Dynamic Detection of Traffic Congestion and Management

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***Abstract*—Traffic congestion has become a major problem in every large city of the world. To ensure a reliable transportation system it is important to have an intelligent traffic control system. In this paper we propose a method for determining traffic congestion on roads using image processing techniques and a model for controlling traffic signals based on information received from images of roads taken by a video camera. We extract traffic density which corresponds to total area occupied by vehicles on the road in terms of total amount of pixels in an image instead of calculating number of vehicles. We dynamically set the timer for each road based on the traffic density in a sequential manner(clock-wise.**

***Index Terms*—Traffic Congestion; Image Pixels; Traffic density**

I. INTRODUCTION

Traffic Congestion is the major problem what we are facing daily. Traffic lights consist of three universal colored lights: the green light allows traffic to proceed in the indicated direction, the yellow light warns vehicles to prepare for short stop, and the red signal prohibits any traffic from proceeding.

Traffic data may come from different sensors. Some examples are use of induction loop, infra-red-light sensor, optical flow etc. Different techniques have been proposed to acquire traffic information. Most of the work detects edge of the vehicles and counts the number of traffic on the road. However, the disadvantage of the method is that counting the number of vehicles may give faulty results when space between the vehicles on the road are very small (i.e. two cars very close to each other may be counted as one vehicle). Moreover, most of the methods treat only cars as traffic but in many part of the world rickshaws, auto rickshaws, bikes are major part of everyday traffic such as in south Asian countries. In this paper, we propose a method that finds out total number of pixels in a video frame which corresponds to the amount of area of occupied by vehicles on the road rather than finding number of vehicles. The greater the amount of area occupied by vehicles on the road the greater the amount of traffic congestion. This way every kind of vehicles can be accounted for traffic density. Using this traffic data we propose a model for traffic signal control depending on the amount of traffic on the road. Time allocated for each road is made variable by weighing its time allocation depending on the traffic density. The conventional traffic system needs to be upgraded to solve the severe traffic congestion, alleviate transportation troubles, reduce traffic volume and waiting time, minimize overall travel time, optimize cars safety and efficiency, and expand the benefits in health, economic, and environmental sectors. This paper proposes a simple, low-cost, and real time smart traffic light control system that aims to overcome many defects and improve the traffic management.

II. RELATED WORK

The major problem that every country facing is Traffic Congestion. To find a solution many researchers have stated different methodologies. [1] Suggests that usage of PIC microcontroller Traffic lights consist of three universal colored lights: the green light allows traffic to proceed in the indicated direction, the yellow light warns vehicles to prepare for short stop, and the red signal prohibits any traffic from proceeding. [2] Suggests that usage of Portable wireless traffic light system (PWTLS). In spite of replacing traffic officers and flagmen by automatic traffic systems, the optimization of the heavy traffic jam is still a major issue to be faced, especially with multiple junction

nodes [2]. [3-7] Suggests that the usage of IR sensors is employed in numerous traffic systems. The IR transmitter and the IR receiver are mounted on either side of a road. When an automobile passes on the road between the IR sensors, the system is activated and the car counter is incremented. The collected information about the traffic density of the different roads of a junction is analyzed in order to modify dynamically the delays of green light at the lane having the significant traffic volume. The whole system could be controlled by PIC microcontroller [1-2, 4-5] or even by PLC [8-9]. [10-12] Suggests that to inform the traffic system about the arrival of the emergency vehicles toward the junction, they are supported by RF emitters that send warning signals to RF transceivers disposed at every traffic light intersection. The triggering sequences of the traffic lights are modified correspondingly in order to provide a special route to the emergency vehicles.[13] Suggests that "A proposed model for traffic signal preemption using global positioning system (GPS)",[15-16]Suggests that predicting the density of the traffic based on image processing in An intelligent automatic traffic light controller using embedded systems But these techniques require the acquisition of good images whose quality are weather dependent, especially with the rain and the fog.[17] Suggests that usage of Sophisticated algorithms to model the various states of the traffic such as Fuzzy Logic.[18] Suggests that usage of Genetic algorithms.[10-12] Suggests that Radio Frequency and arduino and Zigbee technologies in Traffic light control system for emergency vehicles. To inform the traffic system about the arrival of the emergency vehicles toward the junction, they are supported by RF emitters [10-12] that send warning signals to RF transceivers disposed at every traffic light intersection. The triggering sequences of the traffic lights are modified correspondingly in order to provide a special route to the emergency vehicles.

Most published works are dedicated to one junction or intersection where the influence of the adjacent intersections is not examined. Thus, the situation becomes more complicated and widely dependent. Further efforts should be made to achieve complete modeling, monitoring, and control for multiple synchronized junctions.

III. SYSTEM DESIGN

Systems design is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. Systems design could see it as the application of systems theory to product development. There is some overlap with the disciplines of systems analysis, systems architecture and systems engineering.

If the broader topic of product development "blends the perspective of marketing, design, and manufacturing into a single approach to product development," then design is the act of taking the marketing information and creating the design of the product to be manufactured. Systems design is therefore the process of defining and developing systems to satisfy specified requirements of the user.

Until the 1990s-systems design had a crucial and respected role in the data processing industry. In the 1990s standardizations of hardware and software resulted in the ability to build modular systems. The increasing importance of software running on generic platforms has enhanced the discipline of software engineering.

Object-oriented analysis and design methods are becoming the most widely used methods for computer systems design. The UML has become the standard language in object-oriented analysis and design. It is widely used for modeling software systems and is increasingly used for high designing non-software systems and organizations.

System design is one of the most important phases of software development process. The purpose of the design is to plan the solution of a problem specified by the requirement documentation. In other words, the first step in the solution to the problem is the design of the project.

The design of the system is perhaps the most critical factor affecting the quality of the software. The objective of the design phase is to produce overall design of the software. It aims to figure out the modules that should be in the system to fulfill all the system requirements in an efficient manner.

The design will contain the specification of all these modules, their interaction with other modules and the desired output from each module. The output of the design process is a description of the software architecture.

System Architecture Diagram

The below figure shows a general block diagram describing the activities performed by this project.

The entire architecture has been implemented in ten modules which we will see in high level design and low-level design in later chapters.

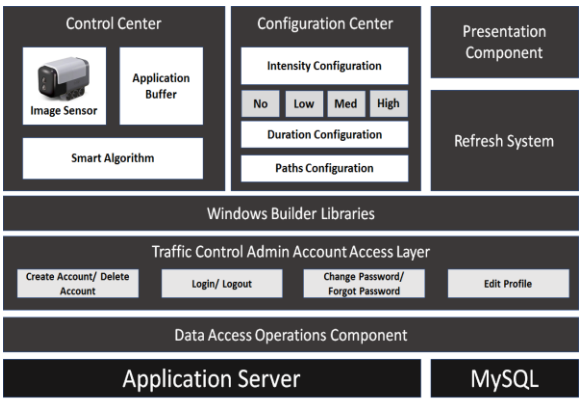


Fig. 1. System Architecture

The entire architecture diagram can be divided into following divisions

A. Data Access Layer

Data access layer is the one which exposes all the possible operations on the data base to the outside world. It will contain the DAO classes, DAO interfaces, POJOs, and Utils as the internal components. All the other modules of this project will be communicating with the DAO layer for their data access needs.

B. Account Operations

Account operations module provides the following functionalities to the end users of our project.

- Register a new seller/ buyer account
- Login to an existing account
- Logout from the session
- Edit the existing Profile
- Change Password for security issues
- Forgot Password and receive the current password over an email
- Delete an existing Account

Account operations module will be re-using the DAO layer to provide the above functionalities.

C. Control Center

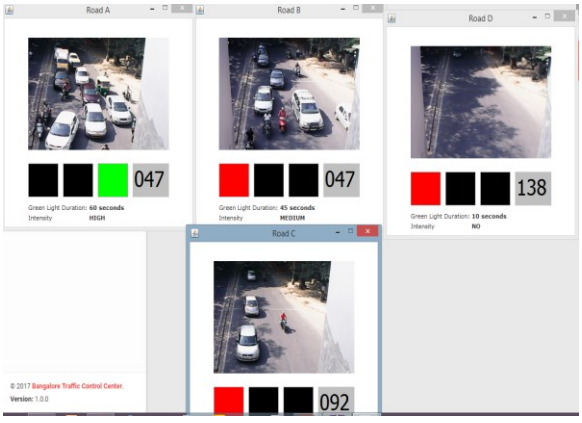
Here, the user can launch the control center which will contain two sub components: Application Buffer and the Smart Algorithm. The application buffer will contain the traffic images from all the roads. Typically, these images will be provided by the image sensors deployed on to the roads. The smart algorithm will contain the implementation of the image segmentation algorithm to find out the density of the traffic on each of the images inputted into the application buffers by the image sensors. Because of the limitations in the hardware, we are going to provide the image input into the application buffer manually from our local disks.

D. Configuration center

The configuration center of this project allows the traffic control admin to configure various parameters that will be used in our algorithm. Various configurable parameters in this project are as follows: Intensity configuration and Green light duration configuration. Through the intensity configuration, the admin of this project can define the intensity ranges for low, high, and medium categories. Through the Green light duration configuration, the admin of this project can define the duration of green light for low, medium, high, and no intensity traffic roads.

E. Refresh System

This module will be helpful particularly when the intensity of the traffic roads keeps changing drastically. Through this module, the admin of the project can re-run the smart algorithm, thus re-assigning the traffic roads into new intensity category and thereby dynamically updating the duration of green light for each of the roads.



IV. IMPLEMENTATION

Implementation is the realization of an application, or execution of a plan, idea, model, design, specification, standard, algorithm, or policy. In other words, an implementation is a realization of a technical specification or algorithm as a program, software component, or other computer system through programming and deployment. Many implementations may exist for a given specification or standard.

Implementation is one of the most important phases of the Software Development Life Cycle (SDLC). It encompasses all the processes involved in getting new software or hardware operating properly in its environment, including installation, configuration, running, testing, and making necessary changes. Specifically, it involves coding the system using a particular programming language and transferring the design into an actual working system.

This phase of the system is conducted with the idea that whatever is designed should be implemented; keeping in mind that it fulfills user requirements, objective and scope of the system. The implementation phase produces the solution to the user problem.

A. Overview of System Implementation

This project is implemented considering the following aspects:

- Usability Aspect.
- Technical Aspect.

1) Usability Aspect

The usability aspect of implementation of the project is realized using two principles:

a.) The project is implemented as a Java application

There could be many ways of implementing this protocol. We have chosen JAVA to come up with the required reader. The reason being many:

Firstly, Java provides a wonderful RTSP libraries which simplifies the implementation part of it.

Secondly, JAVA is platform independent, meaning the project can run on literally any platform which has JVM installed within it.

Thirdly, Oracle Corporation claims more than 70 billion devices run on JAVA which makes the end users used to it.

Lastly, it can be readily portable to any devices like mobile phones, ipads, PDA, and any hand-held devices that are capable of running JAVA.

b.) The user-friendly interface using Java's view architecture

The interface provided by this application is very user friendly and is developed using Java Swings.

2) Technical Aspect

The technical aspect of implementation of the project is realized as explained below:

Servers:

A. Apache Tomcat to develop the product

Apache Tomcat (or simply Tomcat, formerly also Jakarta Tomcat) is an open source web server and servlet container developed by the Apache Software Foundation (ASF). Tomcat implements the Java Servlet and the JavaServer Pages (JSP) specifications from Sun Microsystems, and provides a "pure Java" HTTP web server environment for Java code to run.

Apache Tomcat includes tools for configuration and management, but can also be configured by editing XML configuration files

B. Database

MySQL officially, but also called /maɪ ˈsiːkwəl/ "My Sequel") is (as of 2008) the world's most widely used open source relational database management system (RDBMS) that runs as a server providing multi-user access to a number of databases. It is named after co-founder Michael Widenius' daughter, My. The SQL phrase stands for Structured Query Language.

The MySQL development project has made its source code available under the terms of the GNU General Public License, as well as under a variety of proprietary agreements. MySQL was owned and sponsored by a single for-profit firm, the Swedish company MySQL AB, now owned by Oracle Corporation.

MySQL is a popular choice of database for use in web applications, and is a central component of the widely used LAMP open source web application software stack (and other 'AMP' stacks). LAMP is an acronym for "Linux, Apache, MySQL, Perl/PHP/Python." Free-software-open source projects that require a full-featured database management system often use MySQL.

For commercial use, several paid editions are available, and offer additional functionality. Applications which use MySQL databases include: TYPO3, Joomla, WordPress, phpBB, MyBB, Drupal and other software. MySQL is also used in many high-

profile, large-scale World Wide Web products, including Wikipedia, Google (though not for searches), Facebook, Twitter, Flickr, Nokia.com, and YouTube.

V. CONCLUSION

The Application we designed a smart traffic control system that automatically scans the density of traffic and manages the traffic light accordingly. Our system solves the traffic congestion, Overcomes the transportation troubles, Reduces the traffic volumes and waiting time, Minimizes the traffic time, and Overcomes the burden of manual traffic control.

FUTURE ENHANCEMENTS

Future work of this project includes integrating our system with the image sensors to get the traffic images.

REFERENCES

[1] N. Kham, and C. Nwe, "Implementation of modem traffic light control system", International journal of scientific and research publications, Vol. 4, Issue 6, Jun. 2014.

[2] I. Isa, N. Shaari, A. Fayeez, and N. Azlin, "Portable wireless traffic light system (PWTLS)", International journal of research in engineering and technology, Vol. 3, Issue 2, pp. 242-247, Feb 2014.

[3] P. Sinhmar, "Intelligent traffic light and density control using IR sensors and microcontroller", International journal of advanced technology & engineering research (lJATER), Vol. 2, Issue 2, pp. 30- 35, March 2012.

[4] E. Geetha, V. Viswanadha, and G. Kavitha, "Design of intelligent auto traffic signal controller with emergency override", International journal of engineering science and innovative technology (IJESIT), Vol. 3 , Issue 4, pp. 670-675, July 2014.

[5] G. Kavya, and B. Saranya, "Density based intelligent traffic signal system using PIC microcontroller", International journal of research in applied science & engineering technology (IJRASET), Vol. 3, Issue I, pp. 205-209, Jan 2015

[6] A. Dakhole, M. Moon, "Design of intelligent traffic control system based on ARM", International journal of advance research in computer science and management studies, Vol. 1, Issue 6., pp. 76-80, Nov. 2013.

[7] A. Jadhav, B. Madhuri, and T. Ketan, "Intelligent traffic light control system (ITLCS)", Proceedings of the 4th IRF international conference, Pune, 16 March 2014.

[8] M. Srivastava, Prena et all, "Smart traffic control system using PLC and SCADA", International journal of inoovative research in science engineering and technology, Vol. I, Issue 2, pp. 169-172, Dec 2012.

[9] M. Khanak, "PLC based intelligent traffic control system", International journal of electrical & computer sciences (IJECS), Vol. II, No. 6, pp. 69-73, Dec. 2011

[10] N. Hashim, A. Jaafar et all, "Traffic light control system for emergency vehicles using radio frequency", IOSR journal of engineering, Vol. 3, Issue. 7, pp. 43-52, July 2013.

[11] S. maqbool, U. Sabeel et all, "Smart traffic light control and congestion avoidance system during emergencies using arduino and Zigbee 802.15.4", International journal of advanced research in computer science and software engineering, Vol. 3, Issue. 6, pp. 1801- 1808, Jun 2013.

[12] S. Jaiswal, T, Agarwal, A. singh, and Lakshita, "Intelligent traffic control unit", International journal of electrical, electronics and computer engineering, Vol. 2, Issue. 2, pp. 66-72, Aug. 2013.

[13] N. Mascarenhas, G. Pradeep et all, "A proposed model for traffic signal preemption using global positioning system (GPS)", Computer science & information technology, pp. 219-226, 2013.

[14] P. Parida, S. Dhurua, and S. Priya, "An intelligent ambulance with some advance features of telecommunication", International journal of emerging technology and advanced engineering, Vol.4, Issue 10, Oct. 2014.

[15] G. Monika, N. Kalpana, amd P. Gnanasundari, "An intelligent automatic traffic light controller using embedded systems", International journal of innovative research in science, engineering and technology, Vol. 4, Issue 4, pp. 19-27, Apr. 2015.

[16] K. Vidhya, anf A. Banu, "Density based traffic signal system", International journal of innovative research in science, engineering, and technology, Vol. 3, Issue 3, pp. 2218-2223, March 2014.

[17] O. Chinyere, O. Francisca, and O. Amano, "Design and simulation of an intelligent traffic control system", International journal of advances in engineering & technology, Vol. I, Issue 5, pp. 47-57, Nov. 2011.

[18] D. Rotake, and S. Karmore, "Intelligent traffic signal control system using embedded system", Innovative systems design and engineering, Vol. 3, No. 5, 2012.

[19] L. Jacioa, "Programming 16-bit microcontrollers in C. Learning to fly the PIC 24", I st ed, Newnes Elsevier, 2007.

[20] D. Smith, "PIC in practice. A project - based approach", 2nd ed, Newns Elsevier, 2006

[21] M. Bates, "PIC microcontrollers. An introduction to microelectronics", 2nd ed, Newnes Elsevier, 2004.

[22] M. Mazidi, R. Mckinlay, and D. Causey, "PIC microcontroller and embedded systems", Prentice Hall 1st ed, 2007.

[23] M. Verle, "PIC microcontrollers - Programming in C", 1st ed, MikroElecktronika, 2009.

[24] D. Cristaldi, S. Pennisi, and F. Pulvirenti, "Liquid crystal display drivers Techniques and circuits", springer, 2009.

[25] J. Fraden, "Handbook of modern sensors. Physics, designs, and applications", 4th ed. Springer, 2010.

[26] S. Farahani, "Zigbee wireless networks and transceivers", Newnes Elsevier, 2008.

[27] B. Ghazal, M. Kherfan, K. Elkhatib, and K. Chahine, "Multi control chandelier operations using XBee for home automation", Proceedings of the third international conference on technological advances in electrical, electronics and computer engineering, Beirut, Lebanon, 2015.

[28] B. Ghazal, K. Elkhatib, K. Chahine and M. Kherfan, “Smart Traffic Light Control System”, published in the IEEE, Beirut, Lebanon, 2016.