

# Density Based Traffic Lights

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**Abstract-** In recent years, road traffic has become a serious problem across the globe. Current statistics reveals that a person averagely spends around 4-6 months of his/her life time by simply waiting at traffic signal during his travel. Generally, traffic police can control traffic in several junctions of cities by implementing either hard coded automatic traffic light control system or through manual intervention. However, the conventional hard code-controlled traffic light signal which operates with a fixed time slots is found to be poor efficient since it does not consider the instantaneous traffic density. Hence, the density-based traffic control system available at lowest expenditure will be helpful. The motivation for this work has been originated from the observation carried out at traffic signals located at Nizwa and Muscat cities of Oman. The proposed system includes timer which runs for a specific time and IR sensor is used to count the number of vehicles passing by during that time period.

**Keywords-** IR sensor, Pilot lamp, microcontroller, Traffic control.

## I. INTRODUCTION

With the increasing traffic in metro cities, it is giving rise to number of problems like traffic jams, accidents and traffic rule violation at the heavy traffic signals. These problems have led to an ever-increasing demand for an “intelligent” traffic control system. Getting stuck in between heavy traffic is a headache for each and every individual driving the vehicle and even to the traffic police in controlling the traffic. The traffic is increasing day by day due to increase in automobiles at faster rate and also because of large time delays between traffic lights. So, to solve this problem, we go for traffic density controller.

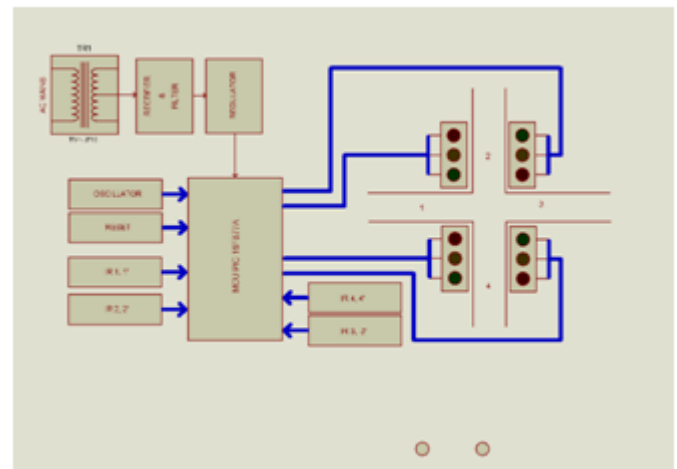
This project solves the problem of semi-automated traffic light system. The purpose for creating this fully automated traffic lights system to manage traffic and provide safety to pedestrians, drivers, vehicles.

The signal operates automatically when the traffic density at the road junction is detected. Because of its simplicity and economy, Arduino was in the choice to write programming according to the requirements, and infrared (IR)

sensors are used in this work to observe the traffic density of the lanes. In order to monitor the traffic density accurately, the IR sensors are placed precisely on each lane.

## CONSTRUCTION

The creation of a traffic lights using microcontroller for specially pedestrians, drivers, vehicles Arduino entails a number of procedures and elements, such as:



### 1) CRYSTAL OSCILLATOR

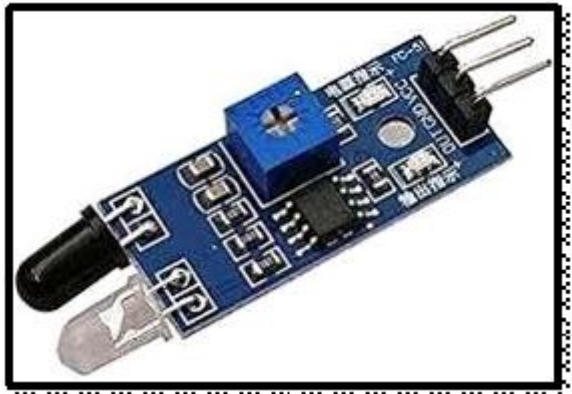
A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wristwatches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits incorporating them became known as crystal oscillators, but other piezoelectric materials including polycrystalline ceramics are used in similar circuits.



## 2) IR Sensor:-

An Infrared light-emitting diode (IR LED) is a special purpose LED that emits infrared rays ranging from 700 nm to 1 mm wavelength. Different IR LEDs may produce infrared light of differing wavelengths, just like other LEDs produce light of different colours.

IR sensor is a device that uses infrared technology to detect objects or changes in the environment. IR sensors can detect a wide range of physical properties such as temperature,



## 3) Jumper Wires:

Jump wires, also known as DuPont wires, are electrical wires with connectors on each end that enable the creation of circuits without soldering. They are frequently used on breadboards, which have slots specifically designed to receive these connectors. Different connector types exist, including solid tips for breadboards and crocodile clips for temporary connections to various components. Additionally, jump wires come in various sizes and colours, aiding in distinguishing different signals within a circuit.



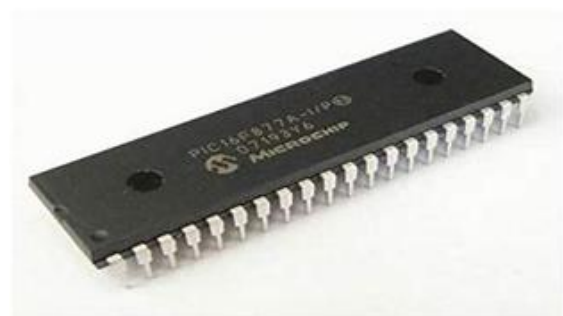
## 4) LED Lights

**Forward Voltage ( $V_f$ ):** This is the voltage required to turn on the LED and make it emit light. Each color (red, green, yellow) will have a specific forward voltage requirement, which is usually mentioned in the LED's datasheet. For a 10mm LED, the forward voltage typically ranges from around 1.8 to 3.5 volts, depending on the color.

**Forward Current ( $I_f$ ):** This is the current flowing through the LED when it's turned on. It's important to ensure that the forward current does not exceed the LED's maximum rating to prevent damage. The forward current is usually specified in milliamps (mA) and can vary based on the LED's color and manufacturer.



## 5) PIC16F877A:



It belongs to the PIC16F family of microcontrollers, which are 8-bit devices.

The PIC16F877A is one of the most well-known and widely used microcontrollers in the PIC16F series.

It features: 8 KB of Flash program memory, 368 bytes of RAM, 256 bytes of EEPROM data memory, 33 I/O pins. Various peripherals including timers, USART, SPI, I2C, analog-to-digital converter (ADC), etc.

Operating voltage range: 2.0V to 5.5V

It is commonly used in a wide range of applications including embedded systems, industrial control, consumer electronics, etc

## Software Technology:

### 1) CCSC Compiler:

A CCS compiler is a software tool used for programming and compiling code specifically for Microchip microcontrollers, including PIC MCU (Microcontroller Unit) and PIC24/dsPIC DSC (Digital Signal Controller) devices. Here are some key points about CCS compilers:

#### Ease of Use:

- CCS compilers are designed to be user-friendly and quick to learn.
- They are suitable for both professional developers and hobbyists.

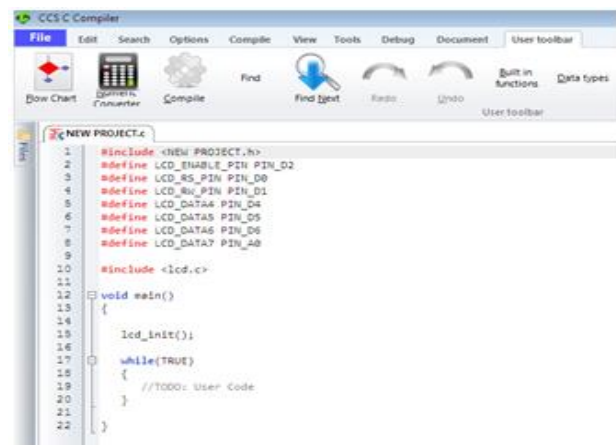
#### Compiler Options:

- C-Aware IDE: An integrated development environment (IDE) that includes a C compiler. It offers features like optimization, built-in functions, and example programs.
- Command Line Compiler: A command-line version of the compiler.
- PIC24/dsPIC Compilers: Specifically tailored for 16-bit and 32-bit PIC® microcontrollers.

#### Features:

- Pro-Level Optimization: CCS compilers optimize code for lower production costs.
- Built-In Functions: Includes a large collection of functions to make programming easier.
- Example Programs: Ready-to-run example programs to jump-start projects.

- Device Libraries: Provides drivers and standard C math libraries.
- Compatibility: Works with third-party tools like Microchip MPLAB® and MPLAB® X.



## II. RESULT, CONCLUSION AND FUTURE SCOPE

### RESULT:

While building a smart traffic lights system with Arduino can be an educational project for learning about electronics and programming, it is strongly advised against implementing the traffic lights using Arduino for specially to reduce overhead for many people (like driver, pedestrian and many more)



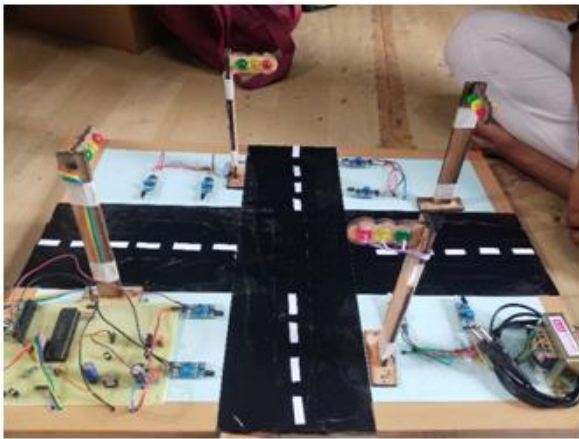
### Future Scope:

In future this system can be implemented in a more advanced way by installing cameras at the traffic signals and based on these images captured by the camera the traffic lights can be ON and OFF depending on the density of traffic. This system can also be used to inform people about different places traffic condition. The data can be transferred using a telephone network between microcontroller and computer. By using this technique an individual can accumulate the data recorded from remote places to his home computer without

going there. The traffic can be controlled for the whole city by sitting at one place

[5] Crystal Oscillator: <https://www.electrical4u.com/crystal-oscillator>

### Main functionalities:



**Vehicle detection:** This will be the core function achieved by the IR sensor which attached on the road. The sensor will sense the Vehicles and set the timer of red,yellow,green lights

**Red light :** It will glow depend on amount of the traffic . the IR sensor will sense the object. If the traffic is sensed only by the first sensor then timer of red will be set to 4 sec. if vehicles sensed by both sensor then the timer od red led will be set for 6 sec.

**Yellow light :** It will glow depend on amount of the traffic . the IR sensor will sense the object. If the vehicle is sensed only by the first sensor then timer of yellow led will be set to 3 sec. if vehicles sensed by both sensor then the timer of yellow led will be set for 3 sec.

**Green light :** It will glow depend on amount of the traffic . the IR sensor will sense the object. If the vehicle is sensed only by the first sensor then timer of green led will be set to 4 sec. if vehicles sensed by both sensor then the timer of green led will be setfor 8 sec.

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