Experiment No: 01

Experiment Name: Design and develop a reprogramable embedded Computer using 8051 Microcontroller.

Objective: The main objective ~~is~~ of this experiment is to develop a reprogramable embedded computer using 8051 Microcontroller.

Theory:

What is an Embedded Computer?

⇒ An Embedded Computer functions as part of a complete device rather than being a standalone computer. Typically, performs highly specific function.

A microcontroller is a small computer on a single - metal - oxide - semiconductor (MOS) VLSI integrated ~~service~~ circuit (IC) chip. It contains one or more CPUs along with memory and programable input/output peripherals.

8051 microcontroller designed in 1981. It has 40 pins, 4kb ROM and 128 bytes of RAM storage. Also has 2 16-bit timers. It has crystal frequency 12 Hz.

It has 8 bit data bus, 16 bit address bus and control signals.

Apparatus :

- # 8051 Microcontroller.
- # LED (any colour)
- # A connected Ground.
- # Connecting wires.

C - Program :

```
# include <reg52.H>
Sbit LED = P2^0;
voide delay (void);
Void main (void) {
 while (1) {
        LED = 0;
        Delay ();
        LED = 1;
        delay ( );
      }
}
voide delay (void) {
 int i, j;
```

```
for (i=0; i<10; i++) {
    for(j=0; j<=1000; j++) {
    }
  }
}
```

Circuit Design:

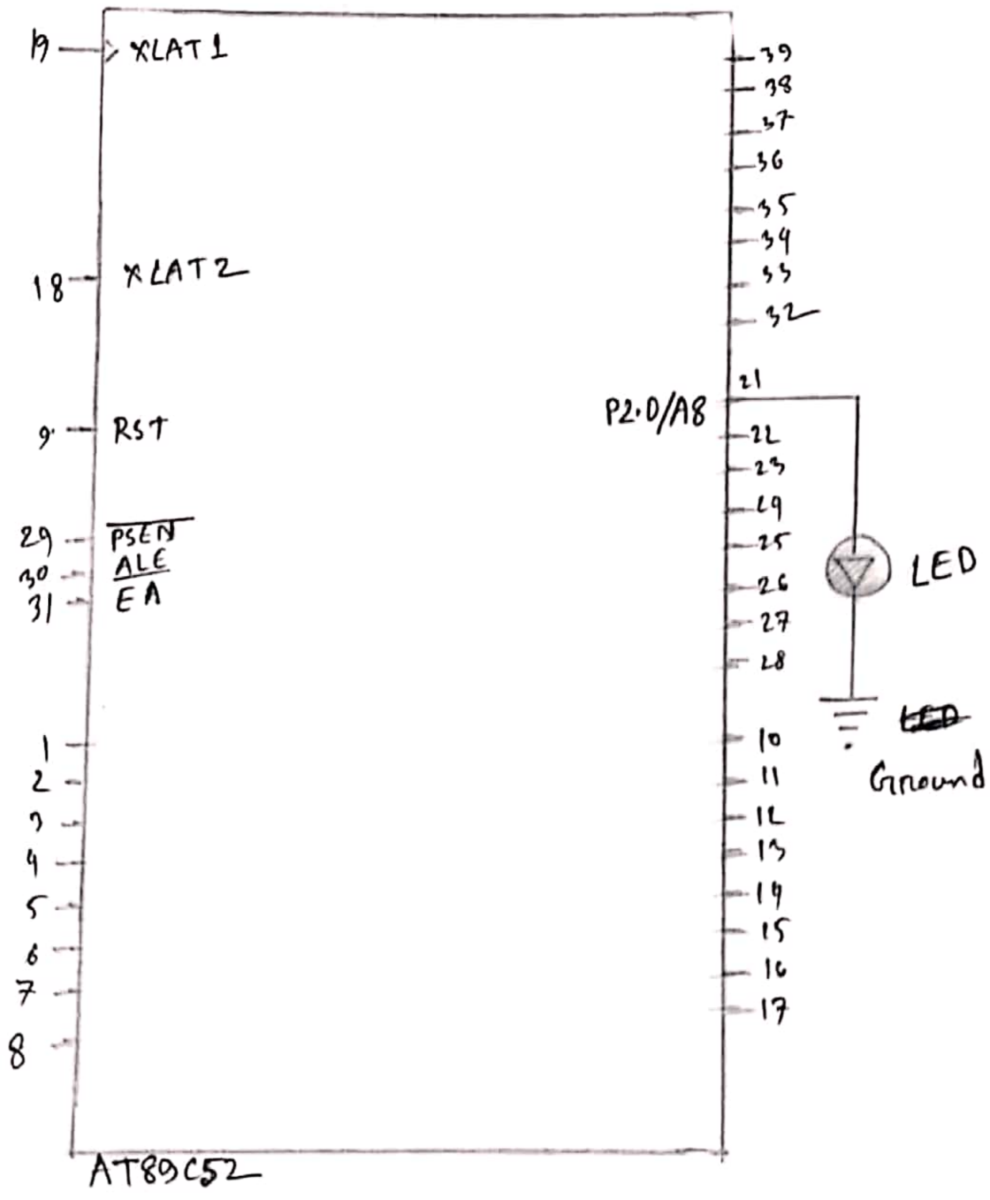

Fig: 8051 microcontroller with LED circuit design.

Procedure :

- We will take AT89C52 microcontroller .
- Then we will take an LED for testing .
- We will also take a ground .
- We will connect pin 21 with the LED and
- We will connect the ground also with LED and that's all for this experiment.

Discussion : By this experiment we can switch on/off on an LED with microcontroller. It may be used in real ~~ri~~ life in future for blinking of an LED .

Experiment No: 2 (a)

Experiment Name: Configure timer control registers of 8051 and develop a program to generate delay.

Objective: The main objective of this experiment is to config control registers and develop program to generate delay.

Theory:

An Embedded Computer functions as part of a complete ~~computer~~ device rather than being a standalone computer. Typically, performs highly spefic function.

TCON is an 8 bit register. Used for generating interrupts internal or external.

ITO/IT1 → Used for timer interrupts.

IE0/IE1 → " " external " .

TR0/ TR1 → Timer 0/1 run control flag when it is 1 it means timer is running.

TF0/TF1 → Timer 0/1 overflow flag. When it is 1 then it is overflow.

8051 microcontroller designed in 1981. It has 40 pins, 4 kb ROM & 128 bytes of RAM storage. Also has 2 16-bit timers. It has crystal frequency 12 Hz.
It has 8 bit data bus, 16 bit address bus and control signals.

Circuit- Design:

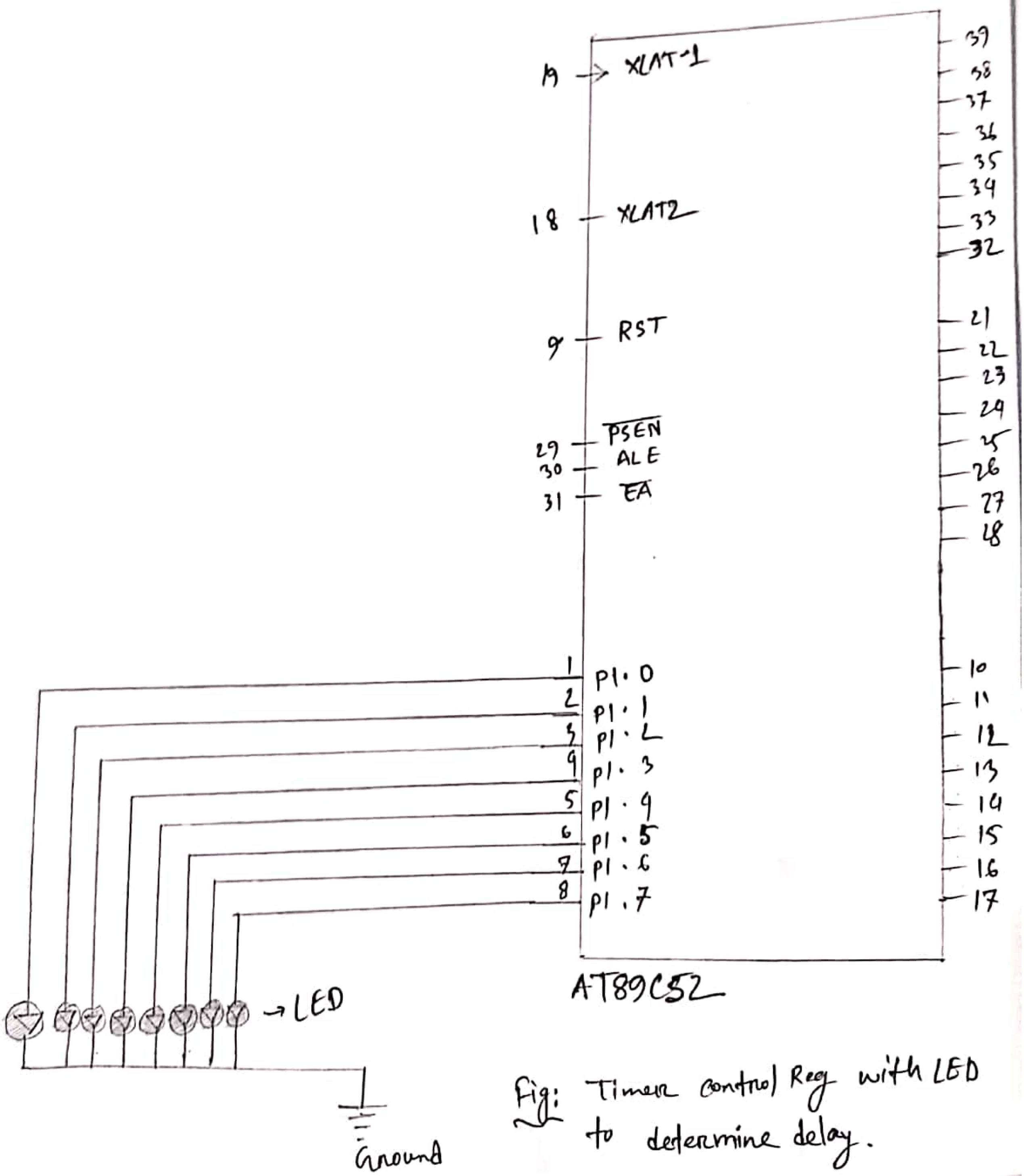

Fig: Timer control Reg with LED to determine delay.

Source Code:

```
#include <reg51.H>
void Delay (void);
void main (void){
 while (1){
        P1 = 0xFF;
        Delay();
        P1 = 0x00;
        Delay ();
      }
  }
  void Delay (void){
      int i,j;
    for (i=0; i< 1000; i++){
    }
    for (j=0; j<1000; j++){
    }
}
```

Procedure:

Apparatus:

AT89C52 microcontroller.
LED (any color)
Ground
Connecting wires.

procedure :

We will take AT89C52 microcontroller, LED and a ground.

We will connect first LED with the pin 1.

We will connect second LED with pin 2 and so on.

All the LEDs are connected with each other and also connected to the ground.

That's all for this experiment.

Discussion :

By this experiment we will be able to make delay of the control register ~~of~~ 8051. This can be used in real life in future to turn off/on the LEDs when there's a lot of LED.

Experiment No: 2 (b)

Experiment Name: Use the general purpose I/O port of two controllers for data transfer.

Objective: The main objective of this experiment is to config two microcontrollers for data transfer using general purpose I/O ports.

Theory: Dedicated GPI/O are always available. It has a frequency of maximum 500 Mhz. It supports multiple standards. It can be configured either input or output.

8051 microcontroller designed in 1981. It has 40 pins, 4 kb ROM & 128 bytes RAM storage. Also has 2 16-bit timers. It has crystal frequency 12 Hz. It has 8 bit data bus & 16 bit address bus and control signals.

Apparatus :

- Two AT89C52 controllers.
- LED (any color)
- Ground
- Connecting wires.

Source Code:

Controller - 1

```
#include<reg51.H>
void delay(unsigned int time);
void main (void) {
 P2 = 0xAA;
 Delay (1000);
P2=0x55;
Delay (1000);
}
Void Delay(unsigned int time){
  unsigned int i,j;
 for(i=0; i<time; i++){
  for(j=0; J<23; j++){
  }
 }
}
```

Controller - 2

```
#include< reg 51.h>
void delay (unsigned int time){
unsigned int i,j;
for(i=0; i<time; i++) {
  for(j=0; j<23; j++) {
  }
 }
}
void main (void) {
  while (1){
       P2 = P1 ;
      delay (1000);
    }
}.
```

Circuit Design :

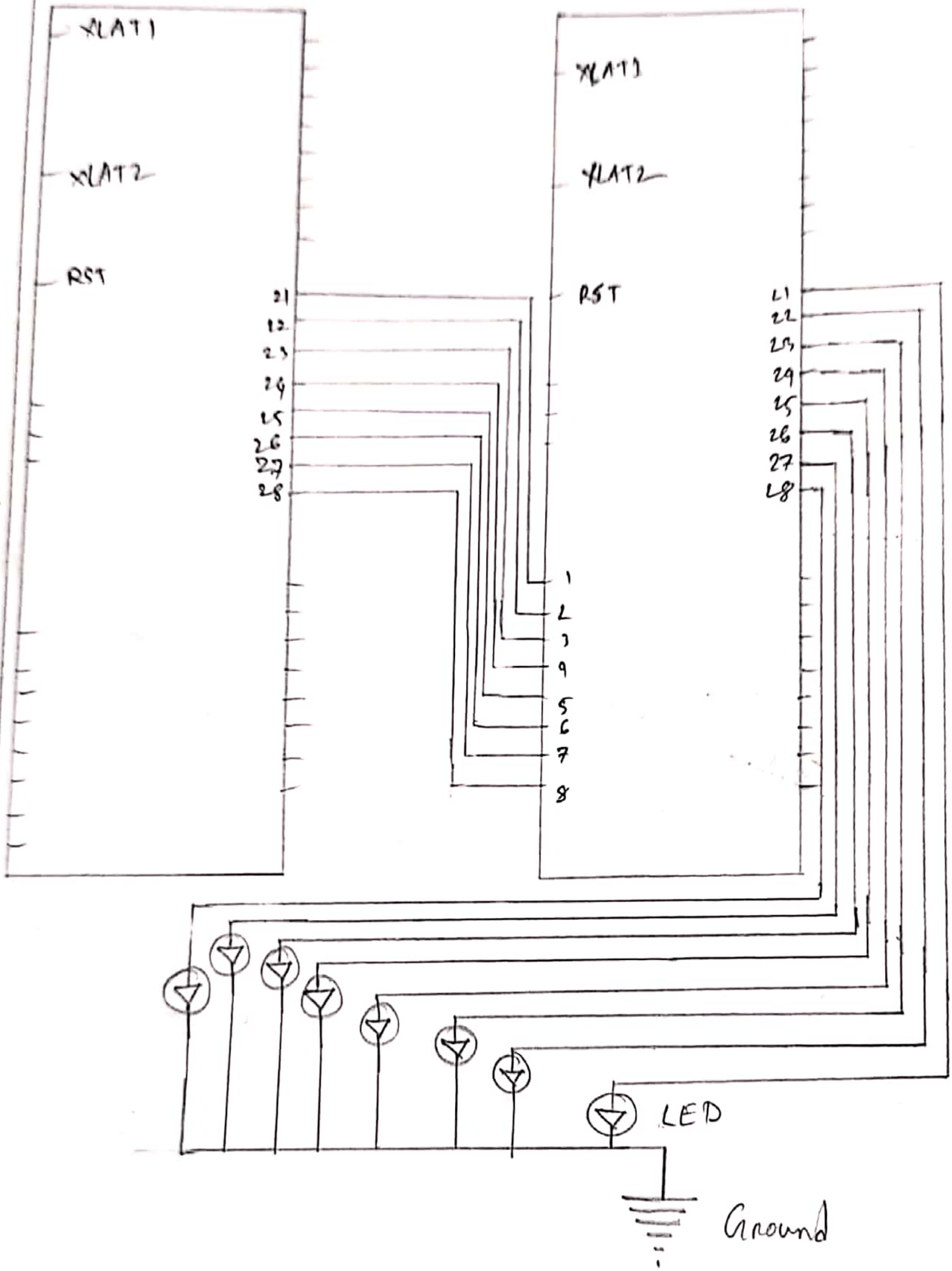

Fig: Transfering data between two controllers .

procedure :

We will take two AT89C52 controller and eight LEDs and a ground.
We will connect first microcontroller's pin no 21 and second controller's pin 1.
Then pin 21 of first controller and 2nd pin of 2nd controller and so on.
We will connect LED with pin 21 to pin 28, total 8 LED.
We will connect a ground with all the LED at bottom and that's all for this experiment.

Discussion : This is a pattern of blinking of some LEDs. It looks ~~amai~~ amazing when they blink serially. It may be helpful in future while designed in lighting of any place or further more.

Experiment No : 3(a)

Experiment Name : Simulate Binary Counter (8 bit) on LEDs.

Objective : The main objective of this experiment is to simulate binary counter on LEDs.

Theory :

A binary counter is a hardware circuit that is made out of a series of flip-flops. The output of one flip-flop is sent to the input of the next flip-flop in the series. A binary counter can be either asynchoronous or synchoronous, depending on how the flip flop are connected together.

8051 microcontroller designed in 1981. It has 40 pins, 4kb ROM & 128 bytes of RAM storage. Also has 2 16-bit timers. It has crystal frequency 12 Hz.

It has 8 bit data bus, 16 bit ~~addrese~~ address bus and control signals.

Apparatus :

- # 8051 Microcontroller.
- # LED (any color).
- # A connected ground.
- # Connecting wires.

Source Code :

```
#include<reg51.h>

~~Voide~~ void delay(int time){
    int i,j;
    for(i=0; i<=time; i++){
        for(j=0 ; j<=23; j++){
        }
    }
}

Void main(){
    P1= 00000000;
    while(1){
```

```
P1++ ;
delay() ;
}
}
```

Circuit Design :

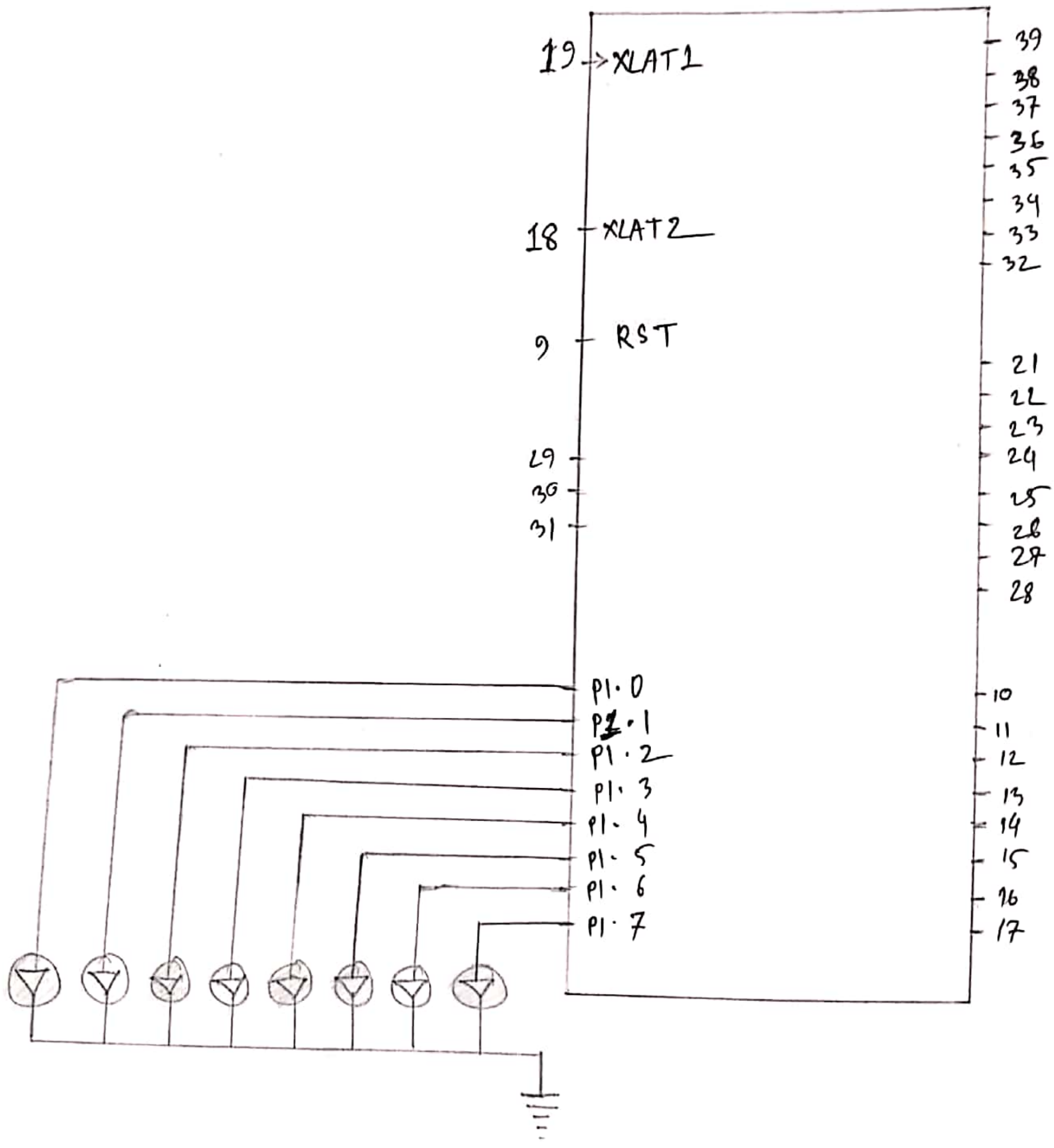

Fig: Binary counter simulator on LED.

Procedure :

First we will take AT89C52 controller, some LED and a ground.

We will connect pin 1 with first LED.
Then the second LED with the pin no 2 and so on.

A ground will be connected with all the ~~groun~~ LEDs and that's all for this experiment.

Discussion : This experiment shows us a different color matching pattern which can be used in real life while designing a home, office or anything like this.

Experiment No : 3 (b)

Experiment Name : To interface 8 LED at I/O ports ~~and at I/O~~ and create different patterns.

Objective : The main objective of this experiment is to make different patterns and also with 8 LEDs at I/O ports.

Theory : An I/O port is a socket on a computer that a cable is plugged into. The port connects the CPU to a peripheral device via a hardware interface or to the network via a network interface. I/O port is an address to transfer data.

8051 microcontroller designed in 1981. It has 40 pins, 4 kb ROM & 128 bytes of RAM storage. Also has 2 - 16 bit timers. It has crystal frequency

12 Hz. It has 8 bit data bus, 16 bit address bus and control signals.

Apparatus:

- 8051 microcontroller.
- LED (any color)
- A ground.
- Connecting wires.

Source Code:

```
#include<reg51.h>
void delay(){
  unsigned int i,j;
  for( i=0; i<23; i++){
     for(j=0; j<1000; j++){
     }
  }
}

void main(){
while(1){

     P1 = 0xAA ;
     delay();
    P1 = 0x55;
   delay() ;
  }
}
```

Circuit Design:

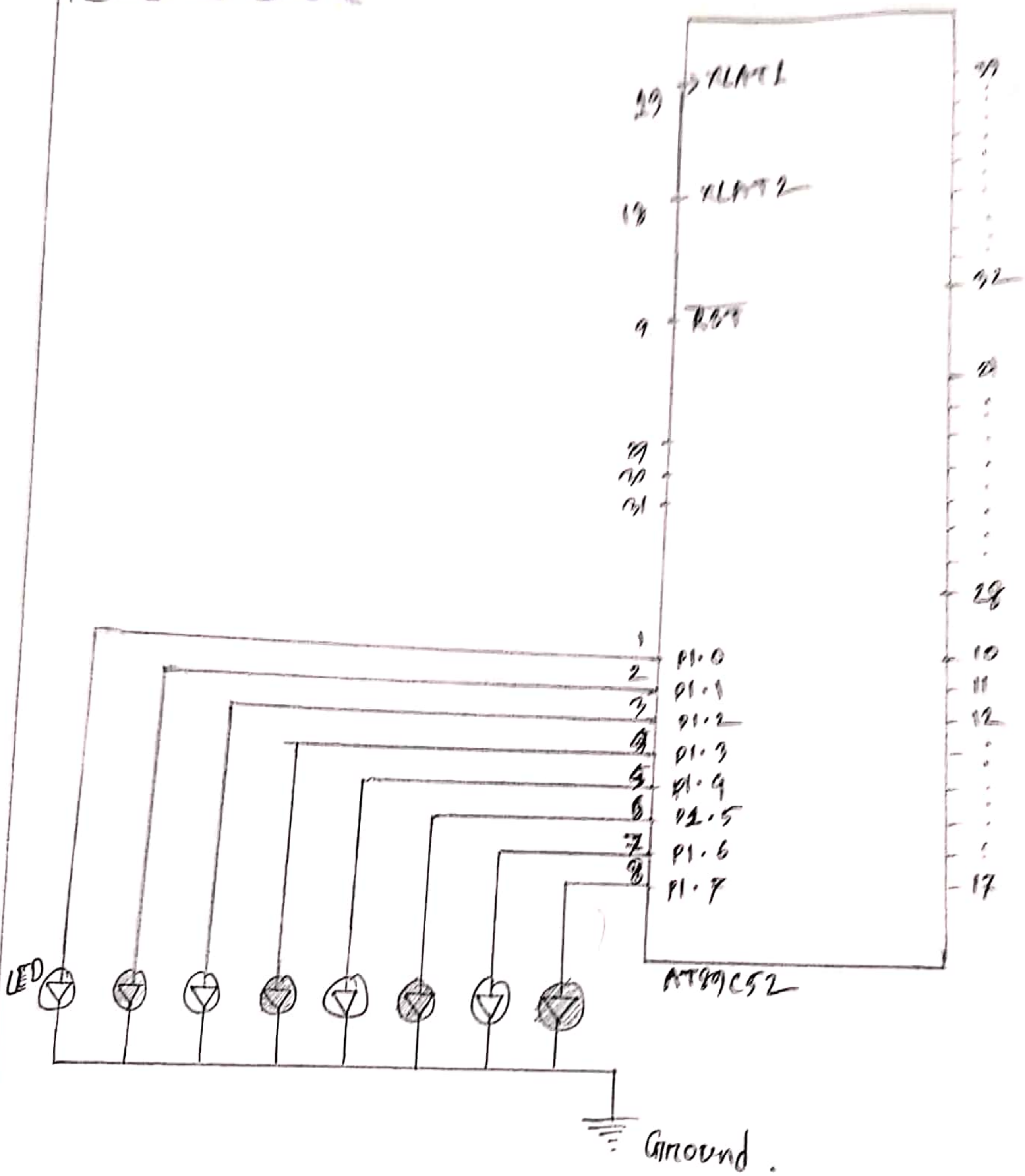

Fig: Different patterns of light with I/O ports.

procedure :

We will take AT89C52 controller, some LED and a ground.

We will connect first LED with pin no 1

Second Pin will connect to the second LED and so on.

All the LED will the connected to the ground, then we will run this to see different patterns.

That's all for this experiment.

Discussion: By this experiment we can also decorate our home, office or like this place with LEDs. It can be used in different purpose for bigger business or anything that can bring profit.

—

Experiment No: 3 (c)

Experiment Name: To demonstrate timer working in and blink LED without using any loop delay.

Objective: The objective of this experiment is to demonstrate timer working in and blink without ~~un~~ using any loop delay (LED).

Theory: A timer is a specialized type of clock which is used to measure time intervals. A timer that counts from zero to upwards for measuring time elapsed is often called a stopwatch. It is a device that counts down from a specified time interval and used to generate a time delay, for example, an hourglass is a timer.

8051 microcontroller designed in 1981. It has 40 pins, 4 kb ROM & 128 bytes of RAM storage. Also has 2 16-bit timers. It has crystal frequency of 12 hz.

It has 8 bit data bus, 16 bit address bus & control ~~sign~~ signals.

Apparatus :

- # 8051 microcontroller.
- # ~~TIMER~~ LED (any color)
- # A ground.
- # connecting wires.

Source - Code :

```
#include <reg51.h>
int i = 0;
void timer_ISR (void) interrupt 1
{
    i++;
    if (i==10) {
        i=0;
        P1++;
    }
}
void main(void) {
    TMOD = 0x01;
    ET0 = 1;
    TR0 = 1;
    EA = 1;
    while (1);
}.
```

Circuit Design :

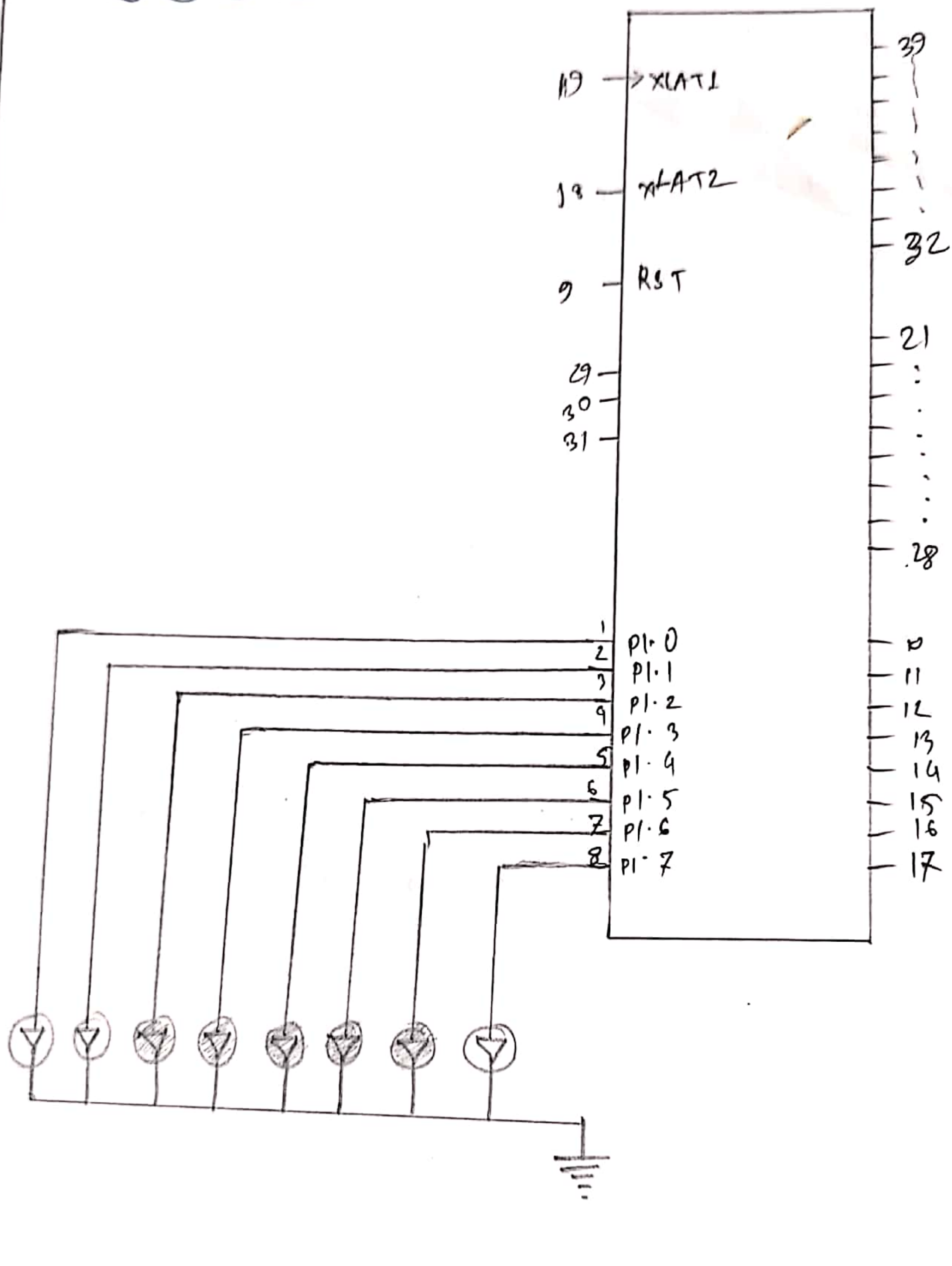

Fig: Blinking of LED without any looping delay function.

Procedure :

First, we will take AT89C51 controller.

Then we will take LED and ground.

We will connect first LED with pin 1 and second LED with pin 2 and so on.

We will connect a ground with all the LED connected to it.

That's all for this experiment.

Discussion :

This is a experiment without loop delay. It can be used in different purpose to make different patterns. This LED can make house, office beautiful by blinking. It is more important to know how to blink in different patterns.

—

Experiment No: 4(a)

Experiment Name: Serial I/O: Configure 8051 Serial port for Asynchoronous Serial Communication.

Objective: The objective of this experiment is to config 8051 serial port for Asynchoronous Serial Communication.

Theory:

Asynchoronous serial communication is a form of serial communication in which the communicating endpoints' interfaces are not continuously synchoronized by a common clock signals. Instead of common synchoronization signal the data steam contains synchoronyzation information in form of start and stop signals, before and after each unit of transmission, respectively. The start signals prepare the receiver for arrival of data and the stop signal resets ~~ist~~ its state to enable triggering of a new sequence.

Apparatus :

8051 Microcontroller.
Virtual Terminal.
Connected Wires.

Source Code :

```
#include<reg51.h>
void send(char x);
void main(void){
TMOD =0x20;
TH1 = 0xFD;
SCON = 0x50;
TR1 =1;
send('M');
send(O);
send(H);
send(A);
send(M);
send(M);
send(A);
send(D);
while(1); }
void send(char x)
{
SBUF = X;
while(TI==0);
TI=0;
}.
```

Circuit Design:

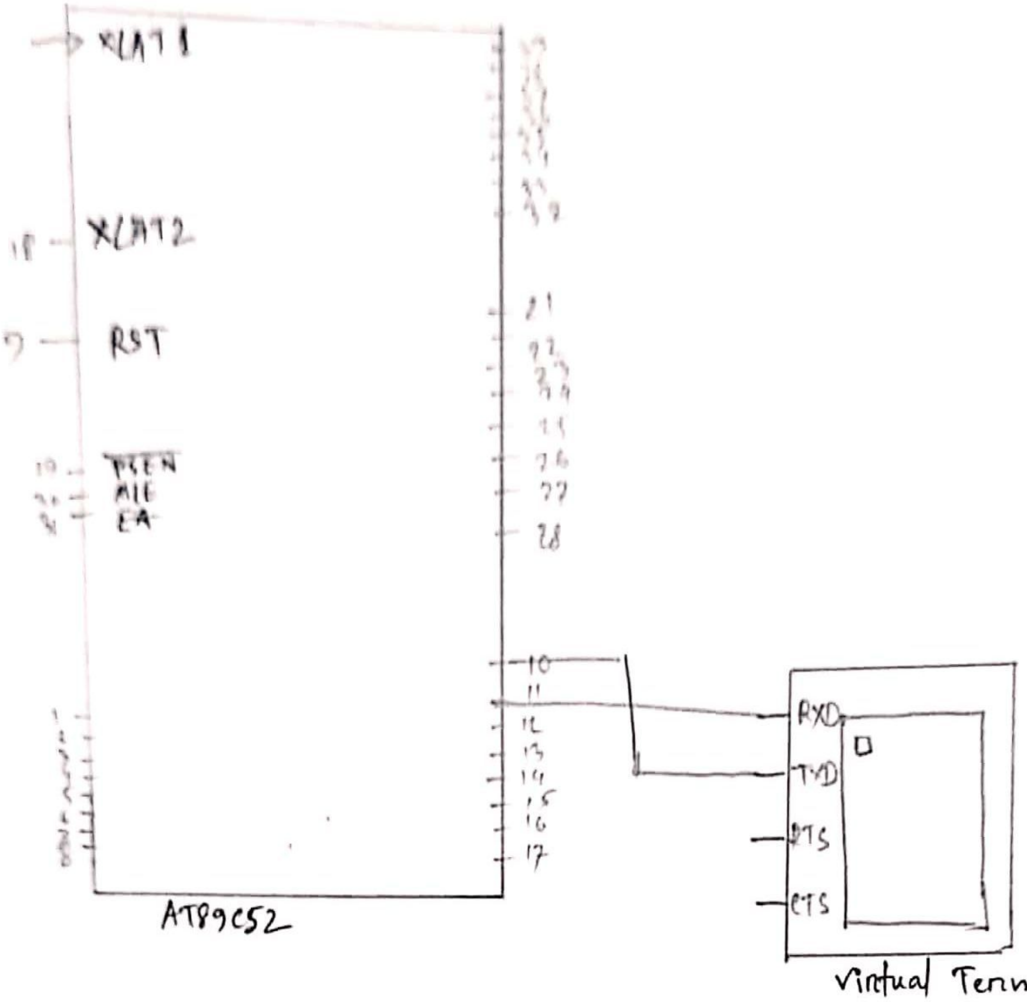

Fig: Asynchoronous Serial Communication.

Procedure:

① We will take AT89C52 microcontroller and a virtual terminal.

② Then we will connect 'RXD' port with pin no 11 and 'TXD' port with pin no 10.

③ Then we will show the output of the experiment.

Discussion :

This aynchononous seriall transmission can be used show number of sequence of characters. Different types of strings are shown here In virtual terminal.

Experiment No: 4 (b)

Experiment Name: To demostrate seven segments LED display and generates counting from 0 to 99.

~~Theory~~ Objective: The main objective of this experiment is to demonstrate seven segments LED display and generates counting from 0 to 99.

Theory: A seven segment display is a form of electronic ~~dot~~ display device for displaying decimal numerals that is an alternative to more complex dot matrix analysis. This displays are widely used in digital clocks, electronic meters, basic calculators etc.

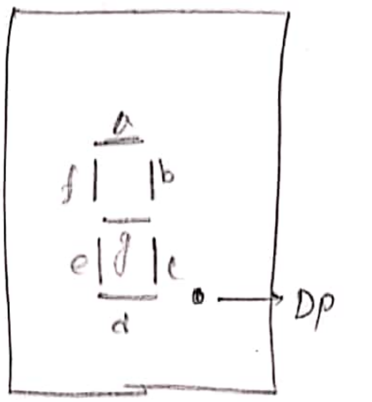

Fig: 7 segment display.

Apparatus :

- AT89C51 microcontroller.
- power .
- Ground .
- 7 segment display .
- Connecting wires.

Source Code :

```
#include <reg51.h>
void delay( unsigned int ms){
  unsigned int i,j ;
  for( i=0; i<ms; i++){
     for(j= 0; j<=1275; j++) { }
  }
}
void main (void){
  char num[] = { 0x3F , 0x06, 0x5B , 0x4F, 0x66 ,0x 6D,
                 0x7D , 0x07 , 0x7F , 0x6F }.
  int i,j, ;
  P2=0x00; P3=0x00 ;
  while (1) {
     for( i=0; i<=9; i++){
        for (j= 0, j<=9; j++) {
             P3 = num[j];
             delay( 50);
        }.
     }
  }
}.
```

Circuit Design :

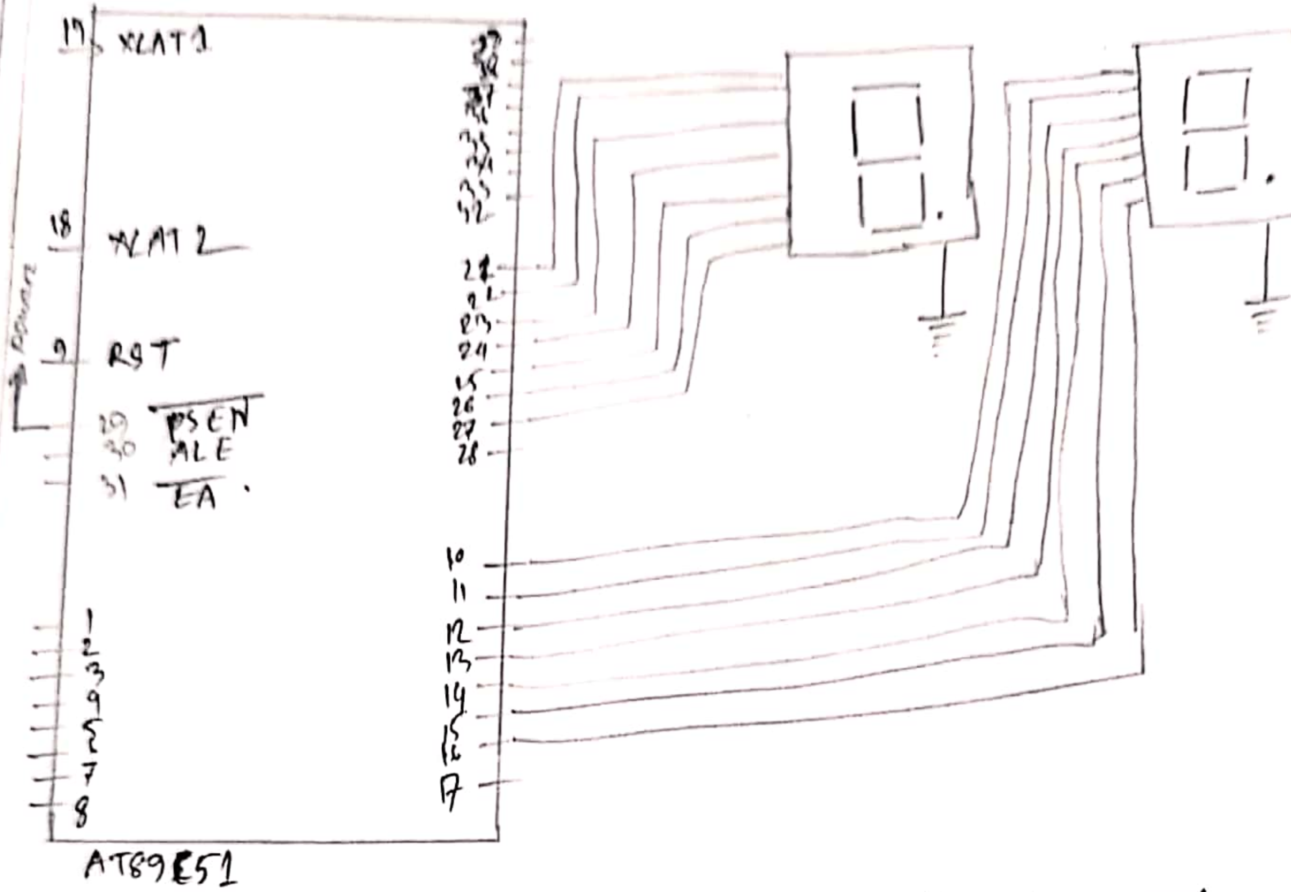

Fig: Seven segment display with AT89C51 microcontroller.

Procedure :

① We will take AT89C51 microcontroller, 7 segment display, ground and power.

② First seven segment display pins will connected from pin 21 to 27 and last pin will connect to ground.

③ Second seven segment display's pins will connect with microcontroller's pin 10 to 16. Last pin will connect to ground.

④ A power will connect to pin 29 ($\overline{PSEN}$).

That's all for this experiment, then we will show the output.

Discussion: This seven segment display used like everywhere. Stopwatch process work through this process. Clock, machines, meters etc are all depends on this seven segment display.

Experiment No: 4(c)

Experiment Name: Interface 8051 with D/A converter and generate Square wave on Oscilloscope.

Objective: The main objective of this experiment is to convert with D/A converter and generate Square wave on Oscilloscope.

Theory: Digital/Analog converter is a device that converts digital code into analog signals mostly for audio. D/A converters (DACs) convert digital audio samples into the analog waveforms sent to audio amplifier & speakers. It also convert digital TV broad-cast to analog TV convert box.

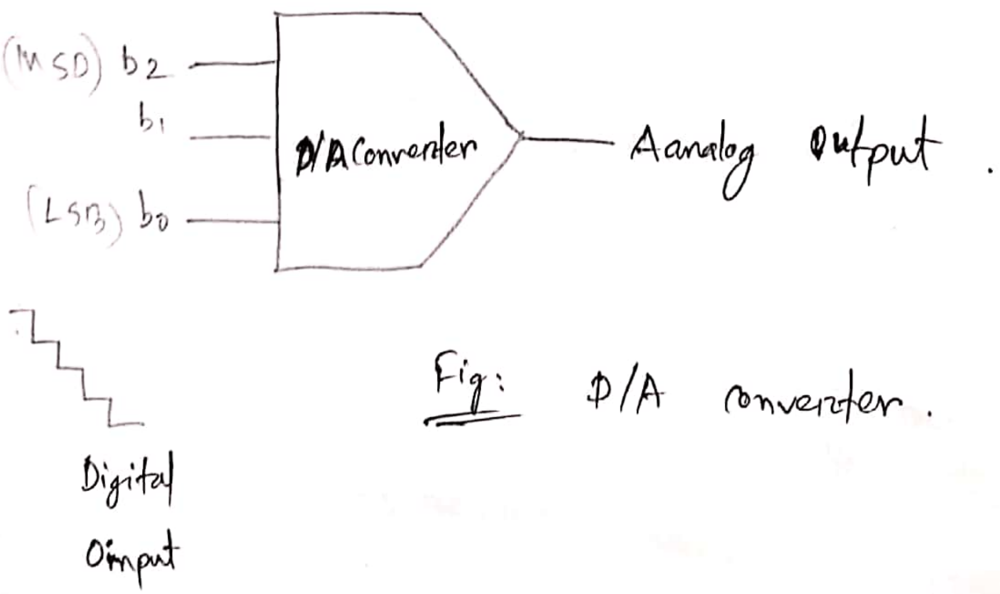

Fig: D/A converter.

Source Code :

```
# include < reg51.h>
void delay ( );
void main( ) {
P2 : = 0x00 ;
while ( 1 ) {
P2 = 0xFF ; delay( ) ;
P2 = 0x 00 ; delay( ) ; }
}

void delay ( ) {
int i;
for ( i=0 ; i< = 5000 ; i++ ) { }

} .
```

Discussion : For this experiment we don't need any circuit design. By a single software we can do that. Different sizes of Square wave are made by D/A converters.

Experiment No: 5 (a)

Experiment Name: Interface 8051 with D/A converter and generate Triangular waves on Oscilloscope.

Objective: The main objective of this experiment is to interface 8051 with D/A converter and generate Triangular waves on Oscilloscope.

Theory: Digital/Analog converter is a device that converts digital code into analog signals mostly for audio. D/A converter converters convert digital audio samples into the analog waveforms sent to audio amplifier and speakers. It also convert digital TV broadca to analog TV convert box.

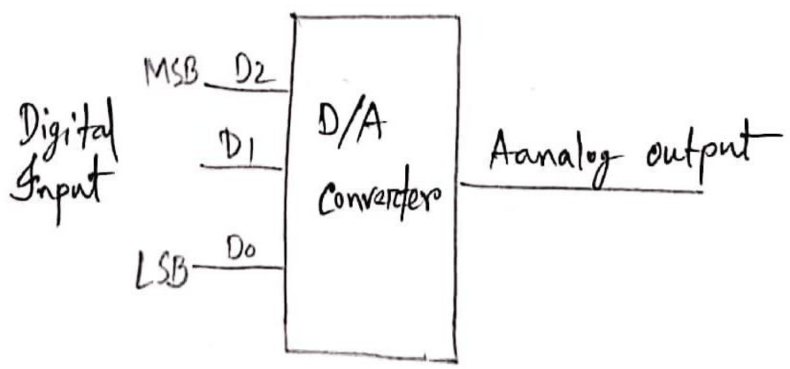

Fig: D/A converter.

Source Code :

```
#include <reg51.h>
void main() {
    P2 = 0x00;
    while (1) {
    do {
        P2 += 0x05; }
    while (P2 < 0xFF);
    do {
        P2 -= 0x05;
    }
    while (P2 > 0x00);
    }
}.
```

Discussion : With this code we can make triangular wave. By D/A converted we can make any shape of wave that is very much helpful for other works.

Experiment No: 5(b)

Experiment Name: Using D/A converter generates sine wave on Oscilloscope with the help of lookup table.

Objective: The objective of this experiment is to use D/A converter and generates sine wave on Oscilloscope with the help of lookup table.

Theory: D/A (Digital to Analog) converter converts digital signals into analog signals. It uses everywhere. Telerision formula use this technology.

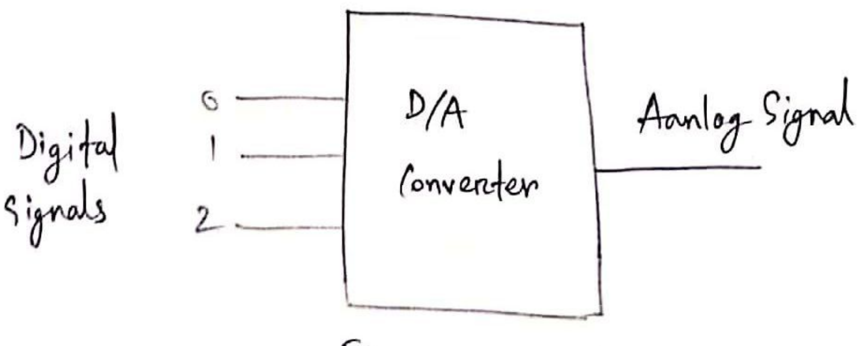

Fig: D/A converter.

A sine wave is a geometric waveform that oscillates ~~down~~ periodically, and defined by the function $y = \sin x$.

Source Code :

```
#include<reg51.h>
# include<stdio.h>
int sine [] = {0,0,5,10,15,20,25,30,35,40,45,45,40,
               35,30,25,20,15,10,5,0,0};

void main ()
{
     int i = ;
     P1 = 0x00;
     while (1)
     {
        for(i=0; i<23;i++){
              P1= sine [i];
        }
     }
}
```

Discussion : With D/A converter we can generate triongular, squave and even sine wave. Sine wave works on 'y' axis. That's why sine function is $y = \sin(x)$. This kinds of experiment needed to design diffent waves making.

Experiment No: 06

Experiment Name: Interface Stepper motor with 8051.

Objective: The objective of this experiment is to interface Stepper motor with 8051.

Theory: A stepper motor also known as step motor or stepping motor is a brushless DC electric motor that ~~divided~~ divides a full rotation into a number of equal steps. It's position can be commanded to move and hold at one of these steps without any position sensor for feedback, as long as the motor is correctly sized to the application in respect to torque and speed.

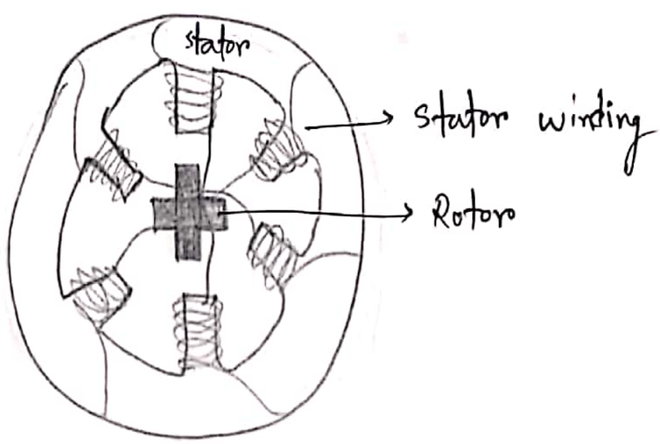

Fig: Stepper motor.

Source Code :

```
#include<reg51.h>
void delay () {
    int i,j ;
    for ( i= 0; i<=100 ; i++) {
      for( j=0 ; j<100; j++){
      }
    }
}
void main() {
  while ( 1){
     P2 = 0x09 ;
     delay () ;
     P2 = 0x03 ;
     delay() ;
     P2 = 0x06 ;
     delay () ;
     P2 = 0x0C ;
     delay () ;
  }
}
```

Procedure:

① At first we will take AT89C51 microcontroller and a stepper motor.

② Then we will connect motor's left side's ~~first~~ upper and lower pin with microcontroller's pin no: 21 and pin no: 24.

③ The we will connect motor's left side's upper and lower pin with the controller's pin no '21' and pin no '22'.

④ The middle pin of motor of both sides will connect to the ground.

By this process we can see the output.

Circuit Design:

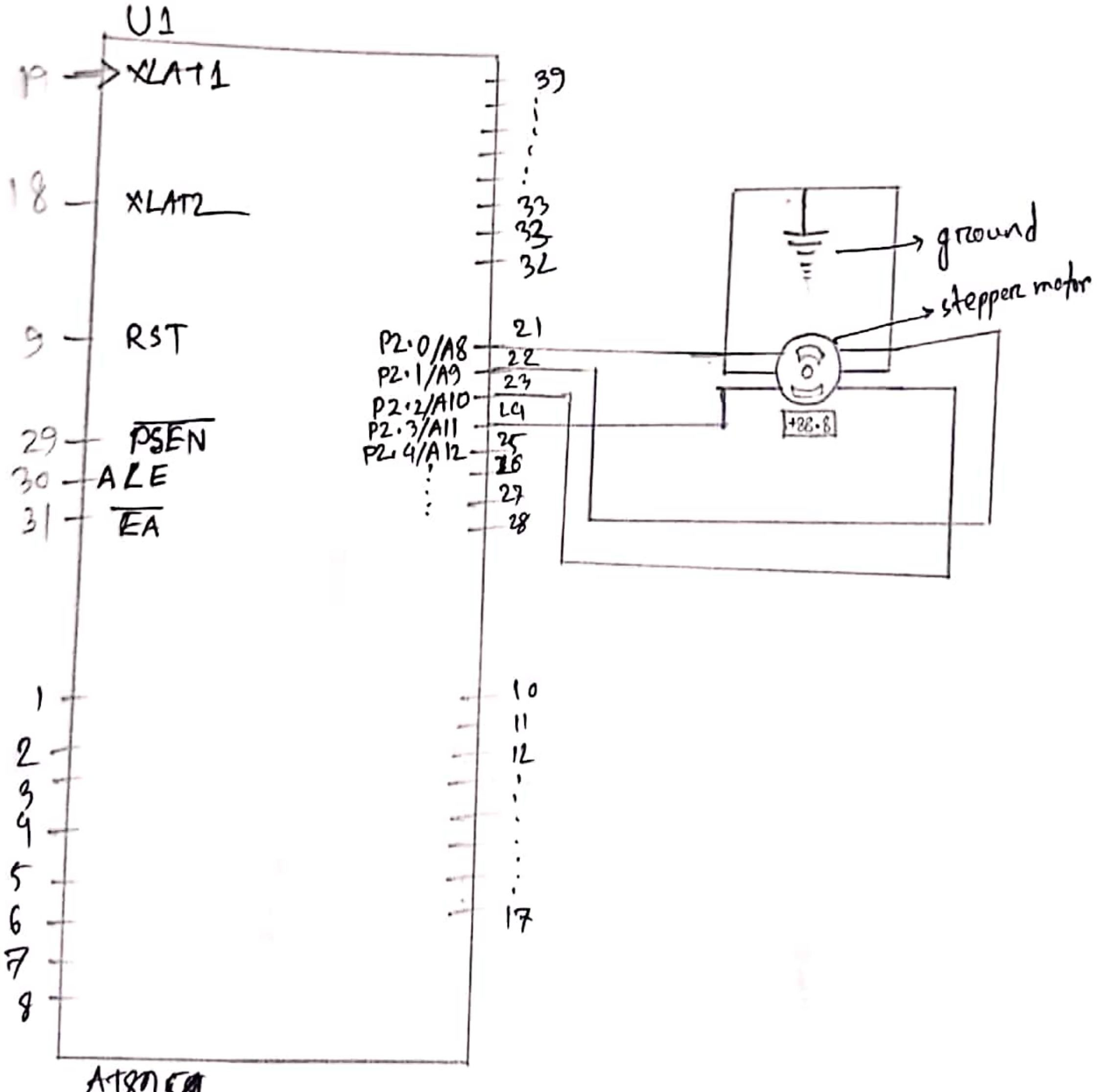

Fig: stepper motor with 8051

Discussion : Stepper motor nowadays uses many sectors. We can control it's rotation, angle and other things. By using this motor we can convert electric power to machine power and can do many important works.

Experiment Name: Generate Traffic signals.

Experiment No: 07

Objective: The main objective of this experiment is to generate traffic signals.

Theory:

Traffic signals, light or spotlight - known as robots in South Africa. It consist normally of three signals. The regular traffic light colours are red, yellow and green, arranged vertially or horizontally in that order. It was first introduced December 1868 on parlimant Square in London to reduce need for police officers to control.

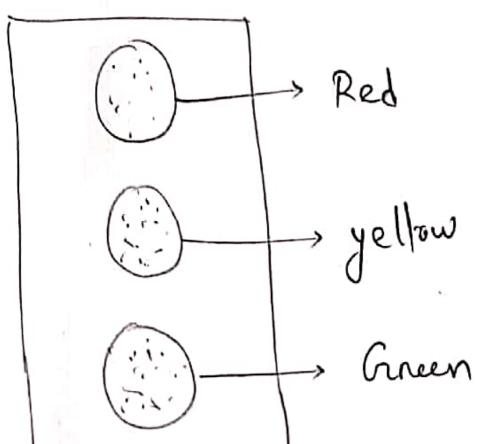

Fig: Traffic Light/Signals.

Source Code :

```
#include <reg51.h>
sbit red = P2^0;
sbit yellow= P2^1;
sbit green= P2^2;
void delay (int time);
void main ()
{  red= yellow = green = 0;
   while(1).
   {  red=1;
      delay (1000);
      red = 0;

      yellow = 1;
      delay (200);
      yellow=0;

      green = 1;
      delay (1000);
      green = 0;
      yellow = 1;
      delay (200);
      yellow = 0;
   }
}.
void delay (int time)
{
   int i,j;
   for( i=0; i<time; i++) {
```

```
for (j=0; j<1000; j++){
    }
  }
}.
```

Circuit Design :

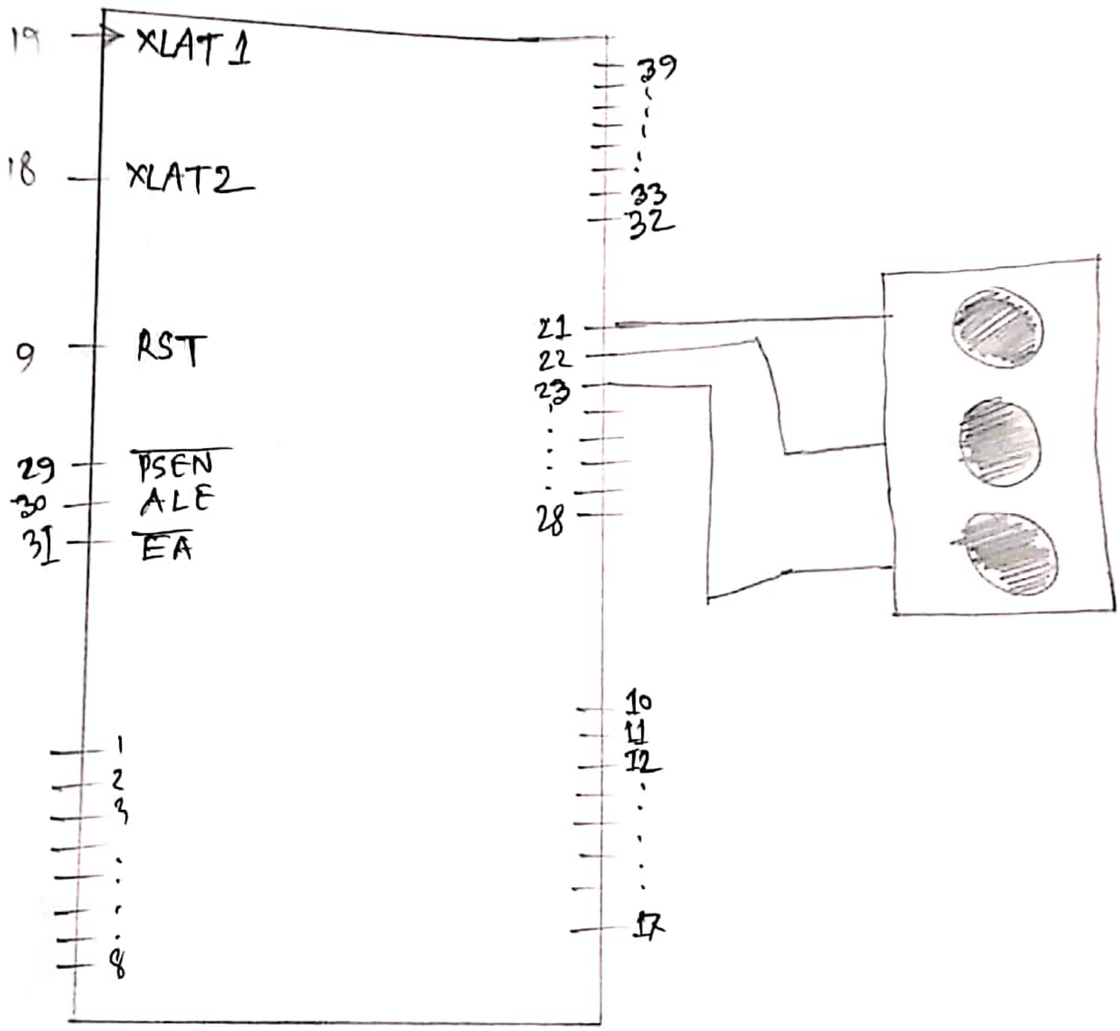

Fig: Traffic Signals.

Procedure :

① We will take AT89C51 controller and traffic light.

② pin no 21, 22, and 23 will connect to as follows: first pin, second pin and third pin of traffic light.

That's all for this ~~to~~ experiment.

Discussion : Traffic signals are widely used nowadays. Everywhere we can see this in road. police can now easily control with the help of this light. We all must follow the traffic rules at any cost.