VANET used for Efficient Detection and Recognition of Objects in Image Processing

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Abstract **- A novel application regarding to the image processing for the Vehicular Ad hoc Network (VANET) is proposed in this paper. Vehicular Ad hoc Networks is a form or type of mobile adhoc network to provide communication among nearby vehicles and nearby fixed equipments or roadside units for improving efficiency and safety of transportation. Creating a query in order to get data from an image captured by a camera placed in a vehicle is the main idea of the application. The query is not related to a database but it is aimed for a still image in real time processing. We could get data by detecting and recognizing objects in an image by using the query. Even though it possesses characteristics of high node mobility and fast topology changes but still it can provide wide variety of services, ranging from safety related warning message system. The paper presents a system and a new language for querying image data. It is a unique solution because a proposed system could process and detect objects specified by a query using object oriented perspective in real-time images.**

Keywords— VANET; query; image object; routing

1. INTRODUCTION

The Vehicular Ad hoc Network (VANET) is a technology having the art of integrating adhoc network, wireless LAN and cellular technology to achieve intelligent Inter-Vehicle Communications (IVC) also known as Vehicle-to-Vehicle(V2V or C2C) communications and Roadside-to-Vehicle Communications (RVC or R2V). Vehicular Ad hoc Network (VANET) is a type of Mobile Ad hoc Network in which communicating nodes are vehicles and roadside communication equipments. In VANETs nodes can communicate with each other without the use of central access-points, means that vehicular nodes are treated as "computers on wheels" or "computer networks on wheels"VANETs provide us the valuable concept for improving efficiency and safety of future transportation. For building VANETs, the basic infrastructure requirements are equipment of radios working in unlicensed band and sensors in the vehicles for V2V communication, deployment

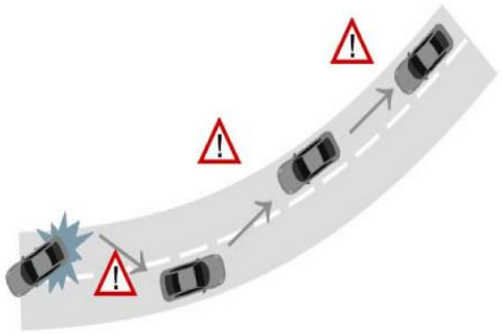

Fig1: Vehicle-to-Vehicle (V2V) communication of info stations (access-points) for V2I communication provides a way for internet access.

VANET (Vehicular Ad-hoc Network) is promising research area. It allows vehicles to communicate with each other or to communicate with the infrastructure on a wireless basis. Deployment of this technology will enable researchers and car manufacturers to provide many safety or comfort software applications for vehicles. In this paper we propose a new VANET application that uses image processing based on the query language for obtaining requested information from an image of traffic scene captured by cameras placed in all vehicles in range. Any VANET participant can use this system in order to get required objects by detection and recognition of objects appeared in traffic.

For example, let's imagine that the police are looking for a wanted vehicle described as a red car with a license plate beginning with two particular characters and ending with one particular character. Moreover the car has a specific symbol on its trunk. Using these descriptions one could define a query and send it through VANET. If some other vehicle locates the wanted car, it can send the answer consisting of the GPS position and the image of the recognized car.

Using query to search for information about the lowest gas price in surroundings of a vehicle could be taken as another example of the system usage. The gas price is usually written on a totem of gas station standing alongside the road. A vehicle passing by a gas station can detect the totem and recognize its content. Afterwards a vehicle could send the answer about the recognized price

and the GPS position.To search for a specified object we must define a complex query consisting of a searched object description, possible location of the object and spatiotemporal relations between the object and other object. It could then help with recognition of the required object. Using this kind of description, system could detect and recognize wanted objects in images of traffic scene captured by VANET participants.

2. VANET ROUTING

Routing plays an important role in VANET applications but the high-speed mobility of vehicles and their rapidly changing topology results in conventional MANET routing proto-cols being inadequate to efficiently and effectively deal with this unique vehicular environment as intermediate nodes cannot always be found between source and destination and end-to-end connectivity cannot always be established. This has prompted researchers to find scalable routing algorithms that are robust enough for the frequent path distributions caused by vehicle mobility, new and novel approaches that can deliver improved throughput and better packet delivery ratio. Sun et al. propose a novel vehicular ad hoc routing protocol that utilizes both Zone Routing Protocol (ZRP) and Global Positioning Information (GPSR).

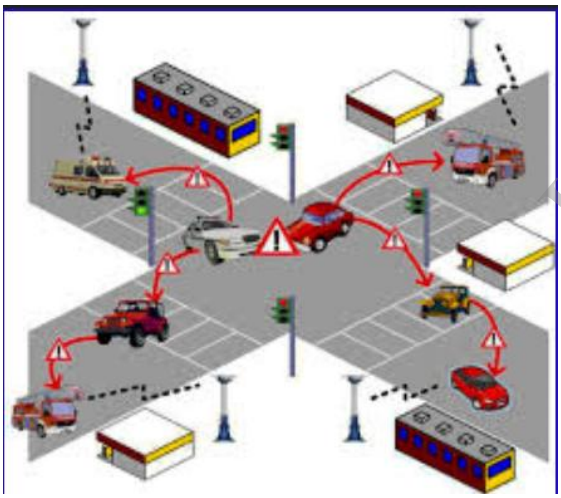

Fig 2: Routing in VANET

Using the history cache to store the movement information of intra-zone vehicles and destination location information, the proposed routing protocol can predict an efficient path. By applying GPSR function on ZRP border nodes only (and not for all of its neighbours), better routing performance can be achieved for VANETs.

The problem of spectrum access is addressed to deal with channel dynamics due to highly mobile nodes. A multi-channel Media Access Control (MAC) design that supports concurrent transmissions by allocating the channel for every beacon interval, is inadequate for fast-fading VANET environments.

In contrast, a MAC design based on opportunistic spectrum access that selects a channel for each transmission cannot provide fair share of spectrum among devices. To address deficiencies of these MAC designs, the design and evaluation of a Cognitive MAC for VANET is presented.

3. PROBLEM DEFINITION AND PROPOSED SYSTEM

Nowadays, Traffic accidents have been taking thousands of lives each year, outnumbering any deadly diseases or natural disasters. Studies show that about 60% roadway collisions could be avoided if the operator of the vehicle was provided warning at least one-half second prior to a collision. So, based on these statistic figures, researchers and scientists switch to computerize and automate the vehicular transportation system so as to reduce the road accidents which in estimation takes lives of about 1.2 million people per year worldwide, and injures about forty times of this number. VANET is one of the solutions to remove these problems but that too needs a mechanism so as to avoid collision, achieve congestion control and low latency in delivering of emergency warning messages. A vehicle to vehicle communication for cooperative collision warning provides such facilities to a large extend but the wireless communication used is unreliable due to channel fading, packet collisions, and communication obstacles, can prevent messages from being correctly delivered in time.

Many recognition tasks for traffic scene are based on object detection. We could detect real objects in traffic from vehicle perspective. Examples of real objects possible to recognize are vehicles, buildings, pedestrians etc. Because high-level image processing algorithms have to be used to recognize those objects, we will call them high-level objects. Besides the real objects there are many low-level features such as color, shape or texture segments, which we could consider as low-level objects. Both of them we will call using term image object. At the beginning we have to identify real objects often occurring in a traffic scene. Then we will make it possible to use those objects in a query together with relations to other objects. It is obvious that we cannot cover all real objects and therefore we have to introduce a possibility to define one's own object type. Using this definition we will be able to detect an arbitrary object.

3.1 Proposed System Highlights

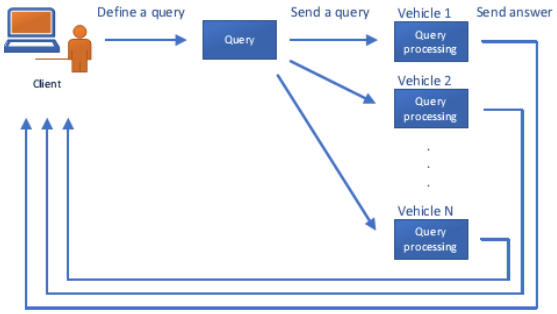

Fig. 3: Proposed system with respect to network point of view

The idea of overall system is simple. A client (a person or a machine) defines a query and sends it to one or more vehicles in some area using IP broadcast or geocast.

Vehicles start processing the query and recognize objects described byit. If a vehicle successfully recognizes a requested object, answer will be sent back to the client as shown in Fig.2

3.2 Query for VANET

A complex task of searching a requested object in an image represents a Query. In order to express complex recognition task as a query we have to decompose task to a set of elementary tasks. These elementary tasks are connected together in a sequence, where every elementary task stands for operation (see Fig. 4). Input and output of every elementary task are sets of image objects.

The system is working with parts of an image, each part representing one image object. Every elementary operation manipulates with a set of image objects on its input in such way that the output can be the same or modified set of image objects (it depends on the kind of the operation). The way the system handles an empty set as the result of the query has to be defined as a part of the query definition. There are two possibilities. The first one is to terminate the processing of the query. The second option is to continue on processing by repeating the query processing from the beginning. Fig.3 shows a diagram of processing through all steps and actions of the proposed system.

The image captured by a camera could be processed periodically until a condition was met (it will continue in processing by query condition in Fig. 3). Because a requested object can appear at random time

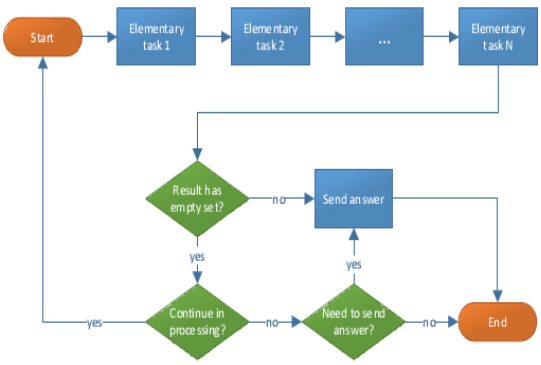

Fig 4 : Processing a query in proposed system

The condition could be set by:

• time– if the timeout passed (for example 2 minutes), the processing will be stopped.

• events– for example if the engine of a vehicle is tuned off or a wanted object is found, the processing will be stopped.

• geolocation– if a vehicle is out of given region by GPS positions, processing will be stopped

4. IMAGE OBJECTS TREE

For the purpose of better manipulating and navigating in image object we have introduced a concept of a tree of image objects. Since an image object consists of other image objects and those image objects consist of other image objects, we decided to decompose all objects to many other objects in a few levels (depth of decomposition being limited Fig.5 shows an example of tree of image objects where the image of traffic scene (root image object) contains two types of interesting objects – vehicles and traffic signs. Moreover, every type can contain other objects e.g. first vehicle contains recognized license plate. A license plate could possibly be decomposed to letters and so on. Given example shows two kinds of interesting objects at first level (three vehicles and two traffic signs) and one (license plate) on second level.

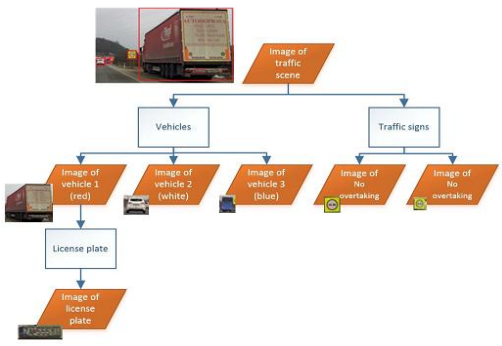

Fig 5 : Image Objects Tree example

5 ADVANTAGES and APPLICATIONS

Safety Oriented, Convenience Oriented, and Commercial Oriented are the main advantages. The important application lies in the concerns of interest to mobile ad hoc networks (MANETs) are of interest in VANETs, but the details differ. Rather than moving at random, vehicles tend to move in an organized fashion. The interactions with roadside equipment can likewise be characterized fairly accurately. And finally, most vehicles are restricted in their range of motion, for example by being constrained to follow a paved highway.

In addition, in 2006 the term MANET mostly described an academic area of research, and the term VANET an application Such a network might pose safety concerns (for example, one cannot safely type an email while driving). GPS and navigation systems might benefit, as they could be integrated with traffic reports to provide the fastest route to work. It was also promoted for free, VoIP services such as GoogleTalk or Skype between employees, lowering telecommunications costs.

6. CONCLUSION

An application principles of the image recognition in a VANET is presented in this paper. It improves safety of vehicles, Supports intelligent transportation system. we have analyse techniques for efficient transmission of emergency warning messages in VANETs We have introduced a new language and system for querying recognized image objects from cameras mounted on a vehicle. We described the query language principles and its basic structure and proven its usability on real-time examples. One possibility of future work is to describe image using innovative semantic technologies.

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