Implementation of Intelligent Traffic Management System

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ABSTRACT

Traffic in today's world is one of the major sources of time delays. Inefficiencies in managing the traffic and underutilization of capacity of roads gives rise to long time delays. An efficient traffic system is needed for safety of lives, property, time and economy. The System proposed solves the problem of high traffic congestion on the Indian roads with the use of control on traffic lights and then increasing the time of these signal based on real time traffic data got from various sources. The proposed system is a design and implementation of low cost, low power consuming and more reliable Infrared based intelligent Traffic System. The system is a wireless network based which contains infrared transmitter with a unique identification number and infrared receiver. As this is a traffic system there is a need to ensure the security of the system as well, This is done by introducing a MD5 checksum to verify that the code is the same and has not been tampered with. The project also includes a checksum to verify the integrity of the message it gets and checks that the message has not been tampered with. The implemented project promises to get the better results in traffic and on road. The project implementation can be improved in various ways, such as higher clearance for emergency services etc. Also more reliable sources of the acquisition of traffic data can be found which will further improve how well the algorithm functions in improving the traffic condition on the road.

INTRODUCTION

Vehicular traffic is continuously increasing around the world, especially in large urban areas. The resulting congestion has become a major concern to transportation specialists and decision makers. The existing methods for traffic management, surveillance and control are not adequately efficient in terms of performance, cost, maintenance, and support. In this paper, the design of a system that utilizes and efficiently manages trafficlight controllers is presented.

In particular, the proposed design is an adaptive traffic control system based on a new traffic infrastructure using Wireless Sensor Network (WSN) and using new techniques for controlling the traffic flow sequences. These techniques are dynamically adaptive to traffic conditions on both single and multiple intersections. A WSN is used as a tool to instrument and control traffic signals roadways, while an intelligent traffic controller is developed to control the operation of the traffic infrastructure supported by the WSN[1]. Such algorithms have been designed which are able to provide the system with adaptive and efficient traffic estimation represented by the dynamic change in the traffic signal's flow sequence and traffic variation. Simulation resultsshowtheefficiencyoftheproposedschemeinsolvingtrafficcongestionintermsoftheaveragewaitingtime and average queue length on the isolated (single) intersection and efficient global traffic flow control on multiple intersections.Atestbedwasalsodevelopedanddeployedforrealmeasurements.

The 2007 Urban Mobility Report estimates total annual cost of congestion for the 75 U.S. urban areas at 89.6billion dollars, the value of 4.5 billion hours of delay and 6.9 billion gallons of excess fuel consumed. On smaller scale, the traffic engineering department in Jordan estimates that the total cost due to congestion in the year 2007 was around 150 million USDs. As such, there is a need for efficient solutions to this critical and important problem. Many techniques have been used including, aboveground sensors like video image processing, microwave radar, laser radar, passive infrared, ultrasonic, and passive acoustic array[2]. However, these systems have a high equipment cost and their accuracy depends on environment conditions As such, it

is becoming very crucial to device efficient, adaptive and cost-effective traffic control algorithms that facilitate and guarantee fast and smooth traffic flow that utilize new and versatile technologies.

An excellent potential candidate to aid on achieving this objective is the Wireless Sensor Network In this paper, an intelligent and novel traffic light control system based on WSN is presented. The system has the potential to revolutionize traffic surveillance and control technology because of its low cost and potential for large scale deployment. The proposed system consists of two parts: WSN and a control box (e.g. base station) running control algorithms. The WSN, which consists of a group of traffic sensor nodes (TSNs), is designed to provide the traffic communication infrastructure and to facilitate easy and large deployment of traffic systems[3]. The proposed system can handle the case of controlling traffic over multiple intersections by communicating among the various nodes and establishing a network and then creating an appropriate time for each intersection. The proposed system follows the international standards for traffic light operation, which makes it easy to adapt or use in the international market.

DESIGN

The solution that has been proposed has been designed keeping the traffic conditions in India where there are extreme fluctuations in the traffic and also there is a need to have low cost devices due the large scale that it will be implemented in. It is proposed to implement far infrared sensors which can be used to detect the traffic at a particular pre calculated threshold point. As there are various street lights in India, these sensors can be mounted on top of the particular street light. Solar panels can be mounted on street lights to supply power to both of the units. Two Sensors can be mounted on the street light as it has been mentioned in the figure 1. The proposed design tries to connect various nodes using sockets and then to send the appropriate data of whether the particularintersection is abovethethresholdorbelowitandtotakeappropriatetimingsforthesignalsaccordingly [4].

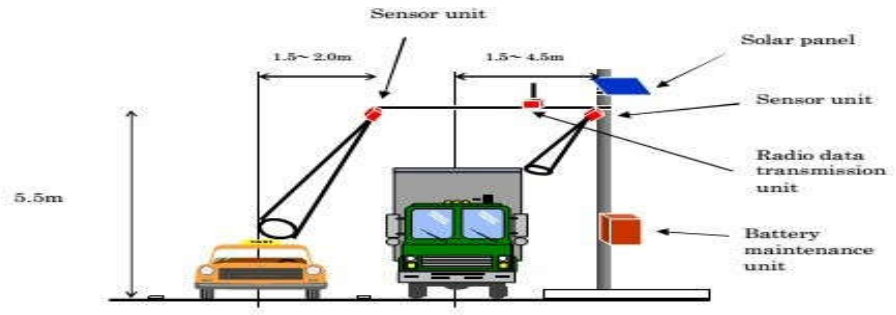

Fig. 1 Structure of sensor on street light

The method proposed can take various nodes into account due to which an entire area can be brought under the algorithm reducing the congestion in the area and improving the flow of traffic. Various security features have also been implemented in the system such as an MD5 hash is generated which is placed on the system and each time the system boots a new MD5 hash is generated which helps in verifying whether the code that is observed has been tampered with or not. If found tampered with, the regular traffic lights are switched on which function till the node is fixed. Also it has been proposed to add a check sum to each of the data that is sent so that when the data is received at the other end then the integrity of the data can be checked to see whether the data has been tampered with and if it has than it raises an alarm and informs the controls system and switches on regular functioning traffic. A block diagram of the proposed system is given below.

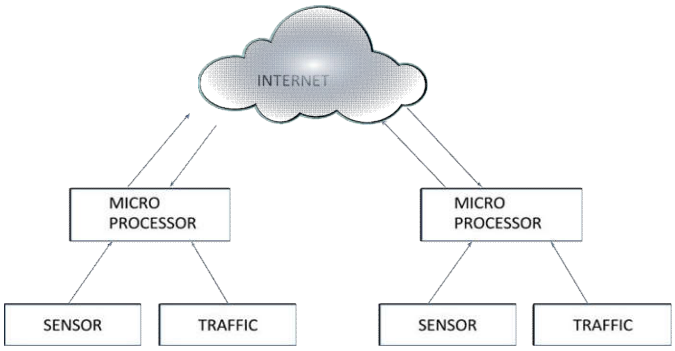

Fig. 2 Block Diagram of system

IMPLEMENTATION

The implementation presented by us has been implemented for two nodes where the nodes communicate with each other using TCP protocol. There are various cases covered by us where they decide the length of their signal based on the signal of the other nodes and the amount of traffic density on the other roads. The cases that have been considered are as follows.

I1	I2	I3	I4	T1	T2	T3	T4
0	0	0	0	N	N	N	N
0	0	0	1	N	N	L	H
0	0	1	0	N	N	H	L
0	0	1	1	N	N	N	N
0	1	0	0	L	H	N	N
	1	0	1	L	H	L	H
0	1	1	0	L	H	H	L
0	1	1	1	L	H	N	N
1	0	0	0	H	L	N	N
1	0	0	1	H	L	L	H
1	0	1	0	H	L	H	L
1	0	1	1	N	N	N	N
1	1	0	0	N	N	N	N
1	1	0	1	N	N	N	N
1	1	1	0	N	N	H	L
1	1	1	1	N	N	N	N

TABLE I. Logic of two Node Street light

The implementation also considers the cases where further expansion of the nodes can be done on other nodes helping in the expansion into more nodes. Further an MD5 algorithm[6] has been developed which help in maintaining the security of the system and securing it against a breach in security.

RESULTS AND DISCUSSION

The project designed was aimed towards providing efficient signaling to reduce the congestion on the roads [7]. Usingthealgorithmonthetestsubjectswehaveconcludedthattheoverallcongestioncomestoalowerlevel and that the minimalistic real time data acquisition method is able to provide a satisfactory amount of accuracy to improve the data. We aim to use an ultrasound sensor instead of an infrared sensor to improve the accuracy in daylight conditions. The project currently aims at using infrared sensors which are unable to work during the day due to sunlight. This could be overcome using ultrasound sensors whichwouldevenduringtheday.Alsotheprojectcurrentlusesinfraredsensorsatvariouspointswhichcauseittoclassifythetrafficdataasbinary.Thismakesthesignaltogivea fixedbonusgreensignaltimeirrespectiveoftheamountoftrafficpresent.

INFERENCE &CONCLUSION

In this project, the design of an intelligent traffic control system, utilizing and efficiently managing WSNs, is presented. An adaptive traffic signal time manipulation algorithm based on a new traffic infrastructure using WSNs is proposed on a single and multiple road intersections. The proposed system with its embedded algorithms is proved to play a major role in alleviating the congestion problem when compared to inefficient classical traffic control systems. Furthermore, our traffic control system can be easily installed and attached to the existing traffic road infrastructure at a low cost and within a reasonable time. The system is self configuring and operates in real-time to detect traffic states and exchange information with other nodes via a wireless communication with self recovery function. In addition, no traffic disruption will be necessary when a new traffic sensor is to be installed.

The project that has been implemented has shown an improvement of nearly 28.34% due to the way that it efficiently manages the balance between cost effectiveness and real time data analysis. Also the project is using MD5 to securely check whether the original program is present causing the project to be secure. This causes the project to be suitable for Indian conditions as it is a balance of being cheap, secure and efficient.

FURTURE WORK

The project could be improved by placing various sensors at different points on the road to give a different bonus green signal accordingly. This would improve the efficiency of the project further. Also the project could use ultrasound sensors to detect the traffic as it is more efficient in daylight conditions.

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