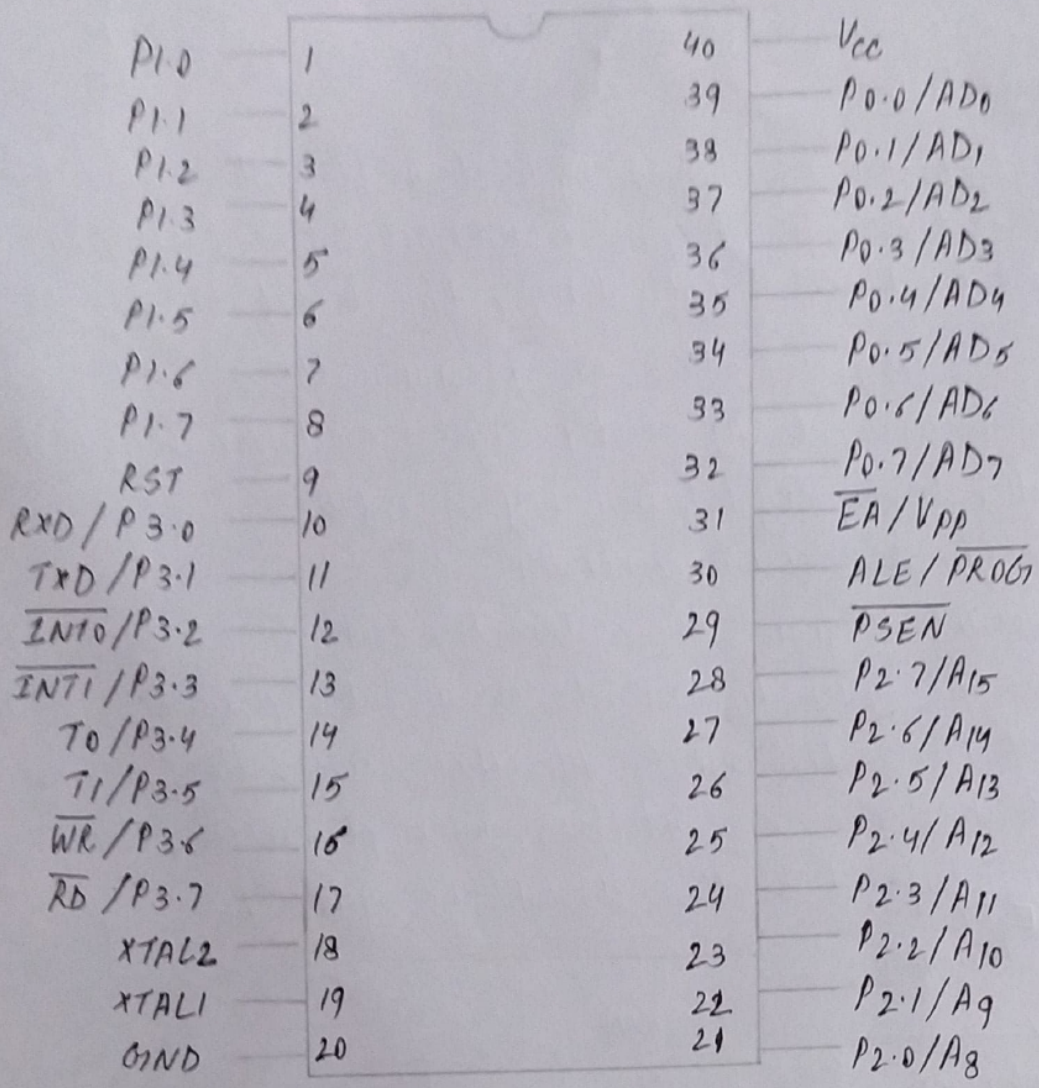
=> Architecture of 8051 microcontroller

In the following diagram, the system bus connects all the support devices to the CPU. The system bus consists of an 8-bit data bus, a 16-bit addre -ss bus and bus control signals. All other devices like program memory, ports, data memory, serial interface, interrupt control, timers and the CPU are all interfaced together through the system bus.



=> 8051 Pin Description

The pin diagram of 8051 microcontroller looks as follows —



- Pins 1 to 8 – These pins are known as port 1. This port doesn't serve any other functions. It is internally pulled up, bidirectional I/O port.
- Pin 9 – It is a reset pin, which is used to reset the microcontroller to its initial values.
- Pins 10 to 17 – These pins are known as port 3. This port serves some functions like interrupts, timer input, control signals, serial communication signals RxD and TxD, etc.
- Pins 18 & 19 – These pins are used for interfacing an external crystal to get the system clock.
- Pin 20 – This pin provides the power supply to the circuit.
- Pins 21 to 28 – These pins are known as port 2. It serves as I/O port. Higher order address bus signals are also multiplexed using this port.
- Pin 29 – This is PSEN pin which stands for Program Store Enable. It is

Used to read a signal from the external program memory.

- Pin 30 - This is EA pin which stands for External Access input. It is used to enable/disable the external memory interfacing.
- Pin 31 - This is ALE pin which stands for Address Latch Enable. It is used to demultiplex the address data signal of port.
- Pins 32 to 39 - These pins are known as port 0. It serves as I/O port. Lower order address and data bus signals are multiplexed using this port.
- Pin 40 - This pin is used to provide power supply to the circuit.

KEIL Software

Keil development tools for the 8051 microcontroller architecture support every level of software developer from the professional applications engineer to the student just learning about ~~#~~ embedded software development.

Result:-

8051 microcontroller and KEIL software was studied successfully.

Experiment-2

Aim:- Write a program to perform addition, subtraction, multiplication and division of two 8-bit numbers and using register A and B and result in RAM from 0x30H.

Software used:- KEIL Software

Code:-

Addition

```
Org 00h
MOV A, #05h
MOV B, #04h
ADD A,B
MOV R0, A
END
```

Subtraction

```
Org 00h
MOV A, #05h
MOV B, #04h
SUB A, B
MOV R0, A
END
```

Multiplication

```
Org 00h
MOV A, #05h
MOV B, #04h
MUL AB
MOV R3, A
END
```

Division

```
Org 00h
MOV A, #05h
MOV B, #04h
DIV AB
MOV R3, A
END
```

Code Explanation:-

1.) Org 00h → Org 00h is a directive that tells the assemble where to write program into microcontroller program memory. By using data address 00h, org tells to store first program instruction into first memory locati-on (address 0000h) which is known as reset vector.

2.) MOV A, #05h → Here # represents that immediate data is provided move instruction where 05h is hexadecimal data. This will move 05h to a register.

3.) MOV B, #04h → This will move immediate data 04h to B register.

4.) MOV R0, A → This command moves content of A to R0 register.

5.) END → This marks end of program.

6.) ADD A,B → This adds content of B and register A and stores the result in register A.

7.) SUBB A,B → This will subtract the content of register of B from the register of A and stores the result in A.

8.) MUL AB → Multiplies content of A and B register and stores the value in register A.

9.) DIV AB → Divide the value in B register with value stored in register A and store the result in register A.

Output :-

Addition

Value given to A = 05h

Value given to B = 04h

final value = 05h + 04h

= 09h → stored in A then transferred to R0.

Subtraction

Value given to A = 05h

Value given to B = 04h

final value = 05h - 04h

= 01h → stored in A then transferred to R0.

Multiplication

Value given to A = 05h

Value given to B = 04h

final value = 05h x 04h

= F4h → stored in A then transferred to R3.

Division

Value given to A = 05h

Value given to B = 04h

final value = 05h / 04h

= 01h → stored in A then transferred to R_3

Result :-

Addition, Subtraction, Multiplication and division successfully carried out and output observed.

Experiment 3

Aim:- Write a program to glow 8 LEDs in a pattern such that one LED on at a time and rotating towards left.

Software used:- KEIL Software

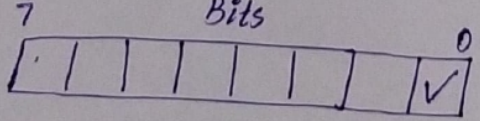
Code:-

```
ORG 00h
START : MOV A, #01h
MOV R1, #08h
Loop4 : MOV P1, A
RL A
ACALL DELAY
DJNZ R1, LOOP4
DELAY : MOV R1 , #0FFh
L3 : MOV R2 , #0FFh
L2 : MOV R3, #0FFh
L1 : DJNZ R3 , L1
DJNZ R2 , L2
L4 : DJNZ R1, L4
RET
END
```

Output:-

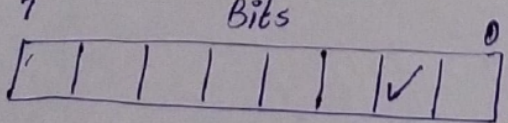
RUN 1

P1 : 0x01



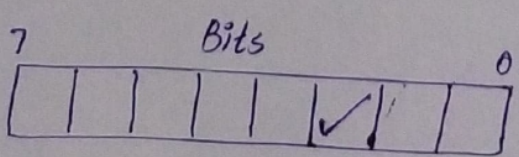
RUN 2

P1 : 0x02



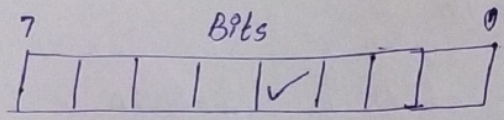
RUN 3

P1 : 0x04



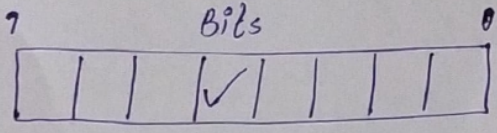
RUN 4

P1 : 0x08



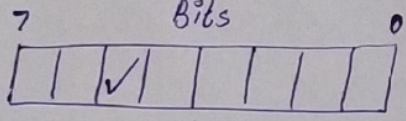
RUN 5

P1 : 0x10



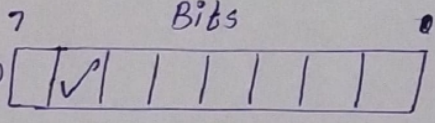
RUN 6

P1 : 0x20



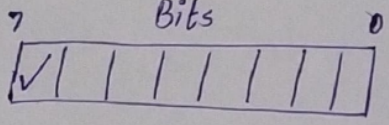
RUN 7

P1 : 0x40



RUN 8

P1 : 0x80



Result :-

The rotating LED pattern has been implemented successfully.

Experiment - 4

Aim:- Write a program to generate a square wave of 1kHz at P1.0 and see the output on LED.

Software Used:- KEIL Software

Code:-

```
        ORG 0
        MOV P1, #00H
        MOV TMOD, #01H
HERE:   SETB P1.0
        ACALL DELAY
        SJMP HERE
DELAY:  MOV TH0, #0FEH
        MOV TL0, #32H
        SETB TR0
HERE1:  JNB TF0, HERE1
        CLR TR0
        CLR TF0
        RET
END
```

Result:-

Square wave is generated successfully using the code.

Experiment-5

Aim:- Write a program for counter using seven segment display with 8051 microcontroller

Software used:- Keil version 5

Theory:-

Seven segment is a very popular digital display device, if display digit from 0 to 9. It consists of 7 LEDs.

Program code:-

```
START :  MOV SP, #68H
         MOV P1, #00H
         CLR P3.4
         CLR P3.5
         CLR P3.6
         CLR P3.7
LOOP :   MOV B, #0
         MOV R1, #10
LOOP1 :  SET B. P3.7
         MOV A, B
         MOV DPTR, #SSDVALUEADDR
         MOVC A, @A+DPTR
         MOV P1, A
         LCALL DELAY
         CLR P3.7
         INC B
         DJNZ R1, LOOP1
         STMP LOOP
DELAY:   MOV TMOD, #01H
         MOV TH0, #0
         MOV TL0, #0
```

```
WAIT : SETB TR0
       JNB TF0, WAIT
       CLR TF0
       CLR TR0
       RET
SSD VALUE ADDR:
       DB 3FH
       DB 06H
       DB 5BH
       DB 4FH
       DB 66H
       DB 6DH
       DB 7DH
       DB 07H
       DB 0FH
       DB 6FH
```

Result :- The program for counters using seven segment display with 8051 microcontrollers was successfully executed on Keil version 5.

Experiment-6

Aim :- Write a program to alternate LED using KEIL

Software used :- KEIL

Program code :-

```
ORG 00H
START: MOV P1, #0FFH
       ACALL DELAY
       MOV P1, #055H
       ACALL DELAY
       ACALL DELAY
DELAY: MOV R1, #003H
  L2:  MOV R2, #003H
  L3:  MOV R3, #003H
  L4:  MOV R4, #003H
  L5:  DJNZ R4, L5
  L6:  DJNZ R4, L6
  L7:  DJNZ R4, L7
       DJNZ R1, L2
       RET
       END
```

Result :- Implementation of glowing of alternate LEDs has been done successfully.

Experiment-7

Aim:- Write a program to display message on LCD display.

Software used:- KEIL

Theory:-

LCD display is an inevitable part in almost all embedded projects and this experiment is about interfacing projects a 16×2 LED with 8051 microcontroller.

Many 16×2 LCD module is a very common type of LCD module that is used in 8051 based embedded projects. It consists of 16 rows and 2 columns of 5×7 or 5×8 LCD dot matrices. It is available in a 16 pin package with backlight, contrast adjustment function and each dot matrix has 5×8 dot resolution.

Program Code:-

```
Org 0H
DATAWRT: MOV A,#38H
CALL WR CDAD
CALL DELAY
MOV A, #0EH
ACALL WRCMD
ACALL DELAY
MOV A,#01H
ACALL WRCMD
ACALL DELAY
MOV A,#82H
ACALL WRCMD
ACALL DELAY
MOV A,#E
ACALL DATAWRT
ACALL DELAY
```

```
MOV A, #E
ACALL DELAY
AGAIN STMP AGAIN
WRCMD
MOV P1, A
CLR P3.6
CLR P3.5
SET BP3.4
ACALL DELAY
CLR P3.4
RET
DATAWRT
MOV P1, A
SETB P3.6
CLR P3.5
SETB P3.4
RET
DELAY: MOV R3, #50
HERE 2: MOV R4, #255
HERE : DJNJ R4, HERE
DJN2 R3, HERE2
RET
END
```

Result:- We have successfully written a program to display message on LCD display.

Experiment-8

Aim:- Write a program to scan 8 keys on the kit and display its binary code on LED.

Software used:- KEIL version 5

Program code:-

```
START : MOV A, #00H
        MOV P1, A
NXK1 : JNB P0.0, NXK2
       MOV A, #01H
       MOV P1, A
NXK2 : JNB P0.1, NXK3
       MOV A, #02H
       MOV P1, A
NXK3 : JNB P0.2, NXK4
       MOV A, #03H
       MOV P1, A
NXK4 : JNB P0.3, NXK5
       MOV A, #04H
       MOV P1, A
NXK5 : JNB P0.4, NXK6
       MOV A, #05H
       MOV P1, A
NXK6 : JNB P0.5, NXK7
       MOV A, #06H
       MOV P1, A
NXK7 : JNB P0.6, NXK8
       MOV A, #07H
       MOV P1, A
```

```
Nxk9 : MOV 31H, #80H
CP : DJNZ 31H, L1
     SJMP START
END
```

Result:- Binary code of 8 keys (0-8) were displayed on the LEDs on the one by one Keil version 5.

Innovation

Aim:- Interfacing ADC to 8051

Software used:- Keil Software

Theory:-

ADC (Analog to Digital) converter 0808/0809 is the 8 bit analog to digital converter. It has 8 channels. It has three address lines, i.e., Pin A, B, C and ALE are used to select one of the analog channel of total 8 channels.

A	B	C	Channel
0	0	0	IN 0
0	0	1	IN 1
0	1	0	IN 2
0	1	1	IN 3
1	0	0	IN 4
1	0	1	IN 5
1	1	0	IN 6
1	1	1	IN 7

ADC 0808 has 3 control signals, i.e., SOC (Start of conversion), EOC (End of Conversion), OE (output Enable).

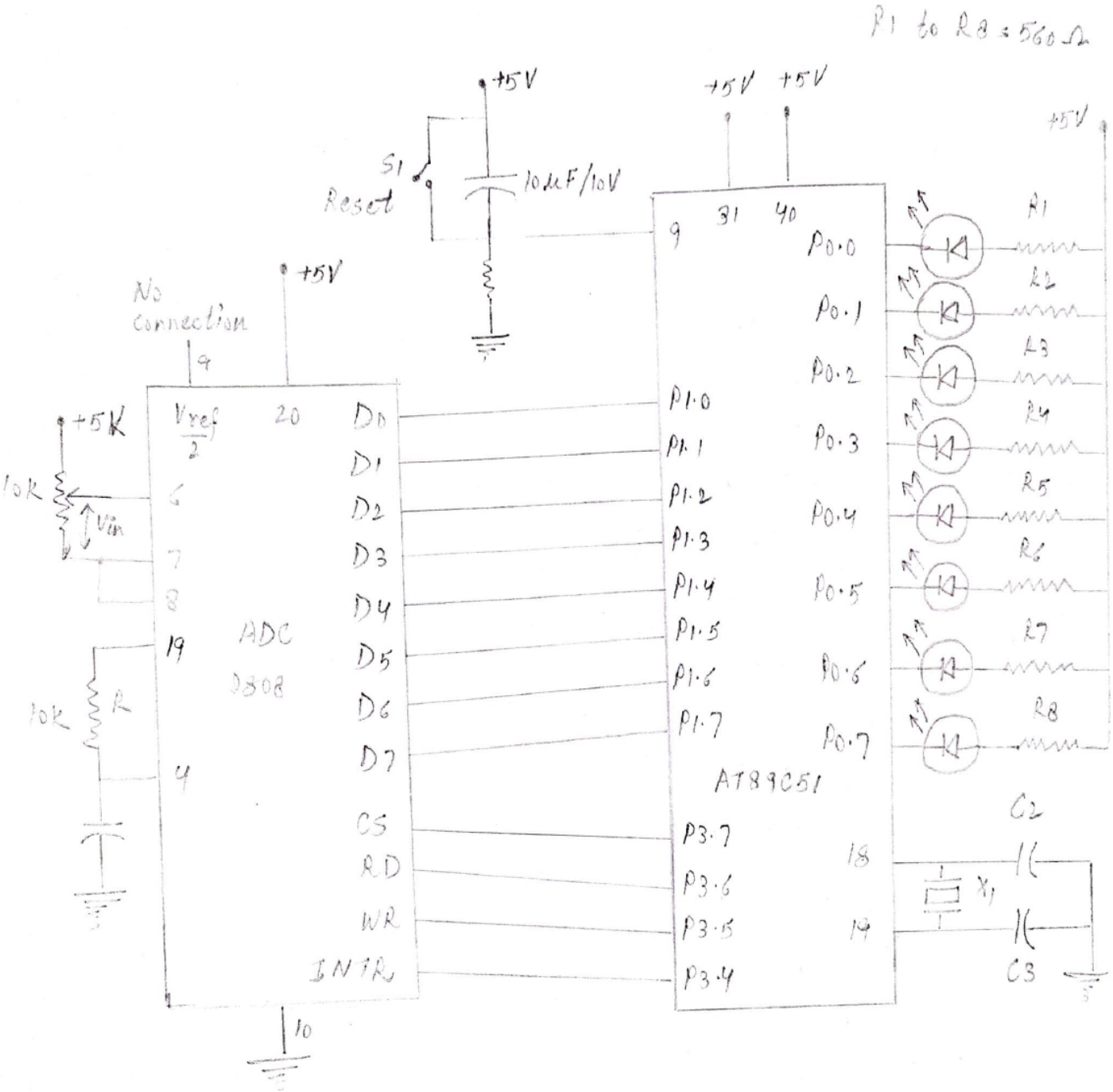
⇒ SOC: When high to low signal is appears to this pin of ADC, ADC then starts conversion.

⇒ EOC: ADC sends this high EOC signal to microcontroller to indicate completion of conversion.

⇒ OE: When a high signal is applied to this pin. Output latch of ADC get enables and converted data is available to microcontrollers.

The reference voltage determines range of analog input voltage. The frequency of clock signal applied determines conversion speed. There is on board preset which can give analog voltage from 0V to +5V (max).

This analog source is connected directly to analog input of ADC chip. The program will read analog input voltage and display digital value on the LCD screen.



Program Code:-

```
START: MOV 81H, #68H
       MOV A, #38H
       LCALL CMDWR
       LCALL DELAY
       MOV A, #01H
       LCALL CMDWR
```

```
        LCALL DELAY
        MOV A, #06H
        LCALL CMDWR
        LCALL DELAY
        MOV A, #85H
        LCALL CMDWR
        LCALL DELAY
        MOV A, R1
        ANL A, #0FH
        LCALL HEXASCI
        LCALL DATWR
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
        LCALL DELAY
LOOP:   SJMP NXTSAMP
CMDWR:  MOV P1, A
        CLR P3.6
        CLR P3.5
        SETB P3.4
        CLR P3.4
        RET
DATWR:  MOV P1, A
        SETB P3.6
        CLR P3.5
        SETB P3.4
        CLR P3.4
```

```
        RET
DELAY : MOV R3, #52H
LOOP1 : MOV R4, #0FFH
LOOP2 : DJNZ R4, LOOP2
        DJNZ R3, LOOP1
        RET
HEXASC3 : MOV DPTR, #ASC11
          MOV A, @A+DPTR
          RET
ASC11 : DB 30H
        DB 31H
        DB 32H
        DB 33H
        DB 34H
        DB 35H
        DB 36H
        DB 37H
        DB 38H
        DB 39H
        DB 40H
        DB 41H
        DB 42H
        DB 43H
        DB 44H
        DB 45H
        DB 46H
```

Result :-

The interfacing of ADC 0808 with microcontroller 8051 using Keil software is done successfully. The above program will read analog input voltage and display digital value on the LCD screen.