Improved Implementation Of Dynamic Traffic Light Control System

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ABSTRACT

Traffic signal management is one of the major problematic issues in the current situation. Such scenarios, every signal are getting 60 seconds of timing on the road at a regular interval, even when traffic on that particular road is dense and therefore it is time to shift more manual mode or fixed timer mode to an automated system with decision making capabilities. Present day traffic signaling system is fixed time based which may render inefficient if one lane is operational than the others. To optimize this problem we have made a framework for Dynamic traffic control system. Sometimes higher traffic density at one side of the junction demands longer green time as compared to standard allotted time We, therefore propose here a mechanism in which the time period of green light and red light is assigned on the basis of the density of the traffic present at that time and the simply that timing interval of the traffic signal purely depends on the number of vehicles on that particular roadside. The major advantage of this system is that it can able to decrease the more waiting time for the drivers to cross road signal. This is achieved by using PIR (proximity Infrared sensors). Once the density is calculated, the glowing time of green light is assigned by the help of the microcontroller (Arduino). The sensors which are present on sides of the road will detect the presence of the vehicles and sends the information to the microcontroller where it will decide how long a flank will be open or when to change over the signal lights.

Keywords - *Traffic signals, Proximity Infrared Sensor, Ardiuno Microcontroller, Internet of things.*

1. Introduction

In today's high speed life, traffic jam becomes a significant issue in our day to day activities. It brings down the productivity of individual and thereby the society as many work hours is wasted within the congestion due to improper signal timing methodology of traffic condition. High volume of vehicles, the inadequate infrastructure and therefore the irrational distribution of the signaling system are main reasons for these chaotic congestions. It indirectly also adds to the rise in pollution level as engines remain on in most cases, an enormous volume of natural resources in sorts of petrol and diesel is consumed without any fruitful outcome. Therefore, in order to get rid of these problems or at least reduce them to significant level, newer schemes need to be implemented by bringing in an IOT based density control system. The system uses Arduino based circuit system to watch traffic light densities and transmits this data online over internet to the controllers. We use IOT Gecko so as to develop the web GUI based system to watch the traffic densities. The system shows current densities to assist monitor traffic conditions on roads.

"One of the important things in the Internet of things in smart cities is the Intelligent Transportation System (ITS). ITS improves Vehicle to vehicle and Vehicle to Infrastructure communication for improving road facilities rather than increasing road capacities or developing new roads and gives traffic related information to the user as well as traffic police. we are going to use IR Sensors. IR sensor is additionally called as an Infra-Red spectrum. IR sensors have 2 parts in it, one is the transmitter and second is a receiver. The transmitter is employed to transmit the sunshine and receiver keeps on receiving the sunshine. When this connection is interrupted, the counting process is started, i.e., when the receiver does not receive the light transmitted by the transmitter it is said that the object is there in between transmitter and receiver. This IR sensor through Left side vehicle turn on left side similarly right side vehicle turn on right side and the center vehicle goes on straight. If the some vehicle goes on straight to another traffic signal then they add together and the signal will activated depends on the density of vehicle. Microcontroller also store vehicles count in its memory. Based on different vehicles count, the microcontroller takes decision and updates the traffic signal delays as a result.

2.Literature Survey

The concept of smart cities has been introduced to mitigate issues associated with growing urban population. There are several definitions associate with smart cities Give to this paper [1]. In that paper One of the various definitions of smart city is "The use of Smart Computing technologies to form the critical infrastructure components and services of a city." the web of Thing (IOT) may be a newly surfaced archetype which aims to supply new opportunities within the field of communication and knowledge technology. In IOT model virtually everything are going to be connected to the web. IOT can therefore, play an important role in smart cities. IOT needs cloud computing infrastructure to integrate devices. A thorough review of current IOT [2]. In this Paper Researcher research the original IOT paradigm, connectivity to Internet is implemented by sensor devices like RFID (Radio Frequency Identification) and other. However, embedded PCs like Raspberry Pi by Raspberry Pi foundation and Galileo by Intel or similar Embedded computing units also can be utilized in IOT infrastructure [3][4]. This paper suggests an IOT based solution for Traffic management for smart cities. Traffic signals are used on the crossroads to arbitrate the traffic rights for the commuters. Three color traffic signaling system was introduced in big Apple City in 1918 for the primary time. This model had a manual control from a tower within the middle of the road. Modern traffic signal was designed in USA additionally. the fashionable traffic signaling standard are outlined in traffic signaling Manual [5]Give to this paper. In that Paper Traffic congestion is a major concern in every metropolitan city. A study shows people spend about 38 hours per traffic year in traffic jams [6]. Initially, the traffic signal system was supported a hard and fast signaling scheme [7]. The researcher gives idea of about traffic signal controlling adaptive consistent with real time traffic volume was introduced in 1982 and has been implemented in various metropolitan cities within the world [8]. In that paper The adaptive traffic light system provided significant improvement in traffic congestion management over first generation traffic control [9]. The third generation of traffic signaling control is featured with fully adaptive and dynamic deciding. The traffic signaling schemes are modified consistent with the important time traffic situation around an intersection. Mostly the traffic signal controlling systems are microprocessor based and typically operate a preprogrammed algorithm. Depending upon the traffic conditions, it might be desirable to switch the traffic signal controlling patterns. The issue of traffic congestion control has been the focus of many researchers. that have reviewed various methods in controller and intelligent systems implementing traffic response strategies [10]. These strategies aim to supply automated regulation of traffic by handling special conditions during a smart way. When has developed a model during which the count of vehicles and their speeds are fed to a backend server to conjecture and supply different alternatives for setting red or green light duration via a traffic signal control interface to resolve the traffic jam problem give this paper[11]. A report published at University of New Mexico has briefed the methods to control the traffic congestion [12]. This paper [13] gives insight to actual implementation of the traffic management in terms of hardware. Gives brief explanation of the how real time traffic flow is monitored and controlled. In that System give advantage of automated system implementation using RFID tags for controlling and monitoring traffic in smart cities[14].This paper gives us information on how to detect a vehicle which needs emergency exit or less time to reach its destination. Emergency vehicles need to reach their destinations at the earliest. If they spend a lot of time in traffic jams. With emergency vehicle clearance, the traffic light turns to green as long because the emergency vehicle is waiting within the traffic junction. The signal turns to red, only after

the emergency vehicle passes through this Strategy[15].In this paper gives the Adaptive control System which receive information from vehicle like position and speed then it utilize to optimize the traffic light. This system specifies the utilization of onboard sensors in vehicle and standard wireless communication protocol Specified for vehicular applications. They implement various traffic light control Algorithms [16].Intelligent traffic system for VANET suggest that creation for smart city framework for VANET consisting of Intelligent Traffic Lights which transmit warning messages and traffic statistic. In that System Various Routing Protocol Has Been Discus And Compare. In that System they suggest that AODB is best fitted to intelligent traffic signal [17]. In this paper Author suggest in reference the info forecasting model for transmitting data from one to other. This System studied about the dynamic control system and supported radio propagation model for predicting path loss &link[18]. The author suggests that in Intelligence road Traffic signaling System. In that system OBUs used. OBUs used destination information for calculating load traffic on road for reducing the conjunction on road. the overall belief is that it's harder to estimate and predict traffic density than traffic flow[19]. In Intelligent Traffic Light and Density Control using IR Sensors and Microcontroller the propose that the delay of Signal not depend on traffic density. The Author optimize the traffic using microcontroller this system reduce traffic jams problem cause by traffic light to extent. The system contains IR Transmitter and IR Receiver. IR count the vehicles on the road Microcontroller generates the result[20].[21]Priority Based Traffic Lights Controller Using Wireless Sensor Network the author implements Adaptive Traffic control System based on (WSN) wireless sensor Network. In that System Time manipulation Used for controlling Traffic Light. This System Control Traffic over Multiple intersections. In [22], authors developed the system that gives the vehicle count by the deep neural technique. After vehicle detection and its count, the system will apply conditional probability to glow the green signal for a specific time period on a particular side according to the vehicle count. Here the author had tried to implement dynamic traffic signaling and proposed timing difference method to give priority when two ViUs are arriving at the same time. The system can able to give priority to one of the ViU (e.g., ambulance or fire brigade) arrived at the same time at lanes of an intersection [23]. In [24], So, authors proposed the system that controls the wastage of electricity in hostels, and helps in monitoring and managing the electrical power requirement. In this system, IR sensors sensed the presence of students in the room with the help of counter. When the student leaves the room, it decreases the count and when it reaches up to zero, this indicates that no one is present in the room. At this time, after few seconds, the switches will automatically turn OFF, if it is ON, and this information will be sent to the server/cloud using IOT where the authorized person can see or watch all the activities in the room.

In our IOT based Dynamic traffic control system using Wireless Sensor Network, after this literature survey we are focusing to implement further system, is a much efficient and make things automated.

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2.1 Problem Statement

The exiting traffic system is generally controlled by the traffic police. The main drawback of this system controlled by the traffic police is that the system is not efficient to deal with the traffic congestion. The traffic police official can either block a road for more amount of time or let the vehicles on another road pass by i.e. this system is decision making. So, It may not be so decent and it entirely depends on the official's decision. Moreover, even if traffic lights are used the time interval for which the vehicles will be showed green or red signal is fixed. Therefore, it may not be able to solve the problem of traffic congestion. In India, it has been seen that even after the presence of traffic lights, traffic police officials are on duty, which means that in this system huge manpower is required and it is not economical in nature.

In current Condition the rapid development of industries, colleges, etc. in particular area, the flow of vehicles has increased in particular direction at particular time slot, but our traffic signal is not smart to avoid this problem related traffic and rush. It was take same time as which is set by the administrator, Controllers, processors. Disadvantages of the system are Traffic congestion, Number of accident is high, because of this death rate is more than other countries.

2.2Proposed Method/System

After studying the various existing system based on traffic control, we have try to solve the Problem About traffic congestions. And we are proposing to some few modifications in our existing system that can make it more effective to resolve traffic related problem. In this system there is no interference of human, so it will cause the chances of mistake nearly about 0.01%. The new proposed system is fully based on density, so it will work on priority base, which means their where traffic is more it will give first priority to clear that lane.

Our system is using Arduino micro-controller. This microcontroller provides the signal dynamic time based on the traffic density. And it can provide facility to handle emergency vehicles automatically and efficiently. This will reduce the rate of accident. This project also does the blob detection. The system is based on C language. This language is simple, easy to understand. The error can be easily detected and removed.

3. Methodology

In this system, the traffic lights are LEDs and the vehicle counting sensor is an IR (infrared sensor). Both blocks are connected to a Arduino microcontroller using physical wires. The Arduino Microcontroller is the traffic light controller which receives the collected sensor data and manages the traffic lights by switching between green, yellow and red. The Microcontroller computes the number of vehicle in the street of the intersection. It is monitoring based on the density by the IR sensor and the compare to the no. of vehicle present on another lane. Then arduino Microcontroller sends the data every minute to the local server. This communication is done using the Arduino Microcontroller serial port. The local server exchanges the data received with the cloud server in order to better predict the changes in timings of the traffic light. This communication is done using Wi-Fi. More specifically, the cloud server uses an equation that takes the data received (number of vehicle) as input then determines the time interval of LEDs needed for a smooth traffic flow. This calculated time is then compared to the current actual time of the LEDs (this data is saved in a database on the cloud server). The server then comes up with a decision. If the current actual green time is less than the calculated time, the decision is to increase the green time, else to decrease the green time. This system work as per below diagram.

3.1 System Hardware

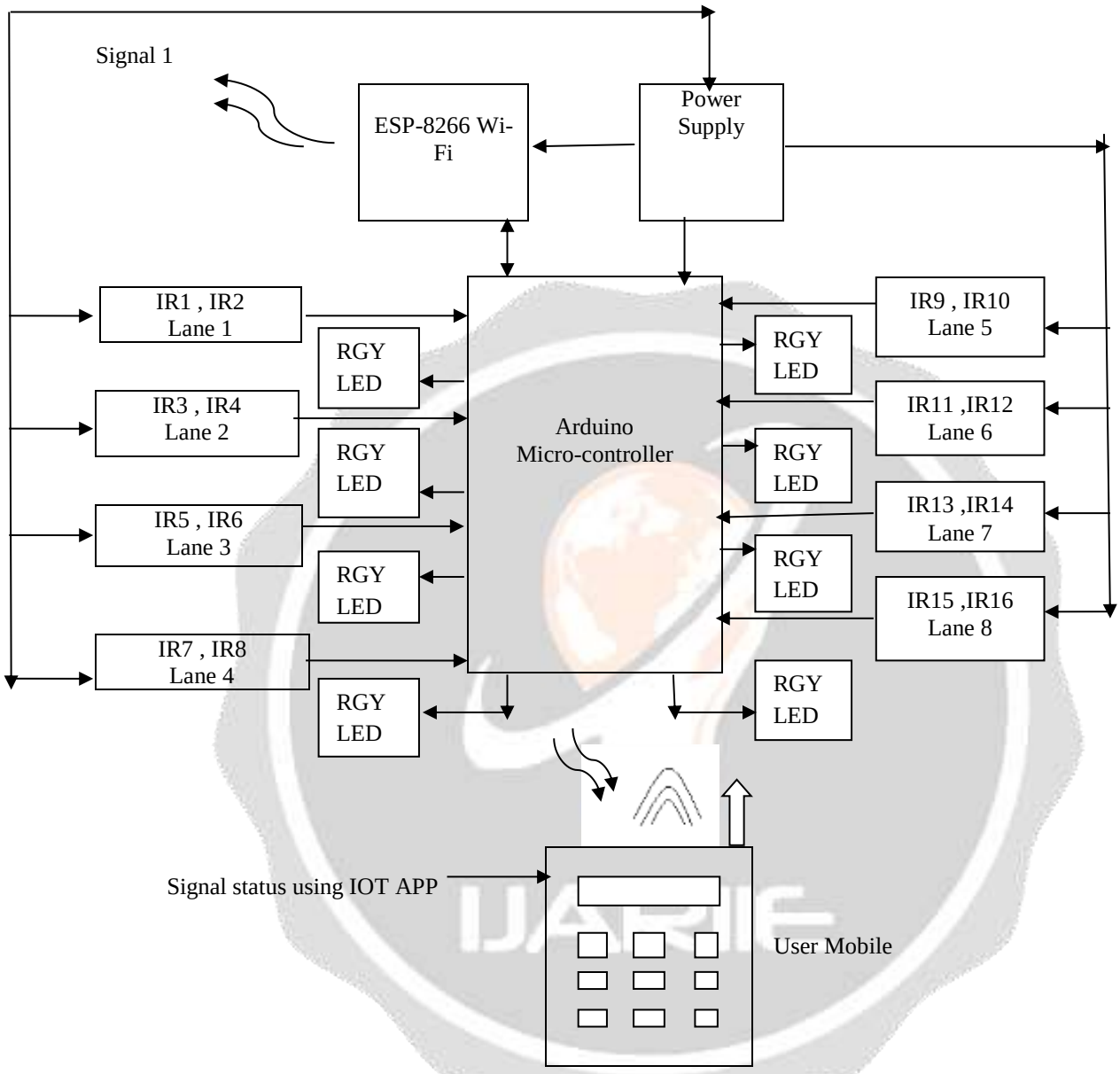

Fig - 3.1 Dynamic traffic control system

The Above figure 3.1 shows the block diagram of the system that we had tried to implement here. It consists of Two Arduino Controller, IR Sensor, and ESP Wi-Fi. Here we are using IR sensors replacing traffic control system to design an intelligent traffic control system. IR sensor contains IR transmitter IR receiver (photodiode) in itself. These IR transmitter and IR receiver will be mounted on same sides of the road at a particular distance. As the vehicle passes through these IR sensors, the IR sensor will detect the vehicle & it will send the information to the microcontroller. The microcontroller will count the number of vehicles, and provide the glowing time to LED according to the density of vehicles. If the density is higher, LED will glow for higher time than average or vice versa.

We have 2 signals A, B. We having total 16 IR sensor for road A -8 and road B-8.Signal A have Four Way a, b, c, d each road have 2 IR sensor a1 a2 once traffic in road a getting full sensor a1 a2 are ON Arduino control the signal and road A open for 5 sec and GREEN LED is ON. If 5 sec completed then signal is started in normal condition.

Simultaneously sensor b1 and b2 are ON then road B open for 5 sec and arduino controller controls the signal B and GREEN LED is ON. If 5 sec completed then signal is started in normal condition. Repeats the process as road c and d. When Traffic is Normal condition then sensor send the information to the micro-controller and arduino micro controller take decision as a signal flow in normal condition, and this information send to the User Using IOT (ESP8266 model) Via Mobile Phone Or Pc. According to data user know about the signal status.

If road A and road B have full traffic at the same time then the road which is firstly block, will be release then another road is release. This Condition depends on the vehicle density. Same process for signal A and B. Arduino microcontroller control the signal according to density and send the traffic information to the user using IoT.

3.2 System Software

Arduino IDE: The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, Mac-OS, Linux) that is written in the
Programming language Python. It is used to write and upload programs to Arduino board. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures.

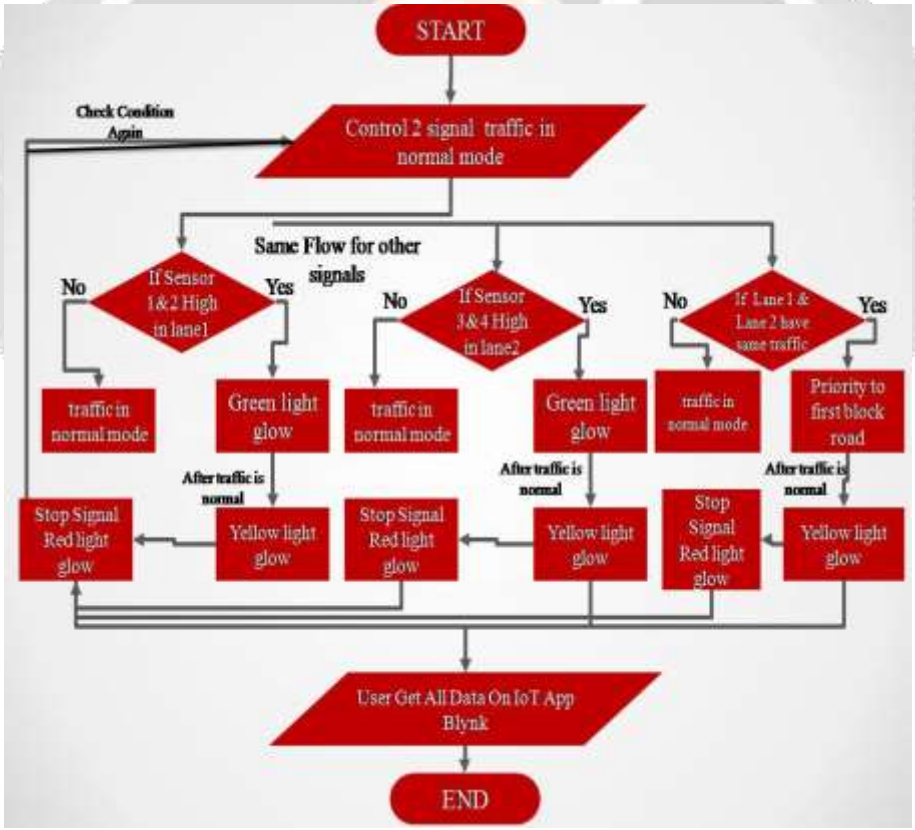

Fig - 3.2 Flowchart for our dynamic traffic control system

4. Result and Discussion

According to figure 3.2, we have Obtain following results as per various stages mentioned in the flow chart.

This system is designed in such a way that it will be able to control the traffic congestion as well as Control the density. The administrator of the system can access local server in order to maintain the system.

Fig - 4.1 Normal Traffic working

As per above figure, at the right most side there is lane 1 and if we moved clockwise it will be lane2 , lane 3, lane 4

As seen fig. 1 traffic system working normally, i.e. fixed green time slot. But what if density is increase in lane 1 as shown in below figure 2?

Fig - 4.2 Density is high in Lane 1

In figure 4.2 shows glowing of light as per the sensor activation. If Traffic is high in Lane 1 Green signal is glow Because Sensor 1 and Sensor 2 are activated.

Fig - 4.3 Clearing of some traffic

In figure 4.3 we can see after some traffic clear, then yellow signal is activated. So it is intimated to slowdown the speed.

Fig - 4.4 Traffic jam in Lane 2

In above figure 4.4 shows when there is traffic will stuck at the intersection then it may create connections so at that time green will glow.

Fig - 4.5 After situation of Traffic jam in Lane 2

In above figure 4.5 shows After Some Traffic clear then sensor are OFF and Controller glow the yellow light to indicate the driver to drive the vehicle slowly.
Number of passing vehicle in the fixed time slot on the road decide the density range of traffics and on the basis of vehicle count Arduino microcontroller decide the traffic light delays for next recording interval.

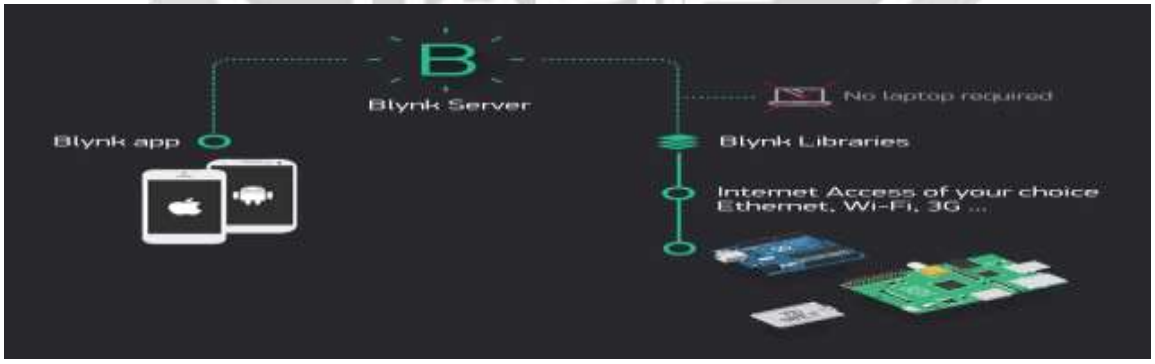

Fig - 4.6 Initial screen of Blynk App

This Blynk App is used to get information to the user about traffic in your mobile.

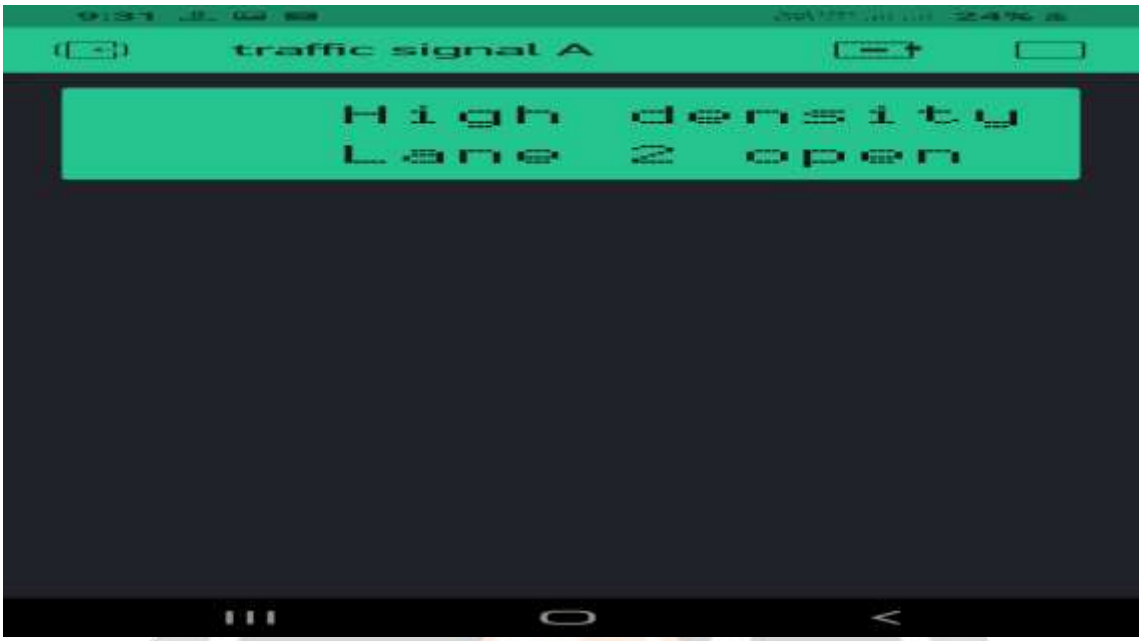

Fig 4.7 Final output of Blynk App

Above figure 4.7 shows If Signal A in Lane 2 Have Number Of vehicle that means Traffic Jam in lane 2 .so user will get intimate on their mobile App which is "High Density in Lane 2." So clear the Lane 2 on first priority.

5. Conclusion

In this system we used distance method for counting vehicles. If 1st sensor is activated then density is low. If both sensors activated in each lane then density is high. After that Arduino controller check the condition for each lane and take decision as priority based.

It is observed from the results that our improved dynamic road traffic management system provides better performance in terms of total waiting time as well as total moving time. Less waiting time won't only reduce the fuel consumption but also reduces air and sound pollution. Also reduces the time wasted at the signals and hence results in effective travelling.

In future this method will be accustomed Inform people about different places traffic condition. This could be done through IOT. Data transfer between the Arduino micro-controller and mobile or laptop also can be done through the IOT, this system allows the network operator to assemble the recorded data from a far end to his information processing system without going there.

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