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Name of the subject: Microcontroller and its Applications   ECE3003

Name: Manish Kondala

Reg no and mobile no:17BEC0845 and 9052659751

Team members:

Kondala Manish – 17BEC0845

M. Sai Pranav Reddy – 17BEC0708

P. Uday Kiran – 17BEC0653

Sparsh Arya – 17BEC0656

1)Introduction:

Conventional traffic light system is based on fixed time concept allotted to each side of the junction which cannot be varied as per varying traffic density. Junction timings allotted are fixed. Sometimes higher traffic density at one side of the junction demands longer green time as compared to standard allotted time.

The proposed system using an 8051-microcontroller interfaced with IR sensors, changes the junction timing automatically to accommodate movement of vehicles smoothly avoiding unnecessary waiting time at the junction.

The sensors used in this project are IR is in line of sight configuration across the loads to detect the density at the traffic signal. The density of the vehicles is measured in three zones i.e., low, medium, high based on which red or green light are glowed accordingly.

Further the project can be enhanced by synchronizing all the traffic junctions in the city by establishing a network among them. The network can be wired or wireless. This synchronization will greatly help in reducing traffic congestion, although we are not implementing it in this project.

2)Motivation:

Do you remember the time when you had to wait for the signal to go green, even though there were no people on the other side of the road?

Nowadays, controlling the traffic becomes major issue because of rapid increase in automobiles and also because of large time delays between traffic lights. So, in order to rectify this problem, we will go for density-based traffic lights system. In this project we are trying to explain how to control the traffic based on density.

With this idea, we can manage traffic more efficiently than the existing traffic control systems. The fact that there was a solution for this problem motivated us to implement this project with 8051 in this course.

3)Literature survey:

The papers referred to in [1][2][3] are the basis to this project.

In [1] we have found that they have successfully studied and proved the results of an optimised traffic light controller in a city using IR sensors and microcontroller. They have done this on a basis of vehicle count and the microcontroller decides the traffic light delays and showed the possibility of future expansion of the project in a big scale

In [2] they take a rather different approach completely changing the perspective by using OpenCV and raspberry pi to calculate the density by detecting the number of cars using a software algorithm.

In [3] they show us a really cost-effective way of making a density-based traffic control that can be implemented in real life.

After analysing all the references, we have found a model that we can do with the resources available.

4)Project Background:

We promised to deliver the project fully functional, in order to do it we need to have some prerequisites. We are supposed to know the interfacing of IR sensors with 8051 , LCD screen with 8051 , LED's with 8051 and also be proficient in ASSEMBLY LANGUAGE PROGRAMING language to program the chip ,simulating it in a software (Proteus in our case) , basic knowledge of today's traffic system and need to know complete information about 8051 working to deliver this project.

5)Objective:

Our objective is to build a two-lane density-based traffic control system with four IR sensors, one LCD and four LED's as traffic lights. We use four IR sensors to detect the traffic density, use LCD, LED's to display traffic signal status and traffic lights.

6)Project description and goals:

This project is all about finding the density or number of cars in a road and giving signals according to the density from IR sensors. The details of all the design aspects will be in the design section, but I can describe the project vaguely.

2 IR sensors on both sides of the road will help us to describe the density of the road by giving the density as high or low or medium .For example if the density detected is low in a lane and high in second lane ,the second lane will be given green light and 1st line will be given red light and also display that 1st line -low and 2nd line-high in LCD display

This project has two main goals:

One is to detect the density and the other is to display the information relevant to people based on the data from the traffic lights

7)Technical Specifications:

Technical specifications of all the main components used:

a) IR sensor:

Basic principle:
Emits IR rays and detects the reflection of the sent rays giving us an analogue value at the output pin. (can be converted to digital)

IR sensor emits and detects only infrared rays (which are invisible to the naked eye), it has an IR LED and IR photodiode.

Operation voltages-3.0 to 5.0v
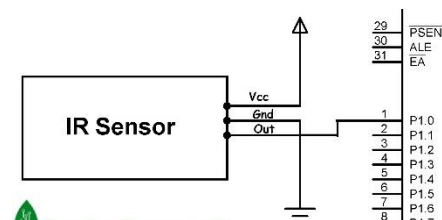
Detection range – 2cm-30cm

Outputs low logic level when detected

Interfacing with 8051:
For this project we are not using an adc so we are only working with one bit of data from each sensor and the interfacing is fairly simple.
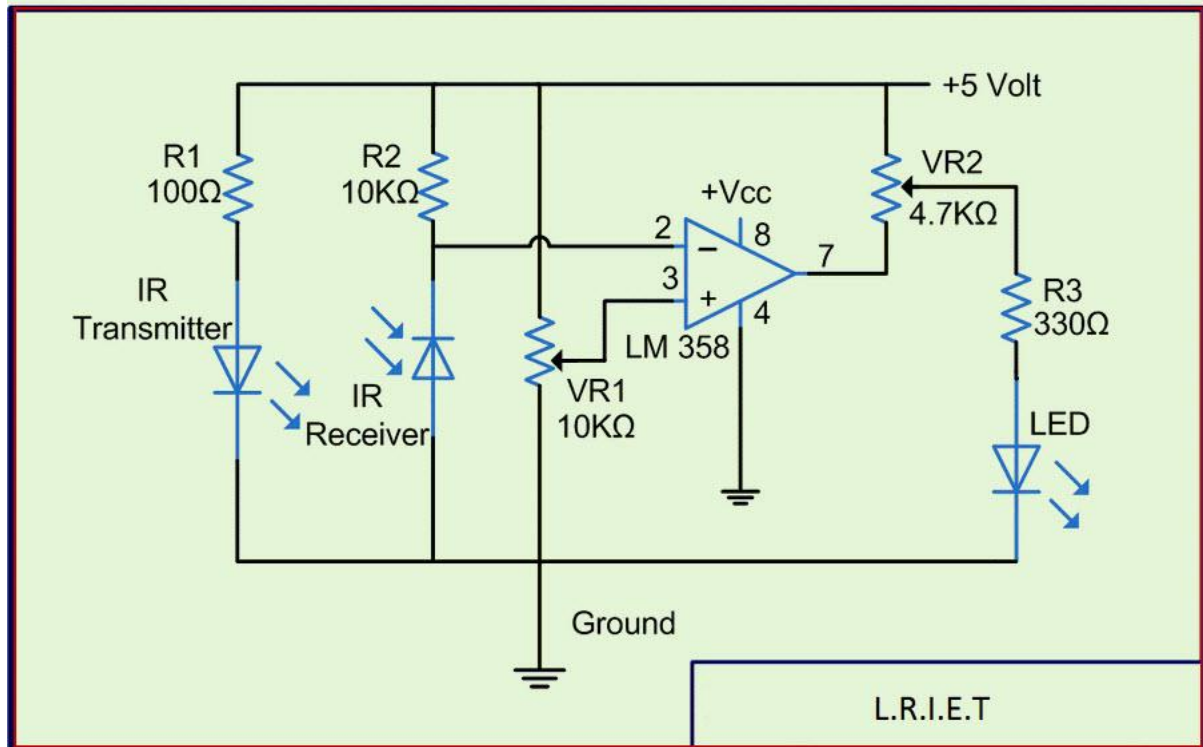
3 pins

Vcc- connect to 5v dc

Gnd – connect to ground

Vout – connected to a port (this is where we get the output either 0 or 1)

Uses:
1) we used it to detect obstacles and estimate the distance

2)can measure heat

3)can detect motion

Circuit diagram and image:

b) LCD:

Basic principle:

We are using a 16*2 LCD which essentially means that it has 16 columns and two rows of letters to display. Each element is lit up by 5*7 crystals embedded inside.

Interfacing with 8051:

There are 16 pins in LCD,

VSS- connected to ground

VCC- 5v DC supply

VEE – contrast adjustment (can vary contrast by varying voltage at this pin)

RS-Register selection (LCD has 2 registers Data(high) and command Registers(low))

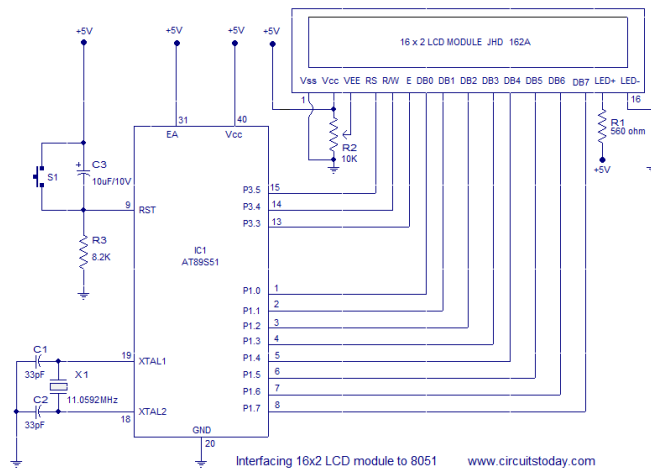R/W – Read(high) or Write/command(low)

E – Enable (high to low transition to enable this module)

DB0-7- data pins

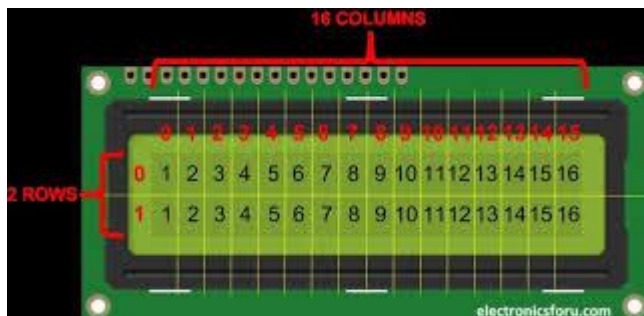LED+ - increase backlight

LED- - decrease backlight

The commands can be referred to in [4]

Interfacing 16x2 LCD module to 8051   www.circuitstoday.com

Uses:

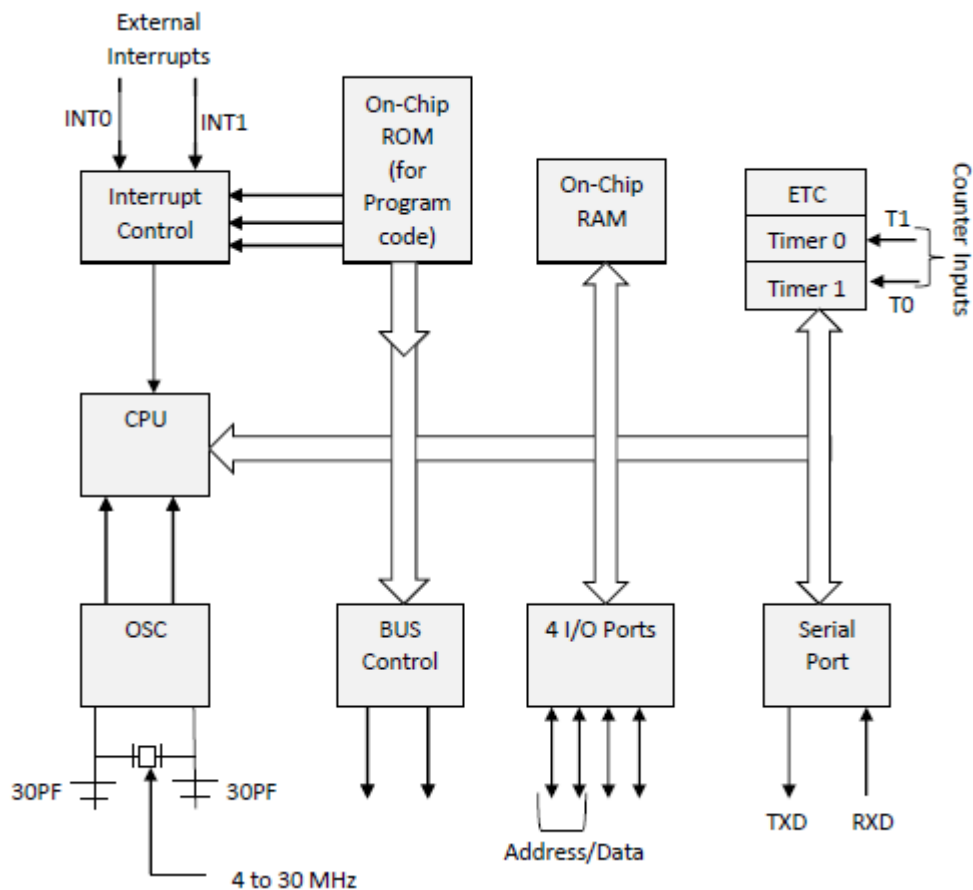Generally used to display letters, characters and numbers.

Image:

c)8051 microcontroller:

Basic overview:

8-bit microcontroller with 40 pins DIP(4 parallel ports),4kb ROM ,128bytes RAM,2 16-Bit timers and 12MHz crystal oscillator
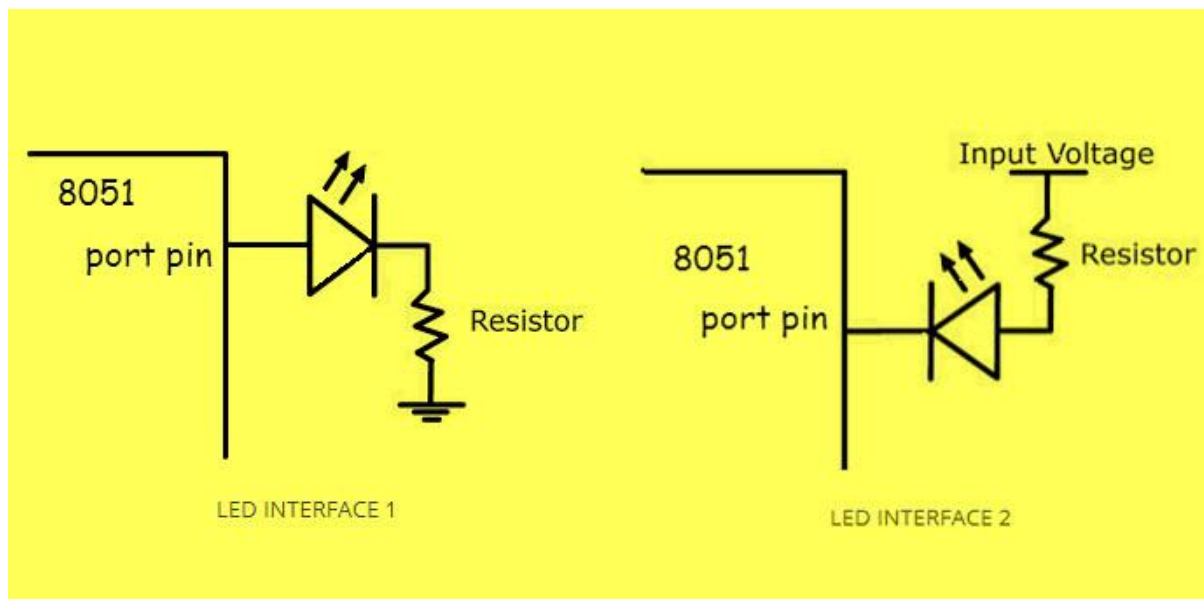
Block diagram:

d)LED's:

Basic principle:

Light emitting diode is a semiconductor device that emits light in different colours when an electric current is passed through it.

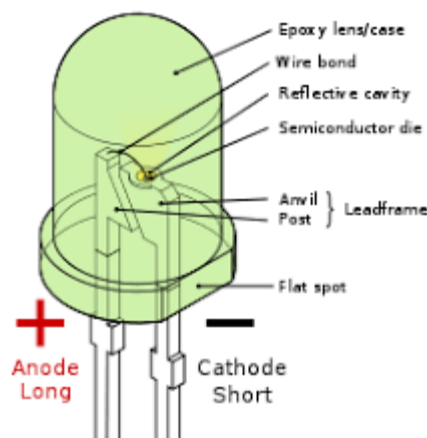### Interfacing with 8051:

We can interface LED's in two ways:

1)LED glows only if pin value is high as current flows towards ground

2)LED glows only if pin value is low as current flows towards pin

Uses:

1)Used to backlight screens

2)Used in automotive vehicles

Image:

8)Design approach:

We designed this model of density-based traffic signal has three essential parts:

1)modelling density:

We have arranged two IR sensors in each lane one in the front and one in the back to get the density.

We judge density as high or low or medium based on the following values from the ir sensor.

If it's

    00- Lane is empty (low density)

    01 or 10- lane is half empty (medium)

    11- lane is full(high)

2)To display red or green light in each lane based on density:

so there are nine possible cases that can happen based on 3 density values which are(and which lane gets green signal or red is mentioned)

Lane A	lane B
Full(green)	full(red)
Full(green)	half(red)
Full(green)	empty(red)
Half (red)	full(green)
Half (green)	half (red)
Half (green)	empty(red)
Empty(red)	full(green)
Empty(red)	half(green)
Empty (red)	empty (red)

For special cases such as

full and full- Lane A will be given priority for 2 seconds and then checks for density again.

Half and half – Lane A will be given priority for 2 second and then checks for density again

Empty and empty - It displays red and red in both and keeps on checking for density
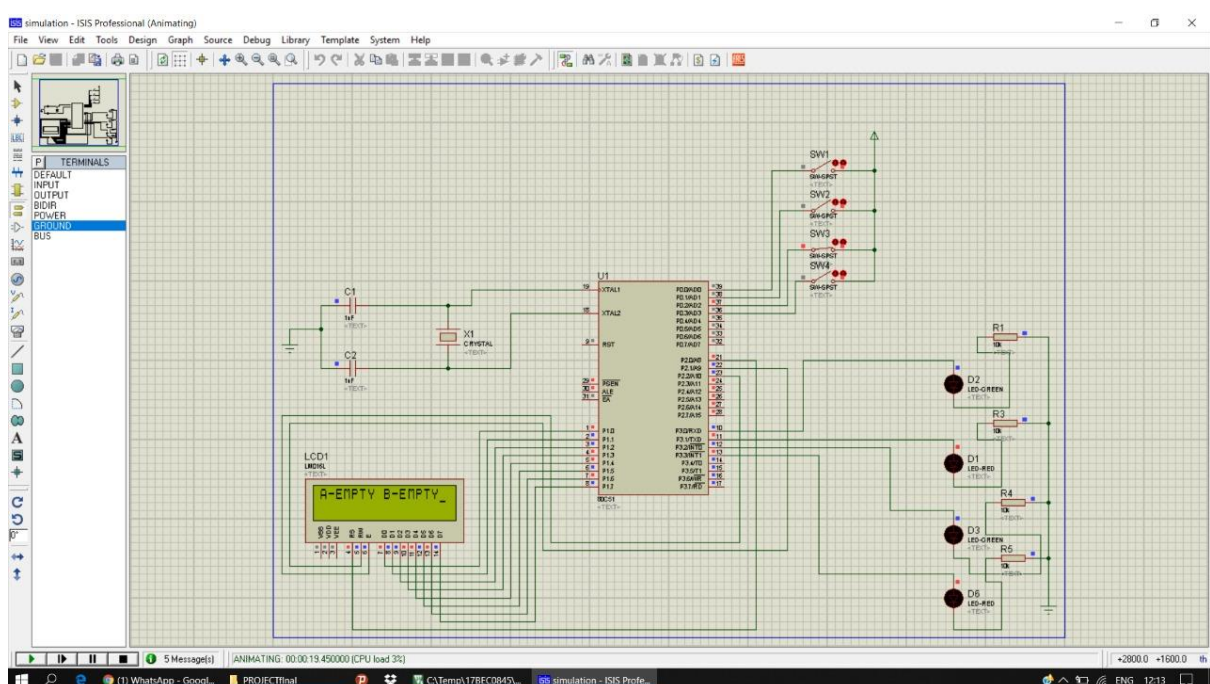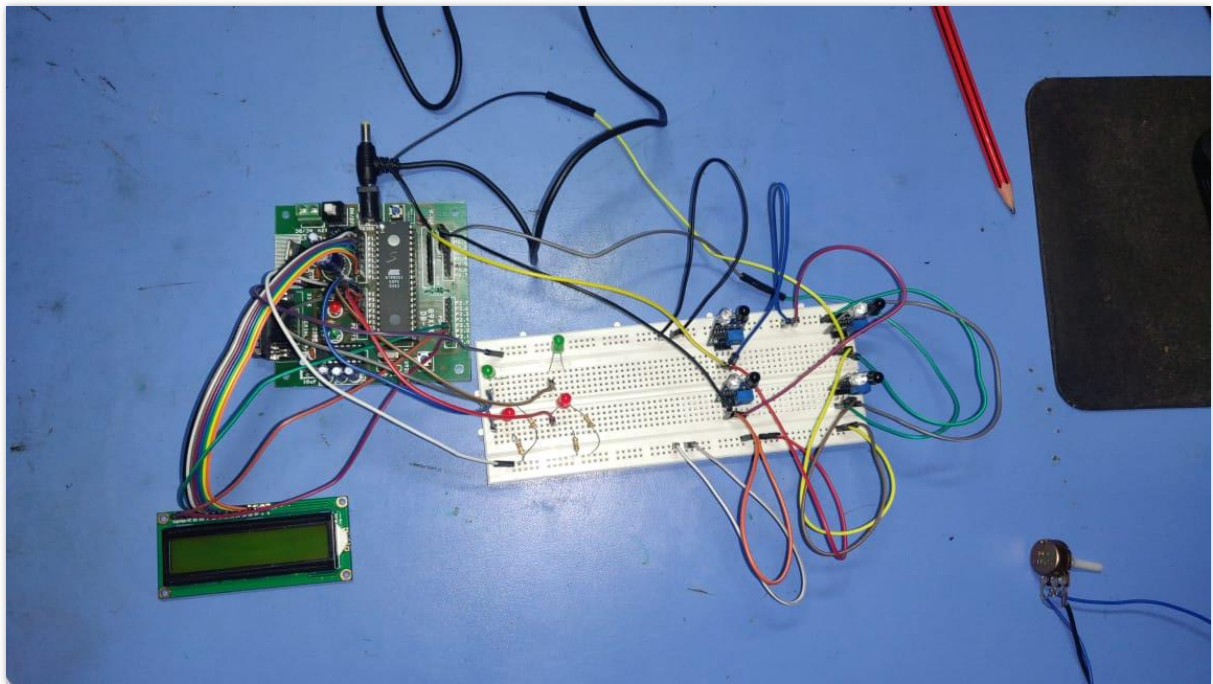
3)To display the status of each lane on LCD:

As per the above-mentioned half and empty status of the lane is displayed using LCD

Example: lane A-Full

Lane B-empty

9)Project Demonstration:

10)Individual Contributions:

pranav→LCD, IR sensor interfacing code and report

Manish→IR sensor, LED interfacing code and overall hardware

Uday→LCD, IR sensor interfacing and report

Sparsh→IR sensor, LED interfacing code and overall hardware

11)Conclusions:

The project used with advanced technology can be used all over the world where there are traffic signals and have a lot of potential to contribute to future automation. Using this project in future, we can know traffic density in the city and new innovative road solutions and public transport calculations can be made according to that.

There is humongous need of efficient traffic management system in our country, as India meets with 384 road accidents every day. To reduce this congestion and unwanted time delay in traffic an advanced system is designed here in this project. With field application of this technology, the maddening chaos of traffic can be effectively channelized by distributing the time slots based on the merit of the vehicle load in certain lanes of multi junction crossing. We have successfully implemented the prototype with decent recourses available. The next step forward is to implement this in real life scenario for incredible results. We believe that this may bring a revolutionary change in traffic management system on its application in real world.

12)References:

[1] Ms Promila Sinhmar "Intelligent traffic light and density control using ir sensors and microcontroller" International Journal of Advanced Technology & Engineering Research.

[2] K.Vidhya, A.Bazila Banu "Density Based Traffic Signal System" International Journal of Innovative Research in Science, Engineering and Technology.

[3] Ganiyu R. A., Arulogun O. T., Okediran O. O. "Development Of A Microcontroller-Based Traffic Light System For Road Intersection Control"International journal of scientific & technology research.

[4] http://www.circuitstoday.com/interfacing-16x2-lcd-with-8051

[5] https://www.elprocus.com/led-interfacing-with-8051-microcontroller/