

# Density Based Traffic Control System Using Google API

Amitendra Bhardwaj<sup>1</sup>, Manisha Mane<sup>2</sup>, Bhakti Shetty<sup>3</sup>, Umang Kacha<sup>4</sup>

Department of EXTC, Viva Institute of Technology, Virar (E), Palghar 401 303

**Abstract**— *The traffic control involves directing vehicular and pedestrian traffic. To achieve success an integrated traffic management system (IMTS) is used as a backbone in any metropolis. This system provides reliability, accuracy and operates on real-time is achievable, along with speed of vehicle and delay. And these three key features enables is to control, monitor quality congestion.*

*The O-D travel time is one of the analysis technique used to measure the travel time between origin and destinations in a précised manner. Also this research includes Google Maps Application Programming Interface (API) which implements the task by developing desktop tools at it initial stage and thereby dynamic update of transportation network data is achieved by successfully maintaining the routing rules and obtains estimated data of O-D travel time matrix.*

*The main aim is to achieve a density based traffic control system at the junction traffic control is achieved by sensing the traffic the traffic density as signaling changes automatically.*

**Keywords-** *Arduino, Google Maps API, O-D travel time, Real time data, Traffic congestion control.*

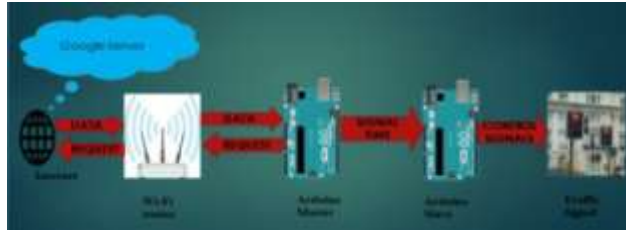
## I. INTRODUCTION

The increase of jam produces losses of many countries resources such as looses of petrol, exhaustion of automobile and lateness of employers in addition of fatigue for both the citizen and the traffic policeman. According to envisions made till date smart road systems were developed in order to reduce traffic by minimizing the total trip time. It is necessary to utilize free roads for a better flow of traffic at a junction. At times wastage of time and power consumption takes place due to green traffic light on the lane where no vehicles are passing by at that moment. Many techniques were adopted in order to find solution of such problems of traffic congestion in urban areas. Various advanced technologies use sensors including micro loop probes, pneumatic load tubes and inductive loop detectors. The main disadvantage of using sensor is that it has a high installation and maintenance cost. Also it interrupts the traffic during installation and repairing of the system. Various ground sensors, radars and ultrasonic sensors are used which increases cost and also their accuracy depends on various environmental conditions.

This paper presents a real time adaptive system based on Google API. This technology is capable of lifting the traffic surveillance system to another level because of its attractive features such as low cost and its potential to large scale deployment. In this system the time period of green light and red light is allotted to each junction on the basis of the density of the traffic present at that time. This is achieved by using Google API. It extracts the traffic density information of a junction through Google maps. Once the density of the junction is calculated, the ON time of green light is allotted by the Arduino.

## II. DESIGN METHODOLOGY

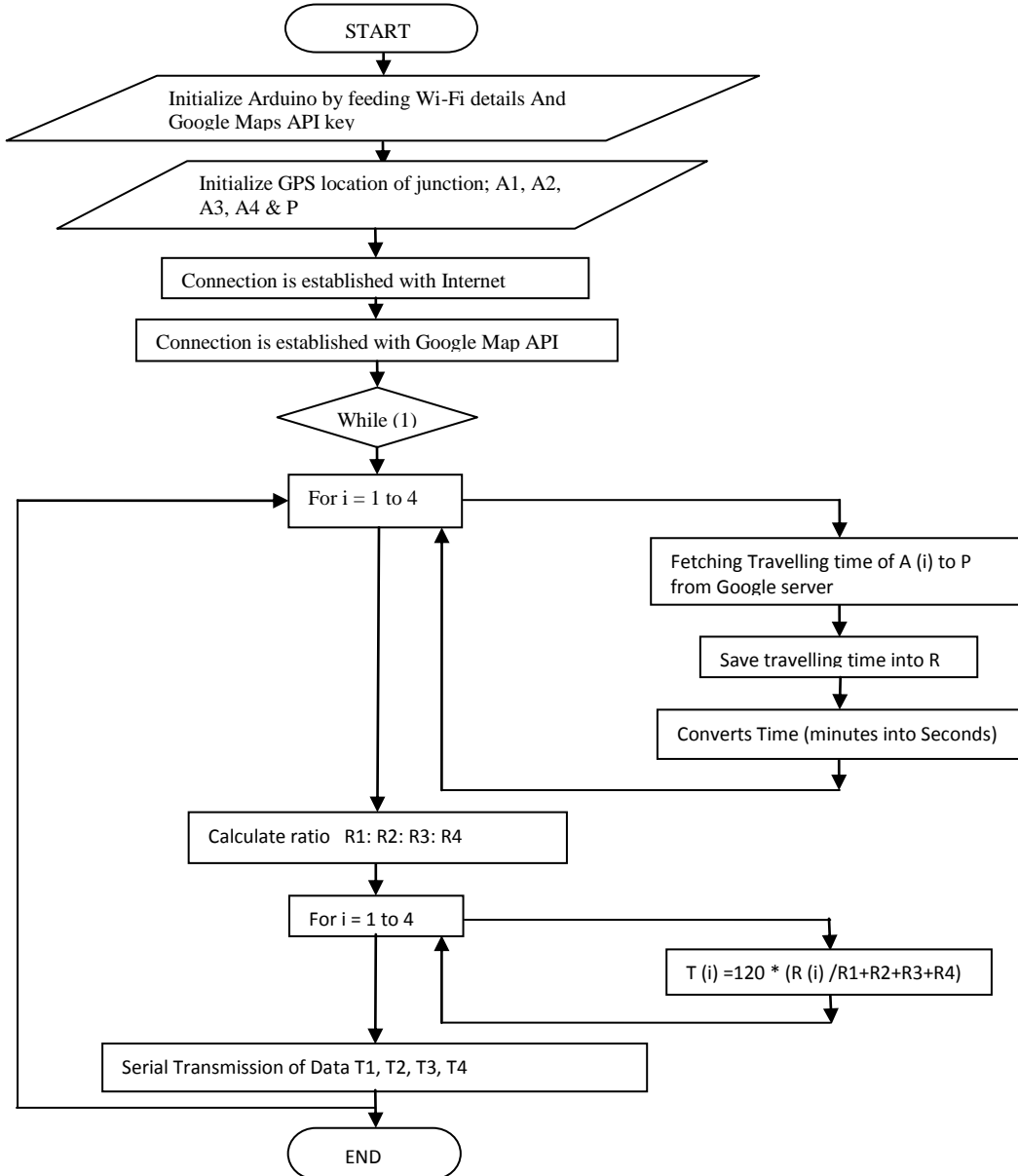
Initially the connection is established between the Arduino Uno and the Google server using Arduino Wi-Fi module via internet. The Google API key already fed into the program uniquely for each system is used by the arduino to login into the Google server. The system is provided with the GPS location of the junction in terms of latitude and longitude. Arduino chipset will request the travelling time data of the junction from the Google server. The Google server will provide the data currently available at the data base of Google Map server. The travelling time is obtained by the Arduino. This travelling time is used to calculate the traffic density on each arm of the junction by converting time into ratio. On the basis of these ratios the system allots the green signal time on each arm of the junction. This whole process is done by the master Arduino. This calculated data is then given as an input to slave Arduino by serial data transmission. The function of slave Arduino is to control the glow time of traffic signal lights according to the data provided by the master Arduino .While the slave Arduino is controlling the traffic signal, the master Arduino perform the function of fetching data and data calculation in background.



**Fig : 1 Block Diagram**

### 2.1 Working of Master Arduino

Below figure shows the flowchart of master Arduino.



**Fig : 2 Flowchart of master Arduino**

The performance of Master Arduino starts by initializing the system by login to the WiFi router and the Google API by its API Key provided to it. It will search for the GPS location of the junction fed in to the program at initial stage.

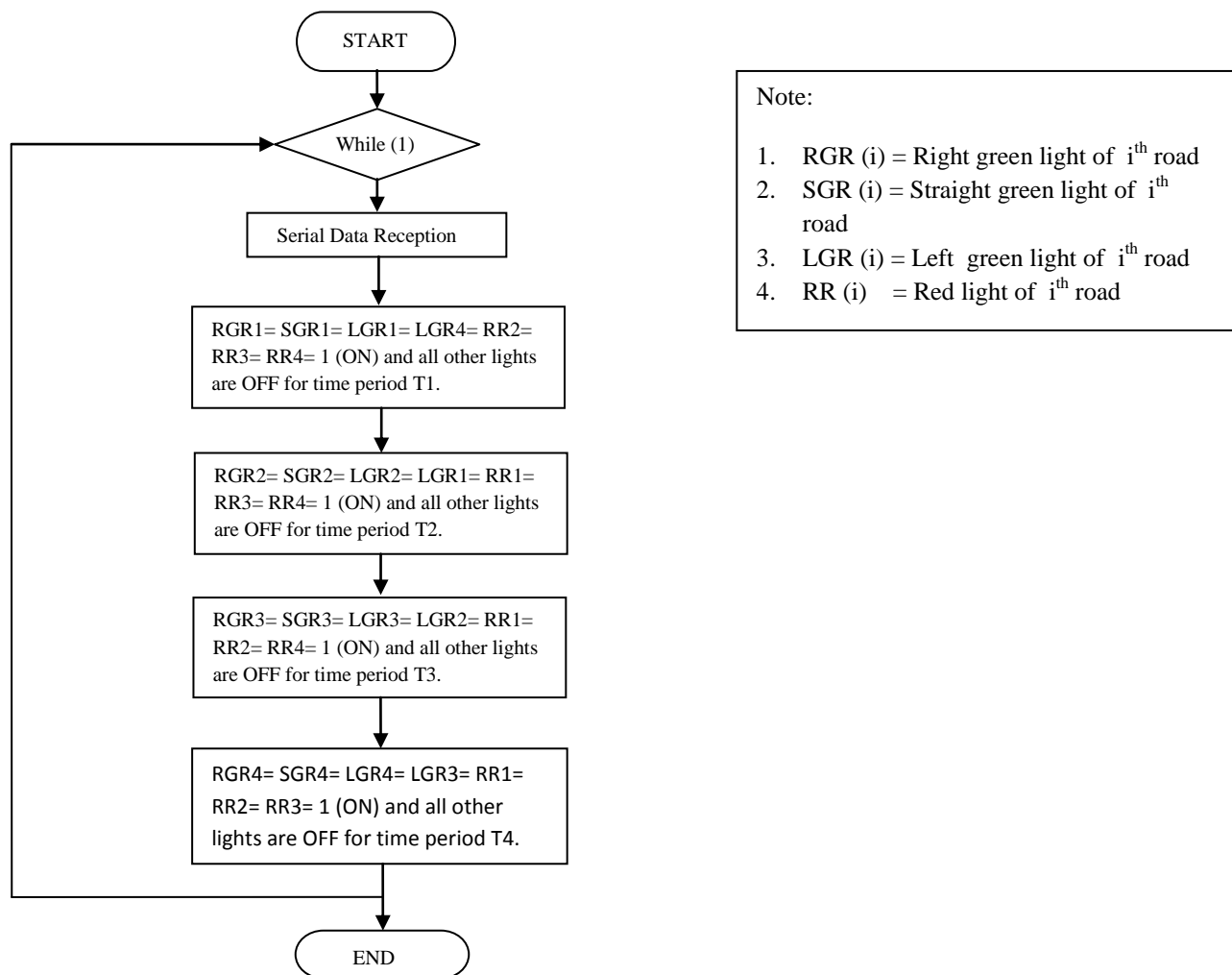
Now we will initialize a while loop in which main function of master Arduino will be done. It will fetch the data of the junction. Fetching of data will be done for four junctions. It will get the travelling time of vehicle from point A to P location for road number 1 and similarly for all the roads of the junction from pointed location to centre of the junction one by ones saved to the array. Then travelling time is converted into seconds for simplification. Then it will calculate the ratio of the travelling time for A-P, B-P, C-P, and D-P. This will to calculate Green Time of traffic light by distributing the 120 seconds of time cycle into four parts using formula,

$$T(i) = 120 * R(i) / [R1 + R2 + R3 + R4]$$

This calculation takes place four times or number of times depending on the roads on a junction. Later this data would be transmitted serially to the Slave Arduino and the operation will continue for each cycle. When data is transmitted to slave Arduino. it will repeat the process of extracting travelling time and further process for next cycle.

### 2.2 Working of Slave Arduino

Below figure shows the flowchart of master Arduino.



**Fig : 3 Flow chart of Slave Arduino**

Main function of Slave Arduino is to control the traffic signal lights according to the data provided by Master Arduino. It starts its working by collecting data by serial communication from the Master Arduino. This Data is time duration of all the roads of junction. Further process is to controls or ON/OFF the Traffic lights. It will ON all the Green lights of the road 1 of the junction and Red lights of other road of the junction. Also the Road at the right hand side of the moving road it's left road movement is started with this. It will turn ON these lights for time delay of T1 received from Master Arduino. Again it will do same process for all the roads (i.e, for Road 2, 3, & 4) only time delay will be different for all the roads.

### III. GOOGLE MAPS API

Google API is a set of application programming interfaces (APIs) developed by Google services and their integration with other services. APIs provide functionality like analytics, machine learning as a service or access to user data (In our project Google API aims at analyzing car travel time data collected from Smartphone's by Google and thereby Geographic Information is by using is by using programming language). Almost everywhere transport or traffic planning tasks takes place by collection of data. Also traditional ways have various drawbacks allowing limited coverage area and some security issues. Google API provides authentication and authorization using the O Auth 2.0 protocol. Also Google API provides client libraries in different language which allow developers to use Google API within their code including JAVA, JavaScript, .NET, Objective-C, PHP and Python. The key feature of API is that it allows you to request traffic map tiles that visualize the data available. Google API uses JavaScript extensively as the user drag the map the grid squares are downloaded from the server and inserted into the page. Locations are drawn dynamically by positioning a red pin on the top of the map images. This is by using GPS technology. The advantage of using GPS technology in smart phones is that it provides higher location data resolution and accuracy. Also frequent data is collected.

The Google API detects traffic time with high precision and demonstrates high penetration rate as compared to CDR technology. The main advantage of Google API technology is that identifies only the vehicle in motion and their by avoid detection of vehicle at rest. Also using Google API provides access of real time data and it promotes freely available Google maps travel time data collected from a large numbers of smart phones with built in GPS sensors and showcase analysis methodology. Here we have attempted to make use of Google maps data by estimating O-D travel time matrix. Here travel time is extracted for more precision. Also we have accessed junction analysis which may be relevant to local investors and city authority. Here each area is divided into various junctions. The junctions are usually bounded by Main Street, a highways local route which poses traffic. The data source used in this study was the Google maps which provide access not only to the network but also to the transport travel time. Here allocation of travel time information depends on a particular read at a specific time on working days and real time data indicating real time speed of vehicle. When android smart phones uses turn on their device and enable their GPS smart phones send back anonymous bits of location data to Google database. This allows is to detect the movement trajectories and make analysis and provide aggregated information to the consumers using the service. Here the information received depends on the recommended route between origin and source calculated by Google maps distance matrix API.

### IV. TRAVELLING TIME

Travel time with respect to traffic control is the time in which the time taken by the vehicle to travel from origin to destination is being calculated. To calculate the travel time of a particular vehicle precisely a data source is the Google maps database which gives us accessibility not only towards to the map but also to the transport travel time. Traffic travel time of Google maps depends on two types of information that is historical data regarding the average travel time on a particular road section at a specific time on specific days and real time data indicating real time speed of vehicle. Crowd sourcing is used by Google maps to calculate traffic data in precise manner. As it uses real time data it uses smart phone users to gather the travelling time data. As soon as the user turns on the GPS location, the phone sends the data of the location in form of various bits of Google database. This allows us to track motion path and further enables us to provide various aggregated information such as speed or travel time. More the number of users higher is the accuracy of data. The travelling time completely depends on the transportation network. When number of arcs and nodes are connected it leads to the formation of transportation network. Estimation of travelling time becomes necessary to obtain shortest path between the origin and the destination on the transportation network. While calculating

the travelling time some factors such as time taken for each turn, speed on each arc and restrictions on turns are taken into consideration. Therefore need of certain elements such as one way streets, underpass impedance, overpass impedance, turn impedance and link impedance becomes necessary. Inclusion of these elements increases the cost along with complexity. If these elements are neglected then it may lead to improper estimation of travelling time, thereby reducing its accuracy. In order to achieve accuracy of the data without increasing the cost and complexity of the system in an alternate way is to use Google API for calculating the travelling time of a network.

## V. CONCLUSION

The traffic light issue is obviously a critical problem that worries citizen and government. The influence of flow efficient conventional traffic system affects the economic, health, financial and environmental domains. The transportation system trouble and the bad monitoring may cause car accidents, traffic jams and roads congestion that puts heavy loads on business and work. The advancements of technologies and the miniature of controlled devices, appliances and sensors have given the capability to build sophisticated, smart and intelligent embedded systems to solve human problems and facilitate lifestyle. Our proposed traffic light control system will surely contribute to the scientific society to replace the existing traffic light systems and manage the flow of automobiles at the intersections by implementing this proposed hardware and software design system.

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## REFERENCES

- [1] Khaled Elkhatib school of engineering, Lebanese International University. "smart traffic light control system". Conference paper April 2016 ISBN: 978-1-4673-6941-1 IEEE.
- [2] Nikhil Lende, Prof.S.S Paygude "Survey on traffic monitoring system using image processing". IJARCT vol 3 issue 12 dec.
- [3] Ms Gaurita R.Choukekar, Mr.Akshay G Bhosale, "Density based smart traffic light control and emergency vehicle detection based on image processing". IRJET vol 5 issue April 2018.
- [4] Yan- Jan Wu, Yin Hai Want, Dalin Qian "A Google map based arterial traffic information system". Proceeding of the 2007 IEEE. Intelligent transportation system conference Seattle, WA, USA Sept 30 Oct 3, 2017.
- [5] K.Vidhiya, A.Bazila Banu "Density based traffic signal system". ICIET vol 3, special issue 3 March 2014.
- [6] Rajeshwari.K , Ashwini A.P, Malleesh M.K ,Chandru. P under guidance of smt Prema, "Smart Life Saver with automatic traffic control". IJTRA vol 5 issue 3 ( may- June 2017).
- [7] Shubham Sahu, Dipanjan Paul, S.Senthilmurugan, "Density Based Traffic Signal Control Using Arduino And IR Sensors". IJNRD | Volume 3, Issue 4 April 2018.
- [8] Mihai Bogdan, "Traffic Light Using Arduino Uno and LabVIEW". The 12th International Conference on Virtual Learning ICVL 2017.
- [9] Deepak Kumar Rath, "Arduino Based: Smart Light Control System". International Journal of Engineering Research and General Science Volume 4, Issue 2, March- April, 2016.
- [10] Mohammed Ehsan Safi, "Smart Traffic light controller based on Microcontroller". IJCCCE Vol.16, No.1, 2016.
- [11] Faghri, Ardeshir, and Khaled Hamad. "Travel time, speed, and delay analysis using an integrated GIS/GPS system." Canadian Journal of Civil Engineering 29.2 (2002): 325-328.
- [12] Al Hussain Akoum Department CCNE, Lebanese University, Saida, Lebanon "automatic traffic using image processing".

- [13] Vytautas Dumbliauskas, Andrius Barauskas. "Application Of Google Based Data For Travel Time Anaysis". Promet – Traffic&Transportation, Vol 29, 2017.
- [14] Swetha .B. R, Yuvasri.D. "Density Based Traffic Control System Using Arduino UNO". SSRG International Journal of Industrial Engineering - (ICRTECITA-2017) -Special issue- March 2017.
- [15] Shabbir Bhusari, Sumit Patil, Mandar Kolbhor. "Traffic Control System Using Respebeery -PI". Global Journal of Advanced Engineering Technologies Volume 4, Issue 4- 2015 ISSN (Online): 2277-6370.