RELAY BASED TRAFFIC CONTROL SYSTEM USING INFRARED PAIR DETECTORS

A PROJECT REPORT SUBMITTED IN THE PARTIAL FULFILLMENT
OF THE REQUIREMENT FOR THE DEGREE OF
Bachelor of Technology
in
Electronics & Communication Engineering

by
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Department of Electronics & Communication Engineering
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Under the Guidance of
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CERTIFICATE

This is to certify that the thesis entitled **"RELAY BASED TRAFFIC CONTOL SYSTEM USING INFRARED PAIR DETECTORS"** submitted by Sambit Dash & Mukesh Kumar in the partial fulfilment of the requirement for the award of BACHELOR OF TECHNOLOGY Degree in Electronics & Communication Engineering at the National Institute of Technology, Rourkela (Deemed University) is an authentic work carried out by them under my supervision and guidance.

To the best of my knowledge, the matter embodied in the thesis has not been submitted to any other University/ Institute for the award of any degree or diploma.

Prof S.K.Das

Date: 5th May, 2012

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ABSTRACT

A relay is usually an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. The IR sensor pair typically consists of an IR transmitter and receiver pair. The IR transmitter is an led that emits light in the infrared region of light spectrum. The IR receiver is a diode constructed in such a way that when the diode is reverse biased ,their light falling on the depleted region causes creation of electron-hole pair and thus this generated pair constitutes current. In our project traffic control system is a simple adaptive controller which will adapt according to amount of traffic in one direction. The system consists of 2 8 channel relay boards whose switching will be controlled by the instructions embedded in the Atmega32 controller. In every direction the road will consist of an IR transmitter-receiver pair at a certain distance from traffic lights. When the traffic will be heavy in one particular direction during emergency situations it will increase the time duration for that particular road.

Keywords: Traffic Control, Adaptive System, Relay Switching Principle, IR Sensor

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Chapter – 01

INTRODUCTION

1.1 INTRODUCTION:-

A traffic light is a collection of two or more coloured lights found at some junctions and pedestrian crossings which indicates whether it is safe and/or legal to continue across the path of other road users.

The operation of standard traffic lights which are currently deployed in many junctions, are based on predetermined timing schemes, which are fixed during the installation and remain until further resetting. The timing is no more than a default setup to control what may be considered as normal traffic. Although every road junction by necessity requires different traffic light timing setup, many existing systems operate with an over-simplified sequence. This has instigated various ideas and scenarios to solve the traffic problem.

To design an intelligent and efficient traffic control system, a number of parameters that represent the status of the road conditions must be identified and taken into consideration.

1.2 Problem Definition

The aim of this project is to design traffic control system that could minimize the waiting time of the vehicles at intersections, when the traffic volume is significantly high.

1.3 Objectives of Project

1. To understand the relay working principle

2. To understand how to make the interfacing between relay board and microcontroller

3. To design a program that works together with a model of four- junction traffic light and sensors.

4. To build the model of four-junctions of simple adaptive traffic light that can overcome the problems of traffic light congestion.

1.4 Project Scope

1. Construct a model of four way junction of a traffic light model.

2. Programme the microcontroller to control the traffic light.

3. Combine the software part and the hardware part to simulate a traffic light system.

1.5 Thesis Outline

Chapter 1 is the introduction to traffic light systems. This chapter also explains about project objectives and scopes and discuss about problem statement.

Chapter 2 will describe all techniques, the theory of different components required for our project.

Chapter 3 focuses on the system hardware & software implementation of traffic light control system.

Chapter 4 deals with results and discussions regarding the project.

Chapter 5 with the conclusions and future recommendations about the project.

Chapter – 02

LITERATURE REVIEW

Traffic signals are the most convenient method of controlling traffic in a busy junction. But, we can see that these signals fail to control the traffic effectively when a particular lane has got more traffic than the other lanes. This situation makes that particular lane more crowded with the vehicles than the other lanes. If the traffic signals can allot different time slots to different lanes according to the traffic present in each lane, then, this problem can be solved easily.

2.1 The Basics of Traffic lights

The most basic traffic light consists of three bulbs with different coloured lenses, which from top to bottom are red, yellow and green.

1. **Red**— this indicates that traffic must stop behind the line. It is compulsory for *all* road users to do so. Some traffic lights even have cameras to catch drivers breaking this law.
2. **Yellow**— this combination of bulbs indicates that the lights are about to change to green, and gives drivers time to release their handbrake and prepare to drive off as soon as they are allowed to do so.
3. **Green**— this indicates that traffic may pass through the junction, provided that it is safe to do so and the way is clear.

2.2 RELAY:-

A relay is an electromechanical device that is actuated by an electrical current. The current flowing in one circuit causes the opening or closing of another circuit. Highly sophisticated relays are utilized to protect electric power systems against trouble and power blackouts as well as to regulate and control the generation and distribution of power. In the home, relays are used in different appliances like refrigerators, washing machines and dishwashers, and heating and air-conditioning controls. Every relay contains a sensing unit, the electric coil, which is powered by AC or DC current. When the applied current or voltage exceeds a threshold value, the coil activates the armature, which operates either to close the open contacts or to open the closed contacts. When a power is supplied to the coil, it generates a magnetic force that actuates the

switch mechanism. The magnetic force is, in effect, relaying the action from one circuit to another. The first circuit is called the control circuit while the second is called the load circuit.

There are three important functions of a relay: On/Off Control, Limit Control and Logic Operation.

On/Off Control: Example: Air conditioning control, used to limit and control a "high power" load, such as a compressor

Limit Control: Example: Motor Speed Control, used to disconnect a motor if it runs slower or faster than the desired speed

Logic Operation: Example: Test Equipment, used to connect the instrument to a number of testing points on the device under test
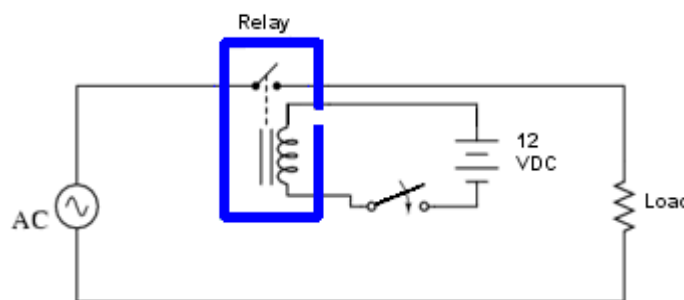
Fig 2.1 – Simple Relay Circuit

2.2.1 Types of Relays

There are two basic types of relays: Electromechanical and Solid State. Electromechanical relays have moving parts, whereas solid state relays have no moving parts. Advantages of Electromechanical relays include lower cost, no heat sink is required, multiple poles are available, and they can switch AC or DC with equal ease.

A.) Electromechanical Relays

General Purpose Relay: The general-purpose relay is rated by the amount of current its switch contacts can handle. Most versions of the general-purpose relay have one to eight poles and can be single or double throw. These are found in computers, copy machines, and other consumer electronic equipment and appliances.

Power Relay: The power relay is capable of handling larger power loads – 10-50 amperes or more.

They are usually single-pole or double-pole units.

Contractor: A special type of high power relay, it's used mainly to control high voltages and currents in industrial electrical applications. Because of these high power requirements, contactors always have double-make contacts.

Time-Delay Relay: The contacts might not open or close until sometime interval after the coil has been energized. This is called delay-on-operate. Delay-on-release means that the contacts will remain in their actuated position until some interval after the power has been removed from the coil. A third delay is called interval timing. Contacts revert to their alternate position at a specific interval of time after the coil has been energized. The timing of these actions may be a fixed parameter of the relay, or adjusted by a knob on the relay itself, or remotely adjusted through an external circuit.

Fig 2.2:- Electromechanical Relay

B.) Solid State Relays:-

These active semiconductor devices use light instead of magnetism to actuate a switch. The light comes from an LED, or light emitting diode. When control power is applied to the device's output, the light General Purpose Relay is turned on and shines across an open space. On the load side of this space, a part of the device senses the presence of the light, and triggers a solid state switch that either opens or closes the circuit under control. Often, solid state relays are used where the circuit under control must be protected

Fig 2.3:- Solid State Relay
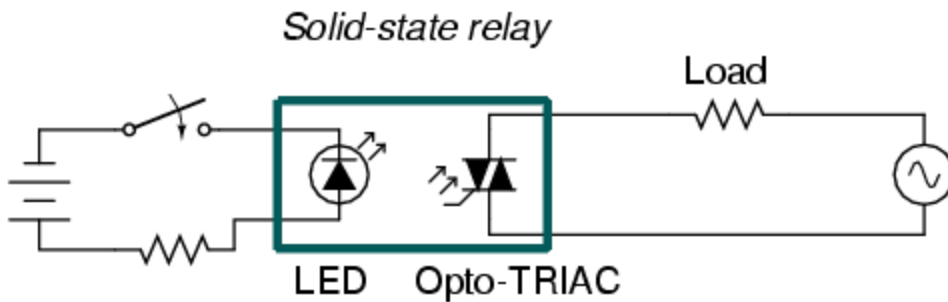
Fig 2.4:- Solid state Relay Circuit

Contact Information

The contacts are the most important parts of a relay. Their characteristics are significantly affected by factors such as the material of the contacts, voltage and current values applied to them (especially, the voltage and current waveforms when energizing and de-energizing the contacts), the type of load, operating frequency, and bounce. If any of these factors fail to satisfy a predetermined value, problems such as metal degradation between contacts, contact welding, wear, or a rapid increase in the contact resistance may occur. The quantity of electrical current that flows through the contacts directly influences the contacts' characteristics. For example, when the relay is used to control an inductive load, such as a motor of a lamp. The contacts will wear faster and metal decomposition between the mating contacts will occur more often as the inrush current to the contacts increases.

2.3 RELAY BOARD: - The relay board is what powers the switching mechanics on your electronic devices. It contains a power supply circuit, regulatory circuitry and of course the relays that you need to turn parts or all of your device (or devices) on and off – or to switch them between states. Normally speaking, the relays on your relay board will be solid state, unlike the mechanical relays that you may see in larger electrical applications (like, for example, the switch you throw to turn off a phased power relay, or the breakers in your home's circuitry). Solid state relays are reliable over a longer term than electro mechanical relays thanks to the simple fact that they have no moving parts (hence the name solid state), which means of course that nothing can seize up or break off and prevent successful operation. The SSR on your relay board will contain a transistor or a number of transistors, through which the switch of state is made.

Early solid state relays suffered a drop in voltage across their transistors, but modern SSRs

are capable of carrying switching loads with much higher currents. The terminology with which one's relay board will be described and/or discussed in manuals, advice and literature is the same terminology that you will find for the discussion of any electronic or electric switches. The basic function of the relays on your relay board is to flick between one or several poles. This is done by throwing contacts between them ("pole" and "throw" are the electrical switching terms we're interested in here). Most of the terminology describing the state of the contacts in your relay board is compressed into acronymic form: NO (Normally Open); NC (Normally Closed); and Change Over or Double Throw (referred to either as CO or DT, both of which mean the same thing).

A **Normally Open contact** is one that is usually disconnected – so in its resting or inactive state the contact is open. A **Normally Closed** contact has the opposite characteristic: in its resting state the circuit is connected and active because the relay has closed on the contact. A Change Over or Double Throw contact connects two linked circuits – one Normally Open and the other Normally Closed. The switch on your relay board throws the pole between the Normally Open and the Normally Closed circuit when the switch is activated. The functions of the switches on your relay board depend (naturally) on your application. In general terms they are commonly used to increase power where there is a weak power source (amplification, usually of a signal); to isolate a controlled and controlling circuit from each other; to switch to a standby power state; to implement a time delay; or to control logic within your electronic circuitry. A series of Normally Open contacts on a relay board is equal to AND; a parallel connection of Normally Open contacts becomes OR.
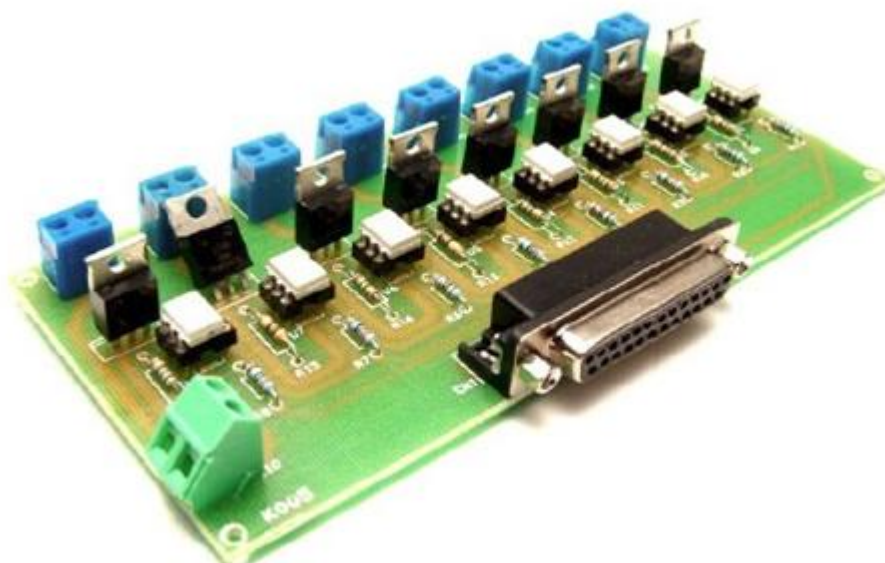
Fig 2.5:- 8-Channel Relay Board

2.3.1 Specifications:-

Channel Relay Board is a simple and convenient way to interface 8 relays for switching application in your project.

Input - 12 VDC @ 336 mA.

Output - eight SPDT relay .

Relay specification - 5 A @ 230 VAC.

Trigger level - 2 ~ 5 VDC.

Berg pins for connecting power and trigger voltage.

LED on each channel indicates relay status.

Power Battery Terminal (PBT) for easy relay output and aux power connection.

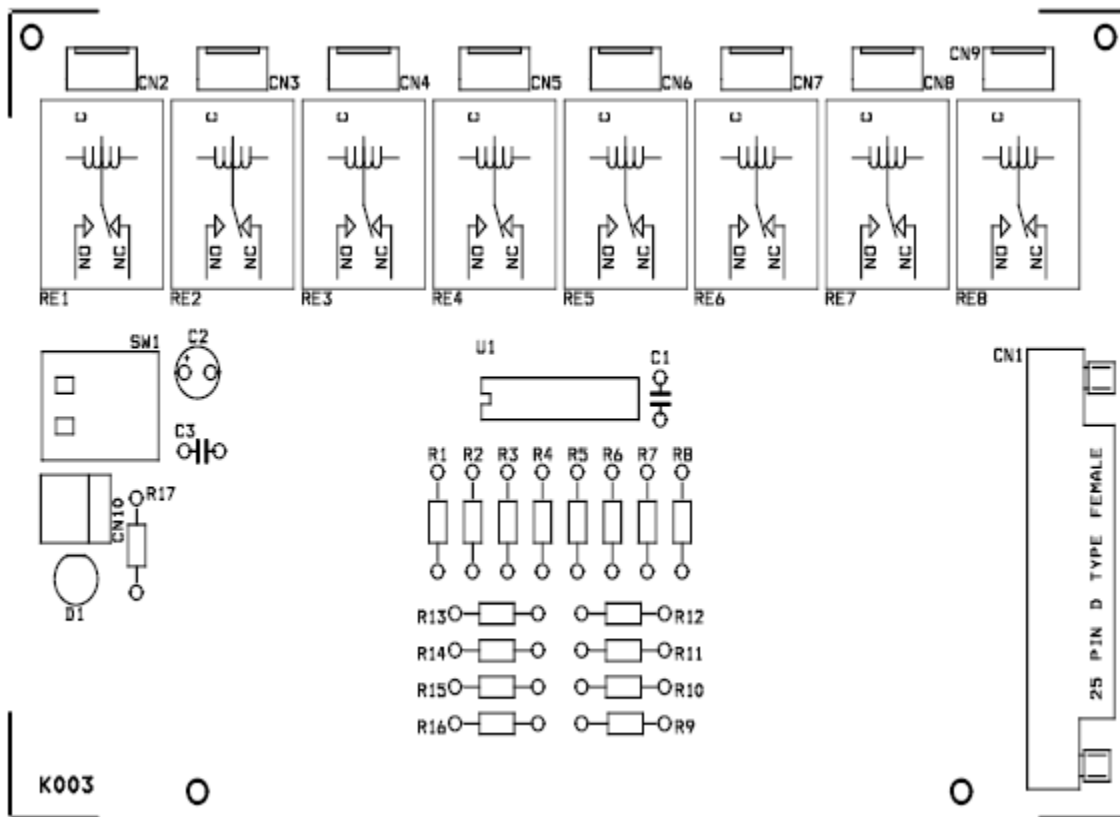Four mounting holes of 3.2 mm each.

PCB dimensions 169 mm x 72 mm.

Fig 2.6:- Circuit Description of 8 Channel Relay Board
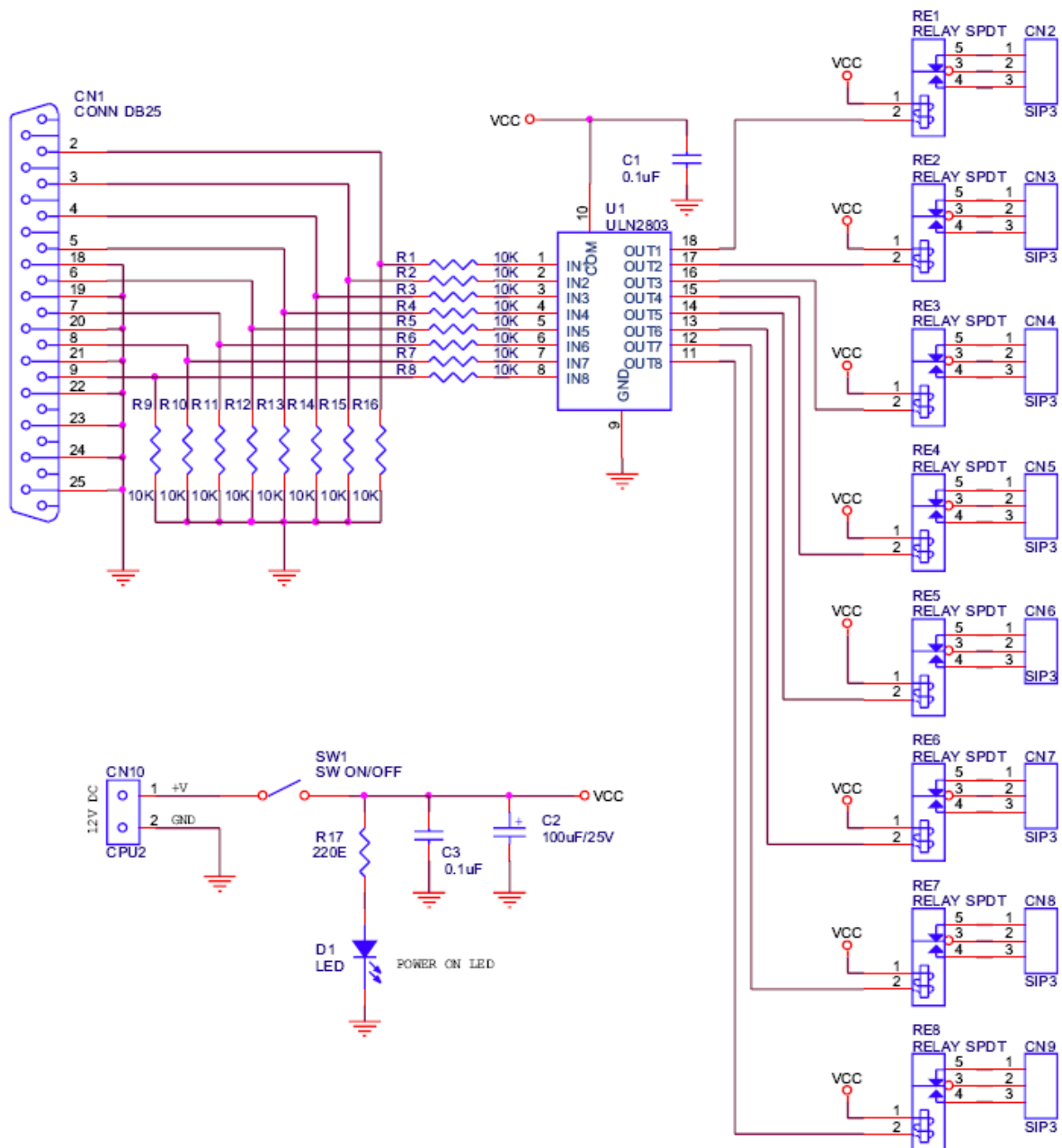
Fig 2.7 Schematic Of Relay Board

2.4 IR SENSOR :-

Infrared sensors are in the form of diodes with 2 terminals. One can buy a pair of such diode (one transmitter and one receiver) at a very low cost of about 5 - 7 rupees only. Tx refers to a transmitter and Rx refers to a receiver diode.
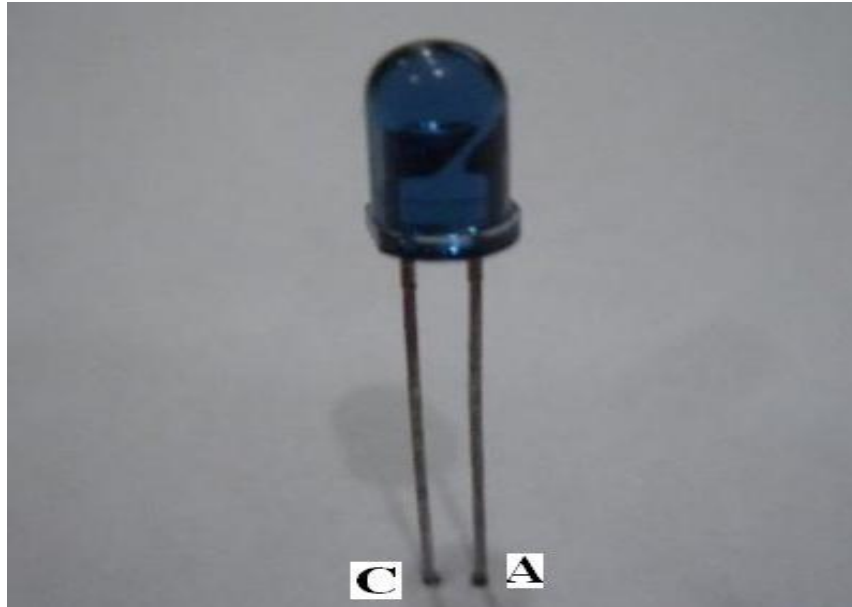
Fig 2.8:- Typical Tx/Rx

Upon careful observation, one will notice that amongst the two 'legs', one has a much wider base within the diode. This is normally the cathode (negative) whereas the leg having a smaller base would be the anode (positive terminal).

Operation:

When the Tx is forward biased, it begins emitting infrared. Since it's not in visible spectrum, you will not be able to see it through naked eyes but you will be able to view it through an ordinary cell phone camera.
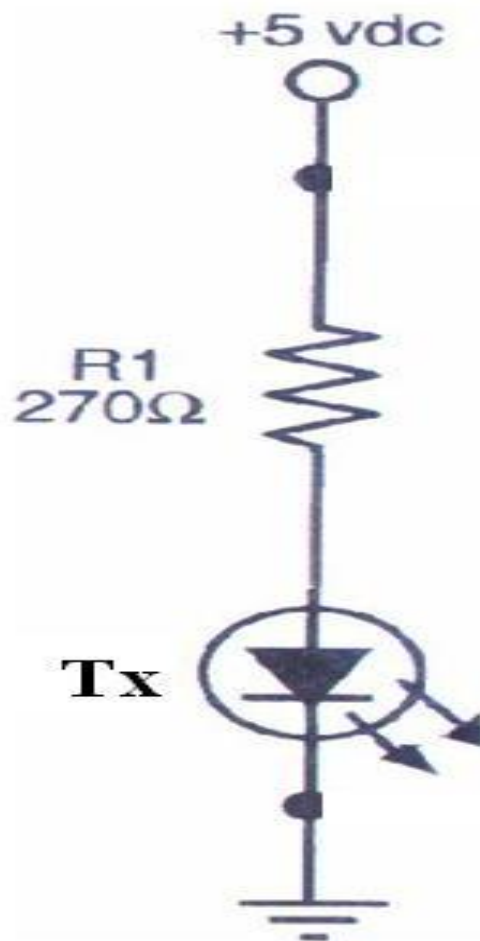
Fig 2.9:- A typical Transmitter Circuit

The resistance R1 in the above circuit can vary. It should not be a very high value (~ 1Kohm) as then the current flowing through the diode would be very less and hence the intensity of emitted IR would be lesser. By increasing the current flowing in the circuit, you can increase the effective distance of your IR sensor. However, there are drawbacks of reducing the resistance. Firstly, it would increase the current consumption of your circuit and hence drain the battery (one of the few 'precious' resources for any embedded system) faster. Secondly, increasing the current might destroy the Tx. So, the final choice should be a calculated trade-off between these various factors.

One can also modulate the IR to achieve better distance and immunity. The receiver diode has a very high resistance, typically of the order of mega Ohms when IR is not incident upon it. However, when IR is incident upon it, the resistance decreases sharply to the order of a few kilo Ohms or even lesser. This feature forms the basis of using IR as a sensor. You will need to connect a resistance of the order of a few mega Ohm in series with the Rx. Then tap

the output voltage at the point of connectivity of these two resistors. A complete Tx-Rx circuit is given below.
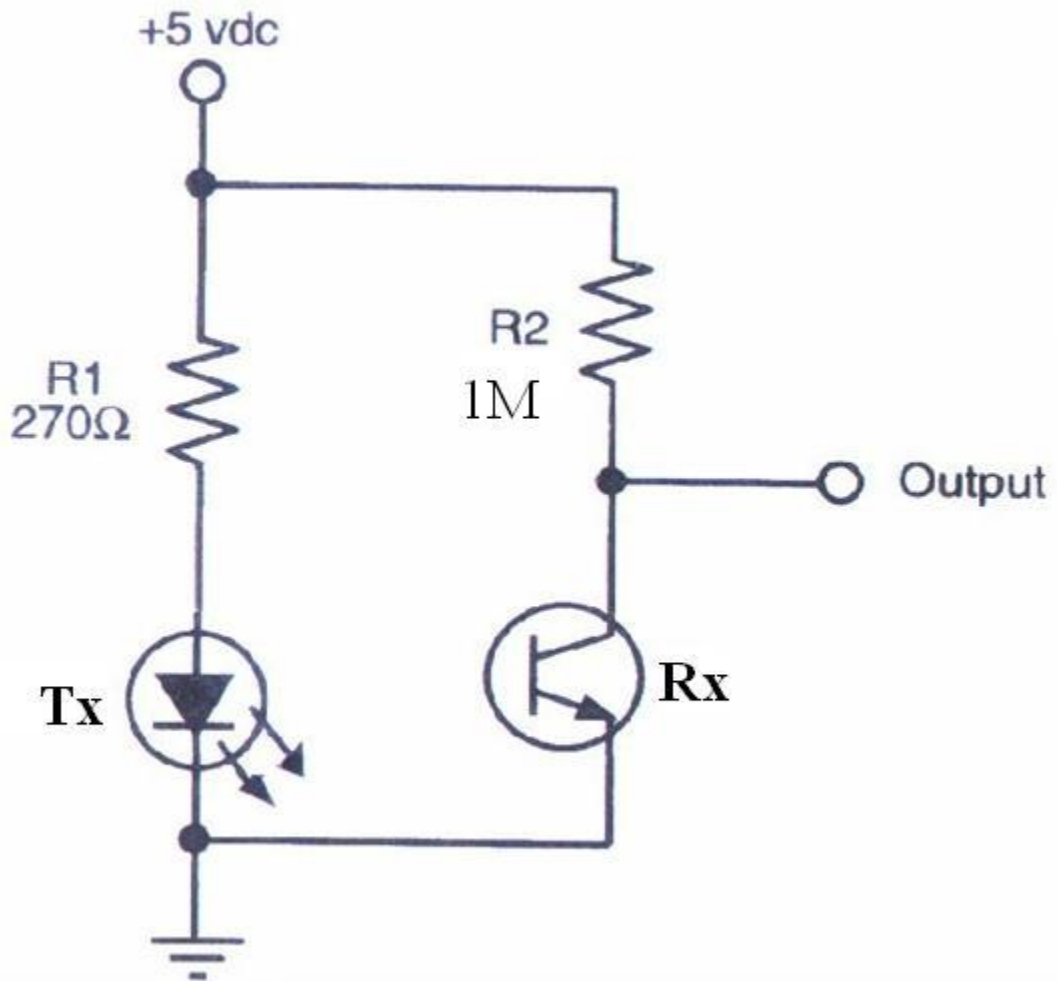
Fig 2.10:- Tx-Rx Pair Circuitry

The output voltage is in the form of analog voltage. One needs to convert it into digital format so that whenever IR is incident upon the Rx, the final conditioned output voltage is a logic high (binary 1) and whenever IR is not incident upon the Rx, the conditioned output voltage should be a logic low (binary 0).

One can use a comparator IC to serve this purpose. A comparator IC compares 2 input voltages using an op-amp and gives logic high or a logic low as the final output. LM324 is one such comparator.

Case1: when IR is not incident upon the Rx.

When the IR Tx is above a black line, the black line will absorb all the IR and will not reflect an appreciable amount of IR for the Rx to receive. If you are making an obstacle avoiding robot, then when there is no obstacle in front of the IR Tx, Rx will not receive back the

transmitted IR. However, when an obstacle comes in front of the Tx, it will reflect the IR incident upon it and hence Rx will receive the IR.

In this case, the output voltage of the sensor = 2.5v. Hence the input voltage at pin2 =2.5v. Input voltage at pin2 > input voltage at pin3 ; Output1=> logic 0
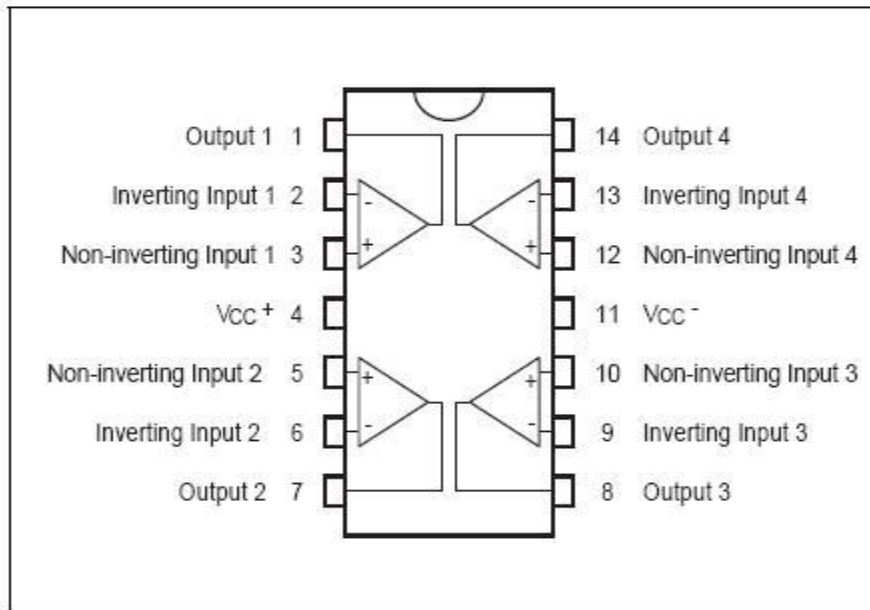
Fig 2.11:- PIN Connection of LM324

Black line or open space
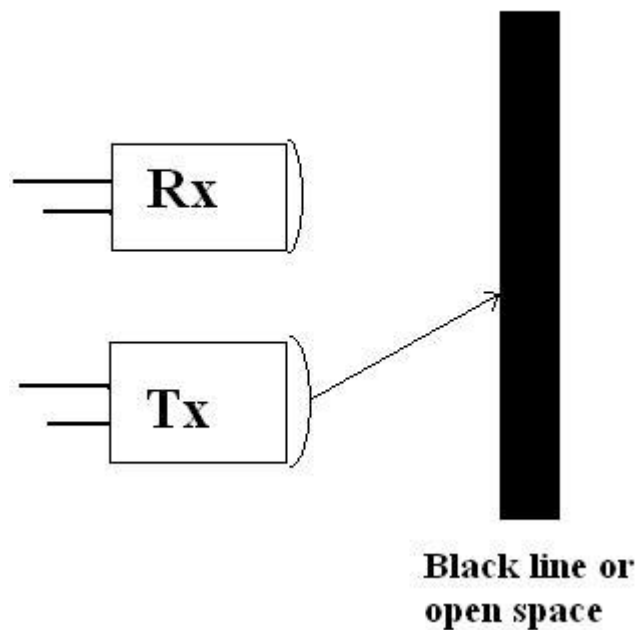
Case2: when IR is incident upon the Rx, the output voltage of the sensor = 1.8v. Hence the input voltage at pin2 =1.8v.

Input voltage at pin2 logic 1

white line or
obstacle
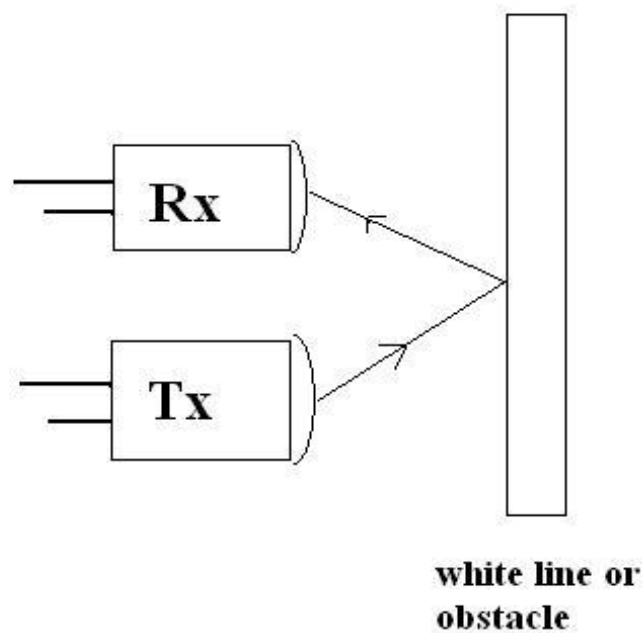
2.5 ATMEGA32 MICROCONTROLLER:-

ATMEGA 32 Development Board is made from double sided PTH PCB board to provide extra strength to the connector joints for increased reliability. Board can work on 7 to 15V AC or DC supply. It has built-in reverse polarity protection. 7805 voltage regulator has heat sink for heat dissipation so that it can supply 1Amp current continuously without getting over heated. It has switches for boot loading, reset and power. It also has RS232 interface with DB9 female connector based on MAX232. All the ports are connected to standard 10 pin FRC connectors. Open pads for connecting microcontroller's pins to external devices are also provided.
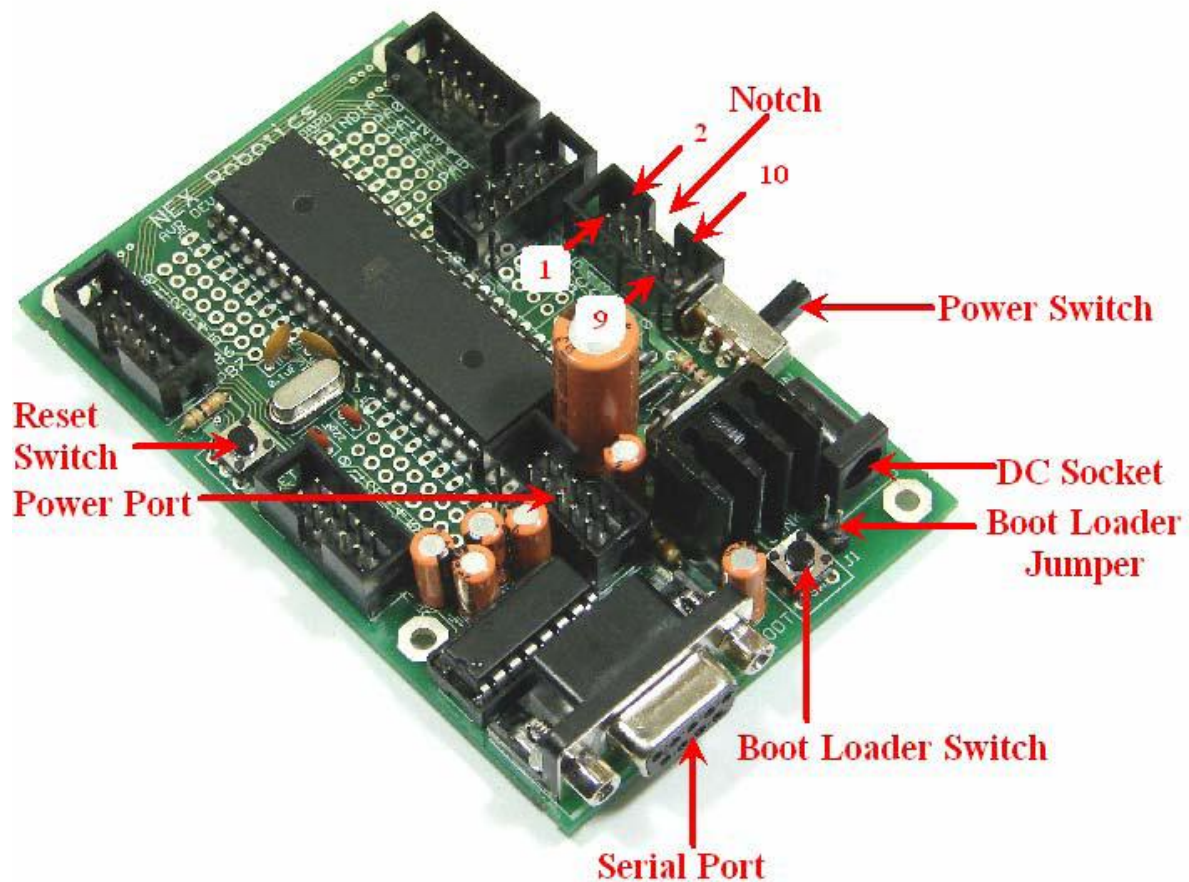
Fig 2.12:- ATMEGA32 DEVELOPMENT BOARD

Features

• High-performance, Low-power AVR® 8-bit Microcontroller

• **Advanced RISC Architecture**

– 131 Powerful Instructions – Most Single-clock Cycle Execution

– 32 x 8 General Purpose Working Registers

– Fully Static Operation

– Up to 16 MIPS Throughput at 16 MHz

– On-chip 2-cycle Multiplier

• **High Endurance Non-volatile Memory segments**

– 32K Bytes of In-System Self-programmable Flash program memory

– 1024 Bytes EEPROM

– 2K Byte Internal SRAM

– Write/Erase Cycles: 10,000 Flash/100,000 EEPROM

– Data retention: 20 years at 85°C/100 years at 25°C(1)

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– Optional Boot Code Section with Independent Lock Bits In-System Programming by On-chip Boot Program

--True Read-While-Write Operation

– Programming Lock for Software Security

• **JTAG (IEEE std. 1149.1 Compliant) Interface**

– Boundary-scan Capabilities According to the JTAG Standard

– Extensive On-chip Debug Support

– Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface

• **Peripheral Features**

– Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes

– One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode

– Real Time Counter with Separate Oscillator

– Four PWM Channels

– 8-channel, 10-bit ADC 8 Single-ended Channels.7 Differential Channels in TQFP Package Only2 Differential Channels with Programmable Gain at 1x, 10x, or 200x

– Byte-oriented Two-wire Serial Interface

– Programmable Serial USART

– Master/Slave SPI Serial Interface

– Programmable Watchdog Timer with Separate On-chip Oscillator

– On-chip Analog Comparator

• **Special Microcontroller Features**

– Power-on Reset and Programmable Brown-out Detection

– Internal Calibrated RC Oscillator

– External and Internal Interrupt Sources

– Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby

• **I/O and Packages**

– 32 Programmable I/O Lines

– 40-pin PDIP, 44-lead TQFP, and 44-pad QFN/MLF

• **Operating Voltages**

– 2.7 - 5.5V for ATmega32L

– 4.5 - 5.5V for ATmega32

• **Speed Grades**

– 0 - 8 MHz for ATmega32L

– 0 - 16 MHz for ATmega32

• **Power Consumption at 1 MHz, 3V, 25°C for ATmega32L**

– Active: 1.1 mA

– Idle Mode: 0.35 mA

– Power-down Mode: < 1 μA

PDIP

(XCK/T0) PB0	1	40	PA0 (ADC0)
(T1) PB1	2	39	PA1 (ADC1)
(INT2/AIN0) PB2	3	38	PA2 (ADC2)
(OC0/AIN1) PB3	4	37	PA3 (ADC3)
($\overline{SS}$) PB4	5	36	PA4 (ADC4)
(MOSI) PB5	6	35	PA5 (ADC5)
(MISO) PB6	7	34	PA6 (ADC6)
(SCK) PB7	8	33	PA7 (ADC7)
$\overline{RESET}$	9	32	AREF
VCC	10	31	GND
GND	11	30	AVCC
XTAL2	12	29	PC7 (TOSC2)
XTAL1	13	28	PC6 (TOSC1)
(RXD) PD0	14	27	PC5 (TDI)
(TXD) PD1	15	26	PC4 (TDO)
(INT0) PD2	16	25	PC3 (TMS)
(INT1) PD3	17	24	PC2 (TCK)
(OC1B) PD4	18	23	PC1 (SDA)
(OC1A) PD5	19	22	PC0 (SCL)
(ICP1) PD6	20	21	PD7 (OC2)

Fig 2.13:- ATMEGA32 PIN CONFIGURATION

Pin Descriptions :-

VCC - Digital supply voltage.

GND - Ground.

Port A (PA7..PA0) - Port A serves as the analog inputs to the A/D Converter.

Port A also serves as an 8-bit bi-directional I/O port, if the A/D Converter is not used. Port pins can provide internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. When pins PA0 to PA7 are used as inputs and are externally pulled low, they will source current if the internal pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B (PB7..PB0) - Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port C (PC7..PC0) - Port C is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. If the JTAG interface is enabled, the pull-up resistors on pins PC5(TDI), PC3(TMS) and PC2(TCK) will be activated even if a reset occurs. The TD0 pin is tri-stated unless TAP states that shift out data are entered.

Port D (PD7..PD0) - Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

RESET - Reset Input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.

XTAL1 - Input to the inverting Oscillator amplifier and input to the internal clock operating circuit.

XTAL2 - Output from the inverting Oscillator amplifier.

AVCC - AVCC is the supply voltage pin for Port A and the A/D Converter. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

AREF - AREF is the analog reference pin for the A/D Converter

Chapter – 03

SYSTEM HARDWARE & AVR PROGRAM FOR TRAFFIC CONTROL SYSTEM

3.1 Introduction

The hardware part of this project is Programmable logic controller (PLC), Power Pack, a traffic light model and pairs of Infra-Red Sensors.. The four ways traffic light model was constructed to display how this traffic light control system is running. This traffic light model has a complete set of traffic light signal which are red, yellow and green. Each lane also has one limit switches represent as a sensor on the road. The sensors are placed on each lane to detect the presence of a car at the junction.

3.2 Traffic light model

The four ways junction is developed using Woods, Screws, Light Emitting Diodes, Resistors and 12V light bulbs. his traffic light model will be four lane based traffic system. In order to display the simulation of the traffic light control system, each traffic light lane has a set of traffic light signal "Red, Yellow, and Green" which changes from red to yellow and then yellow to green and then yellow after that back to yellow and then finally red signal. In this duration, all other lanes have red light glowing to allow the vehicles from the lane having green signal to pass through that lane .As soon as the red light get switched on, the yellow light of next lane in order switches on and then its traffic lights changes in the same sequence. Each lane also has IR sensor on sideway of the road.

The sensor used for the design of these traffic light system is an infra-red detector which as an infra-red diode and transistor as a pair. The sensors are placed on each lane to detect and count the number of cars through that lane. Four infra-red sensors (detectors) are placed on 4 lanes coming to a junction, one per lane. The sensor is placed at a distance away from the junction so that it doesn't get disturbed by the vehicles stopping at the signal. These sensors are connected to the PLC, which counts the pulses coming from the sensors.From this combination of sensor, we will know the expected time for green signal on when each lane change to the green signal

3.3 CODE FOR TRAFFIC CONTROL SYSTEM

```c
#include<avr/io.h>

#include<util/delay.h>

int i,status1=0,status2=0,status3=0,status4=0;

int main()

{

    DDRA=0x00;

    DDRB=0xFF;

    DDRD=0xFF;

    PORTA=0xFF;

    PORTB=0x00;

    PORTD=0x00;


    int en,first,street;

    int emergency1,emergency2,emergency3,emergency4;

    int count1,count2,count3,count4;


    en=1;

    first=1;

    street=1;

    count1=0;count2=0;count3=0;count4=0;

    emergency1=0;emergency2=0;emergency3=0;emergency4=0;


    while(en)

    {

        if((PINA & 0b00001000) == 0b00001000)    //enable = 1 then system is on

        {

            if(first == 1)

            {
```

```
        PORTB|=0b10010000;        // red lights on for 1 n 2

        PORTD|=0b10010000;        // red lights on for 3 n 4

        _delay_ms(1000);

        first=0;

    }

    else

    ;

}

else

break;


switch(street)

{

    case 1:    PORTB&=0b01111111;        //set red light off

           PORTB|=0b01000000;        //set orange light on

           _delay_ms(1000);

           PORTB&=0b10111111;        //set orange light off

           PORTB|=0b00100000;        //set green light on

           for(int i=0;i<1;i++)

           _delay_ms(1000);        //green light on for atleast 10 seconds

           status1=1;

           while(status1)

           {

             if((PINA & 0b01000000) == 0b01000000)    //check if second street sensor activates

               { _delay_ms(1000);

                 count1=count1+1;}

             else

               {

               emergency1=1;

               }
```

25

```c
        if(emergency1 || (count1 >= 4))
        {
           count1=0;

           emergency1=0;

           status1=0;


           PORTB&=0b11011111;        //green light goes off

           PORTB|=0b01000000;        //yellow light goes on

           _delay_ms(1000);

           PORTB&=0b10111111;        //yellow light goes off

           PORTB|=0b10000000;        //red light goes on
        }
     }
     break;




case 2:    PORTB&=0b11101111;        //set red light off

     PORTB|=0b00001000;        //set orange light on

     _delay_ms(1000);

     PORTB&=0b11110111;        //set orange light off

     PORTB|=0b00000100;        //set green light on

     for(i=0;i<1;i++)

     _delay_ms(1000);        //green light on for atleast 10 seconds

     status2=1;

     while(status2)

     {

       if((PINA & 0b00100000)  == 0b00100000)    //check if third street sensor activates

       {_delay_ms(1000);

            count2=count2+1; }
```

```
            else
              {emergency2=1;


              }
          if(emergency2 || (count2 >= 4))
          {
            count2=0;
            emergency2=0;
            status2=0;


            PORTB&=0b11111011;      //green light goes off
            PORTB|=0b00001000;      //yellow light goes on
            _delay_ms(1000);
            PORTB&=0b11110111;      //yellow light goes off
            PORTB|=0b00010000;      //red light goes on
          }
        }
        break;



case 3:    PORTD&=0b01111111;      //set red light off
      PORTD|=0b01000000;      //set orange light on
      _delay_ms(1000);
      PORTD&=0b10111111;       //set orange light off
      PORTD|=0b00100000;      //set green light on
      for(i=0;i<1;i++)
      _delay_ms(1000);      //green light on for atleast 10 seconds
      status3=1;
      while(status3)
      {
```

```c
    if((PINA & 0b00010000) == 0b00010000)    //check if fourth street sensor activates
  { _delay_ms(1000);
     count3=count3+1;}
   else
   {
     emergency3=3;
   }
   if(emergency3 || (count3 >= 4))
   {
     count3=0;
     emergency3=0;
     status3=0;


     PORTD&=0b11011111;      //green light goes off
     PORTD|=0b01000000;      //yellow light goes on
     _delay_ms(1000);
     PORTD&=0b10111111;      //yellow light goes off
     PORTD|=0b10000000;      //red light goes on
   }
}
break;
case 4:    PORTD&=0b11101111;      //set red light off
PORTD|=0b00001000;      //set orange light on
_delay_ms(1000);
PORTD&=0b11110111;      //set orange light off
PORTD|=0b00000100;      //set green light on
for(i=0;i<1;i++)
_delay_ms(1000);      //green light on for atleast 10 seconds
status4=1;
while(status4)
```

```
                {
                    if((PINA & 0b10000000) == 0b10000000)    //check if first street sensor activates
                    { _delay_ms(1000);
                        count4=count4+1;}
                    else
                    {
                     emergency4=1;
                    }
                    if(emergency4 || (count4 >= 4))
                    {
                        count4=0;
                        emergency4=0;
                        status4=0;
                         PORTD&=0b11111011;        //green light goes off
                        PORTD|=0b00001000;        //yellow light goes on
                        _delay_ms(1000);
                         PORTD&=0b11110111;        //yellow light goes off
                         PORTD|=0b00010000;        //red light goes on
                    }
                }
                break;
            default:
                 PORTB|=0b11111111;
                 PORTD|=0b11111111;
                 break;
        }
        street=street+1;
        if(street==5)
        street=1;


    }
return 0;
```

Chapter – 04

RESULTS AND

DISCUSSIONS

All the system of the desired project was implemented and the results of the systems illustrated in this Chapter.

4.1 The Prototype

The prototype was mainly built by combining the wood design and the electrical designs. The 12V power supply needed for the operation of microcontroller and relay board is supplied using 12V DC power adapter.

4.2 Project Operation

The program is downloaded into Atmega 32 microcontroller and 12V power is supplied to both microcontroller and relay board. The traffic signal operation will start by the traffic lights illuminating in first red for all the lanes. Then the yellow light of one lane is illuminated for 2 seconds keeping the red light on for all the directions. Then green light of that lane is illuminated for 15 seconds and then again yellow light is illuminated for 2 seconds. As soon as the yellow light goes off, the red light of next lane in clockwise sequence changes to yellow and red light gets on of previous lane. The process is repeated for every lane and for the same duration until the emergency status is activated.

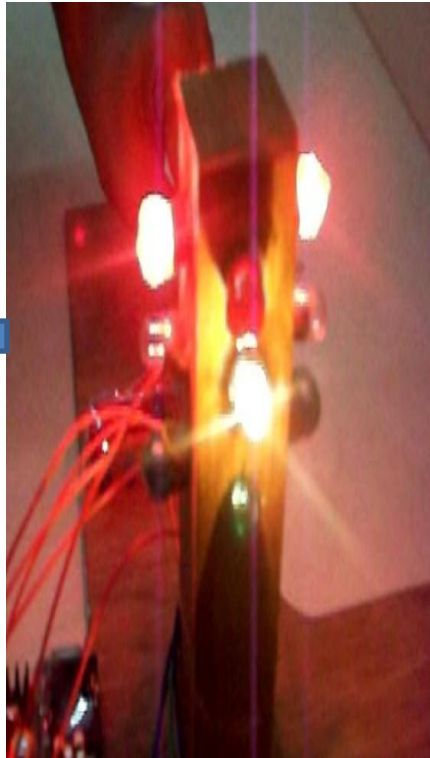**NORMAL TRAFFIC (emergency status off)**

All red lights ON

Yellow ON for lane 1

2 secs

All lights for lane 2 ,3 and 4 are changed in the same sequence

20 secs

Yellow light ON of lane 2

Green light ON of lane 1

4.3 EMERGENCY STATUS ON

The IR sensor is attached at some distance from traffic signal along each lane.These sensor keep track of amount of traffic along each road.When traffic signal is changing in normal traffic in one lane,the IR sensor of next lane keeps checking on the amount of traffic in that lane.When traffic becomes too high in that lane,the IR receiver detects the light reflected back from the vehicle and the emergency status of that lane becomes ON and the time duration of green signal of that lane is increased upto 30 secs to get rid off from the heavy traffic.Same process is carried on for the all the lanes.
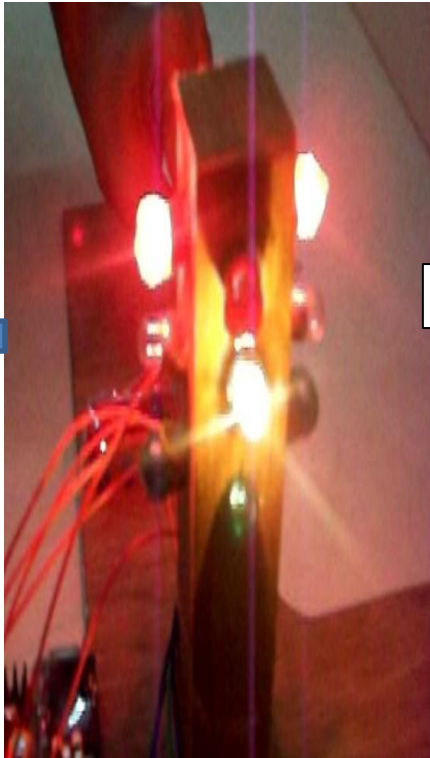
All red lights ON

Yellow ON for lane 1

2 secs

Lights in lane 2 ,3 and 4 are changed will be changed according to their respective emergency status

30sec

Yellow light ON of lane 2

Green light ON of lane 1

(Emergency status ON)

4.4 Advantages

The traffic light system that had been developed presents several advantages. Since the waiting time of the vehicles for the lights to change is optimal, the emission of carbon monoxide from the vehicles is reduced. This will give a positive effect to the greenhouse effect towards the environment.

The traffic light system will also save the motorists' time and reduce their frustration while waiting for the lights to change since it helps in reducing congestion at the traffic intersections.

Chapter – 05

CONCLUSION

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

A traffic light system had successfully been designed and developed with proper integration of both the hardware and the software.. The infra-red sensors were interfaced with the Atmega 32 Microcontroller. This interface is synchronized with the whole process of the traffic system. It could be seen from the objectives of this project, that knowledge and skills were combined together in order to complete this task. For this project, the knowledge of sequential systems, electrical and electronics applications had been proven. The skill involved in this project is the programming skills which makes you to think more as a student.   The system will encounter problems without proper integration of both the hardware and software related to this project.   Besides, this project, gave a challenge of having to learn some other craft related work like painting, drilling, cutting of metals and woodwork. Automatically, this project could be programmed in any way to control the traffic light model and will be useful for planning road system.

5.2 Recommendation

The efficient operation can be achieved when there are enough Input/output cards for the entire component used in this system.   A more sophisticated and flexible PLC with enough input/output cards should be used to provide enough functionality for the traffic light system.

The traffic light system should be programmed and necessary circuitry added to operate in three modes namely: Day, Emergency and Night modes. A wider area board should be used in order to achieve this.

This prototype can easily be implemented in real life situations. Increasing the number of sensors to detect the presence of vehicles can further enhance the design of the traffic light system. Another room for improvement is to have the infrared sensors replaced with an imaging system/camera system so that it has a wide range of detection capabilities, which can be enhanced and ventured into a perfect traffic system. Different sensors should be used on each lane, to test communication strength with the microcontroller.

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