Visvesvaraya Technological University

Belgaum, Karnataka-590 018

A Project Report on

"Intelligent Traffic Control System"

Project Report submitted in partial fulfillment of the requirement for the award of the degree of

Bachelor of Engineering
In
Electrical & Electronics Engineering

Submitted by

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AECS Layout, Bengaluru-560 037

Certificate

Certified that the project work entitled **"Intelligent Traffic Control System"** carried out by Ms. Nanshi Bhuwalka, USN 1CR16EE048; Mr. Rahul P B, USN 1CR16EE055; are bonafied students of CMR Institute of Technology, Bengaluru, in partial fulfillment for the award of Bachelor of Engineering in Electrical & Electronics Engineering of the Visvesvaraya Technological University, Belgaum, during the year 2019-2020. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library.

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DECLARATION

We, [Ms. **Nanshi Bhuwalka (1CR16EE048),** Mr. **Rahul P B (1CR16EE055)],** hereby declare that the report entitled **"Intelligent Traffic Control System"** has been carried out by us under the guidance of **Dr. Shailendra B,** Associate Professor, Department of Electrical & Electronics Engineering, CMR Institute of Technology, Bengaluru, in partial fulfillment of the requirement for the degree of **BACHELOR OF ENGINEERING in ELECTRICAL & ELECTRONICS ENGINEERING**, of Visveswaraya Technological University, Belagaum during the academic year 2019-20. The work done in this report is original and it has not been submitted for any other degree in any university.

Place: Bengaluru
Date:

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Abstract

Now a day all over the world, there has been a rapid increase in vehicle numbers. There are approximately 1 million licensed vehicles in the last year. Due to that traffic problems has increased in the last few years and the present traffic light controllers have limitations because it uses the fixed hardware. They do not have the flexibility of modification on real time basis. The time intervals of green, orange and red signals are fixed therefore the waiting time is more. To make this traffic light controlling more efficient we emerge new technique called as “Intelligent Traffic Control System”. This uses sensors along with embedded technology .The timings of the red and green lights will be smartly decided based on the traffic on roads. As compared to previous fixed mode traffic light controller this new system is more efficient and flexible. It also has facility to pass the emergency vehicles such as ambulance, fire brigade etc. and also detect and track the stolen vehicles. The design also has scope for further expansion.

Acknowledgement

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people, who are responsible for the completion of the project and who made it possible, because success is outcome of hard work and perseverance, but stead fast of all is encouraging guidance. So with gratitude we acknowledge all those whose guidance and encouragement served us to motivate towards the success of the project work.

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CONTENTS

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

With the exploding population, the surging number of vehicles getting registered every day, the increasing severity of gridlocks incurring greater and greater losses in various aspects, the number of accidents that occur due to such congestions, and with the failing strategies that get adopted, it is high time we all, everybody who is victimized by this menace every day, volunteer to find a solution because we know what would content the common people and turn out to be a successful strategy which will work satisfactorily in the long run. This paper is all about introducing an entire system that can help us overcome traffic jams with the least difficulty i.e. a system which can alleviate the severity of the consequences of traffic congestion. This system is thought up with modules which work in a way that facilitates the task of successive modules and the same continues as a cycle, thus making the system independent of human input or intervention. In addition to this, the system's overall outputs are those which have other utilities that are not strictly required for traffic management, thus helping us get a lot more achieved apart from the primary goal of guiding one to make one's way through choke points in the roads with lesser difficulty. Bangalore has grown exponentially in the past two decades. Improvement in the quality of life along with substandard public transportation has resulted in spiraling growth of private automobiles. The resultant offshoot of such a high automobile growth is that now Bangalore is one of the most accident-prone cities in India.

1.1 Problems in Existing System

A. Wastage of Time in Heavy Traffic Jams

With increasing number of vehicles on road, heavy Traffic jams are happened usually at the main junctions commonly in the morning, before office hour and in the evening, after office hours. The main effect of this is increased time wasting of the people on the road. The solution for this problem is

different time delay settings for red, orange and green signals at different junctions. The delay for junctions that have high volume of traffic should be set longer than the delay for the junction that has low traffic heavy.

B. Need to wait at no traffic

People have to wait at certain junctions, even if there is no traffic. Because the traffic light remains red for the preset time period, the road users should wait until the light turns green. The solution of this problem can be obtained by developing a system which detects traffic flow on each road and set timings of the signals accordingly.

C. Emergency vehicle stuck in traffic jam

The emergency vehicle, such as ambulance, fire brigade etc. get struck in the traffic jam. This is because the road users wait for the traffic light to turn green. This is very critical problem because it can cause the emergency case to become complicated, involving life.

D. Detect the stolen vehicle

To detect the stolen vehicle is a very difficult task, the stolen vehicle can be found only by its number and it is a bit tedious task.

E. Impedance to emergency services

Traffic jams are the most nightmarish to vehicles that operate to salvage people from situations of emergency. Each second lost by these vehicles during their commute is a life lost.

F. Uncertainty

Because of unforeseen congestions in the road, travel times are no longer predictable. This poses problems to drivers and reduces productivity. Vehicle wear and tear: Traffic jams cause idling and frequent acceleration and application of brakes which lead to more repairs.

G. Fuel wastage

Idling of vehicles due to traffic congestions lead to fuel emission and waste a huge amount of fuel.

H. Pollution

The emission of fuel due to vehicle idling in traffic releases greenhouse gases with harmful chemicals into the atmosphere, accelerating global warming rates.

Considering about time loss and delays, though it may seem a bit far-fetched to try to eradicate the problem, it would be a huge relief if people are at least aware about the amount of time they will be required to wait under a traffic signal. For example, commuters who are stuck in a gridlock cannot predict how long it will take to cross the specific intersection because they have no idea about the vehicle density and the rate of vehicle flow in the other roads crossing the junction because of the endless queue of vehicles that are already waiting before and after them. The attempt to remedy such situations is where our solution comes in

1.2 RFID(Radio Frequency Identification)

RFID (Radio Frequency Identification), as its name implies, uses radio waves to identify targets. This technology is one among the various methods under the AIDC (Automatic Identification and Data Capture) umbrella, which can recognize targets, fetch desired data from them, and store the collected data in a database.

An RFID module has 3 necessary components :

1. RFID tag/label
2. RFID reader
3. Antenna

RFID tag refers to small electronic devices that consist of a small chip and an antenna. The chip typically is capable of carrying some kind of information depending on applications. The RFID readers, also called interrogators, are

used to recognize the presence of nearby RFID tags.

Figure 1:- RFID Tag

Basic working

The RFID tag affixed to the target item consists of an Integrated Chip (IC) which stores all the information about the particular target. Once the tag receives radio waves from the RFID reader/antenna, the energy received reaches the integrated chip which in turn transmits the desired details about the target to the reader module and saves it in a database for future use.

Selecting the appropriate RFID type

RFID systems can be broken down into two types, i.e active and passive, the former's tag having its own energy source and the latter's relying on energy from the reader module of the RFID system. RFIDs can also be classified into different types based on the frequency range they can operate on

Frequency Based Classifiaction of RFID

- **Low Frequency RFID**
    - Frequency range: 30 Kilo Hertz - 300 Kilo Hertz
    - Read range: Upto 10 centimeters
    - Application: access control
- **High Frequency RFID**
    - Frequency range: 30 Mega Hertz - 300 Mega Hertz

- Read range: 10 centimeters to 1 meter
- Application: payment/data transfer

➢ **Ultra High Frequency RFID**

- Frequency range: 300 Mega Hertz – 3 Giga Hertz
- Read range: Upto 12 meters
- Application: vehicle tracking

Based on the afore mentioned information, the type of RFID to be chosen for tracking vehicles is an active, Ultra High Frequency range operating RFID because it can operate in a wide frequency range and also provides the largest read range, which are very desirable characteristics for a vehicle tracking system.

Placing the RFID tag/label

RFID tags can be placed/fixed in vehicles in the following areas. The read range that can be achieved by tags placed in each of these locations is also mentioned below:

➢ **In the windshield**:

- Read range: 20 feet in ideal conditions.

➢ **In the rearview mirror/ hang mirror**:

- Read range: 20 feet in ideal conditions.

➢ **In the license plate**:

- Read range: 50 feet in ideal conditions.

Comparing the read range facilitated by tags fixed in each of the above areas, it is obvious that the RFID tags placed in license plates would work the best for purposes such as vehicle tracking.

CHAPTER 2

LITERATURE REVIEW

For congestion detection several technologies have been proposed such as inductive loop, magnetometer, visual camera, radar etc

Different Technologies Used

Inductive Loops

They can be placed on the roadbed work at all traffic speeds and are effective at estimating traffic speeds. The electronics unit transmits energy into the wire loops at frequencies between 10 kHz to 200 kHz, depending on the model. The inductive-loop system behaves as a tuned electrical circuit in which the loop wire and lead-in cable are the inductive elements. When a vehicle passes over the loop or is stopped within the loop, the vehicle induces eddy currents in the wire loops, which decrease their inductance. The decreased inductance actuates the electronics unit output relay or solid-state optically isolated output, which sends a pulse to the controller signifying the passage or presence of a vehicle. They require maintenance and installation is quite difficult. Along with these disadvantages, they are susceptible to high error rate in detection and transmission of traffic information.

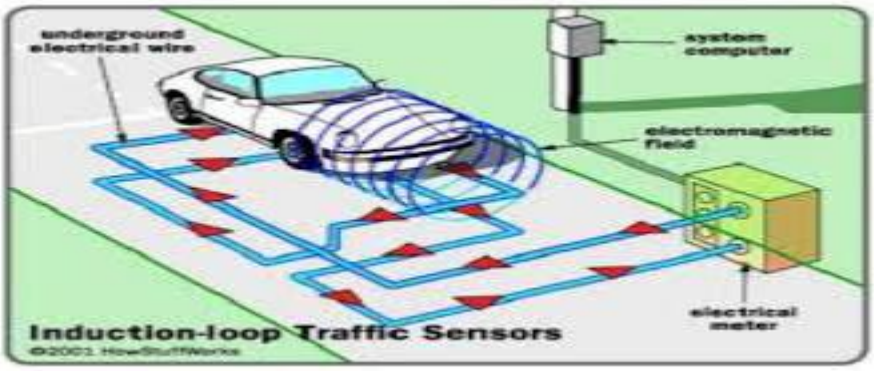

Figure 2:- Induction Loop Traffic Sensors

Magnetometer

Magnetometers can be either wired or wireless. A magnetometer works by using a passive sensing technology to detect large ferrous objects (for example, a truck, automobile, or rail car) by measuring the change in the ambient magnetic field. When a vehicle alters that magnetic field, the sensor detects those changes. As with other sensors, the range of the magnetometer will depend on the target. A wireless magnetometer provides a cost-effective and convenient alternative to other sensing technologies. It requires no wiring or external control box, but achieves an accurate and repeatable response. Furthermore, wireless magnetometers are much less invasive, less expensive, and easier to commission quickly compared to inductive loops. This is because wireless-magnetometer units are small, self-contained, and don't require extensive work under the concrete. The disadvantages of magnetometers are that they require close proximity to vehicle to detect a change in the magnetic field, and while they are relatively cheap, they are intrusive to implement as they require physical installation in the pavement.

Figure 3:- Vehicle Detection Magnetometer

Visual Cameras

Cameras are used as input sensors which collect real time traffic condition data and analyzed these conditions to provide real time outputs.. A traffic camera is video camera which observes vehicular traffic. A monitoring center receives the live video in real time, and serves as a dispatcher if there is a traffic collision or some other disruptive incident or road safety issue. In bad weather conditions visual cameras may not work. Many transportation departments have linked their camera networks to the Internet on online websites, thus making them webcams which allow commuters to view current traffic conditions. They may show either streaming video or still imagery which refreshes at a set interval of seconds or minutes, helping travelers determine whether an alternate route should be taken.

Figure 4:- Visual Cameras

Conventional traffic signals

These traffic signals have been programmed with a fixed timer. They do not consider the volume of the traffic on the street before taking a decision of green or red light. Hence if the volume of traffic is large, it may result in accumulation of traffic on the street and the junctions. Conventional traffic light control systems are based on fixed time intervals of the traffic lights. These conventional fixed traffic light controllers have limitations and are less

efficient because they use a hardware, which functions according to the program that lacks the flexibility of modification and adaptation on a real time basis. Thus due to the fixed time intervals of green and red signals there is excess and unnecessary waiting time on roads and vehicles consume more fuel. This eventually adds up to the environmental pollution and creates several health issues among the people on road and residing nearby. Also these conventional traffic light control systems do not have any provisions to provide any information on traffic densities on various roads, which leads to traffic congestions

Micro controller Based Traffic Signals

The micro controller-based traffic light system allocates green, red & yellow signal time for each path. When the vehicles along one path will move , the other vehicles from the other path will stop at road intersection control. Without any collision microcontroller based traffic signal system direct the movement of vehicles meeting at a road junction . When the time allocated for a specific path has been exhausted, the red light will be ON meaning stop and the next line will be ON (green light) which means the vehicle in that path should start moving. When the time is about to be exhausted, the yellow light will be ON in the third path informing the vehicles in that path to be ready to move, and after some seconds the green light will be ON. Disadvantage of Micro controller Based traffic system is traffic light timing is fixed.

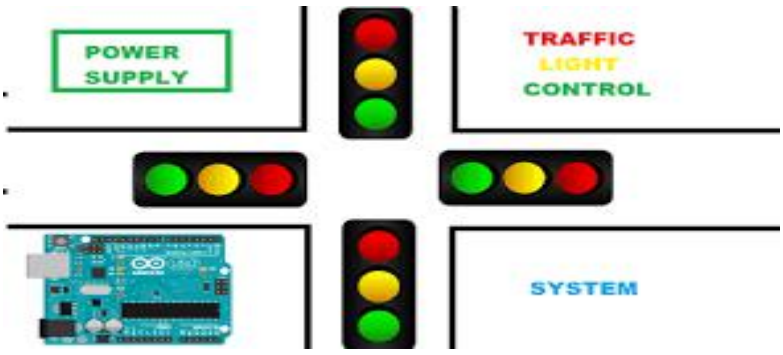

Figure 5:- Micro Controller Based Traffic Signal

CHAPTER 3

COMPONENTS USED

3.1 Arduino mega 2560 R3

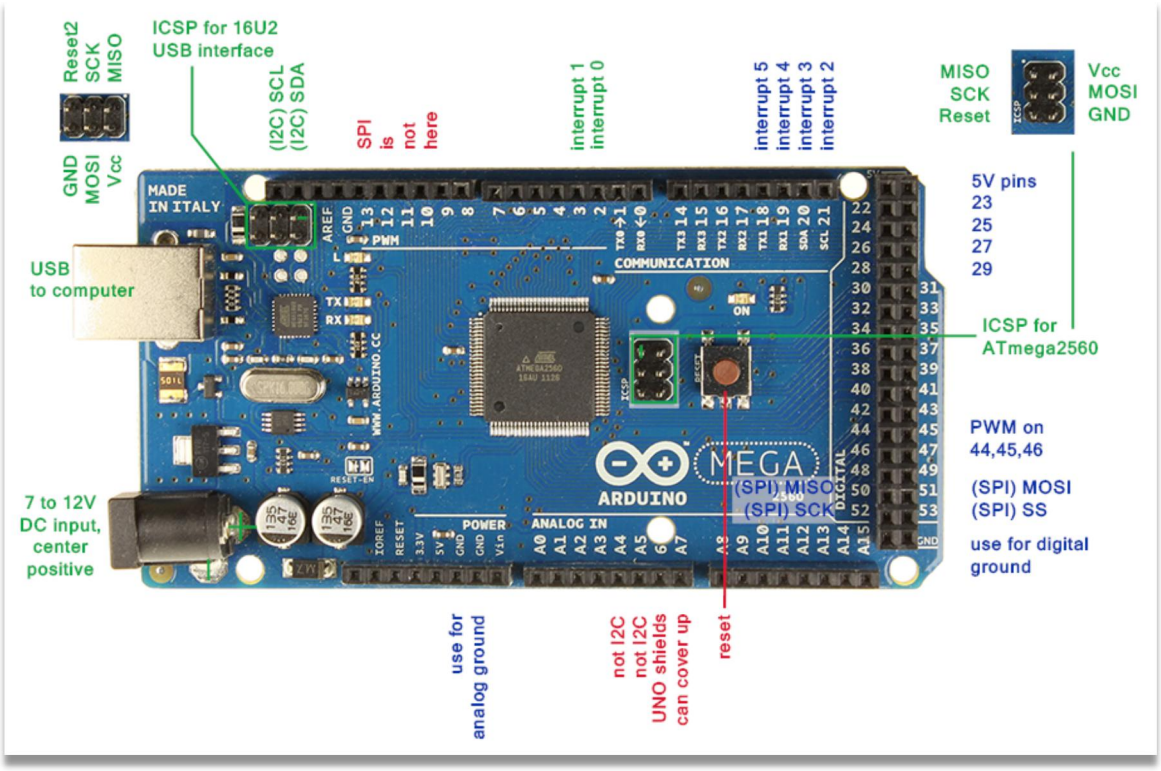

Fig 6 . Arduino Mega 2560 R3 Pinout

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 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. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Mega is compatible with most shields designed for the Arduino Duemilanove or Diecimila.

Technical Specifications

Microcontroller	ATmega2560
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	54 (of which 14 provide PWM output)
Analog Input Pins	16
DC Current per I/O Pin	40 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

Each of the 54 digital pins on the Mega can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

• **Serial: 0 (RX) and 1 (TX); Serial 1: 19 (RX) and 18 (TX); Serial 2: 17 (RX) and 16 (TX); Serial 3: 15 (RX) and 14 (TX).** Used to receive (RX) and transmit (TX) TTL serial data. Pins 0 and 1 are also connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip .

• **External Interrupts: 2 (interrupt 0), 3 (interrupt 1), 18 (interrupt 5), 19**

(interrupt 4), 20 (interrupt 3), and 21 (interrupt 2). These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

• **PWM: 0 to 13.** Provide 8-bit PWM output with the analogWrite() function.

• **SPI: 50 (MISO), 51 (MOSI), 52 (SCK), 53 (SS).** These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language. The SPI pins are also broken out on the ICSP header, which is physically compatible with the Duemilanove and Diecimila.

• **LED: 13.** There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

3.2 RFID Reader (RFID - RC522 RF IC Card Sensor Module)

Fig 7. RC522 RFID Module

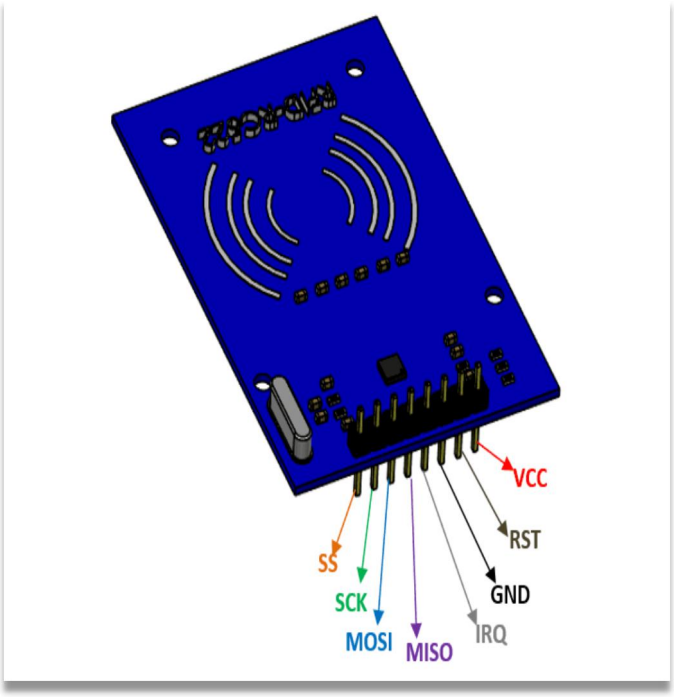

Fig 8. RC522 RFID Module Pinout

The **RC522** is a **13.56MHz RFID module** that is based on the **MFRC522 controller from NXP semiconductors**. The module can supports I2C, SPI and UART and normally is shipped with a RFID card and key fob. It is commonly used in attendance systems and other person/object identification applications.

RC522 Pin Configuration:

Pin Number	Pin Name	Description
1	Vcc	Used to Power the module, typically 3.3V is used
2	RST	Reset pin – used to reset or power down the module
3	Ground	Connected to Ground of system
4	IRQ	Interrupt pin – used to wake up the module when a device comes

		into range
5	MISO/SCL/Tx	MISO pin when used for SPI communication, acts as SCL for I2c and Tx for UART.
6	MOSI	Master out slave in pin for SPI communication
7	SCK	Serial Clock pin – used to provide clock source
8	SS/SDA/Rx	Acts as Serial input (SS) for SPI communication, SDA for IIC and Rx during UART

RC522 Features

- 13.56MHz RFID module
- Operating voltage: 2.5V to 3.3V
- Communication : SPI, I2C protocol, UART
- Maximum Data Rate: 10Mbps
- Read Range: 5cm
- Current Consumption: 13-26mA
- Power down mode consumption: 10uA (min)

3.3 RFID Tags

RFID tags are a type of tracking system that uses smart barcodes in order to identify items. RFID is short for “radio frequency identification,” and as such, RFID tags utilize radio frequency technology. These radio waves transmit data from the tag to a reader, which then transmits the information to an RFID computer program. RFID tags are frequently used for merchandise, but they can also be used to track vehicles, pets, and even patients with Alzheimer’s disease. An RFID tag may also be called an RFID chip.

Fig 9. RFID Tag Pair (Keychain+Card)

3.4 LED'S

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor. White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device.The first visible-light LEDs were of low intensity and limited to red. Modern LEDs are available across the visible, ultraviolet (UV), and infrared wavelengths, with high light output.

In This Project we are making use of LED's of three colours Red, Yellow and Green for illustrating the working of Traffic signals.

Fig 10. RGY LED's

3.5 Piezo Buzzer

Piezo buzzers are simple devices that can generate basic beeps and tones. They work by using a piezo crystal, a special material that changes shape when voltage is applied to it. If the crystal pushes against a diaphragm, like a tiny speaker cone, it can generate a pressure wave which the human ear picks up as sound.

Fig 11. Piezo Buzzer

3.6 NPN transistor

The transistor in which one p-type material is placed between two n-type materials is known as NPN transistor. The NPN transistor amplifies the weak signal enter into the base and produces strong amplify signals at the collector end. In NPN transistor, the direction of movement of an electron is from the emitter to collector region due to which the current constitutes in the transistor. Such type of transistor is mostly used in the circuit because their majority charge carriers are electrons which have high mobility as compared to holes.

Fig 12. NPN Transistor BC337 Pinout

CHAPTER 4

DESIGN OF THE SYSTEM

4.1 Circuit Connection

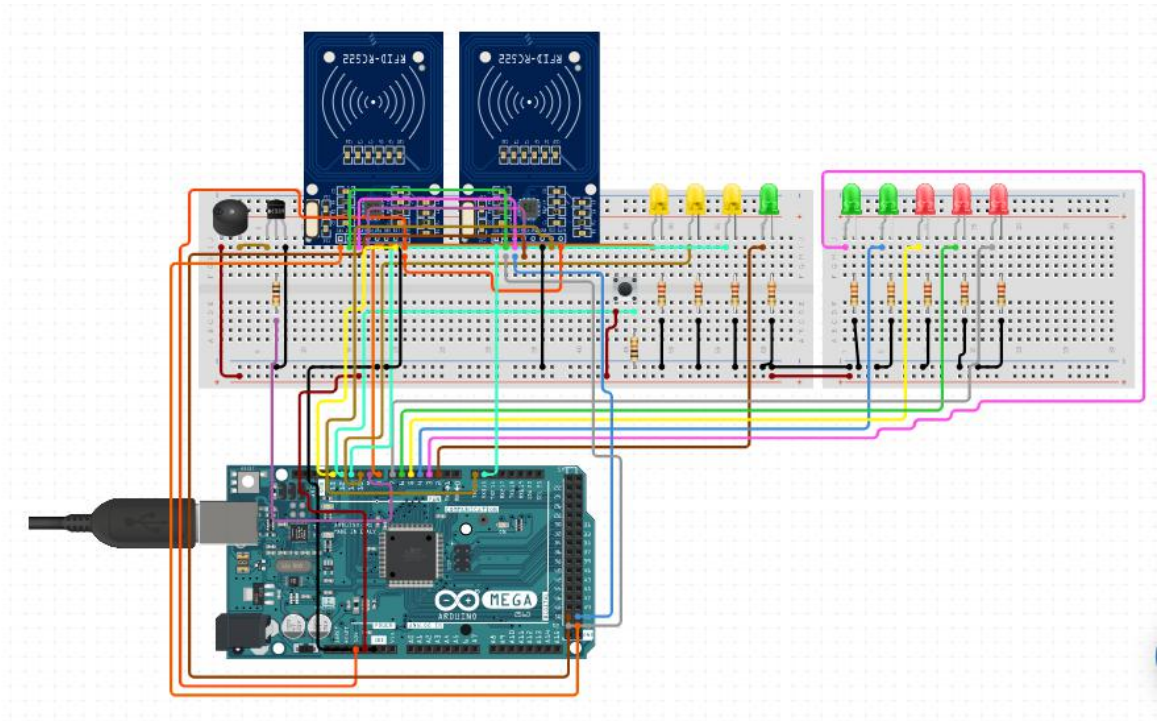

Fig 13. Circuit diagram

The circuit consists of Arduino mega 2560 R3 which connected to a system or powered by an external supply.It also consists of 2 RFID readers, Red(3) Yellow(3) Green(3) LED'S, few resistors, Piezo puzzer, NPN Transistor (BC337), Switch. All of these components are connected to the I/O pins of the Mega board.

4.2 Proposed Model

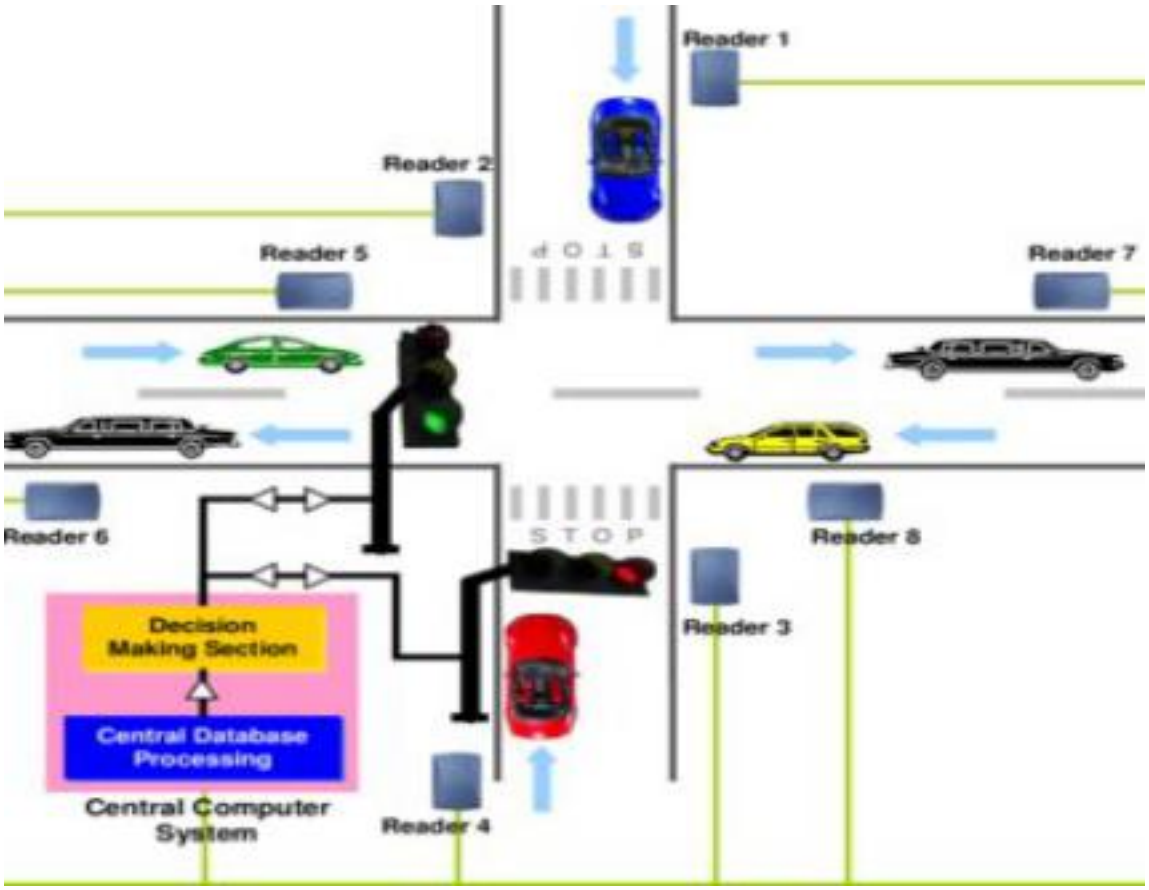

Fig 14 . Intelligent Traffic Control System using RFID

Problems that usually arise with standard traffic control systems, especially those related to image processing and beam interruption techniques are avoided using RFID based traffic control system. 8 RFID readers are used for each intersection.. The road is divided into two lanes. RFID reader in each lane track the vehicles passing through it. Every vehicle has a RFID enabled device that stores a vehicle identification number (VIN). VIN number that provides the information regarding the priority of the vehicle and type of the vehicle. Readers collects the information regarding the vehicles approaching towards the junctions. The Central processing unit calculates the volume and speed of vehicles on each road according to information collected by readers. Speed of vehicle is determined by the time taken for it to cover the distance between two readers. If speed of a vehicle is below a specified threshold, it is detected as congestion and the Central Processing System notifies the preceding traffic signal about this. On receiving such information, traffic on

that corresponding road is halted for certain duration to avoid congestion on the proceeding road.

4.3 Advantages and Applications

Advantages:

- Smooth traffic flow on roads.
- Priority based traffic control.
- Traffic signals are fully automated and operated according to the current volume of traffic.

Applications:

- Reliable traffic data can be generated based on statistical purposes

Chapter 5

CONCLUSION

The system is based on simple principle of RFID tracking of vehicles, can 11 operate in real-time, improve traffic flow and safety, and fully automated saving costly constant human involvement. The advantages ITCS can provide were demonstrated in detail which vouches for its effectiveness in traffic management systems. However it is a debatable issue that to monitor every vehicle is morally acceptable or, not and whether it is against one of the basic civil rights, privacy.It is more efficient and flexible. The timings of the red and green light will be smartly decided based on traffic on roads.It has the facility to pass the emergency vehicle. It also can detect and track stolen vehicles.

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