EMBEDDED SYSTEMS PROJECT (EE3401)

Embedded System for Energy-Efficient Street Lighting Control Using 8051

Electrical Engineering Project submitted to the

National Institute of Technology Rourkela

In partial fulfillment of

***Bachelors in technology** in*

Electrical Engineering

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TOPIC: AUTOMATIC STREET LIGHT CONTROL USING SENSORS AND MICRO CONTROLLER

ABSTRACT:

Electricity being one of the primitive resources, must be utilised carefully, as the number of vehicles during night time are less frequent, building up a sensor-based street lights helps in saving electricity. 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 the standard of living etc.The project implemented here is one such project where the microcontroller based system automatically controls the street lights.

OBJECTIVE:

The aim of this project is to automatically turn on or off the street lights by detecting vehicle movement. We implemented this project using an 8051 Microcontroller and two Infrared (IR) sensors.

The job of the circuit is to turn on the first street light when a vehicle's movement is detected and to turn off that light as soon as the same vehicle's movement is detected by the second street light. The goal is to conserve energy by lighting up only the necessary sections of the highway based on the presence and movement of vehicles..

WORKING

In this project, an automatic street light controlling 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. The placement of the sensors is important as it will determine the functioning of the project.

When vehicles passes the Sensor 1, it detects the vehicle an turns on the street light. This action will indicate to the 8051 Microcontroller that a vehicle has passed through first street light.

Hence, the microcontroller will turn on the light will keep the light turned on.

When the vehicle starts travelling from street light one to two, Sensor 2 detects the vehicle coming, Sensor 1 detects that a vehicle has left. The microcontroller will not turn off the street light 1 unless the sensor 2 detects the vehicle incoming.

So to summarize, as sensor 1 detects a vehicle's movement, street light one will get switched on and then when the sensor 2 detects the vehicle's movement, and sensor 1 detects the departure of the vehicle, the street light one will get turned off and the street light 2 will get turned on.

COMPONENTS REQUIRED:

- AT89C51 Microcontroller
- 8051 Development Board
- 2 x Infrared Sensors
- 16 x 2 LCD Display
- 5V Relay Module • Lamp
- Connecting Wires
- Power Supply
- Proteus
- Bread Board

CIRCUIT DESCRIPTION:

A 16 x 2 LCD Display, two IR Sensors and a 5V Relay Module must be connected to the 8051 Microcontroller.

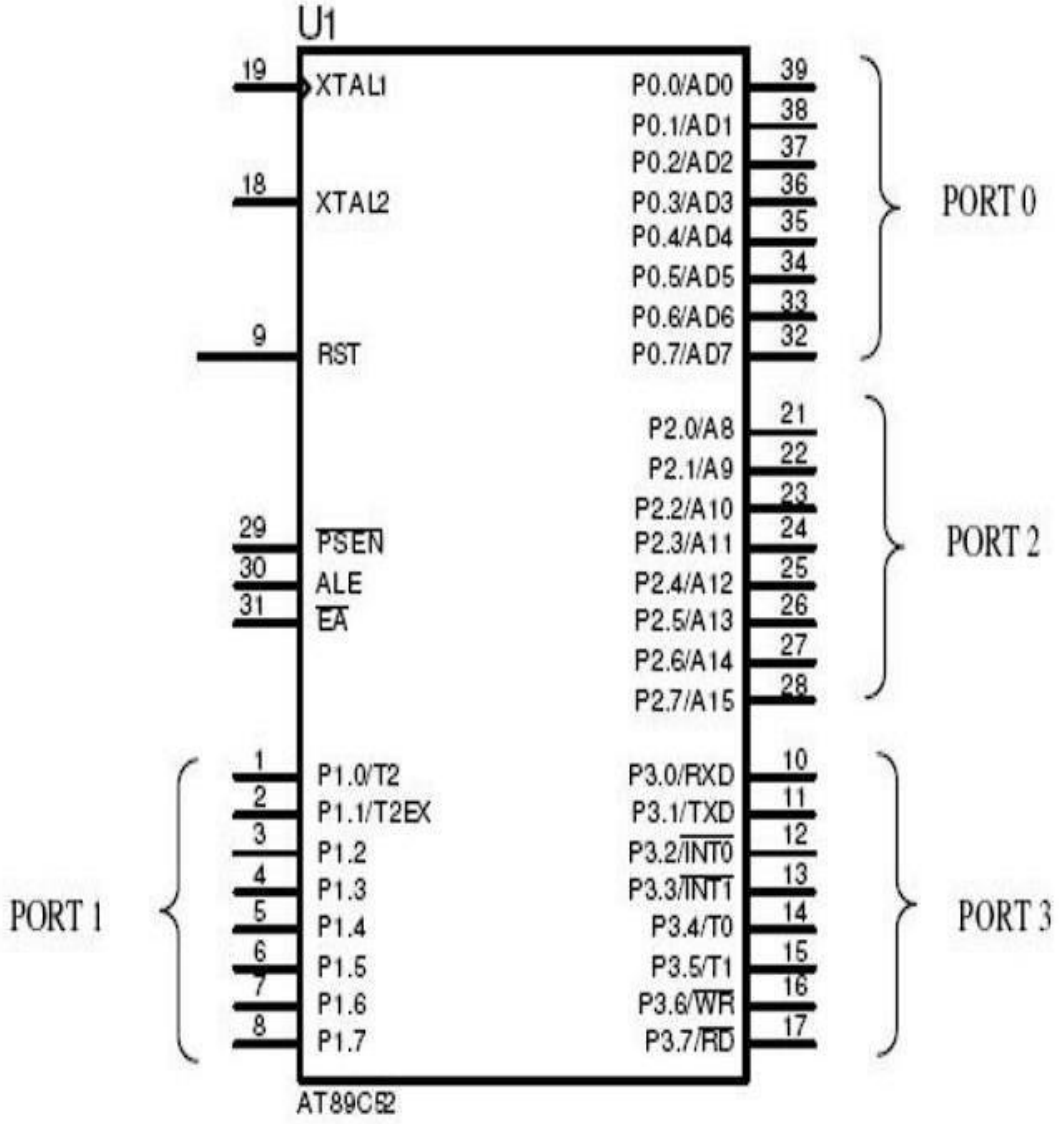
First, connect the 8 data pins of the LCD to PORT1 pins i.e. P1.0 to P1.7.

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.

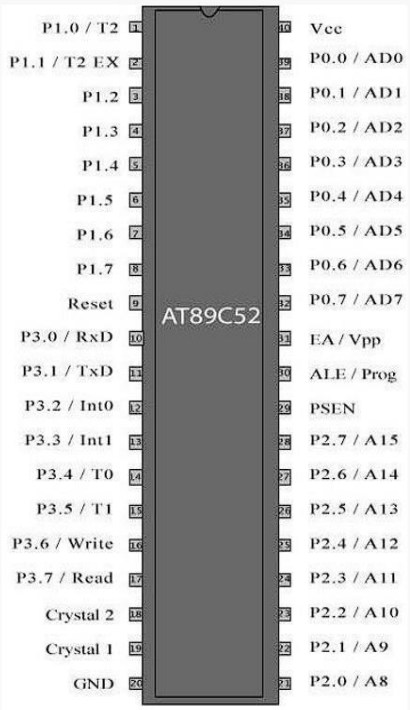
Two Reflective type IR Sensors are connected to PORT2 pins i.e. P2.0 and P2.1. Detailed circuit of the IR Sensor is mentioned in the Component Description.

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 (which consists of 5V Relay, Transistor, Diode and a Resistor).

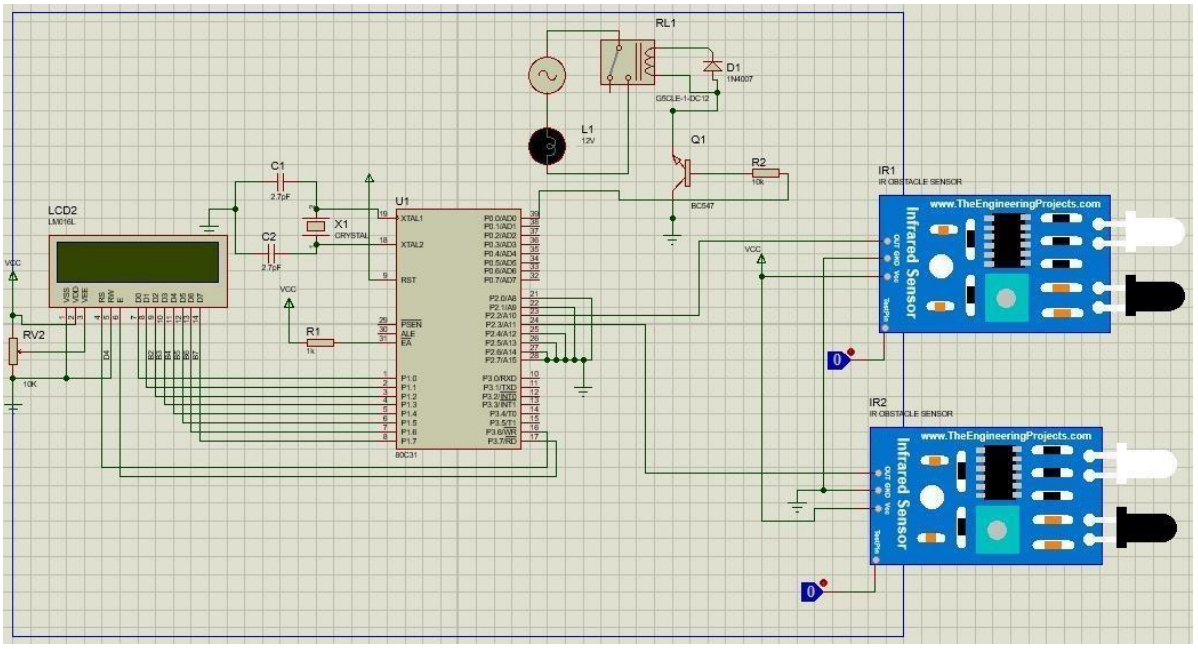
I/O Port Pin and microcontroller connection diagram:



PIN DIAGRAM OF AT89C52 MICROCONTROLLER :



CIRCUIT DIAGRAM :



CODE

```
; storing essential information on ROM at 0400h (in range of 4K)

;MAKING LOOKUP TABLE

Table: org

0400H

DB "STREET LIGHT VEHICLE EXIT VEHICLE ENTRY COUNT: NO VEHICLE
INVALID OPERATION"


;START OF PROGRAM FROM 0000h


org 0000H


MOV DPTR,#0400H          ; its used as data pointer that means its locates at 0400H
ADDRESS of ROM


MOV P2,#0FFH             ; assigning PORT 1 as input


MOV P0,#00h


MOV R6,#00h          ; R6 ACTS AS COUNTER


; LCD SETUP,START DISPLAY,CHECKING SENSORS


ACALL Lcd_setup


ACALL Display


ACALL Check
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```
Lcd_setup:
MOV A,#38H          ;setup 2 line 5*7 matrix display
ACALL command
MOV A,#0CH          ;Display ON and cursor OFF
ACALL command
MOV A,#01H          ;Clear the old data
ACALL command
;MOV          A,#06H;if used then cursor increment mode
;ACALL command
MOV A,#80H          ;cursor home and starts left most point
ACALL command
RET


command:
  MOV P1,A          ;command on port A
  CLR P3.6          ; register select as 0 for command
  ;CLR P3.1         ; display mode as write mode(R/!W)
  SETB P3.7         ; Make latch as 1
  CLR P3.7          ; to falling edge
  ACALL Delay
RET


work:
  MOV P1,A  ;data on port A
  SETB P3.6   ; register select as 1 for data
  ;CLR P3.1    ; display mode as write mode(R/!W)
  SETB P3.7  ; Make latch as 1
  CLR P3.7     ; to falling edge
  ACALL Delay
  RET
```

```
Delay:                          ;SOME delay for LCD
  MOV TMOD, #01H                ;Program TMOD -->(0000 0001)2 ...
      Timer0 Mode1
  MOV TL0, #0D4H                ;Load lower byte of Count
  MOV TH0, #050H                ;Load upper byte of Count
  MOV TCON, #10H                ;Program TCON --> (0001 0000)2 …
      start Timer0
  WAIT: JNB TCON.5, WAIT        ;Wait for overflow
  MOV TCON, #00H                ;Stop Timer0
  RET


 ;welcome message Display:

  MOV R3,#0Ch                   ;display of welcome message
  MOV R2,#00h


  ACALL lcd_displayer
  RET


;checking
Check:
  CLR C
  ACALL Delay
  MOV A,P2          ;read the data
  MOV B,#0CH
  CJNE A,B,find     ;check the data if 00h(initial case)
  SJMP Check
```

```
;identifying sensor
find:
  ACALL Delay
  CLR C
  CJNE A,#00h,goon
ACALL Check
  goon:
  CLR C
  CJNE A,#08h,EXIT   ;checking with entry if not equal than its must be exit
  CLR C
  CJNE A,#04h,ENTRY  ;checking with eXIT if not equal than its must be ENTRY
  ACALL Check

; ENTRY MODE
ENTRY:
  SETB P0.0
  ACALL Delay
  MOV A,#01H                ;Clear the old data
  ACALL command

  MOV R2,#19h                       ; displaying of person entering
  MOV R3,#20h
  ACALL lcd_displayer

  ACALL Entry_count                 ; counting of persons
  CLR C
```

```
  SJMP Check


;entry count
Entry_count:
  MOV A,#0C0H              ;FORCE CURSOR TO SECOND LINE
  ACALL command

  MOV R2,#21h              ;displaying of "COUNT:"
  MOV R3,#2ch
  ACALL lcd_displayer
  ;count increment
  CLR C
  MOV A,R6                 ; getting data from R6 register
  ADD A,#01                ; adding "1"
  MOV R6,A                 ;new data stored back to R6 counter register
  DA A                     ; converting from hex to decimal value (after addition only)
  MOV R2,A
  ACALL ConvertDisplay     ; converting data to ASCII code
  RET


; exit mode
EXIT:
  ACALL Delay
  MOV A,#01H               ;Clear the old data
  ACALL command
  CLR C
  CJNE R6,#00h,counter     ; check the counter
  MOV R2,#39h
  MOV R3,#3Fh
```

```
   ACALL lcd_displayer                ; if zero then give error message "INVALID"


   MOV A,#0C0H                        ; Force cursor to second line
  ACALL command

   MOV R2,#41h                        ; showing of error message "Operation"
   MOV R3,#49h
   ACALL lcd_displayer



   SJMP Check

counter:                              ;
   MOV R2,#0Dh
   MOV R3,#18h
   ACALL lcd_displayer

   ACALL Exit_count                   ;
CLR C
   CJNE R4,#00H,moveon
CLR P0.0    moveon:
   SJMP Check
;exit counting Exit_count:
   MOV A,#0C0H
ACALL command
;count decrement
   CLR C
   CJNE R6,#00h,start                 ;
```

```
   ACALL message
   RET

start:
   MOV A,R6                ;get data from counter
   CLR C                   ; clear carry other wise it subtraction would be with carry
   SUBB A,#01              ; subtract with "01"
   MOV R6,A                ; store to R6
   DA A                    ; converting from hex to decimal value (after addition only)
   MOV R4,A                ; lets store it at R4 (DAA data) upcoming operations may
distrub A


   CLR C
   CJNE R6,#00h,continue          ;BEFORE MOVING ON LETS CHECK IF ANY
PERSON IS THERE
   clr P0.0
   ACALL message

continue:                  ;Displaying "count"
   SETB P0.0
   MOV R2,#28h
   MOV R3,#2Dh
   CLR C
   ACALL lcd_displayer

   MOV A,R4                ;value showing
   MOV R2,A
   ACALL ConvertDisplay
```

```
  ACALL Check



ConvertDisplay:
    CLR C  ; Clear carry flag
    MOV B,#10h
    MOV A,R2
    DIV AB          ; Divide A by B, quotient in A, remainder in B
    ADD A, #30h     ; Convert quotient to ASCII
    ACALL work              ; Display the ASCII character

    MOV A, B        ; Move the remainder back to A
    ADD A, #30h     ; Convert remainder to ASCII
    CALL work               ; Display the ASCII character

    RET

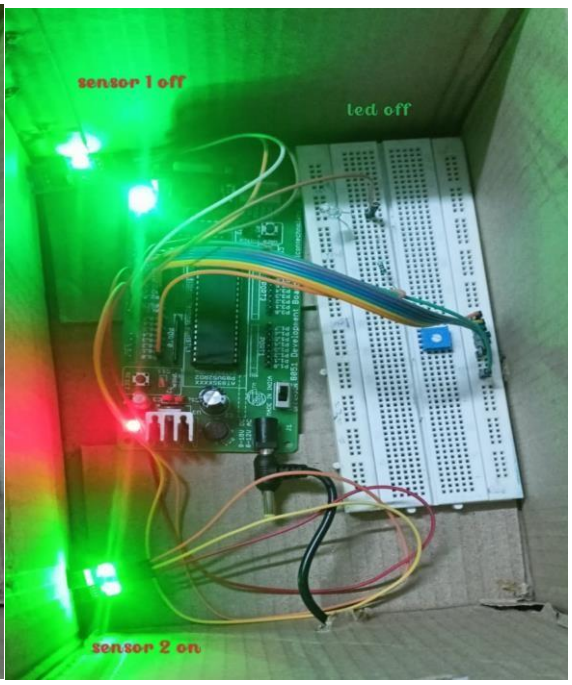
message:                    ;
   MOV R2,#2Fh
   MOV R3,#37h
  ACALL lcd_displayer
   ACALL Check
   RET

lcd_displayer:      ;sending bit by bit to LCD display
   MOV A,R2
   MOV B,R3 do:
   MOVC A,@A+DPTR
```

```
ACALL work
INC R2
CLR C
MOV A,R2
CJNE A,B,do
RET

Here: SJMP Here
END
```

Simulation pics:



ADVANTAGES:

- Reduced Light pollution, Energy conservation
- Cost-effective, longevity of street lights
- Enhanced Safety

CONCLUSION:

By sensing vehicle movement, the created embedded system provides a workable alternative for energy-efficient street lighting. By installing such systems on highways, substantial energy savings and the promotion of sustainable urban infrastructure practises can be achieved.