SSRG International Journal of Electronics and Communication Engineering Volume 7 Issue 1, 20-23, January 2020
ISSN: 2348 – 8549 /doi:10.14445/23488549/IJECE-V7I1P104

Priority Based Traffic Signal System using Google Maps

Abhishek Sachan, Kushal Khanna, Shobhit Srivastava, Prof.A.B. Patil

Students of Electronics and Telecommunication Department,

Bharati Vidyapeeth (Deemed to be) University
Dhankawadi, Pune, India. 411043

Received Date: 25 December 2019
Revised Date: 29 January 2020
Accepted Date: 02 February 2020

***Abstract* —** *In modern life, we have to face many problems: traffic congestion and it is becoming more serious day after day. The major cause leading to traffic congestion is the high number of vehicles caused by the population and the development of the economy. Traffic congestion is a condition on road networks that occurs as use increases and is characterized by slower speeds, longer trip times, and increased vehicular queuing. Nowadays, traffic lights mostly operate on fixed cycles in developing countries or are manually controlled by traffic inspect two or three times a day according to congestion characteristics. These manual and fixed solutions aim to sort out road sections with low traffic flows, but, for the major sections, such solutions are not effective due to short temporal and spatial congestion changes. We are using wi-fi enabled WeMos D1, an ESP 8266 module for transmission and reception of the data. This WeMos is interfaced with the Telegram bot to communicate to the system, and an API key is obtained via the Google Cloud Platform. Here, the latitudes and longitudes are put as a command in the telegram bots, which allow us to know the congestion and the traffic adjustments needed in a region. The traffic congestion levels then decide the time allocated to a particular direction at a traffic signal.*

Keywords —
API: Application Program Interface
IR Sensor: Infrared Sensor
PIR Sensor: Passive Infrared Sensor
IDE: Integrated Development Environment

I. INTRODUCTION

Traffic congestion is a frustrating problem in our daily lives. Waiting for a long time at the traffic lights is often a source of despair to us all. Sometimes, the traffic in one direction is significantly larger than the traffic in another direction, but due to the same time being allotted for the other direction, the direction with more traffic suffers. Here, we determine the time for which a signal will be green or red based on the traffic in the respective directions, classified in three zones: high, medium, low. Here we are monitoring the traffic via google maps. We will be accessing google maps through our code for the telegram bot. A telegram bot is an automated communicating client generated by the "Botfather" library of telegram. This will help us to understand the signal time requirements of the junction. We will also need a Google API key which we will get from the google clouds platform.

With the rising standards of computational technology, single-board computers, software packages, platforms, and APIs, it has become relatively easy for developers to create systems for controlling signals and informative systems. Hence, for enhancing the power of Intelligent Transport Systems in automotive telematics, we used crowdsourced traffic congestion data from Google to adjust traffic light cycle times with an adaptable system to congestion in this study. Since crowdsourced data are used, the system does not entail the high infrastructure cost associated with sensing networks. A full system module-level analysis is presented for implementation. The system proposed is fail-safe against temporal communication failure. Along with a case study for examining congestion levels, generic information processing for the cycle time decision and status delivery system was tested and confirmed viable and quick for a restricted prototype model. The information required was delivered correctly over sustained trials, with an average time delay of 1.5 s and a maximum of 3 s.

II. COMPARATIVE TECHNOLOGIES

There have been previous attempts to control the traffic using density-based traffic signal systems. We will explain all of that one by one.

A. TRAFFIC CONTROL USING PROXIMITY SENSORS

In this method, a set of IR or PIR sensors can activate a change in the cycle time or the lights. In the case of a less traveled street that may not need a regular cycle of green lights, a proximity sensor will change the light when cars are present. This type of control

depends on having some prior knowledge of traffic flow patterns in the intersection so that signal cycle times and proximity sensors' placement may be customized for the intersection. However, this method is unreliable as these sensors' reliability is not high, and there is great scope for error.
IR sensors sometimes may absorb normal light also. As a result, the traffic system works improperly. IR sensors work only for fewer distances. We have to arrange IR sensors accurately; otherwise, they may not detect the traffic density.

B. TRAFFIC CONTROL USING IMAGE PROCESSING

. Here, the vehicles are detected by considering the captured images instead of using timers or electronic sensors placed on the pavement. A web camera is placed at the traffic light, which captures the road through which the vehicle count is estimated, and traffic is controlled. Using image processing in traffic control is found to be a better technique than the existing methods. It reduces traffic congestion without any wastage of time caused by a green signal on an empty road without any vehicles. It is implemented in Matlab to reduce the traffic based on density. Four main steps are considered for the system: a) image acquisition, b) RGB to grayscale transformation, c) image enhancement, and d) morphological operations. A camera is installed and used to capture video of the highway. The video is recorded continuously in consecutive frames, and each frame is compared to the initial captured image. The total number of cars present in the video is found out using image processing algorithms. If the total number of cars exceeds a predefined threshold, heavy traffic status is displayed as a message.
The image-based processing techniques, though accurate, need high-performing hardware systems that incur a lot of costs. These hardware systems need bulky systems to be operated on.

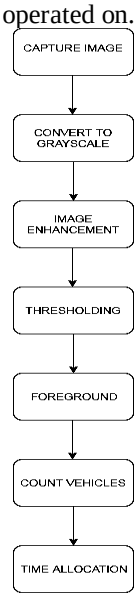

Fig 1: Flowchart for Image Processing Based Traffic Signal Systems

C. TRAFFIC CONTROL USING GOOGLE MAPS

This is the method which we are using in this project. This method is based on Google Maps. This represents a software-oriented approach in the field of Traffic Control. The hardware resources to be used here are already provided in normal traffic signals. We will need some timer circuits and the interfacing of the hardware with Google Maps. This is done by obtaining a Google API key via The Google Clouds Platform. This API key is then interfaced with the telegram bot. With the telegram bot's help, we can specify the latitudes and longitudes for the traffic to be calculated. We are using a WeMos D1 Mini, which is a wi-fi-enabled microcontroller. It ensures the internet connectivity of the system.
This approach is very cost-effective compared to the hardware approaches. It is widely different from previously existing methods of traffic manipulation.

III. PROPOSED SYSTEM AND FLOW OF THE SYSTEM

The proposed methodology adopted in the present project work is depicted in the block diagram below shown above in a very highly abstracted manner with various blocks numbered as 1 through, which are explained as follows.

TRANSFORMER:

There are two types of transformers:

1. Step-up transformer
2. Step down transformer

The one which we have used in our project is the Step-down transformer. The step-down transformer steps down the incoming voltage to the desired voltage, 5 Volts.

RECTIFIER:

Since our devices work on direct current (DC), therefore we have to convert the incoming alternating current (AC) to direct current (DC). Also, Lithium polymer batteries can power up our microcontroller as the output obtained from the Lithium batteries is direct current (DC) only.

REGULATOR:

The voltage regulator's prime function is to remove the voltage spikes in the incoming DC signal and stabilize the desired voltage. It is also used to protect our passive devices from voltage irregularities.

WeMos D1 MINI:

Wemos D1 Mini is a mini wi-fi device based on the ESP8266EX chip. This device is a very compact solution for prototyping small smart objects linked to the World Wide Web thanks to the ESP8266 wi-fi functionalities. The Wemos D1 Mini features 4MB of flash memory, 80MHz of the system clock, around 50k of usable RAM, and an on-chip Wi-fi Transceiver. We have programmed the

microcontroller using Arduino IDE, and we have used the following libraries:

1. Google API library
2. Universal Telegram Bot library
3. ESP8266 library

TRAFFIC LIGHTS:

We have used LEDs to represent the traffic signals. The LED's have been represented in the following manner:

1. Red - Stop Signal
2. Yellow - Wait Signal
3. Green - Go Signal

GOOGLE MAPS API:

We are using this feature to obtain the live traffic data from Google's server based on the service provided by the transits currently present in that area. The data obtained from Google API depends upon the following factors:

1. Historical Data
2. Seasonal Occasions
3. Third-party apps
4. Local authorities' server

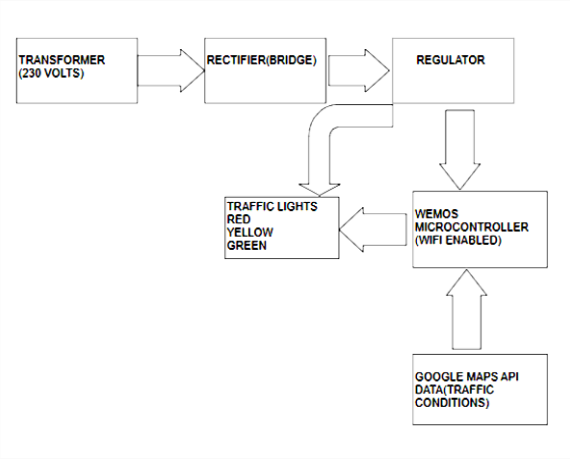

Fig 2: Block-diagram of the proposed methodology

IV. TIME ALLOCATION

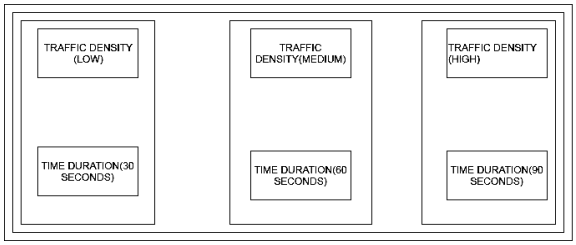

Fig 3: Time allocation for traffic signals

As you can see in the above figure, the time allocated to different directions at a junction will depend on the current traffic density. If the density is high, 90 seconds are allocated to that particular direction; if the traffic density is normal, 60 seconds are provided. If the traffic condition is light, 30 seconds are provided. This allocation of time will help in better management of the system.

V. FLOWCHART OF THE METHODOLOGY

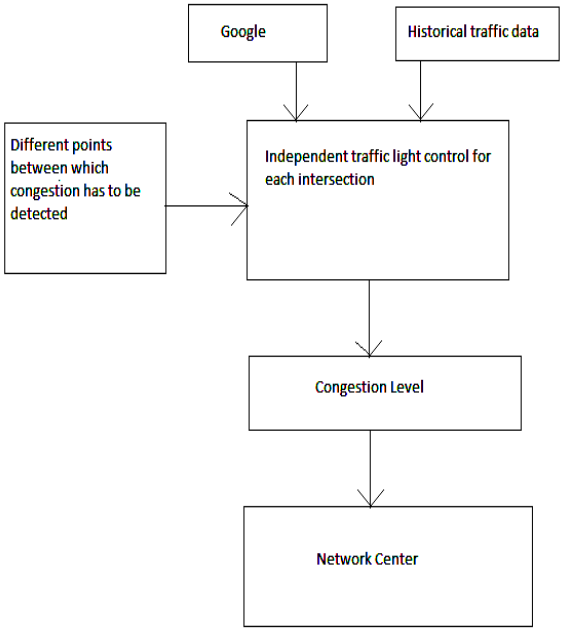

Fig 4: Flow-chart of the methodology used.

The above flowchart represents the acquiring of the traffic information into the system. The information is accessed from Google or taken using historical data. This information is sent to the traffic light control system, determining the points where congestion has to be detected. This is then forwarded to obtain the congestion level and then passed to the network center for achieving this over a range of traffic junctions.

VI. SCOPE OF THE PROJECT

Often we see that a particular direction has a lot of vehicles, say 200. The vehicles in this direction have to wait 60 seconds and then get the green light for 60 seconds. A lot of times, this time is not enough. In the other direction, 50 vehicles need only 30 seconds to pass by. But due to the uniform time given to all the directions, they get 60 seconds, which causes a state of no motion for about 30 seconds. Hence, this project serves to give the green light time depending upon the traffic density.

- This project can be implemented in regions with traffic issues.
- It can be utilized when there are many exits at a roundabout t, and the traffic is unevenly distributed.
- The traffic police of a city can use this project to coordinate the traffic on a big scale.

VII. ADVANTAGES OF THE TECHNOLOGY

- The following advantages drive the use of C in embedded systems
- It is small and reasonably simpler to learn, understand, program, and debug.

- C Compilers are available for almost all embedded devices in use today, and there is a large pool of experienced C programmers.
- Unlike assembly, C has the advantage of processor-independence and is not specific to any particular microprocessor/ microcontroller or system. This makes it convenient for a user to develop programs that can run on most of the systems.
- As C combines the functionality of assembly language and features of high-level languages, C is treated as a 'middle-level computer language' or 'high-level assembly language.'
- It is fairly efficient
- It supports access to I/O and provides ease of management of large embedded projects.

Advantages of Arduino IDE

- The biggest advantage of Arduino is it's ready to use structure
- Arduino has its library of examples present inside its software
- Arduino has an easy, effortless function.
- Arduino has many forums present on the internet

Advantages of the Google Map approach:

- It is a software-oriented approach.
- It works on real-time based systems.
- It takes historical data into account.
- Using this method, a lot of money is saved, which would otherwise be used in installing complex hardware systems.
- This approach allows us to implement our system over a network of junctions.

VIII. DISADVANTAGES OF THE TECHNOLOGY

- The model needs continuous internet connectivity so that the microcontroller could analyze the live traffic data results, and it can allocate the time according to that.
- The model is currently applicable to only a certain number of traffic junctions in a city with a good number of smartphone users as google collects data from the transits' smartphones.
- Google traffic information is also based on previous historical data, weather information, festivals, and occasions.
- While you are no longer limited to a maximum number of requests per day (QPD), the following usage limits are still in place for the Maps JavaScript API: 500 requests per second (QPS).

IX. CONCLUSION

In the sources we studied, traffic observation was done with IR, PIR sensors, or ultrasonic sensors. These methods have many limitations, and they can fail; hence we are implementing the use of Google Maps using the Telegram Bot. Here we give the latitudes and longitudes in our code for a telegram to find the place's traffic condition. This is done by importing the Telegram library in Arduino and then initiating a conversation with the Telegram Bot. This bot communicates with Wemos and Google API. We can also implement this method over a network of traffic junctions to oversee an entire city's traffic. The proposed methodology represents a software-oriented approach to traffic control.

ACKNOWLEDGEMENT

The team members would like to acknowledge the efforts of our project guide, Prof. A.B.Patil. Her continuous efforts have propelled us to achieve our ideas. We would also like to thank all of our friends who have given valuable inputs to pursue this project. We want to thank our Head of Department, Dr.Shruti Oza, for her continuous guidance. We would also like to thank Prof. R.B. Ghonghade for his insights. We extend our thanks to our college: Bharati Vidyapeeth University, College of Engineering, for providing us with the infrastructure to perform the project.

REFERENCES

[1] DESIGN AND IMPLEMENTATION OF A DENSITY-BASED TRAFFIC LIGHT CONTROL WITH SURVEILLANCE SYSTEM: Y. N. Udoakah and I. G. Okure, DEPT. OF ELECTRICAL/ELECTRONICS & COMPUTER ENGR', UNIVERSITY OF UYO, UYO, AKWA IBOM STATE. NIGERIA

[2] Density Based Traffic Control System Using Image Processing: Uthara E. Prakash, Athira Thankappan, Vishnupriya K. T., Arun A. Balakrishnan Department of Electronics Cochin University of Science and Technology, India

[3] Traffic Density-Based Light Control System: Inam Ullah Khan, Muhammad Umar Khan, Hafiz Muhammad Salman, Syed Bilal Hussain Shah

[4] Density Based Traffic Light System: Sayan Ghosh, Shaurya Kumar, Gautam Ghosh

[5] Research on Google map algorithm and implementation: J. Cui, X. Wang

[6] Creating a Bot using the Telegram Bot API: Satish Manohar Talim

[7] Google timeline accuracy assessment and error prediction: Andrea Macarulla Rodriguez, Christian Tiberius, Roel van Bree, Zeno Geradts.

[8] S.Jayadharshan, R.M.Barath, Mr.P.Selvaprasanthm.E, "Mapping of Tourism Place in Puducherry using GIS" SSRG International Journal of Civil Engineering 5.6 (2018): 17-23.

[9] Akshay A. Adsod , Prof. Nitin R. Chopde. "A Review on: Web Mining Techniques", International Journal of Engineering Trends and Technology (IJETT), V10(3),108-113 April 2014.

[10] Nandish M S , Mr. Chetan Balaji , Prof. Shantala C P. "An Outdoor Navigation With Voice Recognition Security Application For Visually Impaired People", International Journal of Engineering Trends and Technology (IJETT), V10(10),500-504 April 2014.