

Web Technology in Traffic Management

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ABSTRACT

Traffic flow monitoring and analysis has been active research and engineering topic for more than two decades. Road traffic management involves directing vehicular and pedestrian traffic around a construction zone, accident or other road disruption, thus ensuring the safety of emergency response teams and the general public. Traffic congestion is a major issue that happens across urban cities around the world. Traffic congestion has a major impact on countries in several aspects: high fuel consumption, air pollution and slower economic growth. The solution to the traffic congestion problem is proposed in the paper. A prototype is designed which helps to monitor and control traffic.

Keywords : electronic system, software system, traffic management algorithm, web server.

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I. INTRODUCTION

Traffic congestion is a major concern in every metropolitan city. A Traffic light is a signaling device that is placed on a road intersection and serves two main purposes: avoid vehicle accidents and ease traffic congestion, by controlling vehicle movements. Traffic management measures are aimed at improving the safety and flow of traffic, reducing traffic emissions and utilising traffic artery capacity more effectively. Traffic management is used to curb the demand for transport and affect the selection of the mode of transport, route, or the time of travel or transport.

Most of the countries tend to use the Fixed Cycle Traffic Light System which tends to cause traffic congestion in particular road bound with heavy traffic flow. Under fixed time operation, the traffic signals will display green to each approach for the same time every cycle regardless of the traffic conditions. This may be adequate in heavily congested areas but where a lightly trafficked side road is included within the sequence it is very wasteful if in some cycles there are no vehicles waiting as the time could be better allocated to a busier approach. Thus, a dynamic cycle Traffic Light System is required to ease traffic congestion.

II. METHODOLOGY

The current Fixed Cycle Traffic Light System where the green time is fixed for all kind of traffic causes congestion and is not the most efficient way of managing the flow of traffic. The proposed model however will ease the flow of traffic by varying the green light duration in the traffic system. This is accomplished by two major systems: electronic

system, and software system. The overall system block diagram is shown in Fig 1.

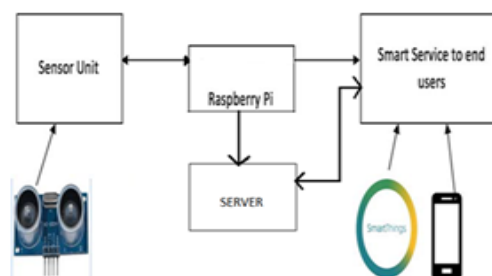


Fig1 Block diagram of the proposed system.

In the proposed model ultrasonic sensors are used to detect oncoming traffic, these set of sensors are aligned parallel to the road and these sensors are connected to raspberry pi. The greater the traffic intensity the more number of sensors triggered. This data is then processed by the raspberry pi which assigns predefined duration of green time for varying cases of traffic intensity. The data is saved on the online database which can be accessed through a remote app by any user.

III. ELECTRONIC SYSTEM

The electronic system consists of communication between microprocessor, traffic lights, and sensors.

3.1 Raspberry Pi

The proposed dynamic traffic signal controlling algorithm requires an intelligent hardware platform which could give dependable performance in the harsh traffic environment. For this purpose, the Single Board Computer (SBC) attributed with networking features would be a suitable choice. There are some popular SBCs such

as Intel Galileo, Raspberry Pi and Arduino. Choice of a SBC depends upon the application. Raspberry pi is selected over other contemporary SBCs due to following reasons: Raspberry Pi has lowest cost among all other SBCs. The operating system on Raspberry pi allows convenient software updates and installation like any other standard Linux machine. Finally, the Raspberry Pi can be configured as a web server, which is the requirement of the proposed algorithm.

3.2 LEDs and Ultrasonic sensors

LEDs were used in the prototype to represent traffic lights and ultrasonic sensors were used to detect traffic.

IV. SOFTWARE SYSTEM

The software system includes green light calculation algorithm, cloud server, control system and monitoring application for efficient traffic management.

4.1 Traffic algorithm

An array of ultrasonic sensors are placed parallel to the road. The traffic density is classified based on the number of sensors triggered. If one sensor is triggered, the green light time is programmed to be x seconds. If two or three sensors are triggered, then the green light time is programmed to be y seconds, any more resulting in z seconds.

$$z > y > x \quad (1)$$

Table 1. Traffic Density classification based on Sensor data

Sensors Triggered	Traffic Density
1	LOW
2 or 3	MEDIUM
4 or more	HIGH

4.2 App

The App is designed using Android Development Studio. This is the official Integrated Development Environment (IDE) for the android platform and uses JAVA programming language and is user friendly to set up the app. Fig 2 shows screenshot of Android Studio.

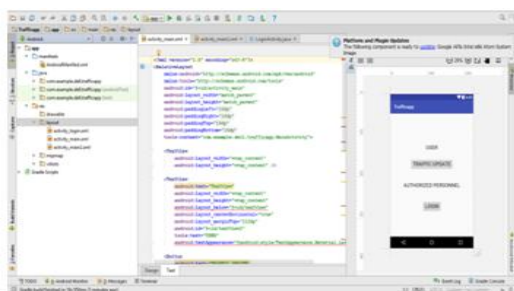


Fig 2. Android Studio

4.3 Apache Web Server

A web server is a computer system that processes requests via HTTP, the basic network protocol used to distribute information on the World Wide Web. The term can refer to the entire system, or specifically to the software that accepts and supervises the HTTP requests.

Apache is the most widely used web server software. Apache is an open source software available for free. It runs on 67% of all web servers in the world. It is fast, reliable, and secure. It can be highly customized to meet the needs of many different environments by using extensions and modules.



Fig 3 Default Apache WebPage

4.4 MYSQL database

MySQL is an open-source relational database management system (RDBMS). With its proven performance, reliability, and ease-of-use, MySQL has become the leading database choice for web-based applications. Additionally, it is an extremely popular choice as a database when used in various embedded applications.

4.5 PHP (Hypertext Pre-processor)

PHP is a general-purpose scripting language that is especially suited to server-side web development, in which case PHP generally runs on a web server. Any PHP code in a requested file is executed by the PHP runtime, usually to create dynamic web page content or dynamic images used on websites or elsewhere.

V. EXPERIMENTAL SET UP

The sensors monitor real time data and sends it to the processing unit (raspberry pi). Raspberry pi in turn processes the data given and executes the traffic management algorithm and stores the traffic density data in the server. The server can be accessed through a mobile App which indicates the traffic density and appropriate commands may be given to manage the traffic lights regarding the traffic situation by authorized officials in order to ease the flow of traffic.



Fig 12 App status after Login button is clicked

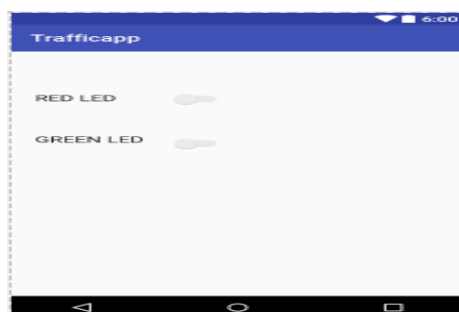


Fig 13 App status after signing in

VII. CONCLUSION

Fixed Cycle Traffic Light System used these days does not guarantee efficient and easy flow of traffic, lanes that are congested and lanes that are free get treated the same way making it very time consuming and in efficient. However from the results obtained from the above proposed system it is expected that the lanes with heavy traffic get more green time while lanes with medium or less traffic get lesser green time respectively, making this system efficient and time saving.

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