International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 09 | Sep 2021 www.irjet.net p-ISSN: 2395-0072

Automated Traffic Signal Control System

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Abstract - *Traffic congestion in today's world is growing exponentially. This is because of the growing population and unorganized driving sense of the people. This leads to a lot of inconvenience on the road. This problem can be eliminated by removing the fixed static signals at busy road junctions. This paper provides us with a blueprint that can act as a solution for the above problem. Hence, if we can fetch the number of cars at every signal junction then we can make the signal timing dynamic by using the proposed algorithm.*

Key Words: **Traffic Signal, Bubble Sort, Google Traffic Data Extraction, Sinking Sort, Load Balancing.**

1.INTRODUCTION

The proliferation of permanent vehicles has been a matter of administrative care in many modern cities around the world. Several attempts have been made to build automated systems to solve this problem. Most current systems use pre-determined time circuits to use road signals, which do not work well because they do not work at the current value of the road you are crossing. To avoid these problematic communities, use hardware sensors to monitor traffic status. These tools work well, however, with some limitations. One of the drawbacks is the high maintenance costs of these tools.

Google maps is a map-based Google service that provides satellite imagery and real-time traffic (Google Traffic) that analyses GPS-determined locations transmitted to Google by a large number of phone users. By calculating the speed of users over long distances, Google is able to generate a live street map. Google processes raw incoming data about mobile device locations, and extracts unusual ones like regular mail vehicles. When the user limit is affected locally, the overcrowding and highways on the Google map change colour. Real-time traffic information is important in avoiding traffic congestion. It is often seen in modern automotive control systems that vehicles have to wait when crossing the road even if there is little or no traffic on the other side. There are other problems as well, such as ambulances being caught in a red traffic signal and wasting valuable time. Overcrowding is often translated into lost time, missed opportunities, lost productivity, delivery delays, and general rising costs.

1.1 Load Balancing Network

Load Balancing Network contains devices that use mathematical techniques to give computer systems the ability to "read" (e.g., continuously improve the performance of a particular task) from data bandwidth traffic, without explicit programming. Therefore, by integrating the network concept of load measurement sample data from Google Traffic an automated traffic control system can be developed that can effectively control traffic signals based on real-time traffic instead of current statistical values that do not consider real-time traffic congestion or can adapt to emergencies, emergency services and rerouting the traffic route.

It eliminates the need for traffic police to stand at a junction to control traffic by hand and pass information to the next signal officer on the radio. This automated system has a lot of perspective by comparing traffic cops and can be easily updated in real time in a large local area.

2. Existing Solution

In India, no such solution has yet been implemented. But there are some similar implementations around the world. For example, let's take the case of the traffic systems in the United Kingdom developed and installed by ***"Auto Mate Systems Limited"***

Table -1: Comparison of project model to existing solution

Comparison of project model to existing solution			
Sr no.	Parameter	UK based system	Our system
1	MAPS	The system in UK uses cameras instead of MAPS to know the traffic status	Google maps are used to know the status of traffic on different routes
2	Supervision	Not supervised	Supervised
3	Recovery	In case of a system failure, the traffic signals stop working resulting in unsupervised traffic across the road	In case of a system failure, the supervisor can control the traffic signal in order to maintain the conduct of the traffic properly
4	Accuracy	Not very accurate because in cameras, the two wheelers are not visible properly and thus the system cannot detect them	As google maps uses the number of active mobile phones to detect the traffic in any area, the system is more accurate than the existing system
5	Time Allotted	As cameras are involved, the time allotted to each route will not be accurate or according to the traffic as it is difficult to detect the amount of traffic.	Because of the google maps, the exact amount of traffic is detected using satellite imagery and the time is allotted according to the algorithm which uses the percentage traffic per kilometer to allot the time to different routes.
6	Employment options	Due to completely unsupervised traffic systems, people are provided with less employment option	As the system is partially supervised, the employment options are open for people

These are a few points in which our system is different from the traffic systems in UK. This system was proposed in UK by a private firm named AUTOMATE SYSTEMS The system was installed in different cities in UK

3. LITERATURE SURVEY

Traffic jams are a major problem in big cities. In India robots are based on a system of time which means whether or not cars exist will always be fixed which makes people wait unnecessarily for a long time. An important aspect of urban traffic is that even the clearly defined geographic/markings on the roads do not run on the tracks. High-traffic routes tolerate longer waiting times. [2] Low-traffic routes often get a green signal. Here we suggest a density-based traffic signal algorithm.

The system is designed to manage the time of the road signal according to the amount of traffic in its corresponding lane. The system represents the power of road traffic obviously using traffic judgments. By measuring traffic in a particular line of traffic, signal times are adjusted so that a particular route is clearer and then another with more people. The whole system works according to an algorithm that allows for smooth flow and efficiency in all four ways. It also contains emergency evacuation that allows car managers to disassemble a signal in the event of an ambulance or emergency vehicle arriving. [3]

3.1 PROPOSED METHOLODGY

Negative assumptions in the existing computer system of all work are suggested after the initial analysis. The Android app was created using Android Studio with Java as a programming language. The proposed plan is achieved by two organizations namely, Admin and User. Managers need to sign in with their pre-enabled login credentials to access the android app. After successful login, the administrator can access all modules and manage each task accurately. Managers can perform tasks such as adding new routes, removing unwanted routes and updating existing routes. Admin will set the Default Timings for Signals, Number of Cars Manipulation on each lane and in emergency admin can control traffic signal Manually. User can check the traffic signal and traffic on google map. The system is divided into 4 subsystems:

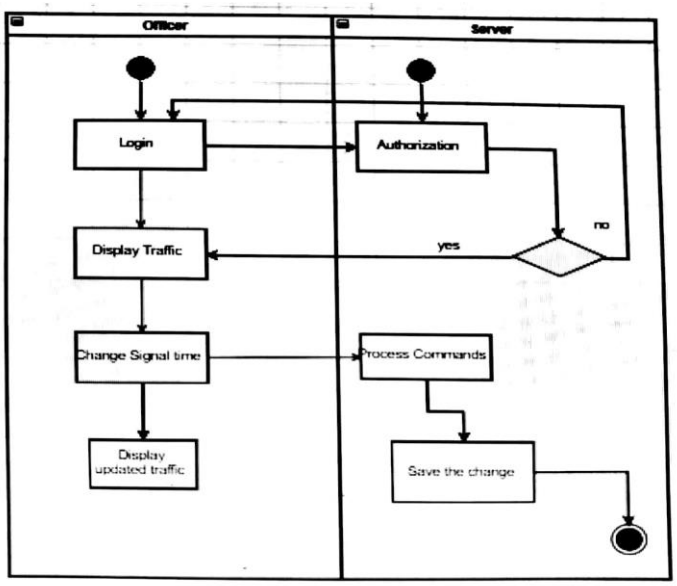
- Google Traffic Data Extraction
- User Android APP to view live traffic signal automation for every route
- Admin Android APP to manipulate live traffic signal automation
- Traffic Automation Module

User Android APP to view live traffic signal automation for every route: This subsystem is dealing with the front-end GUI of the project and displays the sample manually inputted information regarding the automation and management done by the Traffic Automation Module.

Admin Android APP to manipulate live traffic signal automation: This subsystem is dealing with the front-end GUI of the project and displays the Traffic Automation information regarding every lane and allows manipulation of the data for Manual control or fine tuning.

Traffic Automation Module: This consists of a module co ordinating with the various APIs used in the project to store, analyze and process the traffic data from a SQL database. This module is split across the USER as well as the ADMIN android app.

Fig -1: Activity Diagram (officer/admin giving inputs to system)



3.2 GUI DESIGN

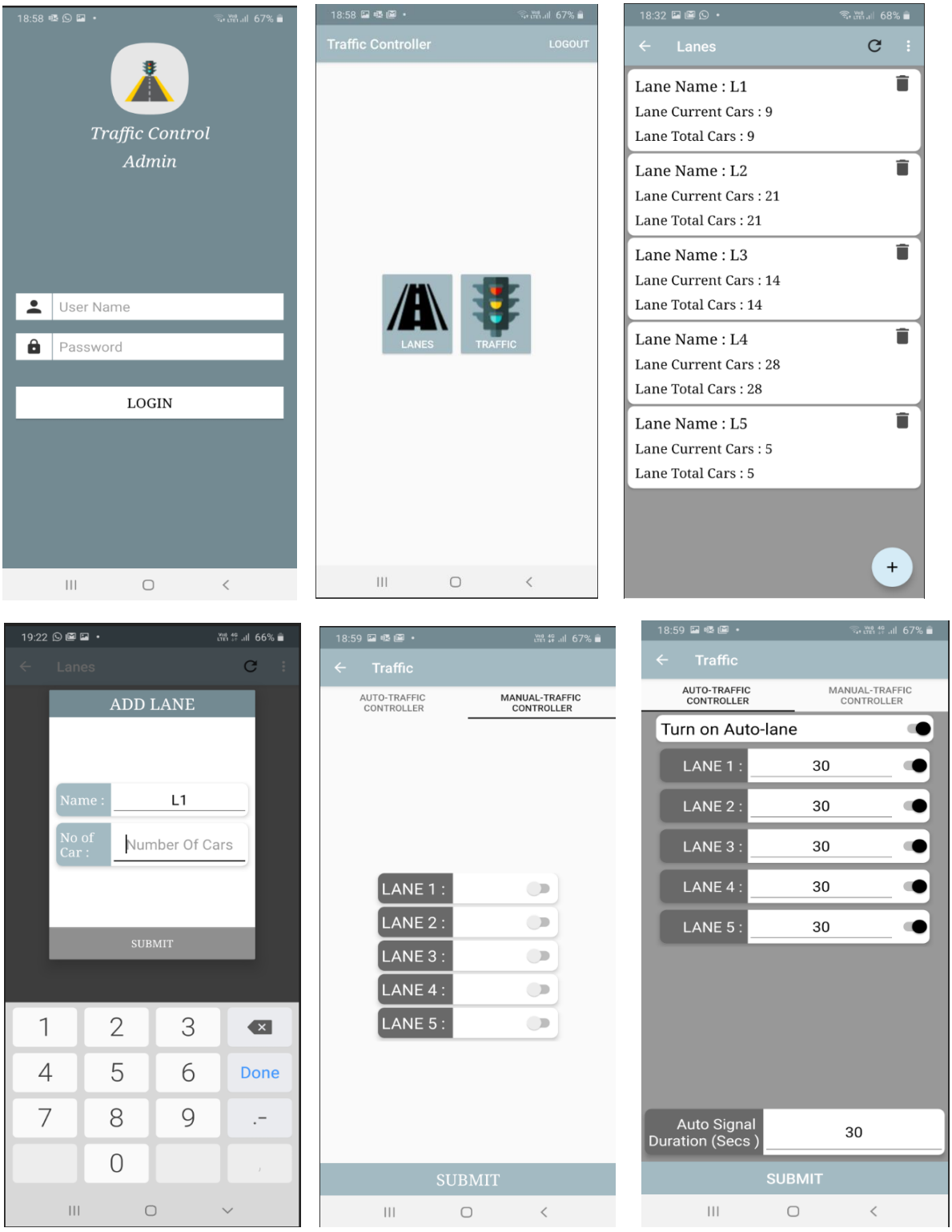


Fig-2: GUI design

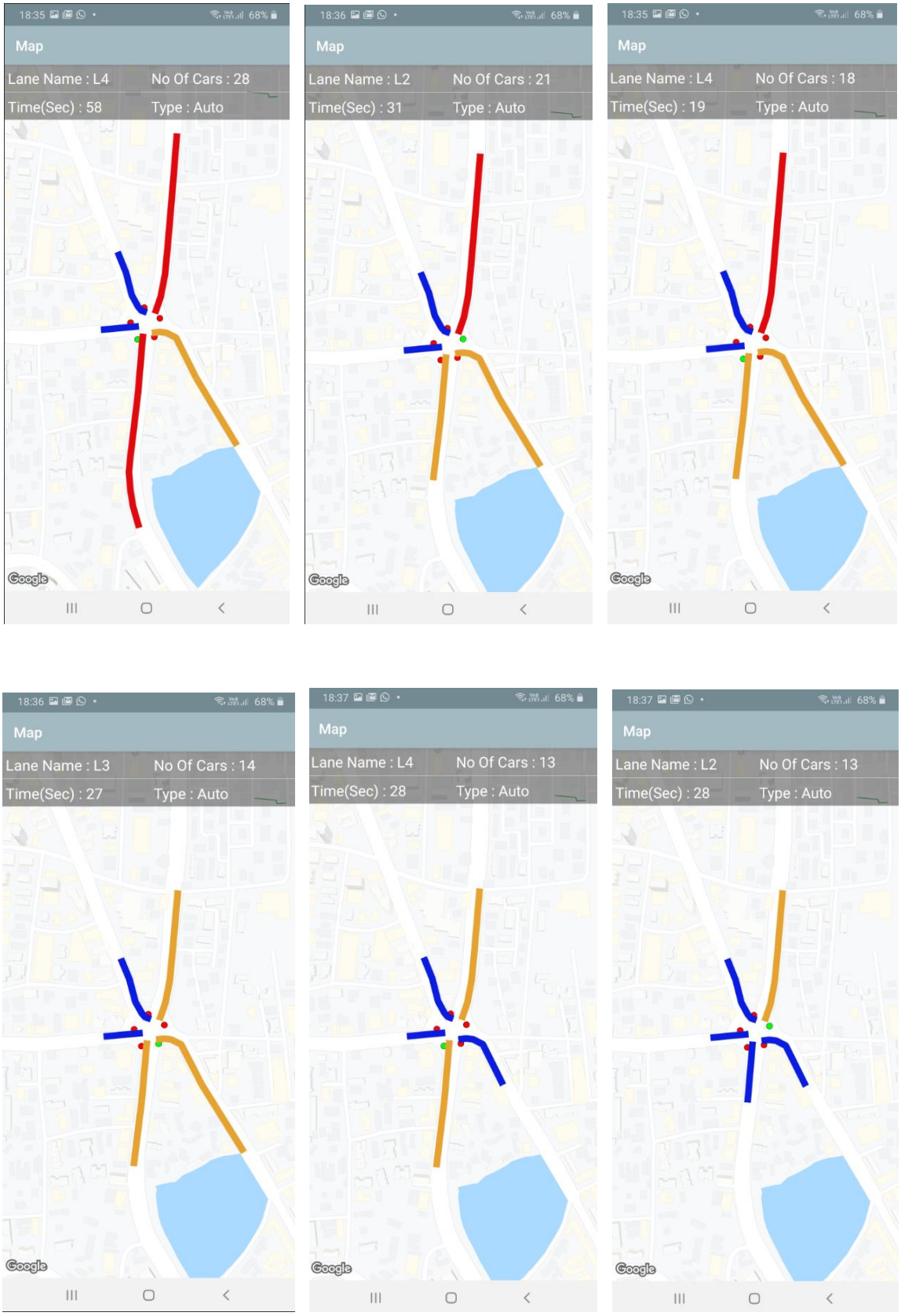


Fig-3: Traffic congestion and priority lanes

4. IMPLEMENTATION

Early versions of Google Maps depend solely on data collected from traffic sensors, many of which have been filed by government transport agencies or private companies specializing in compiling traffic data. Using radar, infrared or laser radar technology, sensors can detect the size and speed of passing vehicles and transmit that information outside a server. But here we are simply going classify congestion on road based on number of cars in that congestion. The application will identify type of congestion (Red, Orange & Blue) using a classification algorithm. In this basic classification Algorithm, we are going to classify congestions based on number of cars in that congestion. Blue Congestion – 0 to 10 cars, Orange Congestion – 11 to 20 cars, Red Congestion – 21 & above

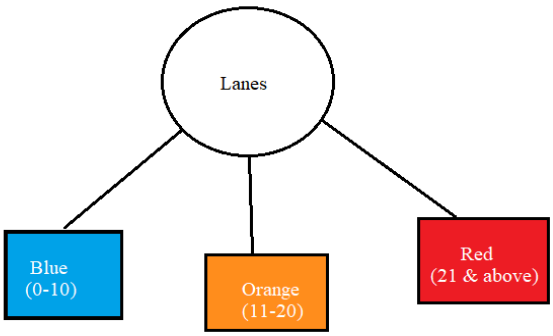


Fig-4: Priority lane distinction

Now the task is to convert the red lane into orange. We already know that red lane has 21+ cars according to classifications. To convert it into orange lane, we need to reduce the number of cars below 21. To perform such action, we need to first assume that time taken by each car to pass a signal is 5 seconds. Let 'a' be the variable of number of cars. Let 'Ci' be the current time of signal on that particular lane 'Li'

Rule.

If (a>20)

Then do

B=a - 20

Break

*C= B*5;*

Cd= C - Ci;

Ci=Ci + Cd;

End

Example.

Let's say lane L1 (Red Lane) has 35 cars and C1=30sec

i.e., a=35.

Our goal is to convert that red lane into Orange.

Applying the Rule

B=35-20=15

So

C=15*5=75

Cd= C-C1=75-30= 45

C1= C1+Cd= 30 +45;

As the number of cars reduced to 20, the lane will become orange by increasing the traffic timings by 45secs.

For the priority of the lanes to open we have used Bubble Sort. **Bubble sort**, also referred to as **sinking sort,** is a simple programming system that often goes through a list, compares nearby objects and changes them when they are in the wrong order. The pass through the list is repeated until the list is sorted. The bypass list is repeated until the list is filtered. The algorithm, which is a type of comparison, is called a small or large "bubble" at the top of the list. If the given list is to be sorted upwards, bubble sort will start by comparing the first item of the same members to the second item, if the first item is larger than the second item, it will change both items, and then continue to compare the second and third item, and so on. If we have complete n factors, then we need to repeat this process n-1 times. Similarly, n is the number of lanes. The algorithm will run n-1 times. Depending on the number of cars inputted by the admin, the lanes will open and start releasing the cars. The lane with the maximum number of cars will open first and so on and so forth. We have assumed each car will take 4 seconds to move out of the lane, so depending on the density of the lane, the signal will prioritise and open using Bubble sort.

5. RESULT AND EVALUATION

Performance Report: Case Study is a state-of-the-art version of the entire process that aims to answer many questions such as: What is the problem? Is there a possible solution to the problem? Should the problem be solved? A feasibility study is conducted if the problem is well understood. A feasibility study is required to determine whether the proposed plan is feasible by considering the technical, operational and economic aspects. By conducting a detailed study of whether management can have a clear idea of the proposed plan. The following is considered for project performance to ensure that the project is diverse and has no major obstacles. Possible studies include the following:

• Technical Performance

• Economic Access

• Possible Performance

In this section, we learn about the effectiveness of all the proposed systems, and then come up with the best solution to the problem. Process finding is studied based on the following three key factors.

Technical Performance: In this step, we confirm whether the proposed programs are technically feasible or not. that is, all the technologies needed to improve the system are readily available or not. Technical Performance determines whether an organization has the expertise and skills required to accomplish a project and how this can be achieved. The process can take place for the following reasons: You have to decide whether it is worth considering the whole project or whether the benefits derived from the new system are worth the cost. Financial benefits should be equal to or exceed the cost. In this issue, we should consider: Cond Costs There are all the necessary technologies to improve the system. The system is highly flexible and can be expanded continuously.

o This system can provide guarantees of accuracy, ease of use, reliability and data security.

o This program provides a quick answer to the question.

Our project is technically viable because, all the technology required for our project is readily available.

o Application: Android v5.0 or Higher (For Android Devices)

o Languages: Java, Database System: MS-SQL Server

o Writing Tool: MS – Word

Economic Availability: Economically, this project is entirely possible because it does not require additional funding and in terms of time, it is entirely possible to complete the project in 6 months. In this step, we determine which proposal is the most economical. We compare the financial benefits of the new system with the investment. The new system is available to the economy only if the financial benefits outweigh the investment and costs. Economic Availability determines whether a project goal can be within the resource limits allocated to it or not. Includes a full system search.Hardware and Software costs of the application category are considered, Development tools, Maintenance costs etc. Our project is economically viable because the cost of development is very small compared to the financial benefits of the application.

Functionality Uses: In this step, we validate various aspects of the performance of the proposed systems such as human capacity, time, etc., any solution that uses less efficient resources, which is the most efficient solution. The solution must also work and be able to use it. Acquisition Activity determines whether the proposed application user intentions can be integrated into the current operating system. Processing and presentation methods are fully accepted by clients as they can meet all user needs. Customers participate in the planning and development of the system. The proposed system will not cause a problem under any circumstances. Our project is viable because the time and needs of the staff are met. We are a four-member team and have worked on this project for three months.

6. FUTURE SCOPE

With more access clearance to google maps API and GPS image data we can scale the project to a larger area coverage and also have more accurate data for input. With the help of the Indian government this project can control and automate the traffic signals in real time with sensor inputs and dynamic traffic control could be established truly. Also, this project if given more time to develop can be expanded to other services such as provision of optimal routes across two points on the map for example ambulances or fire brigades. More data sets from the google API with unrestricted access would mean we could use it to make the signal automation more accurate without any assumptions of the car density. Have more concurrency control measures to ensure that data across devices is consistent. With more time and access to street layout from google maps and the government of India we could map more routes in our application and add more signals and expand the area considered.

7. CONCLUSIONS

In this report, we have presented a traffic system using machine learning. The system is built using Android Studio, JAVA, RESTful API, MySQL, Google Map API and XML. It is capable of fetching the traffic status directly from google maps, analysing the traffic status and providing a pass to the routes where the traffic is more. The system is supervised by traffic police at every time to keep an eye on emergency cases which cannot be recognized by Google maps like an ambulance passing or a fire brigade truck passing the signal. Thus, the signal can be changed manually also. The important data about the timings of the signal and traffic density is saved on the database We have integrated all this technology to present the traffic system using an Android Application

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