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Innovative Technology For Smart Road

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Abstract:

In traffic junction, we can see red, orange and green lights along with the displaying timer. The traffic as to wait for a fixed period of time to make a move. For example, one as to wait for a fixed period of time even though the traffic is more in that particular lane. This leads to "TRAFFIC JAM" which is a major problem – the society is facing. Along with, another added problem that our country is facing is "SCARCE OF ELECTRICITY". Street lights are always switched ON at midnights. For example, even if there are no vehicles moving at midnight, street lights are glowing which is not actually necessary. Improper utilization of street light, electricity is used unnecessarily which is a "NATIONAL WASTE".

Index Terms — IR (infrared) sensor, Pic Micro-controller

I. Introduction

In modern life we have to face with many problems one of which is traffic congestion becoming more serious day after day. It is said that the high volume of vehicles, the inadequate infrastructure and the irrational distribution of the development are main reasons for increasing traffic jam. The major cause leading to traffic congestion is the high number of vehicle which was caused by the population and the development of economy. Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The most common example is the physical use of roads by vehicles. When traffic demand is great enough that the interaction between vehicles slows the speed of the traffic stream, these results in some congestion .As demand approaches the capacity of a road (or of the intersections along the road), extreme traffic congestion sets in. When vehicles are fully stopped for periods of time, this is colloquially known as a traffic jam or traffic snarl-up. Traffic congestion can lead to drivers becoming frustrated and engaging in road rage. In order to avoid the congestion in the traffic. In traffic environments, Traffic Sign Recognition (TSR) is used to regulate traffic signs, warn the driver, and command or prohibit certain actions. A fast real-time and robust automatic traffic sign detection and recognition can support and disburden the driver, and thus, significantly increase driving safety and comfort. . Due to the massive growth in urbanization and traffic congestion, intelligent vision based traffic light controller is needed to reduce the traffic delay and travel time especially in

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developing countries as the current automatic time based control is not realistic while sensorbased traffic light controller is not reliable in developing countries. Traffic congestion is now considered to be one of the biggest problems in the urban environments. Traffic problems will be also much more widely increasing as an expected result of the growing number of transportation means and current low-quality infrastructure of the roads. In addition, many studies and statistics were generated in developing countries that proved that most of the road accidents are because of the very narrow roads and because of the destructive increase in the transportation means. Christo Ananth et al. [2] proposed a system about Efficient Sensor Network for Vehicle Security. Today vehicle theft rate is very high, greater challenges are coming from thieves thus tracking/ alarming systems are being deployed with an increasingly popularity. This idea of controlling the traffic light efficiently in real time has attracted many researchers to work in this field with the goal of creating automatic tool that can estimate the traffic congestion and based on this Variable, the traffic sign time interval is forecasted In order to prevent the loss of electricity in street lights which is unnecessarily used, we deploy light sensors and motion sensors which can minimize the wastage of electricity.

II. Proposed Method

Infrared sensors are used to detect the traffic intensity which gives a signal to PIC microcontroller about the traffic intensity and this will be able to clear the traffic.This is used to clear the traffic jam which is the major problem in the cities. Camera module is used to identify the vehicles which are violating the traffic rules, also a remote is given for emergency vehicle to change the signal and it is differentiated with the different colour.

In this system, sensors are used to prevent loss of energy by the unnecessary usage of street lights at midnight. At nights street lights are switched ON even if there are no travelling vehicles. So, in order to overcome this, sensors are used for street lights and when a vehicle pass through the sensors, the street light is switched 'ON' and when the vehicle passes the particular street light, the next street light will be switched 'ON' automatically and the previous lights are switched 'OFF'. This is continued throughout the street thereby saving the energy.

2.1 Block Diagram

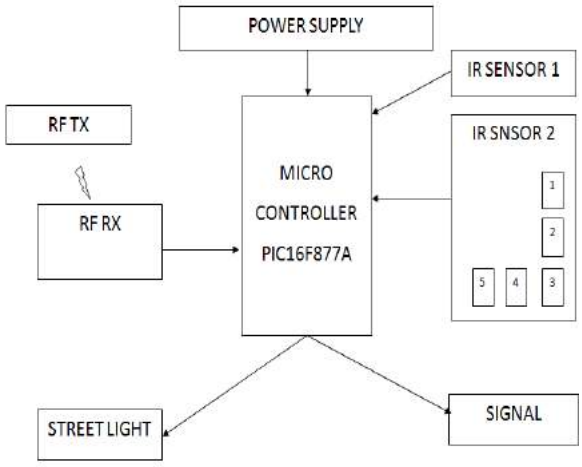

fig : 1 block diagram

IR transmitter and receiver will be placed on either side of the road at some distance from the traffic signal.IR Rays passes between the transmitter and receiver continuously.

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Whenever a vehicle passes between the transmitter and receiver, it blocks the IR rays to pass from transmitter to receiver. So whenever a vehicle blocks the IR rays, the IR sensor consider it as count and it also increments the count value for each vehicle entry. The IR sensor senses the density of the traffic for a regular interval of time in when the vehicle passes the particular street light, the next street light will be switched 'ON' automatically and the previous lights are switched 'OFF'.

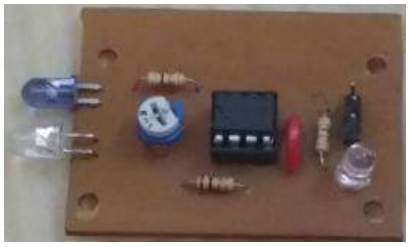

Fig.2 : Infra sensor

An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. It is also capable of measuring heat of an object and detecting motion. Infrared waves are not visible to the human eye. In the electromagnetic spectrum, infrared radiation is the region having wavelengths longer than visible light wavelengths, but shorter than microwaves. The infrared region is approximately demarcated from 0.75 to 1000µm. The wavelength region from 0.75 to 3µm is termed as near infrared, the region from 3 to 6µm is termed mid-infrared, and the region higher than 6µm is termed as far infrared. Infrared technology is found in many of our everyday products. For example, TV has an IR detector for interpreting the signal from the remote control. Key benefits of infrared sensors include low power requirements, simple circuitry, and their portable feature.

this manner and sends the information to the PIC. The count in the traffic signal can be adjusted by the controller based on the density of traffic received from IR sensor. In Street light IR sensors are used for street lights and when a vehicle pass through the sensors, the street light is switched 'ON' and

B. PIC MICROCONTROLLER:

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1640 originally developed by General Instrument's Microelectronics Division. The name PIC initially referred to "Peripheral Interface Controller".PICs are popular with developers and hobbyists alike due to their low cost, wide availability, large user base, extensive collection of application notes, availability of low cost or free development tools, and serial programming (and re-programming with flash memory) capability.

The Major Features of PIC 16F877A Micro Controller:

1) It consists of only 35 single word instructions

2) All single cycle instructions except for program branches are of two cycles

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3) Operating speed: DC - 20 MHz clock input
4) DC - 200 ns instruction cycle
5) Interrupt capability (up to 14 sources)
6) Eight level deep hardware stack
7) Direct, indirect and relative addressing modes
8) Power-on Reset (POR), Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)
9) Watchdog Timer (WDT) with its own on-chip RC oscillator for reliable operation
10) Power saving SLEEP mode
11) Selectable oscillator options
12) Low-power, high-speed CMOS FLASH/EEPROM technology
13) Wide operating voltage range
14) Provides commercial and Industrial temperature ranges
15) Low-power consumption

2.3 Circuit Descriptions

A. Power supply:

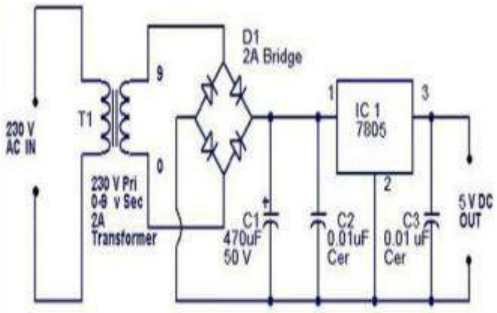

Fig 3: Power Supply

In most of our electronic products or projects we need a power supply for converting mains AC voltage to a regulated DC voltage. For making a power supply designing of each and every component is essential. Here I'm going to discuss the designing of regulated 5V Power Supply.
Let's start with very basic things the choosing of components

Component List :

1. Step down transformer
2. Voltage regulator
3. Capacitors
4. Diodes

Let's get into detail of rating of the devices :

Voltage regulator :

As we require a 5V we need LM7805 Voltage Regulator IC.
7805 IC Rating :

- Input voltage range 7V- 35V
- Current rating I_c = 1A
- Output voltage range $V_{Max=5.2V}$, $V_{Min=4.8V}$

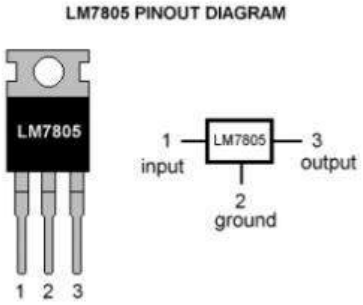

Fig 4:LM7805 – Pin Diagram

Transformer :

Selecting a suitable transformer is of great importance. The current rating and the secondary voltage of the transformer is a crucial factor.

- The current rating of the transformer depends upon the current required for the load to be driven.
- The input voltage to the 7805 IC should be at least 2V greater than the required 2V output, therefore it requires an input voltage at least close to 7V.

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- So I chose a 6-0-6 transformer with current rating 500mA (Since 6*√2 = 8.4V).

NOTE : Any transformer which supplies secondary peak voltage up to 35V can be used but as the voltage increases size of the transformer and power dissipation across regulator increases.

Bridge Rectifier :

The full wave bridge rectifier is designed to convert an AC sine wave to an full wave pulsating DC signal . The bridge isnormally connected to the secondary terminals of the transformer. Current will flow from a point with a higher potential to a point of lower potential.Consider a center tapped transformer of 12V-0-12VAC. If we use full wave rectifier for rectification the output voltage of full wave rectifier is 12V DC. Because in full wave only one diode conduct during each cycle. If we use bridge rectifier for rectification the output voltage of bridge rectifier is 24V DC. It is twice that of the full wave rectifier output. Because in bridge rectifier two diodes conducts during each cycle. For only center tapped transformer we use bridge rectifier for higher voltage, for lower voltage we can use either bridge rectifier or full wave rectifier For normal transformer the output of full wave rectifier and bridge rectifier is same. So we can use either full wave rectifier or bridge rectifier. Full wave rectifier produces lower voltage and bridge rectifier produces higher voltage for center tapped transformers . We can generate either higher voltage or lower voltage by using bridge rectifier for center tapped transformer.

2.4 Proposed circuit diagram

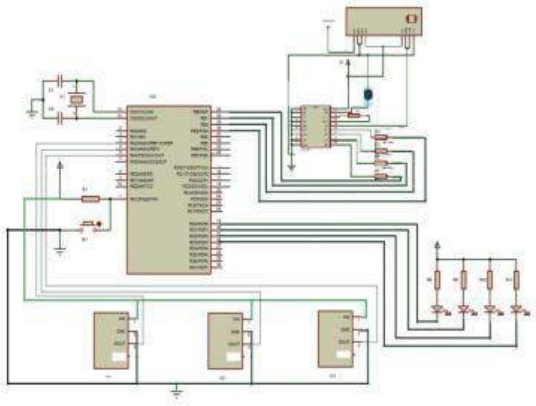

fig5: Interfacing diagram of Strret light using IR Sensor

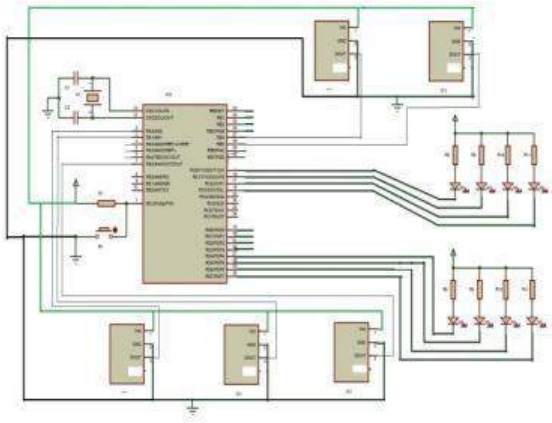

fig6: Interfacing diagram of traffic signal using IR Sensor

BRIEF DESCRIPTION OF IR & PHOTO DIODE SENSING SWITCH

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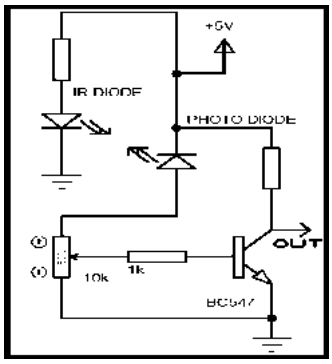

Fig 7: IR and Photodiode

IR diode is connected through a resistance to the dc supply. A photo diode is connected in reverse biased condition through a potential divider of a 10k variable resistance and 1k in series to the base of the transistor. While the IR rays fall on the reverse biased photo diode it conducts that causes a voltage at the base of the transistor. The transistor then works like a switch while the collector goes to ground. Once the IR rays are obstructed the driving voltage is not available to the transistor thus its collector goes high. This low to high logic can be used for the microcontroller input for any action as per the program

Working:

The project uses the IR interruption concept for providing logic state change to the input of the MC as explained above. The project uses a number of IR diodes facings photodiodes. Thus the transistors Q_1, Q_2, Q_3, Q_4, Q_5 are in conducting state. As the collector of those transistors are connected to corresponding port pins form as an input for the program to the executed based on change of logic state.

Twelve number of LEDs representing as signal lights are connected to the output of the MC in sink mode to port ‘o’, port 1 & port 2. While all the input coming from Q1 to Q5 are in logic low state, the output LED’s i.e., 3 per junction that is Red, Amber & Green of each side way of a four traffic junction follow switch ON green timing in fixed intervals in a sequential clockwise direction. Thus during low traffic density in one of the way, fixed green timing for each way in a junction are provided. While any one of the way is blocked with more no.of vehicles the IR blocking happensThere are three zones with three set of IR sensing arrangement In this project the transistors Q_1 to Q_5 goes high because of IR interruption while the vehicle comes in between the photodiode & the IR diode.This the logic high sensed at the MC input changes the green ON time to a higher value for allowing more vehicles to pass through. After sometime similarly any other way gets more traffic, the sequential timing gets automatically increased for that way. Each way is divided into 3 active zones, each zone representing some specific length. Based on the IR interruption the green ON time increases, thus more the vehicle longer will be the green signal time. Thus dynamic time control is achieved based on the traffic density.

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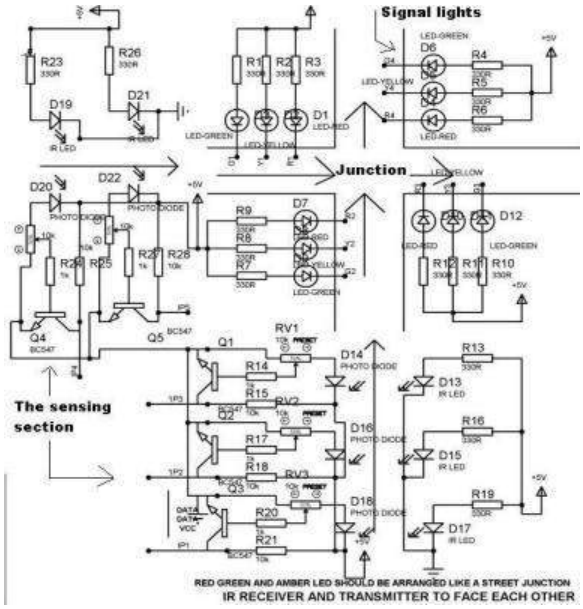


Fig 10 : For Traffic Signals

Following section takes care of RF override

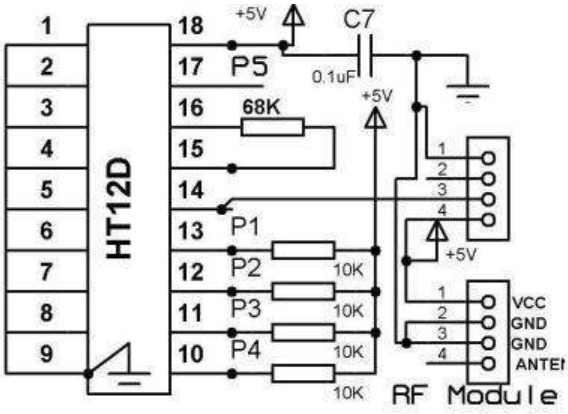
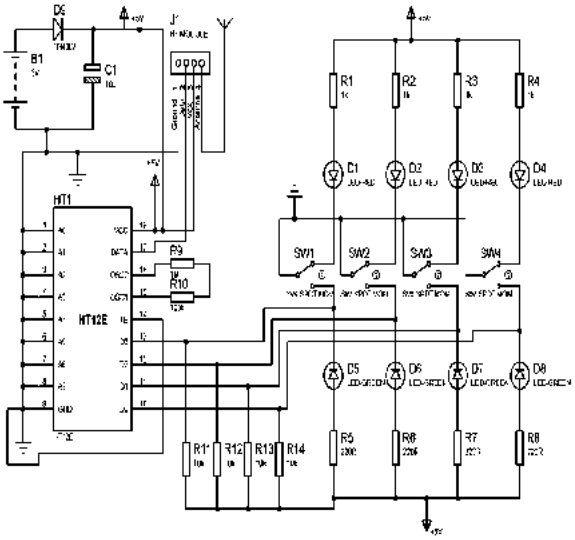


Fig 11 : Rf Override

The above circuit is used for receiving the serial data over the RF receiver module and then feed the 4 bit data to the controller from P1,P2,P3,P4 .

Following circuit is used for RF transmit inn override mode



The circuit is powered by a battery with D9 working as reverse protection .Sw1 to sw4 placed on the hand held unit are meant as to which direction the emergency vehicle is required to move.. Thus based on the switch ,the corresponding LED glows to indicate the direction of override and the same is fed in form of 4 bit data to the HT12E the encoder IC that sends serially the data to the transmitter module placed at J1. This data is received by the receiver as explained above to enable only one green traffic signal LED in a junction of 4 while all the rest 3 are kept in red. Thus the emergency vehicle gets green signal. After a preset time the junction returns to normal sequence time based traffic signal with density sensing as usual as explained earlier.

1. DC power supply circuit:

It comprises of a step down transformer (230v-12v AC), bridge rectifier circuit, a voltage regulator with filter capacitors and a power indicating LED. The step down transformer directly converts 230v AC to 12v AC supply. The output is still AC and it fluctuates around 12v. This

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12v AC is given as input to a bridge rectifier circuit which converts it to 12v pulsating DC. The pulsating DC obtained as output from the rectifier is given to voltage regulator through a filter capacitor. The main function of voltage regulator is to provide a constant voltage of 5v. In other words, if there is any fluctuation in the input of regulator, but the output will be a constant 5v DC. The capacitor1 (470microf) filters out the pulsating DC to ripple less DC. The second capacitor eliminates any other ripples in the output. Thus, we get a steady supply of pure 5v DC. This is indicated by the LED which is present in the power supply circuit.

3. Highway street light circuit:

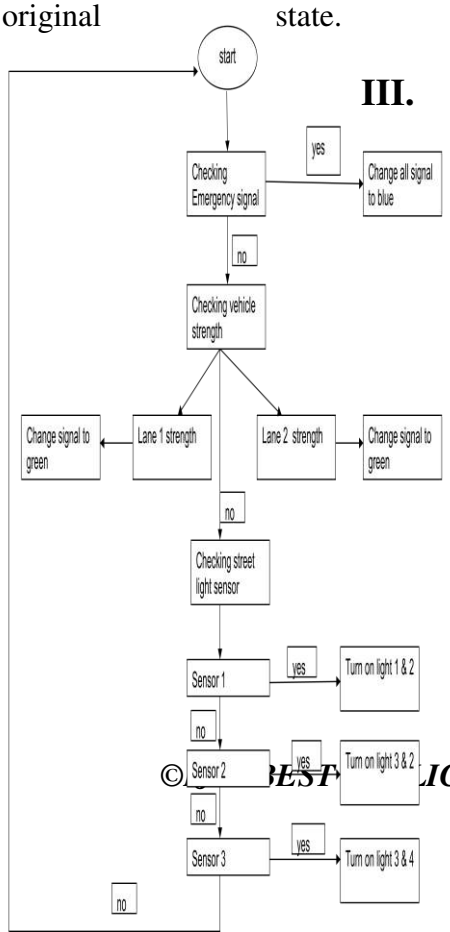
The highway model consists of 14 streetlights and 8 pairs of photodiodes-IR diodes used as sensors, variable resistors and transistors which acts as switch. The IR diodes are placed on one side of the road and photodiodes are placed on the other side of the road, directly facing the IR diodes.

Consider the case when there is no vehicle on the highway. In this case, the IR radiation emitted from the IR diode directly falls on the photodiode which is exactly opposite to it. This causes the photodiode to fall in conduction state. This implies that photodiode conducts and current passes through it. The current passes through the photodiode and goes through the variable resistor and the base-emitter region of the transistor. This in turn connects the collector of the transistor to the emitter. From the circuit diagram we can see that emitter is connected to ground which implies that the collector also goes to the ground. The collector region of the transistor is connected to the port 1 (input port) which in turn goes to ground i.e., logic ZERO. So, to summarize we can say that, when there is no vehicle on the highway, then the inputs to the microcontroller port 1 is ZERO.

Consider the case when a vehicle obstructs the IR radiation path. In this case, IR radiation is blocked and hence it does not fall on the photodiode. This in turn implies that photodiode doesn't conduct. Hence there is no current flowing through the transistor. So, the collector is at HIGH state. As we know that all collectors are given as input to the microcontroller, so the port 1 of the microcontroller goes HIGH. Let us assume that the first Photodiode-IR diode pair IR path is obstructed. This leads to a transition from ZERO to HIGH at P1.0 pin.

The microcontroller is programmed in such a way that, whenever the pin P1.0 goes high, then a window of lights ahead from the vehicle glows. In other words, the respective pins of port 2 and port 3 go HIGH. This process goes on i.e., as the vehicle moves forward, the street lights ahead of it glows and the trailing lights goes back to its original state.

III. Flow chart



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IV. Software Tools

MPLAB IDE is a software program that runs on a PC to develop applications for Microchip microcontrollers. It is called an Integrated Development Environment, or IDE, because it provides a single integrated "environment" to develop code for embedded microcontrollers. A development system for embedded controllers is a system of programs running on a desktop PC to help write, edit, debug and program code – the intelligence of embedded systems applications – into a microcontroller. MPLAB IDE runs on a PC and contains all the components needed to design and deploy embedded systems applications. The typical tasks for developing an embedded controller application are: A. Create the high level design. From the features and performance desired, decide which PICmicro or dsPIC device is best suited to the application, then design the associated hardware circuitry. After determining which peripherals and pins control the hardware, write the firmware – the software that will control the hardware aspects of the embedded application. A language tool such as an assembler, which is directly translatable into machine code, or a compiler that allows a more natural language for creating programs should be used to write and edit code. Assemblers and compilers help make the code understandable, allowing function labels to identify code routines with variables that have names associated with their use, and with constructs that help organize the code in a maintainable structure. B. Compile, assemble and link the software using the assembler and/or compiler and linker to convert your code into "ones and zeroes" – machine code for the PICmicro MCU's. This machine code will eventually become the firmware (the code programmed into the microcontroller). C. Test your code. Usually a complex program does not work exactly the way imagined, and "bugs" need to be removed from the design to get proper results. The debugger allows you to see the "ones and zeroes" execute, related to the source code you wrote, with the symbols and function names from your program. Debugging allows you to experiment with your code to see the value of variables at various points in the program, and to do "what if" checks, changing variable values and stepping through routines. D. "Burn" the code into a microcontroller and verify that it executes correctly in the finished application.

Of course, each of these steps can be quite complex. The important thing is to concentrate on the details of your own design, while relying upon MPLAB IDE and its components to get through each step without continuously encountering new learning curves.

V. Conclusion

Thus we have studied the optimization of traffic light controller in a City using IR sensors and microcontroller. By using this system configuration we tried to reduce the possibilities of traffic jams, caused by traffic lights, to an extent and we have successfully gets the results. No. of passing vehicle in the

fixed time slot on the road decide the density range of traffics and on the basis of vehicle. In this paper, we study the problem of road traffic congestion in high congestion hot-spots in developing regions. We believe that this represents only a first step in the development of low-cost, deployable strategies for alleviating congestion in developing regions .Our project is checked and the output is verified.

The future work lies towards generating electricity by developing smart speed breakers in roads. In future we can also reduce the traffic by using zigbee.

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