Automated Density Based Traffic Light Control System Using Arduino Platform

Saranya J, Jayashwanth J.S, Kiran J, Harish S, Linga Kumar T

Abstract— In recent years, traffic Jams has become a serious problem across the globe. Current statistics reveals that, an average person spends around 4-6 months of his/her life by simply waiting for green light during traffic. Also when delay increases, it affects the commuters reach their destination so late resulting in severe consequences on day and day basis. In common, traffic can be controlled in several main junctions by incorporating either automated traffic light control system or through manual intervention by traffic police. However conventional traffic light system which involves fixed time slot allotted to each side of the junction is found to be poor efficient since it does not consider the varying traffic density. At certain instances, priority of the traffic system has to be changed dynamically based on more number of vehicles waiting on the road, arrival of VIP vehicles and ambulance vehicles etc. By considering the above facts, we have proposed an automated traffic light system which has inbuilt potential to prioritize the lane which is heavily congested. Our proposed system includes timer which runs for a specific time period and IR sensor is used to count the number of vehicles passing by during that time period. It also includes LED which is turned green on the lane with more number of vehicles. These peripherals were actuated based on the programming logic that is embedded in Arduino Mega platform. Finally, implementation results for the proposed system are provided in this paper.

Index Terms— IR sensor, Arduino Mega, Traffic lights(LED).

I. INTRODUCTION

Over recent years, more people have started moving from rural to urban areas for their survival fitness. Increase in population around the globe has led to usage of more vehicles (2,3 & 4 wheelers) and this has led to emergency crises in traffic management for supervising the traffic scenarios in both (pedestrian or vehicles). In this regard several studies have been either proposed or implemented towards avoiding traffic congestion on the lane having more number of vehicles. Y. N. Udoakah et.al developed a traffic light control system using PIC18F4550 microcontroller interfaced with IR sensor to reduce the traffic at the road intersections [1]. Vaishali B et.al developed a traffic control system with an collision alert at the intersection of roads using ARM7 microcontroller. Here traffic signals were

dynamically varied based on density of vehicles residing on the lane. Also collision alert were detected using ultrasonic sensor and alert message is delivered to intended recipient using Wi-Fi module [2]. Y M Jagadeesh et.al developed an sensor based traffic light control system with dynamic control which in turn reduces the Average Trip Waiting Time (ATWT)[3]. Siddharth Srivastava et.al developed a microcontroller based timer control system wherein traffic signals were changes dynamically based on the captured traffic images using high resolution cameras. Image processing tool using MATLAB were used for processing the traffic signals [4]. R.Tina et.al, developed an Intelligent traffic light control system based on edge detection techniques for reducing the traffic congestion and its operational costs [5]. Among all the above mentioned systems, our proposed system is found to be superior on the basis of costs & efficacy.

II. SYSTEM DESIGN

This section describes the conceptual design of traffic Light control system (Fig.1) as shown below.
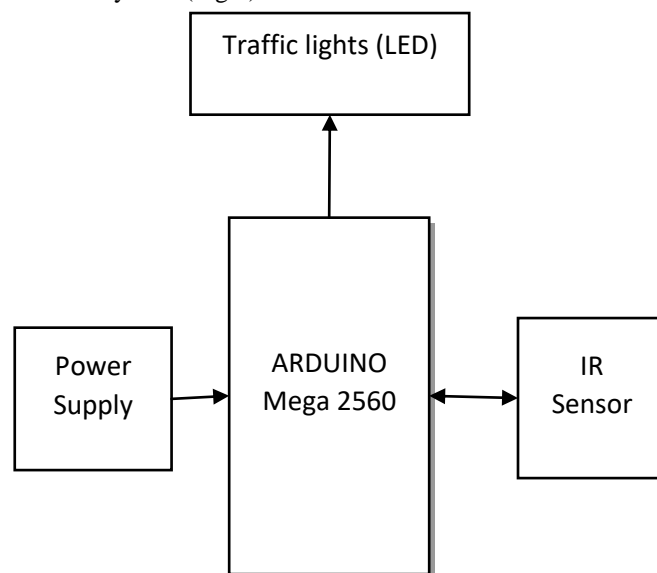

Fig. 1. Block diagram of the proposed system

Our proposed system includes Arduino Mega platform which is interfaced with IR sensor and LED's (Red & Green only). The IR sensor connected with the Arduino senses the number of vehicles residing in the lane. The output of IR sensor is given to ARDUINO board for further actuation of either red or green light on the lane based on

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programming logic embedded inside the arduino platform. The logic inside our controller is that, if any particular lane has green light recurring for two times, then for the third time the other lane is given priority thereby allowing the lane which has more number of vehicles to pass through. This usage scenario exhibits the efficacy of our developed system.

III. HARDWARE SYSTEM DESIGN

A. ARDUINO MEGA 2560

The Arduino Mega 2560 is a microcontroller which is based on ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

The specifications of ARDUINO MEGA 2560 are as follows:

Fig.2. ARDUINO MEGA 2560

B. IR SENSOR

An Infrared (IR) sensor is an electronic instrument that is used to sense the presence of objects which is at a distance greater than 20-30 cm. IR sensor changes its state from HIGH to LOW upon detecting the object. This is called as state change detection.

Operating Voltage	5V
Input Voltage (recommended)	7-12V
Digital I/O Pins	54 (of which 15 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	256 KB of which 8 KB used by bootloader
SRAM	8 KB
EEPROM	4 KB
Clock Speed	16 MHz

Table1: Specifications of Arduino Mega 2560

Fig.3. IR SENSOR

C. LED

The LED is a PN-junction diode which emits light when an electric current passes through it in the forward direction. In the LED, the recombination of charge carrier takes place. The electron from the N-side and the hole from the P-side are combined and gives the energy in the form of heat and light. The LED is made of semiconductor material which is colourless, and the light is radiated through the junction of the diode.
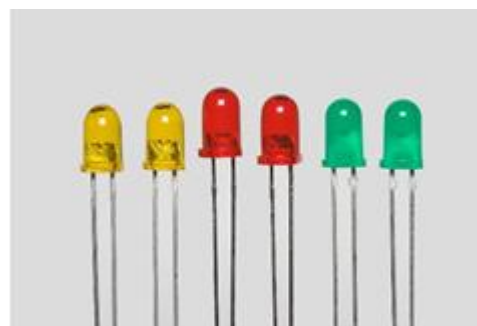

Fig.4 LED

IV. SOFTWARE SYSTEM DESIGN

ARDUINO LANGUAGE

The coding language that Arduino uses is very much like C++, which is a common language in the world of computing. The code we write in arduino is passed directly to a C/C++ compiler (avr-g++). All standard C and C++ constructs supported by avr-g++ should work in Arduino. A code which is intended for Arduino hardware can be written using any programming language with compilers that produce binary machine code for the target processor.
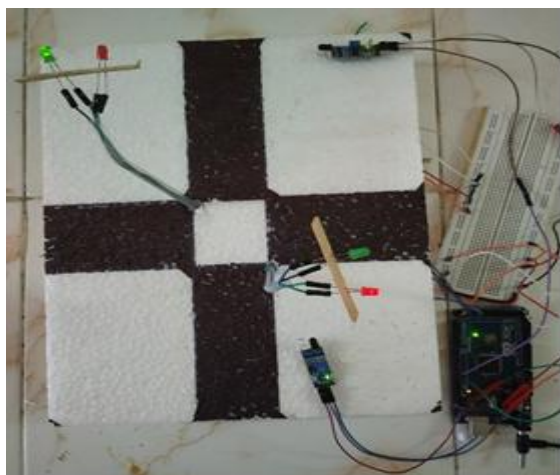
V. RESULTS AND DISCUSSION

Fig.5 Overall Module with Lane1 having Green signal and Lane2 having red signal.

The above figure illustrates the usage scenario where, Lane 1 is given green signal assuming more vehicles are there in it.
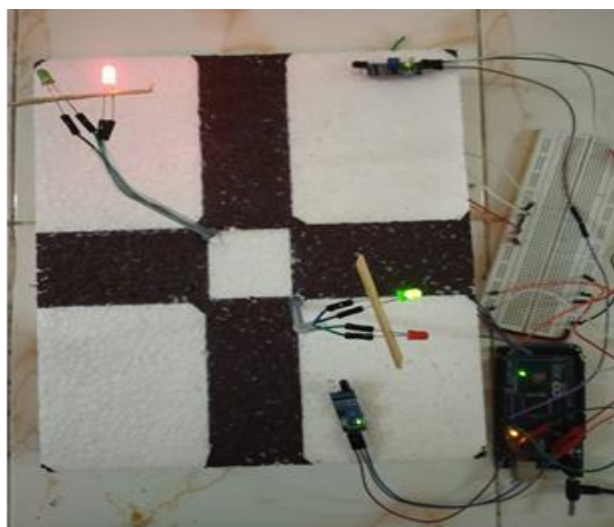

Fig.6 Overall Module with Lane2 having Green signal and Lane1 having Red signal.

The above figure illustrates the usage scenario where, Lane 2 is given green signal assuming more vehicles are there in it. It further illustrates the efficacy of our proposed system in prioritizing the lane which has more vehicles.
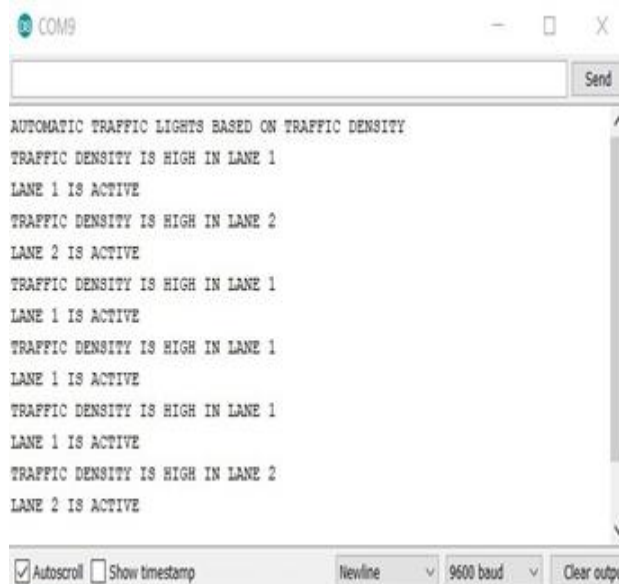

Fig.7 Output of Proposed system on Serial Port.

Fig 7 illustrates the output of our proposed system as seen in serial port. This monitoring section is available in control room. With the help of serial port which is available in Arduino platform status of traffic density residing in road lanes can be seen.

VI. CONCLUSION

This project focuses on reducing the unwanted delays which is caused at road intersections. The unnecessary traffic congestions which occur due to more number of vehicles floating on the road lanes during prime hours (i.e.) morning and late evening hours are reduced by means of counting the number of vehicles at each lane and giving priority to the lane which has more number of vehicles. In future, sound sensor can be interfaced with arduino platform to detect the frequency of the ambulance heading towards traffic signal. It can be assigned highest priority irrespective of traffic density residing in lanes. This can save the life of human who are in urgent need of medication.

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