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RESEARCH ARTICLE OPEN ACCESS

TRAFFIC CONGESTION CONTROL

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Abstract:

An Embedded system is a system that has software embedded into computer hardware which makes a system dedicated to an application or specific part of an application. An embedded system is one that has dedicated purpose software embedded in computer hardware. It is independent system or a part of large system. It is an electronic device that contains microprocessor or microcontroller and digital signal processor is used for image processing. A processor is an important unit in the embedded system hardware. It is the heart of the embedded system. Embedded systems are especially suited for use in transportation, fire safety, safety and security, medical applications and life critical systems as these systems can be isolated from hacking and thus be more reliable.

Keywords: Traffic Congestion, Microcontroller, Embedded System, Image Processing, RFID

INTRODUCTION

In today's world there is no efficient traffic system, one way of providing efficient traffic system is by manipulating traffic lights dynamically based on traffic size. Also there are no priority services for any priority vehicles like ambulance hence some services other than normal services must be provided to priority vehicles. User faces traffic jam due to lack of notification hence must be regularly notified about current traffic conditions if he wishes to. Some strict action is required against the rule breakers such as fine deduction or in worst case license invalidation. There is a drastic need to solve these problems for efficient management of traffic. Nowadays Wireless Sensor Networks (WSN) has been applied in various domains like weather monitoring, military, home automation, health care monitoring, security and safety etc. or in a nut shell one can say wireless sensor network can be applied in most of the domains .Traffic Signal System or traffic monitoring is a vast domain where WSN can be applied to gather information about the incoming flow of traffic, traffic load on a particular road, traffic load at particular period of time (peak hours) and in vehicle prioritization. WSN installed along a road can be utilized to control the traffic load on roads and at traffic intersections

OBJECTIVE

In developing countries traffic congestion is one of the major problems. Congestion is the root cause of various problems including traffic jams, traffic rule violation and accidents. This has adverse effects on human lives. Traffic lights play an important role in traffic management. Traffic lights are the signaling devices that are placed on the intersection points and used to control the flow of traffic on the road. The problem of traffic light control can be solved by RFID based system. With this system, we can consider the priority of different type of vehicles and also consider the density of traffic on the roads by installing RF reader on the road intersections. Radio frequency identification is a technique that uses the radio waves to identify the object uniquely. RFID is a technique that is widely used in the various application areas like medical science, commerce, security, Electronic toll collection system, access control etc.

There are three main components of RFID: RFID tag, RF Reader and Database. RFID is a wireless technology that uses radiofrequency electromagnetic energy to carry information between the RFID tag and RFID reader. Some RFID systems will only work within the range inches or centimeters while others may work for 100 meters (300 feet) or more. Various types of tags are available but we can mainly divide them into two categories:Passive tags and active tags. The passive tags don'tcontain any internal power source. The active tags contain a battery as an internal power source used to operate microchip's circuitry and to broadcast theinformation to the reader. The range and cost of these tags is more as compare to passive tags. A GSM modem is a specialized type of modem, which accepts a SIM card and operates over a subscription to a mobile operator, just like a mobile phone. GPS is also used along with the RFID in order to locate the position of vehicle whenever theft occurs.PIC 16F877A is used here to control all the processes that are involved and Fire Brigade are also stuck in traffic and waste their valuable time. The proposed system provides quality of service to Emergency vehicles and improves the accuracy of Automatic Traffic Light Violation Detection system as well as helps to trace out the stolen vehicles using RFID

The traffic light control plays a vital role in any intelligent traffic management system. The green light sequence and green light duration are the two key aspects to be considered in traffic light control. In many countries, most traffic lights feature fixed sequences and light length duration. Fixed control methods are however only suitable for stable and regular traffic, but not for dynamic traffic situations. Looking at the present state of practice, the green light sequence is determined without taking the possible presence of emergency vehicles into account. Therefore, emergency vehicles such as ambulances, police cars, fire engines, etc. must wait in traffic at an intersection as depicted which delays their arrival at their destination causing loss of lives and property. In Ireland, an average of 700 fatalities was noted every year due to late ambulance responses.

PROPOSED SYSTEM

Microcontroller based traffic control system is an application specific project, which is used to control the traffic. During normal time the signal timing changes automatically on sensing the traffic density at the junction but in case of any emergency vehicle like ambulance, fire brigade etc., requiring priority are built in with RF control to override the set timing by providing instantaneous green signal in the desired direction while blocking the other lanes by red signal for some time.

We describe the functionality of the Traffic Management Centre (TMC) and the role of each of its units. The schematic of a typical Traffic Management Centre (TMC) is presented. The presently used traffic light pre-emption systems can be categorized based on their operation as: optical systems, radio-controlled systems, GPS-based systems and acoustic sensor-based systems. Acoustic sensor-based systems outperform the other pre-emption systems in terms of accuracy and installation cost. Extensive work has been conducted on detecting emergency vehicles based on their siren sounds. We summarize the proposed approaches for emergency vehicle detection based on siren sounds.

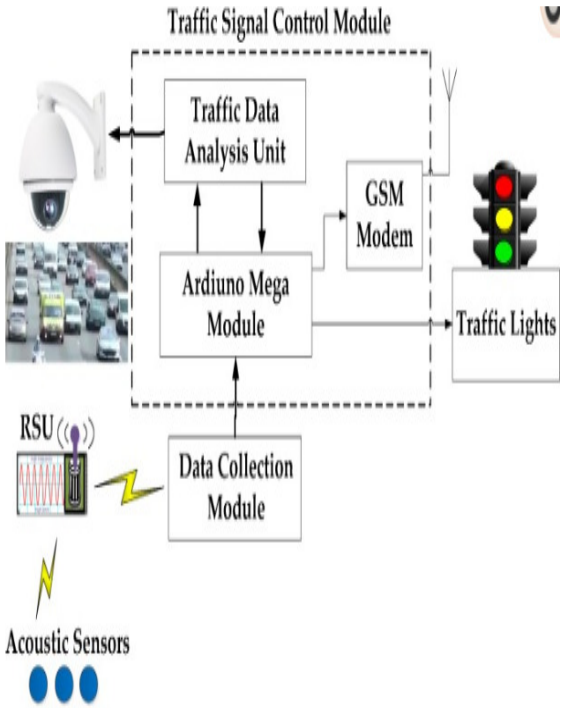

Figure1b: Traffic signal management

The acoustic sensors collect the siren signals and forward them to the Road Side Unit (RSU). The Road Side Unit (RSU) includes a frequency measuring controller (Arduino UNO) to detect the emergency vehicles. The RSU collects the siren signals from the acoustic sensors and forwards them to the frequency measuring controller. The controller detects the emergency vehicle by its siren frequencies. The controller measures the frequencies of siren signals and computes the average of measured frequencies. The frequency measuring controller sends the alert signal to the traffic signal controller (Arduino Mega), if the frequency is between the range of yelp or wail. The traffic signal controller stops the fixed sequence and light length algorithm and executes the emergency vehicle dispatching algorithm on receipt of arriving emergency vehicle information. The data collection module gathers the data from all the RSU's and forwards it to Traffic Signal Control Module (TSCM). The TSCM has two units, namely traffic analysis unit and traffic signal controller (Adriano mega). The camera sensor captures the real-time traffic video and inputs the traffic analysis unit, where the raw traffic data is processed and analyzed. The traffic controller unit gets the data like distance, velocity, traffic density, vehicle count, etc. from the traffic analysis unit. The controller executes the proposed algorithm and sends its decision to traffic lights. After the passage of an emergency vehicle, the system resumes its normal operation, i.e., fixed sequence and light length algorithm. In the following, we discuss distance measurement techniques, vehicle counting methods, a distance-based emergency vehicle dispatching algorithm and the simulation environment.

PROBLEM IDENTIFICATION

Traffic congestion is a severe problem in many major cities across the world. An adaptive traffic control system can be developed where the traffic load and emergency vehicles are continuously measured by sensors connected to a microcontroller-based system which also performs all intersection control function

METHODOLOGY

A 8 bit ATMEGA328P microcontroller is used for this paper each traffic lane has a sensor to check the traffic in that lane every time depending on the traffic condition microcontroller calculates the time required to keep the green signals enables for the lane. This cycle continues until any emergency vehicle comes. The emergency vehicle can control the signal of its lane and make it using wireless controller.

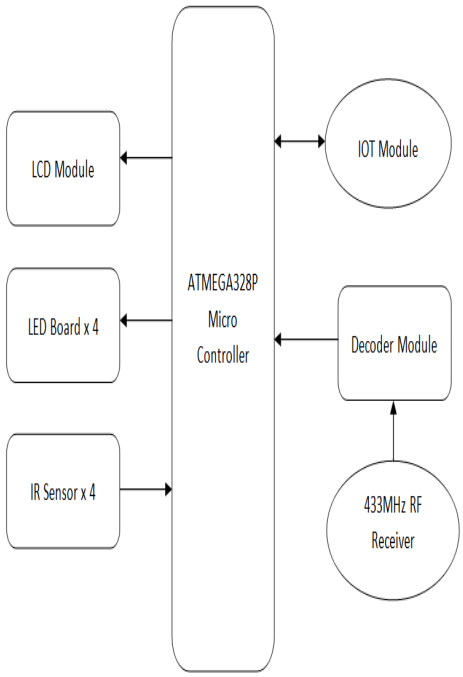

Fig.1c Block diagram of Sensor Control

Under the proposed work, each intersection contains RFID reader. The road is divided into two lanes. Each lane has its RFID to track the vehicles to passing through it. Each intersection point has its own data base to store the information regarding to vehicles that passes from it with timestamp and traffic light. Every vehicle has a RFID enabled device that stores a vehicle identification number (VIN). Every vehicle has its unique VIN number that provides the information that regarding the priority of vehicle and type of vehicle. With the help of VIN we can uniquely identify the vehicle and its owner. In the proposed work RFID, tag will store vehicle identification number. These numbers is divided in three parts. First part represents the priority of the vehicles. Next part represents the type of vehicle and next, digit represents the vehicle number. In the proposed work, different types of vehicles have different type of priorities. Vehicles are divided into 4 categories. First system category includes Ambulance, Fire brigade vehicles and VIP vehicles. These vehicles have a highest priority. Day time priority of 3rd category is high as compare to 4th category but during night hours the priority of heavy vehicles is high.

APPLICATIONS

i)SENSOR NETWORKS APPLICATION

Sensor networks may consist of many di□erent types of sensors such as seismic, low sampling rate magnetic, thermal, visual, infrared, and acoustic and radar, which are able to monitor a wide variety of ambient conditions that include the following

- ➢ Temperature
- ➢ Humidity
- ➢ Vehicular movement
- ✓ Lightning condition
- ✓ Pressure,
- ✓ Soil makeup,
- ✓ Noise levels,
- ✓ The presence or absence of certain kinds of objects,
- ✓ Mechanical stress levels on attached objects, and
- ✓ The current characteristics such as speed, direction, and size of an object.

Sensor nodes can be used for continuous sensing, event detection, event ID, location sensing, and local control of actuators. The concept of micro-sensing and wireless connection of these nodes promises many new application areas. We categorize the applications into military, environment, health, home and other commercial areas. It is possible to expand this classification with more categories such as space exploration, chemical processing and disaster relief.

Sensor nodes can be used for continuous sensing, event detection, event ID, location sensing, and local control of actuator

ii) MILITARY APPLICATIONS

Wireless sensor networks can be an integral part of military command, control, communications, computing, intelligence, surveillance, reconnaissance and targeting (C4ISRT) systems. The rapid deployment, self-

organization and fault tolerance characteristics of sensor networks make them a very promising sensing technique for military C4ISRT. Since sensor networks are based on the dense deployment of disposable and low-cost sensor nodes, destruction of some nodes by hostile actions does not a□ect a military operation as much as the destruction of a traditional sensor, which makes sensor networks concept a better approach for battlefields. Some of the military applications of sensor networks are monitoring friendly forces, equipment and ammunition; battlefield surveillance; reconnaissance of opposing forces and terrain; targeting; battle damage assessment; and nuclear, biological and chemical (NBC) attack detection and reconnaissance

iii)**ENVIRONMENT APPLICATIONS**

Some environmental applications of sensor networks include tracking the movements of birds, small animals, and insects; monitoring environmental conditions that a□ect crops and livestock; irrigation; macro instruments for large-scale Earth monitoring and planetary exploration; chemical/ biological detection; precision agriculture; biological, Earth, and environmental monitoring in marine, soil, and atmospheric contexts; forest fire detection; meteorological or geophysical research; flood detection; bio

complexity mapping of the environment; and pollution study Forest fire detection: Since sensor nodes may be strategically, randomly, and densely deployed in a forest, sensor nodes can relay the exact origin of the fire to the end users before the fire is spread uncontrollable. Millions of sensor nodes can be deployed and integrated using radio frequencies/ optical systems. Also, they may be equipped with e□ective power scavenging methods [12], such as solar cells, because the sensors may be left unattended for months and even years. The sensor nodes will collaborate with each other to perform distributed sensing and overcome obstacles, such as trees and rocks that block wired sensors' line of sight.

ADVANTAGES

- During normal time the signal timing changes automatically on sensing the traffic density at the junction but in case of any emergency vehicle like ambulance, fire brigade etc., requiring priority are built in with RF control to override the set timing by providing instantaneous green signal in the desired direction while blocking the other lanes by red signal for some time.
- It reduces the possibilities of traffic jams caused by traffic lights to an extent

DISADVANTAGES

- While they do help manage the flow of traffic, one of the other disadvantages of traffic signals is that they can cause traffic delay. Waiting for a traffic light to turn or waiting for a car in a turn lane to safely cross an intersection can result in long wait periods. Excessive delays can translate to wasted fuel, air pollution and costs to motorists.

CONCLUSION

The paper demonstrates automatic traffic signal control based on the traffic density in the route, the manual effort on the part of the traffic policeman is saved. The design and implementation of this technique is directly targeted for traffic management so that emergency vehicle on road gets clear way to reach their destination in less time and without any human interruption.

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