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Traffic Information System Using Vehicle AD-HOC Network

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Abstract:

We propose distributed, collaborative traffic congestion detection and dissemination system using VANET that makes efficient use of the communication channel, maintains location privacy, and provides drivers with real time information on traffic congestions over long distances. The system uses vehicles themselves, equipped with simple inexpensive devices, as gatherers and distributors of information without the need for costly road infrastructure such as sensors, cameras or external communication equipment here traffic information service for which traffic data are collected over ad-hoc networks from neighbor vehicles, processed to minimize the data size, and eventually provided to its destination. The proposed scheme simply relies on the existing navigation systems in vehicles and wireless communication devices for vehicle-to-vehicle communication, rather than on a separately established server. It allows collecting and analyzing traffic status of large areas without incorporating separated monitoring systems, e.g., probe cars and enables to provide accurate traffic information to drivers in timely manner.

1.INTRODUCTION:

Automobile traffic is a major problem in modern societies. Millions of hours and gallons of fuel are wasted everyday by vehicles stuck in traffic. According to the Texas Traffic Institute, drivers in the US wasted 4.2 billion hours of time, 2.9 billion gallons of fuel, and a total cost of 78 billion dollars in 2005 due to traffic delays. Technology is at a point today in which vehicles themselves could be used to compile and analyze traffic data and relay it to the drivers in a format that will allow them to make smart decisions to avoid congested areas. Communications between vehicles can be achieved either through vehicle-to-vehicle (V2V) communications and/or vehicle-to-infrastructure (V2I).

Vehicular ad-hoc networks (VANET) are a form of mobile ad-hoc networks (MANET) that provide communications between nearby vehicles and nearby fixed equipment. Congestion detection is only one of many applications of VANETs and it is not designed to be used as means for automated driving but rather as a tool to deliver information to the driver that will help him/her make decisions to avoid heavy traffic. Developing a traffic congestion detection system will have tremendous impact on the economy, the environment and society in general allowing us to spend less time stuck in traffic and more time doing more productive and enjoyable activities. Vehicular Over-the-air Traffic Information Gathering (VOTING), that is capable of detecting traffic congestion areas in real-time with data collected and disseminated by vehicles using V2V communications, without the need for any external infrastructure (such as antennas, satellites, etc.), and developing the tools for interactively simulating.

Vehicular ad hoc networks (VANETs) can provide scalable and cost-effective solutions for applications such as traffic safety, dynamic route planning, and context-aware advertisement using short-range wireless communication. To function properly, these applications require efficient routing protocols. However, existing mobile ad hoc network routing and forwarding approaches have limited performance in VANETs. This dissertation shows that routing protocols which account for VANET-specific characteristics in their designs, such as high density and constrained mobility, can provide good performance for a large spectrum of applications.

1.2 Related Work:

Much of the research in VANET focuses on simulating vehicular traffic [13] [14] [15] [16] [17] [18] and multi-hop routing [19] [20] [21] [22].

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Using vehicle based GPS systems we can create an ad-hoc wireless network that can find and disseminate traffic congestion information. Collision avoidance systems [26] [27] are designed to detect a traffic incident in real-time and rapidly relay this information to nearby vehicles to prevent a collision. very fast over short distances and needs to be extremely reliable as it has a direct effect on life-and-death Higher levels contain aggregated information.

Donrbush et al [4] from the University of Maryland proposed a novel system for congestion detection where each node analyzes the collected statistics eliminating the need for a central entity. Yoon, Noble and Liu of the University of Michigan [6] proposed a system for traffic estimation that is based on road segmentation and focuses on complex inner-city traffic. When congestion sizes exceed transmission ranges, common in freeway scenarios the use of multi-hop communications is required in order for all vehicles in the congestion to have knowledge of all other vehicles in the congestion.

Because vehicles constantly move, these two pieces of information will be undistinguishable from two pieces referring to two different vehicles. Most recently, companies have began to realize the potential of using vehicles as collectors of traffic information, Dash Navigation, CA started offering a service in 2009 called The Dash Driver Network that allows drivers to broadcast their location and speed in exchange for receiving updated traffic information compiled from other vehicles in the network. The CAR 2 CAR communication Consortium [29] an non-profit organization initiated by European vehicle manufacturers with the objective of improving road traffic safety and efficiency published in 2007 a manifesto in which it proposes standards for V2V and V2I communications among other things.

Other organizations [30] initiated by industry, government and universities have started similar efforts in the last few years. In 2008, the European Union took a major first step towards deployment of systems relying on V2V and V2I communications by reserving a radio frequency across the EU for vehicle applications aiming at enabling co-operative systems between carmakers [31]. The EU expects this action to lead to the eventual roll-9 out of the first production examples early next decade with the first efforts expected to be focused in the area of road safety.

AD-HOC NETWORKS:

2.1 Mobile Ad-Hoc Networks (MANET) :

Mobile Ad Hoc Networks are flexible wireless networks that do not rely on any external infrastructure such as routers or radio towers, the network is formed by the nodes themselves, and messages are usually sent using multi-hop routing in which network nodes act as routers to deliver messages outside of the sender's transmission range. The primary challenge for building a MANET is for each device to continuously maintain the information required to properly route traffic. Each MANET node may be able to move independently in a manner not necessarily predictable by other nodes. MANETs have been studied extensively [35].

2.2 Vehicular Ad-Hoc Networks (VANET):

Many car manufactures and research institutions are investigating ways of establishing vehicular networks. Because of the flexible nature of Mobile Ad Hoc Networks (MANET), they represent an attractive solution for inter-vehicular communications. VANETs have some unique characteristics not shared by other types of MANETs:

- Vehicles move at high speed.

- Mobility patterns are somehow predictable as movement is constrained by road infrastructure. In some situations such as highway traffic, the mobility patterns become highly predictable.

- Large coverage area. Vehicles travel over long distances and traffic information may be useful to vehicles hundreds of miles away.

- Power consumption is not a major concern. Vehicles are mobile power plants.

- Vehicles have a high cost and therefore can be equipped with additional sensors without significantly impacting the total cost.

- VANET's topology is extremely dynamic as vehicles go in and out transmission range quite rapidly.

- Vehicles travel long distances in a small amount of time when compared to other mobile networks. Research of VANETs has been a topic of interest in recent years.

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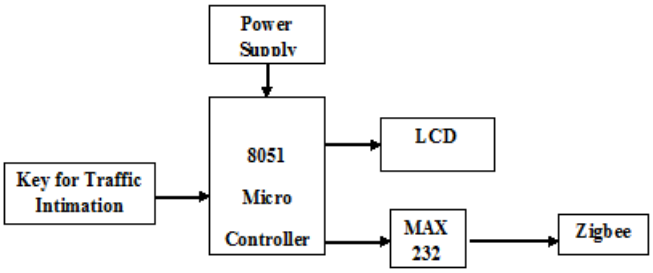
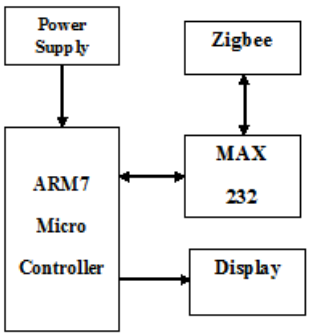
2. BLOCK DIAGRAM:

Vehicle section:



INFORMATION COLLECTING DEVICE:



2.1BLOCK DIAGRAM EXPLANATION:

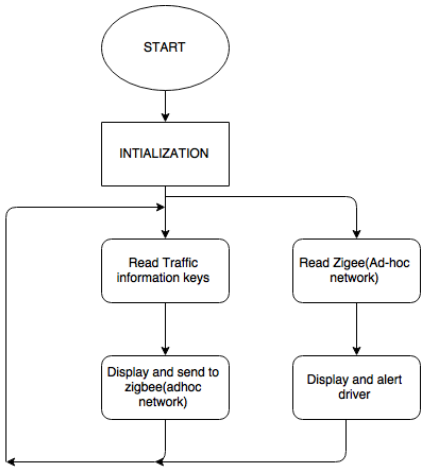
The proposed system consists of four locks representing three vehicles and information collecting device. Each vehicle system consists of traffic information collecting keys, and the microcontrollers to analyze the data from traffic information keys. And display section to display the information to the driver. And the system consists of Zigbee wireless module to transmits/ receive traffic information to/from nearest vehicles. And the system consists of one information collecting device which has the microcontroller, zigbee and display unit, here the system collect the traffic information from different vehicles and work like a monitoring system to dynamically clearing traffic, and managing the traffic dynamically by passing information to the vehicles through adhoc network .

2.2WORKING PRINCIPLE:

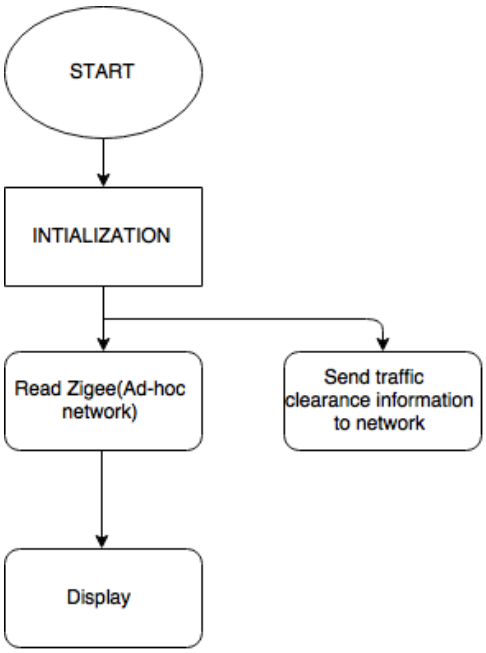
The system works on the principle of ad-hoc network. In which the information pass-through the nodes(vehicles). Without maintaining any server. The ad-hoc networks are mostly used to avoid to go for long range communication technologies.

3. FLOWCHART:

Vehicle section:



Information collecting (Monitoring system):



4. ADVANTAGES AND APPLICATIONS:

ADVANTAGES

1.Separation from central network administration.

2.Self-configuring nodes are also routers.

3.Self-healing through continuous re-configuration.

4.Scalability incorporates the addition of more nodes.

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APPLICATIONS:

Military arena:

An ad hoc networking will allow the military battleground to maintain an information network among the soldiers, vehicles and headquarters (Bangnan et al., 2003).

Provincial level:

Ad hoc networks can build instant link between multimedia network using notebook computers or palmtop computers to spread and share information among participants (e.g. Conferences).

Personal area network:

A personal area network is a short range, localized network where nodes are usually associated with a given range.

5.CONCLUSION:

The system propose a traffic information service simply relying on the existing Navigation/GPS systems in vehicles and wireless communication devices for vehicle-to-vehicle communication, rather than on a separately established server. The proposed scheme collects traffic information over inter-vehicle networks, processes it to minimize the size, and transmits it to the destinations.

This scheme uses three wireless communication channels and only a single selected last-vehicle is allowed to transmit the traffic information to the opposite lanes, which reduces the probability of wireless communication collision. Compared to the existing service, it has more advantages that it provides traffic information in timely manner and it can offer no charge service as well.

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