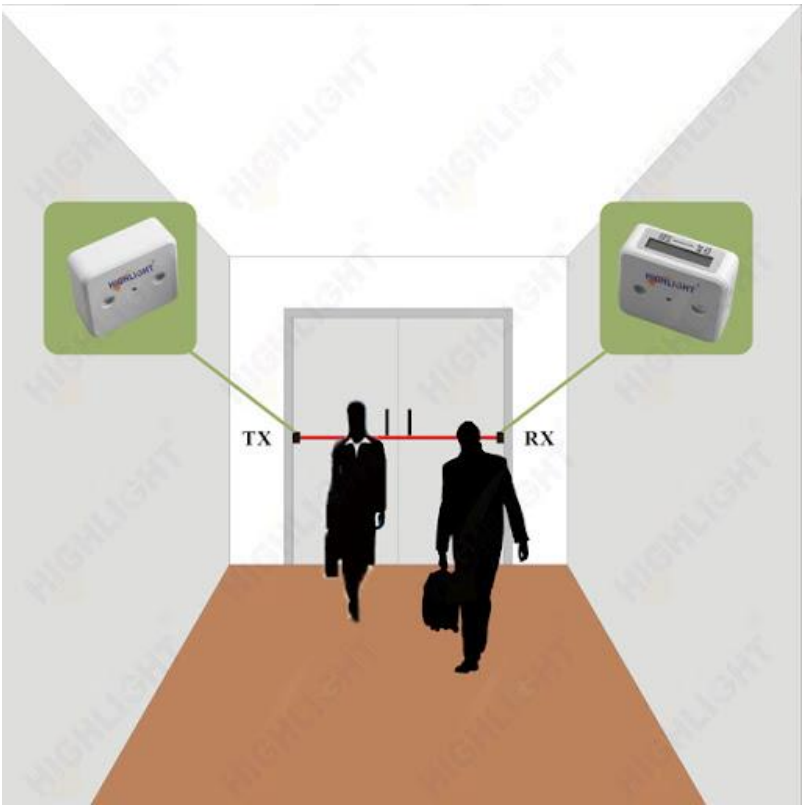
AUTOMATIC ROOM LIGHTING SYSTEM AND BIDIRECTIONAL VISITOR COUNTER



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ABSTRACT

In this project,The design and working of an Automatic Room lighting Circuit using Microcontroller (8051),

Automatic Room lighting circuit implies automatically turn on or off the lights ina room.We often forgot to switch off lights when we leave a room.By using this system ,we intentionally forget about the lights as the system will automatically take care of them.

The aim of this project is to automatically turn on or off the lights in a room by detecting the human movement. This project using 8051 Microcontroller and two IR sensors.

The lights will turned on when the person enters first sensor, the lights will turnedoff when the person leaves the second sensor.. While the visitors of any room needs to counted manually, Hence our project gives freedom of counting visitors automatically with help of IR Sensor and Bidirectional visitor counter.

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CHAPTER 1

1.1 INTRODUCTION

Automatic Room Lighting System is a microcontroller based project that automatically turn on or off the lights in a room. Electricity, being one of the most important resources, must be utilized carefully.

We often forget to switch off lights or fans when we leave a room. By using this system, we can intentionally forget about the lights as the system will automatically take care of them.

The digital World we are living in allows us to use different technologies to automatically perform certain tasks. Such automation is very useful in certain areas like energy consumption, reducing human efforts, improving standard of living etc.

The project implemented here is one such project where the microcontroller based system automatically controls the room lights.

This project is to automatically turn on or off the lights in a room by detecting the human movement. We implemented this project using 8051 Microcontroller and twoInfrared (IR) sensors.

Since the job of the circuit is to turn on the light when someone enters the room and turn off the light when the last person leaves the room, the project has to internally count the number of visitors entering and leaving the room. Hence, the project acts as an Automatic Room Lighting System as well as Bidirectional Visitor Counter.

Microcontroller

8051 microcontroller is designed by Intel in 1981. It is an 8-bit microcontroller.It is built with 40 pins DIP (dual inline package), 4kb of ROM storage and 128 bytes of RAM storage, 2 16-bit timers. It consists of are 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.

The pin diagram of 8051 microcontroller looks as follows:

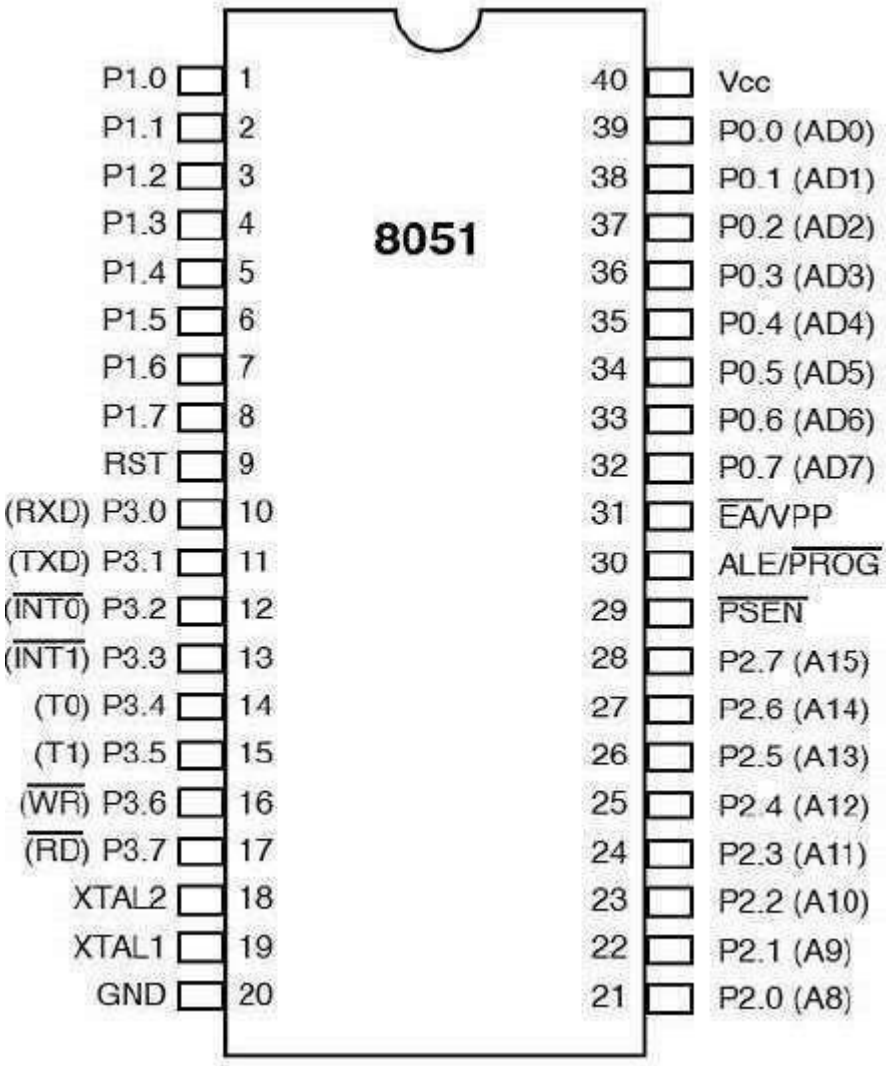


Fig 1 Pin diagram of 8051

Pin Description

VCC

Supply voltage.

GND

Ground.

Port 0

Port 0 is an 8-bit open drain bidirectional I/O port. As an output port each pin can sink eight TTL inputs. When 1‟s are written to port 0 pins, the pins can be used as highimpedance inputs. Port 0 may also be configured to be the multiplexed low order address/data bus during accesses to external program and data memory. In this mode P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pull-ups are required during program verification.

Port 1

Port 1 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 1 also receives the low-order address bytes during Flash programming and program verification.

Port 2

Port 2 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that uses 16-bit addresses (MOVX @ DPTR). In this application it uses strong internal pull-ups when emitting 1s. During accesses to external data memory that uses 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register. Port 2 also receives the high- order address bits and some control signals during Flash programming and verification.

Port 3

Port 3 is an 8-bit bidirectional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 also serves the functions of various special features of the AT89C51 as listed below:

Port Pin	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	$\overline{\text{INT0}}$ (extenal interrupt 0)
P3.3	$\overline{\text{INT1}}$ (extenal interrupt 1)
P3.4	T0 (timer 0 extenal input)
P3.5	T1 (timer 1 external input)
P3.6	$\overline{\text{WR}}$ (extenal data memory write strobe)
P3.7	$\overline{\text{RD}}$ (external data memory read strobe)

Table 1 Special Features of Port 3

RST

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device.

ALE/$\overline{\text{PROG}}$

Address Latch Enable output pulse for latching the low byte of the address during accesses to external memory.This pin is also the program pulse input (PROG) during Flash programming. In normal operation ALE is emitted at a constant rate of 1/6 the oscillator frequency, and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external Data Memory. If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode.

$\overline{\text{PSEN}}$

Program Store Enable is the read strobe to external program memory. When the AT89C51 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

$\overline{\text{EA}}$/VPP

External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming, for parts that require 12-volt VPP.

XTAL1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2

Output from the inverting oscillator amplifier.

Oscillator Characteristics

XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier which can be configured for use as an on-chip oscillator, as shown in Figure 1. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, XTAL2 should be left unconnected while XTAL1 is driven as shown in Figure 2. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clocking circuitry is through a divide-by-two flip-flop, but minimum and maximum voltage high and low time specifications must be observed.

Idle Mode

In idle mode, the CPU puts itself to sleep while all the on-chip peripherals remain active. The mode is invoked by software. The content of the on-chip RAM and all the special functions registers remain unchanged during this mode. The idle mode can be terminated by any enabled interrupt or by a hardware reset. It should be noted that when idle is terminated by a hardware reset, the device normally resumes program execution, from where it left off, up to two machine cycles before the internal reset algorithm takes control. On-chip hardware inhibits access to internal RAM in this event, but access to the port pins is not inhibited. To eliminate the possibility of an unexpected write to a port pin when Idle is terminated by reset, the instruction following the one that invokes Idle should not be one that writes to a port pin or to external memory.

Power Down Mode

In the power down mode the oscillator is stopped, and the instruction that invokes power down is the last instruction executed. The on-chip RAM and Special Function Registers retain their values until the power down mode is terminated. The only exit from power down is a hardware reset. Reset redefines the SFRs but does not change the onchip RAM. The reset should not be activated before VCC is restored to its normal operating level and must be held active long enough to allow the oscillator to restart and stabilize.

CHAPTER 2

PROJECT MODULES

2.1 CIRCUIT DIAGRAM:

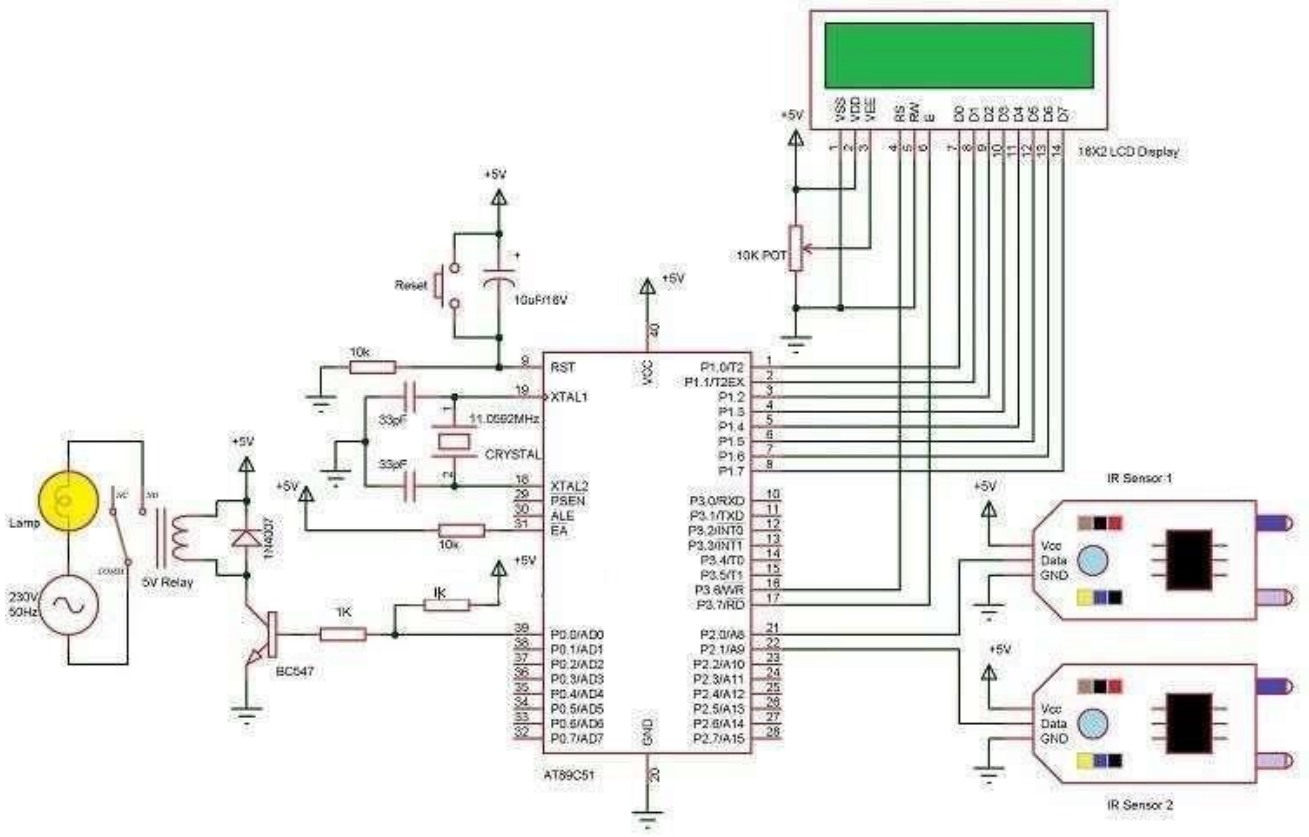


Fig 2 Automatic room lighting system and bidirectional visitor counter

2.2 SYSTEM COMPONENTS

- AT89S51 Microcontroller (8051 microcontroller)
- 8051 Development Board
- 2 x Infrared Sensors
- 16 x 2 LCD Display
- 5V Relay Module
- Lamp
- Connecting Wires
- Power Supply

2.2.1 AT89S52(8051 Microcontroller)

The AT89S52 comes from the popular 8051 family of Atmel Microcontrollers. It is an 8-bit CMOS microcontroller with 8K as Flash memory and 256 bytes of RAM. Since it is similar to the trust worthy 8051 architecture, these microcontrollers are as per industry standard. It has 32 I/O pins comprising of three 16-bit timers, external interrupts, full-duplex serial port, on-chip oscillator and clock circuitry.

The Microcontroller also has Operating mode, Idle Mode and Power down mode which makes it suitable for battery operated applications. Few considerable drawback of the microcontroller is that it does not have in-built ADC and does not support SPI or I2C protocols. However you can utilise external modules for the same.

AT89S52 Features

• 8K Bytes of In-System Programmable (ISP) Flash Memory
– Endurance: 10,000 Write/Erase Cycles
• 4.0V to 5.5V Operating Range
• Fully Static Operation: 0 Hz to 33 MHz
• Three-level Program Memory Lock
• 256 x 8-bit Internal RAM
• 32 Programmable I/O Lines
• Three 16-bit Timer/Counters
• Eight Interrupt Sources
• Full Duplex UART Serial Channel
• Low-power Idle and Power-down Modes
• Interrupt Recovery from Power-down Mode
• Watchdog Timer
• Dual Data Pointer
• Power-off Flag
• Fast Programming Time

2.2.2 IR Sensor Module

An Infrared or IR Sensor is a simple circuit that is used to detect objects (Proximity Sensor) or measure distance (Range Finder). An IR Sensor consists of 3 components:an IR Transmitter (IR LED), an IR Receiver (like a Photo Diode) and a signal processing circuit.

We have used reflective type IR sensor modules in this project. The detailed circuit diagram of the module is shown in the following image.

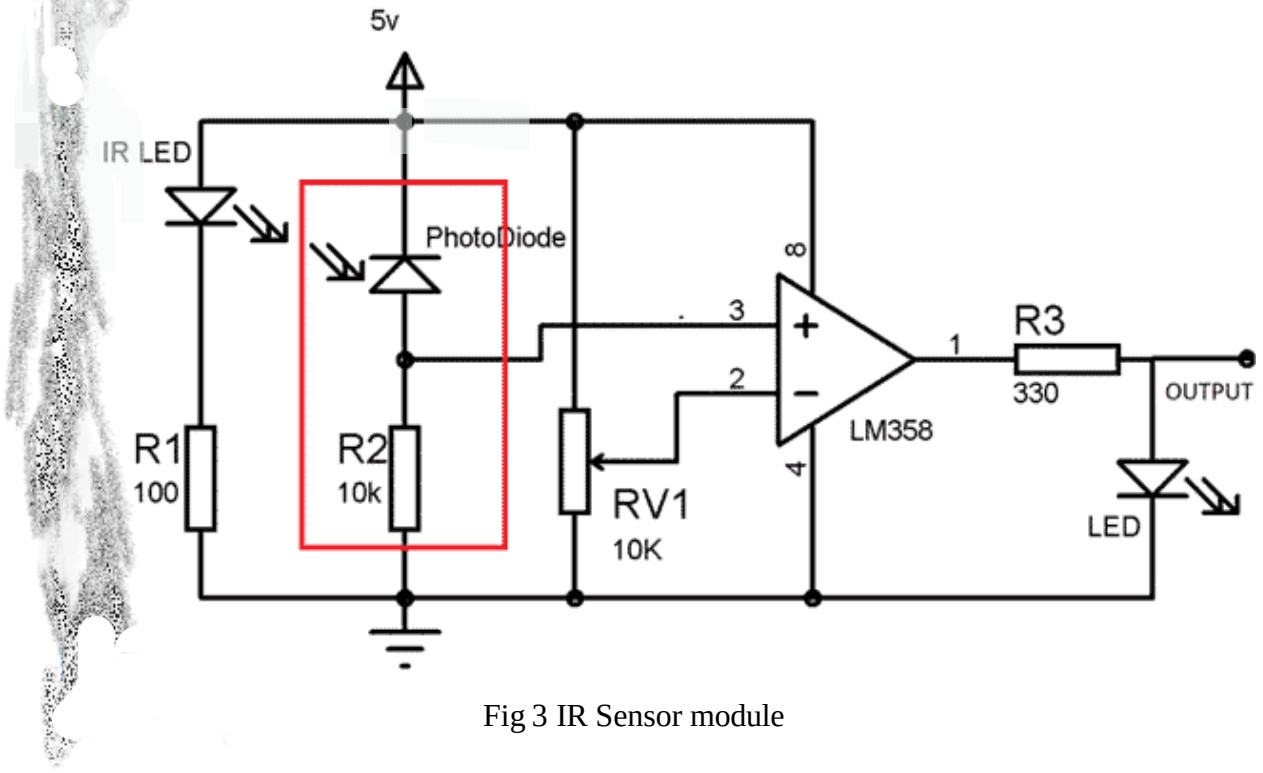


Fig 3 IR Sensor module

2.2.3 5V Relay Module

A 5V Relay Module is used in this project which helps 8051 Microcontroller to operate high voltage AC loads like a light. The detailed circuit of the Relay Module is shown in the following image. It consists of a 5V Electromechanical Relay, an Optocoupler IC, transistor, two resistors and two diodes.

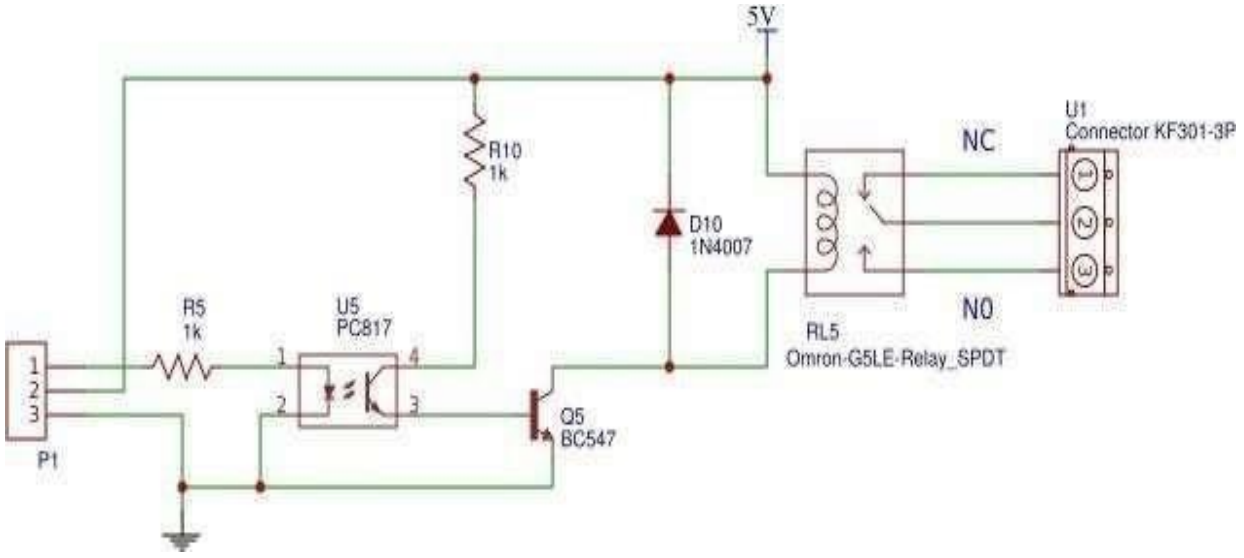


Fig 4.Relay model

2.2.4 6 x 12 LCD Display

Liquid Crystal Display (LCD) is widely used in various electronics applications. It is commonly used in various systems to show different status and parameters. LCD16x2 has 2 lines with 16 characters in each line. Each character is made up of a 5x8 (column x row) pixel matrix.

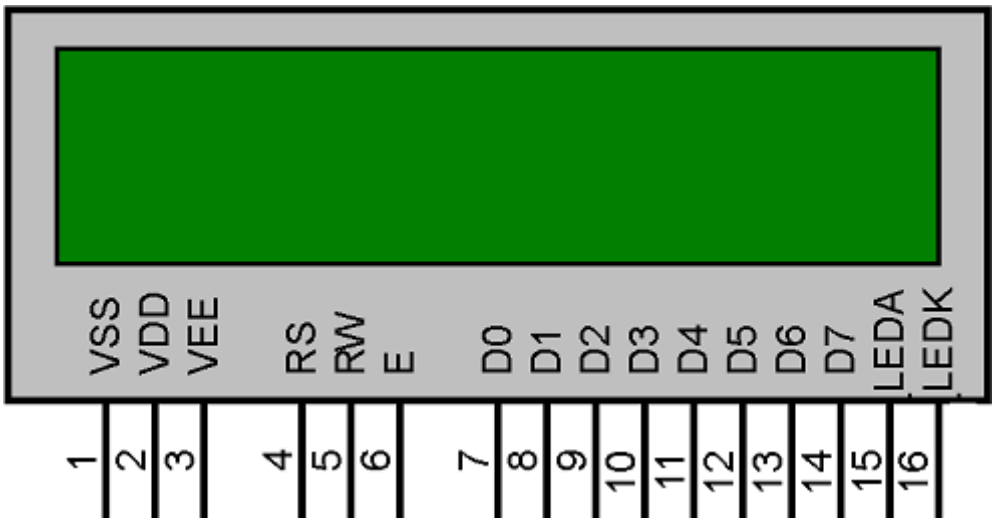


Fig 5 16 x 2 LCD Display

First two pins of LCD16x2 are used for ground and supply (+5 V).

Pin 3 - VEE pin

This pin is used for adjusting the contrast of the display. Voltage on this pin defines contrast on display, lower the voltage, higher the contrast. We can connect 4.7 k pot for contrast adjustment or simply connect this pin to ground to get maximum contrast.

Pin 4 –RS: Register Select pin

RS = 0: Data on the D0 to D7 pins is considered as a command.

RS = 1: Data on the D0 to D7 pins is considered as data to display on LCD16x2.

Pin 5 – RW: Read / Write pin

RW = 0: Write data to the LCD

RW = 1: Read data from the LCD

Pin 6 –E: Enable

This pin is used to latch the data present on the data pins D0 to D7. High to low Pulse with a minimum width of 450 ns is required to latch the data to the display.

Pins 7:14 - DATA pins D0 to D7

Data pins are used to send data/command to the LCD16x2 as parallel 8 data bits.

Pin 15:16 - LED + and LED -

Liquid Crystal Displays don’t have their own light like seven segment displays. Therefore, the module has a backlight LED. Supply to this LED is provided through these pins.

2.2.5 LAMP

An electric light, lamp, or light bulb is an electrical component that produces light. It is the most common form of artificial lighting. Lamps usually have a base madeof ceramic, metal, glass, or plastic, which secures the lamp in the socket of a light fixture, which is often called a "lamp" as well. The electrical connection to the socketmay be made with a screw-thread base, two metal pins, two metal caps or a baynote cape.

Fig 6 Lamp

2.2.6 MCU 8051 IDE

MCU 8051 IDE is a free software integrated development environment for microcontrollers based on the 8051. MCU 8051 IDE has a built-in simulator not only for the MCU itself, but also LCD displays and simple LED outputs as well as button inputs. It supports two programming languages : C (using SDCC) and assembly and runs on both Windows and Unix-based operating systems, such as FreeBSD and Linux.

Features:

• MCU simulator with many debugging features: register status, step by step, interrupt viewer, external memory viewer, code memory viewer, etc.

• Simulator for certain electronic peripherals like LEDs, LED displays, LED matrices, LCD displays, etc.

• Support for C language

• Native macro-assembler

• Support for ASEM-51 and other assemblers

• Advanced text editor with syntax highlighting and validation

• Support for vim and nano embedded in the IDE

• Simple hardware programmer for certain AT89Sxx MCUs

• Scientific calculator: time delay calculation and code generation , base converter, etc.

• Hexadecimal editor

2.3 CIRCUIT CONNECTION

The design of the circuit for automatic room lighting project. The circuit diagram shows all the connections with respect to microcontroller. If you are doing this project on a development board, some of the connections mentioned in the circuit diagram might not be necessary.

Also, we have used modules for Relay and IR Sensor and hence, the connections are shown with respect to those modules only. Corresponding circuit diagrams are also provided.

Coming to the circuit design, a 16 x 2 LCD Display, two IR Sensors and a 5V Relay Module must be connected to the 8051 Microcontroller. First, connect the 8 data pinsof the LCD to PORT1 pins i.e. P1.0 to P1.7.

The 3 control pins of LCD i.e. RS, RW and E are connected to P3.6, GND and P3.7 pins respectively. A 10 KΩ Potentiometer is connected to contrast adjust pin of LCD
i.e. its pin 3.

Two Reflective type IR Sensors are connected to PORT2 pins i.e. P2.0 and P2.1. Detailed circuit of the IR Sensor is mentioned in the Component Description.

The input of the 5V Relay is connected to PORT0 pin P0.0. The detailed circuit of the 5V Relay module used in the project is explained in the component description section. Alternatively, you can construct the circuit as per the circuit diagram (whichconsists of 5V Relay, Transistor, Diode and a Resistor).

2.4 OPERATION

In this project, an automatic room lighting system is developed using 8051 microcontroller. The working of the project is explained here.

The main component of the project is IR Sensor and we have used two of them. Theplacement of the sensors is important as it will determine the functioning of the project.

Practically speaking, both the sensors must be placed on the either side of the door orentrance of the room. The sensor placed on the outside of the room is named as Sensor1 and the sensor, which is placed on the inside is named Sensor 2.

When a person tries to enter the room, Sensor 1 detects the person first and then Sensor 2. This action will indicate the 8051 Microcontroller that the person is entering the room.

Hence, the microcontroller will turn on the light and also increments the visitor counter to 1. If there are more visitor, the microcontroller will keep the light turned on and increments the visitor counter accordingly.

When a person tries to leave the room, Sensor 2 detects the person first and then Sensor 1. This process will make the microcontroller to understand that a person is trying to leave the room and hence, it will decrement the count of visitors. The microcontroller will not turn off the light until the last person has left the room.

As the visitors start leaving the room, the visitor count will be decremented and whenthe last person leaves the room, the count be comes 0. During this point, the microcontroller understands that there is nobody in the room and turns OFF the light.

2.5 INPUT SPECIFICATION

The circuit involves using five major components – 8051 Microcontroller, LCD display, IR sensor, 5V.

Reset Circuit Design: The reset resistor is selected such that the voltage at the reset pin, across this resistor is at minimum of 1.2V and the width of the pulse applied to this pin is greater than 100 ms. Here we select a resistor of 10KΩ and a capacitor of 10μF.

Oscillator Circuit Design: The oscillator circuit is designed using a crystal oscillator of 11.0592 Mhz and two ceramic capacitors each 33pF. The crystal is connected between pins 18 and 19 of the microcontroller

Microcontroller Interfacing Design: The set of LCD display interfaced to Port P3 of the microcontroller and a Relay is interfaced to the port pin P0.0. The IR sensor is interfaced to the microcontroller such that all the input pins are connected to port P2.

2.5.1 CODING

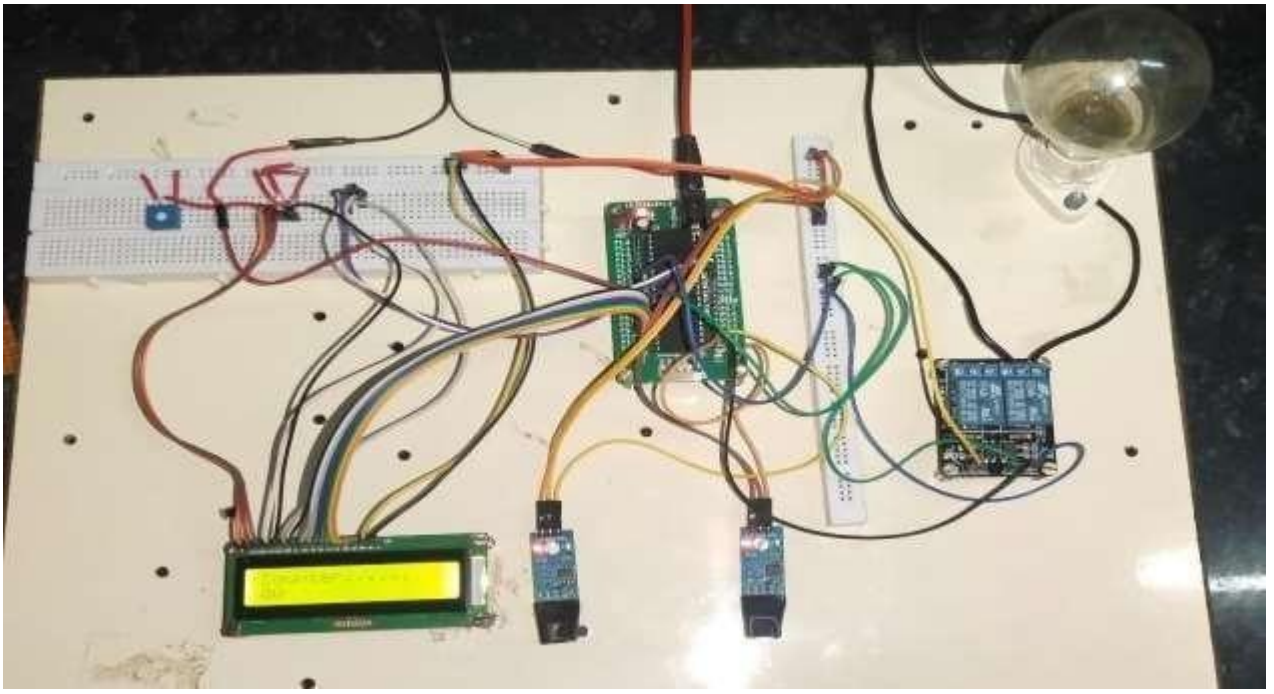
```
#include<at89S8252.h>
#define lcd P3
#define rs P0_7
#define e P0_6
#define relay P2_2
#define s1 P2_0
#define s2 P2_1
void delay(int);
void cmd (char);
void display(char);
void init(void);
void string(char*);
void view(int);
int count=0;
int no[10]={48,49,50,51,52,53,54,55,56,57};

void main()
{
 init();
 string("Counter.....");
 cmd(0xc0);
 view(count);
 while(1)
 {
 while(s1==1&&s2==1)
  {}
  if(s1==0)
  {
   while(s2==1)
   {}
   if(count!=99)
   {
    count=count+1;
   }
   while(s2==0)
   {}
   view(count);
  }
  else if(s2==0)
  {
   while(s1==1)
   {}
   if(count!=0)
   {
    count=count-1;
   }
```

```
   while(s1==0)
   {}
   view(count);
  }
  if(count==3)
  {

  relay=0;
  }
  else if(count==0)
  {
  relay=1;
  }
 }
}

void delay(int d)
{
        unsigned char i=0;
        for(;d>0;d--)
        {
                for(i=250;i>0;i--);
                for(i=248;i>0;i--);
        }
}

void cmd(char c)
{
 lcd=c;
 rs=0;
 e=1;
 e=0;
 delay(5);
}


void display(char c)
{
 lcd=c;
 rs=1;
 e=1;
 e=0;
 delay(5);
}
```

```
void string(char *p)
{
 while(*p)
 {
  display(*p);
  *p++;
 }
}

void view(int n){
		cmd(0xc0);
		display(no[(n/10)%10]);
		display(no[n%10]);
}
void init(void)
{
		delay(10);
		cmd(0x38);
		cmd(0x01);
		cmd(0x0C);
		cmd(0x06);
		cmd(0x80);
}
```

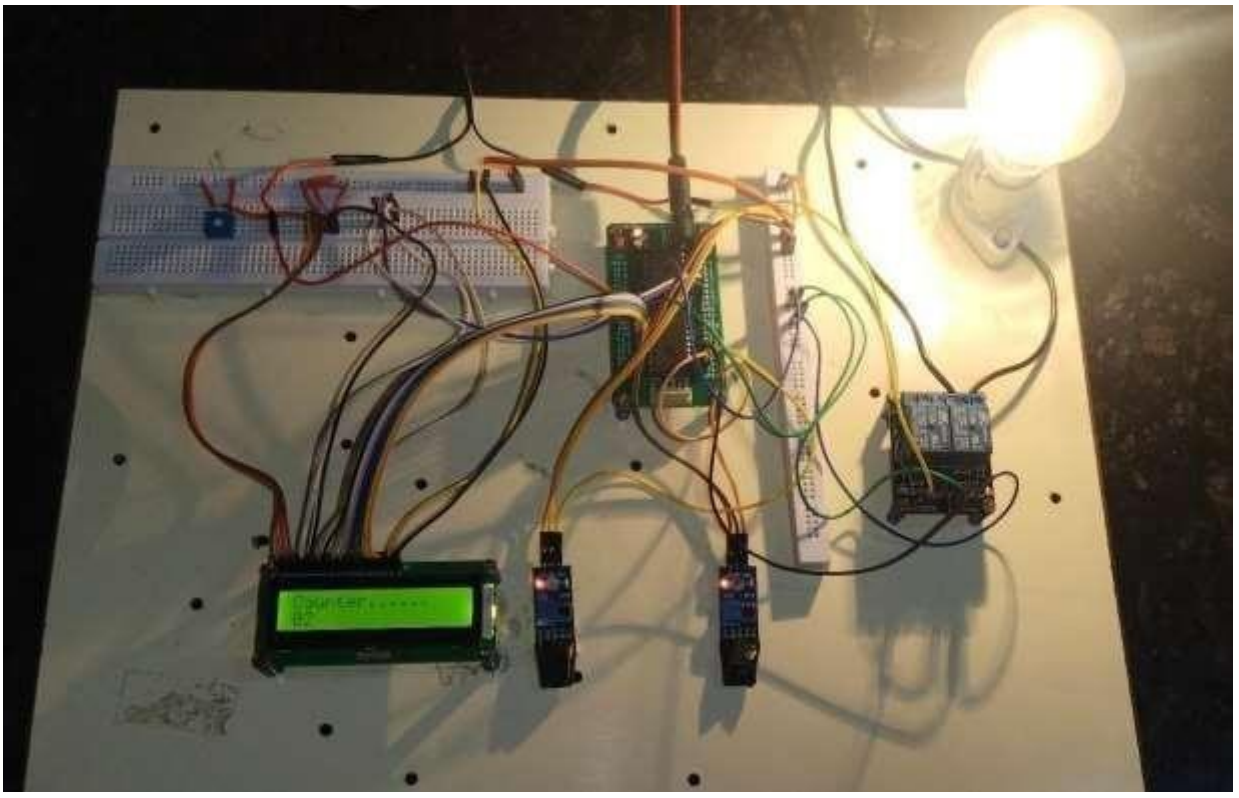
2.6 OUTPUT

INPUT:



LCD DISPLAY:

AFTER PASSING OBJECT**:**



CHAPTER 3

CONCLUSION

Hence by this project we can design an effective detecting system that can monitor in automatic room lighting system and bidirectional visitorcounter in schools, colleges etc… with IR sensor and LCD display. The uniqueness of this project is only alerting the automatic room light while entering.

Advantages of the project:

- Energy conservation
- Our homes because we often forgot to switch off our room lights
- To count person entering the room and leaving the room

Applications:

- Automatic Room Lighting with Bidirectional Visitor Counter can be used to automatically turn on the light in a room when a person enters the room and turn it off when the person leaves the room.
- The project can also be dubbed as a Bidirectional Visitor Counter it is an integral part of the Automatic Room Lighting circuit.
- The project can be modified with LEDs and as the number of persons in the room increases, the number of LEDs turning ON also increases.

CHAPTER 4

REFERENCE

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