LAN Based Intelligent Traffic Light System with Emergency Service Identification & Density Based Control & Logging

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Abstract- **In this paper we implemented a traffic lights control system using LAN technology which has the capability of mimicking human intelligence for controlling traffic lights. It aims to do analysis, design, develop and deploy monitoring and information system jointly with the help of state of the art traffic equipment, to enable the safe and efficient and effective movement of traffic for all road users. In this work we implemented the first based on LAN networking. The aim of this paper is to design and implement the network based car traffic control system. This system mainly comprises of signalized junctions and central computer (sever) that is connected to every traffic signal junction (clients). Its main task is to adjust, in real times, signal timings in response to variation in traffic demand and system capacity. Real time data from traffic controls are collected and transported to a central computer (server) for analysis. The results of this work are reduction in normal recurring, significantly enhanced operational tools congestion to effectively manage traffic incidents, reduced pollution, faster response to reports of faults, improved public transport service, reduction in emergency response times and safer travel and less congestion during road works.**

Keywords: LAN, Signalized junctions, Traffic signal junction, Response times and Congestion.

I. INTRODUCTION

In the developing IT world, everything is so improving time by time. Transportation is very important for every country. Advances in transport technology have brought benefits, but growing vehicle fleets and escalating furl use have also created problems. If transportation is clear, traffic jam and air pollution will be less. Moreover, by controlling car traffic, car accidents case will be reduced in every country. Traffic congestion is one of the main roles in every country. This leads to economic losses, argument the population and has a great impact of the quality of life. One common approach to try to handle traffic congestion is to build infrastructure, such as roads and bridges by pass lane, fly over etc. But in the past year, it is becoming increasingly more difficult to build more infrastructures to at least diminish traffic jams. Not only the height cost, but also the lack of space and the environmental damage of building new road have to be considered. A different approach is needed, based on the applying intelligent in order to manage traffic flow in a more effective and efficient manner.

This lead to a relatively new research area called Intelligent Transportation System (ITS) which is basically concerned with the application of information and communication technologies (ICT) to the planning and operation of transportation system. Traffic observation, control and real time management is one of the major components within future intelligent transportation systems (ITS). This involves, for instances design and construction of LAN based car traffic control system. It is widely accepted by the transportation community that ITS makes exiting transportation facilities efficient, minimizing the need to build more infrastructure. Intelligent Transportation Systems (ITS), advanced electronics, communications, and computer systems that increase the efficiency and safety of urban and highway transportation.

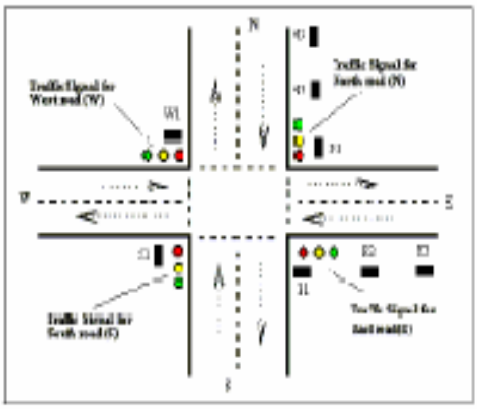

Fig. Layout of traffic light system

Adaptive traffic control systems are employed in cities worldwide to improve the efficiency of traffic flows, reduce average travel times and benefit the environment via a reduction in fuel consumption. One of the main and most common functions of such systems lies in adaptive control of traffic lights. This ranges from simple lengthening or shortening of green and red light durations in an intersection according to the actual presence of cars in the respective lanes, to coordination of green light phases among neighboring intersections on main thoroughfares. This adaptability is made possible with the use of sensors (typically in the form of magnetic loop detectors embedded under the road pavement) that feed data to roadside traffic

light controllers, and a communications infrastructure that connects among the intersections and a traffic management centre, as well as, in some cases (typically in large cities), a hierarchy of regional computers (RC) that perform the control decisions for respective portions of the system. Traditionally, the communications layer of traffic control systems has been based on wired connections, either private or leased from public telecommunications operators. While for many years such leased lines (operating at 300bps) have served their purpose well, they have several shortcomings, such as a significant operating cost, inflexibility, and difficulty of installation in new sites. In certain cases, alternative solutions, operating over public infrastructure, have been deployed for specific sites where private or leased lines were not a viable option; these ranged from ADSL, regular dialup, or cellular (GPRS). However, using public network for traffic control could suffer from inconsistent delay jitters and reliability issues.

Have you ever observed that in the midst of traffic, whenever siren sound of an ambulance or fire brigade is heard, the first reaction from the public as well as the traffic police will be to look towards the approaching ambulance in amusement to find how far are it from them and how the vehicle is approaching. In this melee, the traffic becomes chaotic making it more difficult for the ambulance or the fire brigade to move forward. It takes some time for the moving traffic to come to a halt and give way to the ambulance. Even in such a situation, there would be some two-wheeler or vehicle driver wanting to go ahead of every one without bothering! The worst part is when the constable managing the traffic themselves becomes the onlooker to the scene. They will be just watching as to how the ambulance driver is able to negotiate and move ahead of the surging traffic jam! Often the ambulances get stuck at the traffic signals where all other vehicles try to squeeze in to all the available space so as to move ahead as soon as the signal turns green. Unlike western countries, Indian cities cannot think of having separate lanes for emergency purpose because the roads are not broad enough. Its time for the traffic experts, police and the transport authorities to evolve a clear cut guideline as to what is the correct procedure to be followed by the traffic constable, public and the drivers of ambulance/fire brigade as the case may be. In absence of any specific guidelines the drivers of ambulance tend to steer the vehicle from whichever side they find it convenient. Other vehicles while giving way move here and there creating more chaos than facilitate.

The need of the hour is to understand the gravity of such an emergent situation by every body. People should immediately act on hearing the siren instead of looking here and there in bewilderment. All vehicles must immediately be brought to the left side leaving the right side absolutely free for the un-obstructive passage of ambulance. The role of traffic constable should be well defined to bring all the vehicular traffic to a halt on to the left side on hearing any siren sound from approaching vehicle. They should ensure that no body (including VIP vehicle) is allowed to go ahead overtaking others until the ambulance passes.

'Golden hour' is the key to one's life and instead of becoming a mere onlooker, let us be pro-active at the first sound of siren on road from an ambulance, fire brigade or even a police van/jeep (provided the last one is not carrying family of police personal to a school, mall or a film show!).

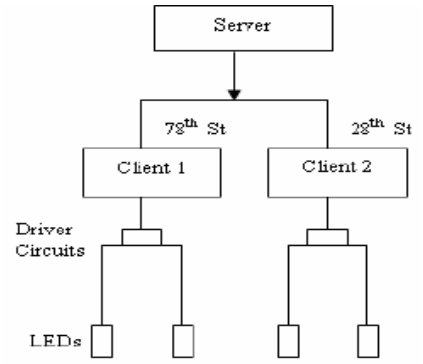

Fig. Block Diagram of the Car Traffic Light Control System interface with LAN networking

Our system basically proposes to do the following:

1. Every traffic light junction is connected to the central computer via LAN, i.e each traffic light junction has its own IP address.
2. Timing & Sequences of traffic lights can be planned & controlled by the central computer.
3. In case of VIP movement or occasion's traffic diversions or movement can easily be controlled via central computer only.
4. Our systems measures density of traffic on a four lane and adjusts traffic light timing accordingly.
5. The density measurements are logged up to the central computer periodically for analysis, maintenance & research.
6. Our system also integrates with emergency services vehicles and detects their presence wirelessly via RF technology, so that an emergency service vehicle such as an ambulance always encounters a green light only.

II. LOGICAL BLOCK DIAGRAM

A. Explanation of Logical Block Diagram

As we can observe there is a crossroad shown in the diagram, consisting of four different lanes. An ambulance is going from lane1. The patient is carried in the cardiac van, whose various parameters are being measured by the sensory units inside the van. These parameters are constantly being sent to the hospital unit via RF Receivers integrated on every traffic light pole and communicated to hospital by central server via LAN.

The hospital you can see is at the side of road and it is receiving these vitals via a dedicated network. The information is shown on the pc connected to this via s/w used here is a very user friendly and front end s/w, i.e Visual basics. Sensor is a crucial element in an intelligent traffic control. The most common sensor is inductive loop. It is very common in vehicle actuated system to detect vehicle presence. It is also very common in an urban traffic control system to count the number or to measure headway of approaching vehicles.

However, the main drawback of the inductive loop is its failure to measure queue length accurately. Another type of sensor is video detection system. This system is very flexible and able to carry out traffic count and measure queue length accurately. The price of commercial video detection system is very high as compared to inductive loop system. However a local institution has developed a low cost video detection system with the same capability as the commercial system. In our traffic control system, used the IR sensors to get the information of traffic jams by sensing with 38kHz infrared sensors. IR sensors have the more advantage than the other sensors. They can give the stable data to clients in LAN networking with the integrated system. This interface is synchronized with the whole process of the traffic control system. Increasing the number of sensors to detect the presence of cars can further enhance the design of the traffic light system. If the infrared sensors were replaced with imaging system/ CCTV camera a wide range of detection capabilities can be performed, which can be enhanced and ventured into a perfect traffic system. Based on this control system, we can manage the traffic light in all around the nations with WAN.

III. HARDWARE COMPONENTS OF CAR TRAFFIC CONTROL SYSTEM

This system is designed as six important parts. The first section is IR modulation system that is used to detect the presence of cars. It includes two parts. One is IR transmitter which is used 555 timer as astable multivibrator and oscillator and another is IR receiver which is used 555 timer monostable multivibrator and oscillator. The second component is the sensor driver that gets the output of IR modulation system which is used 7432 OR gates. The third, Optocoupler senses the output of the signal control gate and it is applied PC 817 between circuit and computer for auto separating their ground. The fourth part is used DB 25 parallel port for connecting computer and circuit. In parallel port, there are 6 pins for output and 2 pins for input. The fifth, power supply module includes step down transformer to change 220 V (AC) to 12V, four bridge Diodes, and 7805 Regulator (for regulation unstable pulse). The last part is traffic control LED that demonstrates traffic signal. This paper presents for two lanes –
one ways (for sensing).

The Operation of Car Traffic Control System Based LAN Networking

This circuit is for two lanes one way. There are two sensors for one lane are used in each point. So there are four IR transmitters and four receivers. In IR modulation system, IR transmitter is used as astable multivibrator and receiver is used as monostable multivibrator using 555 timers. IR transmitter is connected to 9V and the other components are used 5V regulated power. The input circuit of an optical coupler is typically an LED, but the output circuit can take several forms, such as the photo transistor. When the input voltage forward-biases the LED, light transmitted to the photo transistor turns it on, producing current through the external load. If IR transmitter and receiver sense the traffic jams, the output signal of receiver is as input of 7432 OR gate. If the output signal of OR gate is ‘1’, there has been traffic jams. If IR transmitter and receiver do not sense the traffic jams, the output of OR gate is '0'.If the output of OR gates is 0, there has not been traffic jams. The opto-coupler can be connected for the auto separates the grounds of circuits and PC. Moreover it can be give the definite data to the respective parallel port which is connected to the client. Similarly, another client is achieved the data. The output of optocoupler is as inputs of parallel port. In parallel port, there are used 2 pins input and 6 pins of output pins of 25DB connector parallel and the output of parallel is connected with optocopuler to achieve the stable light of LEDs. To improve the light of LEDs, we used the oscillator and can get the brightness of output LEDs. The server connects two clients using LAN network. The server can control real time for traffic jams.

Software Implementation

After the hardware had been setup, a program written in the VB.net programming language into the sever and clients. The simulation of the algorithm of the traffic signal system was done using VB software. Furthermore, the IR detectors interfacing according to the traffic system using the software is created. The signal from the sensor is acquired through the optocoupler, which is connected to the computer (clients). The setting time of traffic light sequence for yellow, green and red LEDs is written in programming for sever and clients. For user setting time, the changes of traffic light signals (yellow, green and red) in the range about 2 to 20 sec. If there is no traffic jams, the sequence of traffic signals is play with user setting time. If there are jams informed from IR receiver, the setting times are looped again for green light.

CONCLUSION

The traffic light control system based LAN had successful been designed and developed. The sensors were interfaced with the integrated system. This interface is synchronized with the whole process of the traffic control system. Increasing the number of sensors to detect the presence of cars can further enhance the design of the traffic light system. If the infrared sensors were replaced with imaging system/ CCTV camera a wide range of detection capabilities can be performed, which can be enhanced and ventured into a perfect traffic system. Based on this control system, we can manage the traffic light in all around the nations with WAN.

The intelligent traffic management system proposed in this work is a distributed automation systems based on Internet and Web technologies. The system uses the Ethernet as a communication backbone between individual nodes located at different traffic intersections and a central traffic management unit. Each node consists of an embedded web server interfaced with the traffic signals and used to monitors

and control its operation. The proposed system offers a low cost solution to the needs of tomorrow's traffic management. As future work, we will be looking into techniques for optimizing the method of generating the dynamic web pages.

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