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A Review of Global Positioning System Device Forensics in Vehicular Ad-hoc Networks

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Abstract

Global Positioning System (GPS) is a navigation device. A navigation device which are providing the basic directions, maps, traffic movements on roads. Global Positioning System (GPS) signals in the formal of latitude and longitude data and same is converted into graphical representation or in the form of readable text mode. Present day smart phones are mostly provided with the GPS.

Global Positioning System (GPS) devices as being useful sources of evidence. For criminal investigations, accident reconstruction, search and rescue, and more, there are many situations where GPS data can prove invaluable to examiners in a GPS forensics case. A Vehicular Ad-Hoc Network or VANET is a technology used to collect and aggregate real-time speed and position information on individual vehicles.

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Keywords : GPS(Global Positioning System), VANET(Vehicular Ad-Hoc Network), Navigation device, GPS forensics case.

1. Introduction

Now days Global Positioning System (GPS) is very important part of our life. GPS devices uses to shows the basic directions, road maps and for many applications. Vehicular Adhoc Networks uses the GPS devices in wide variety of applications such as Unmanned Arial Vehicles (U.A.V.) to operate autonomously, tracking of vehicle fleets, cargo, rental vehicles, bank cash vans etc. GPS infrastructure also plays important role in forensic implications of this technology. GPS devices have access to location information as well as time data.

In digital forensic investigation many modern devices are use with having many functionality like Bluetooth, media players, Audio and video calling. GPS devices uses in vehicle at the time of occurrence of the evidence.

The GPS devices can be PDAs, Smart phones with storage form like hard disk , flash media. All the events and data store in this devices. In a forensic context, the

extraction of log and user related information is at increased priority. The data recovered can be used to assist a diverse array of criminal and civil investigations. In particular dates, times and geographical positions may be valuable in reporting events of interest. Mobile smart phones and PDAs are the huge source of information widely used for forensic investigations.

GPS extract information like Route, Home Location, Security Location ,Call Logs, Videos, Audios, Photos.

Some GPS Devices used with respect to VANET in forensic analysis.

1) Garmin Device.
2) TomTom Device.
3) Device uses Micro Technology.
4) Magellan Device.
5) Navman Device.

Forensic cases of GPS in VANET:

1) Road Accidents/ Hit and Run.
2) False Signals and Alarms.
3) Missing rented vehicles and Bank cash vans.

In the Above case GPS plays important role. GPS provides related information . it helps in in field of forensic

1)The Location of Vehicle
2)The Current Location of vehicle

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3) The last journey that was plotted(if stored)
4) Call Logs: incoming calls, outgoing calls, missed calls
5) Contacts
6) GPRS data

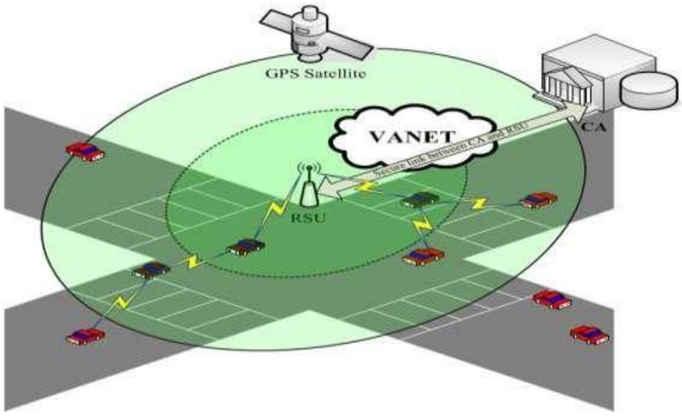

Figure 1. Shows Vehicle to Infrastructure Communication

In above figure shows how the GPS signal tracking. GPS Devices placed in vehicles and this devices sends signals to Satellite with the help GPS Antenna .so it trace all the details of vehicle by using the satellite. So at the time of investigation it plays very crucial role in field of forensic.

2. Overview

2.1) GPS (Global Positioning System) :

The GPS project first began in 1973 and became fully operational in 1994. The system is run by the United States Department of Defence and was originally intended for military applications only, but was made available for public use on completion. The GPS system consists of a network of 24 active satellites (and 8 spares) located nearly 20,000 km above the earth's surface -
that's the same as driving from Melbourne to Perth six times! Each satellite broadcasts different signals which can be tracked by a GPS receiver on earth, which are then analyzed by the GPS receiver to determine its precise location.
The signals operatein all weather conditions but can't penetrate through solid objects, so GPS receivers perform best when they have a clear view of the sky.
GPS receivers come in all different shapes and sizes, are widespread and are affordable.
Today, GPS receivers can be found in watches, phones, tablets, computers, carsand a wide variety of other devices.
GPS receiver must know the following things:
1.The location of at least four GPS satellites above it
2.The distance between the receiver and each of those GPS satellites.
by analysing radio signalstransmittedfrom the GPS satellitesandtiming how long it takes for the signal to travel from the satellite to the receiver.
If a GPS receiver cannot do this for at least four satellites, it will not be able to figure out where it is. If more than four satellites are detected, the accuracy of the trilateration increases.

2.2) VANET(Vehicular Ad-hoc Network):

Vehicular ad hoc networks (VANETs) are created by applying the principles of mobile ad hoc networks (MANETs) – the spontaneous creation of a wireless network for data exchange – to the domain of vehicles.VANETs were first mentioned and introduced in 2001 under "car-to-car ad hoc mobile communication and networking" applications, where networks can be formed and information can be relayed among cars. It was shown that vehicle-to-vehicle and vehicle-to-roadside communications architectures will co-exist in VANETs to provide road safety, navigation, and other roadside services. VANETs are a key part of the intelligent transportation systems (ITS) framework. Sometimes, VANETs are referred as Intelligent Transportation Networks

VANETs support a wide range of applications – from simple one hop information dissemination of, e.g., cooperative awareness messages (CAMs) to multi-hop dissemination of messages over vast distances. Most of 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.

Example applications of VANETs are:

- **Electronic brake lights**, which allow a driver (or an autonomous car or truck) to react to vehicles braking even though they might be obscured (e.g., by other vehicles).
- **Platooning,** which allows vehicles to closely (down to a few inches) follow a leading vehicle by wirelessly receiving acceleration and steering information, thus forming electronically coupled "road trains".
- **Traffic information systems**, which use VANET communication to provide up-to-the minute obstacle reports to a vehicle's satellite navigation system.
- **Road Transportation Emergency Services** – where VANET communications, VANET networks, and road safety warning and status information dissemination are used to reduce delays and speed up emergency rescue operations to save the lives of those injured.
- **On-The-Road Services**– it is also envisioned that future transportation highway would be one that is "information-driven" and "wirelessly-enabled". When one drives on the road, VANETs can help the driver to discover services (shops, gas stations, etc) on that street, and even be notified of any sale going on at that moment. Drivers can also book a cinema ticket while driving their way to the cinema

2.3) Digital Forensic:

Digital forensics (sometimes known as digital forensic science) is a branch of forensic science encompassing the recovery and investigation of material found in digital devices, often in relation to computer crime.The term digital forensics was originally used as a synonym for computer forensics but has expanded to cover investigation of all devices capable of storing digital data. With roots in the personal computing revolution of the late 1970s and early 1980s, the discipline evolved in a haphazard manner during the 1990s, and it was not until the early 21st century that national policies emerged.

Digital forensics investigations have a variety of applications. The most common is to support or refute a hypothesis before criminal or civil courts. Criminal cases involve the alleged breaking of laws that are defined by legislation and that are enforced by the police and prosecuted by the state, such as murder, theft and assault against the person. Civil cases on the other hand deal with with protecting the rights and property of individuals (often associated with family disputes) but may also be concerned with contractual disputes between commercial entities where a form of digital forensics referred to as electronic discovery (ediscovery) may be involved.

Forensics may also feature in the private sector; such as during internal corporate investigations or intrusion investigation (a specialist probe into the nature and extent of an unauthorized network intrusion).

The technical aspect of an investigation is divided into several sub-branches, relating to the type of digital devices involved; computer forensics, network forensics, forensic data analysis and mobile device forensics. The typical forensic process encompasses the seizure, forensic imaging (acquisition) and analysis of digital media and the production of a report into collected evidence.

As well as identifying direct evidence of a crime, digital forensics can be used to attribute evidence to specific suspects, confirm alibis or statements, determine intent, identify sources (for example, in copyright cases), or authenticate documents. Investigations are much broader in scope than other areas of forensic analysis (where the usual aim is to provide answers to a series of simpler questions) often involving complex time-lines or hypotheses.

3. Literature Review

2018 P N Ramakrishnan, " Forensic Analysis of Navigation System (GPS) –A Case Study"

A navigation device which are presently commonly available providing the basic directions, maps, grocery shops, establishments, traffic movements, roads, vital institutions etc. based on the receipt of the signals received by the device i.e. Global Positioning System (GPS) signals in the formal of latitude and longitude data and same is converted into graphical representation or in the form of readable text mode. Present day smart phones are mostly provided with the GPS. Data retrieval from such GPS devices is a challenging in nature.

2013,website http://www.car-to-car.org/index.php

Vehicular Ad-hoc NETwork (VANET) is a form of mobile ad-hoc network (MANET) that provides vehicle-to-vehicle and vehicle-to-roadside wireless communications. It was first introduced by the US Department of Transportation. Indeed, because of its unmistakable societal impact that promises to revolutionize the way we drive, various car manufacturers, government agencies and standardization bodies have spawned national and international consortia devoted exclusively to VANET.

2008 , R. He, H. Rutagemwa, and X. Shen, "Differentiated reliable routing in hybrid vehicular ad-hoc networks"

VANET is a highly movable wireless ad hoc network that is meant to support road safety, monitoring the traffic etc. In VANET environment, each vehicle can go for access to data from RSU or can communicate to any other vehicle. In this scenario, service scheduling becomes an important challenge to provide equal distribution of data access. "Data Scheduling" measured a very important issue in VANET to successful delivery of data item to the vehicle in proper and accurate way. Communication among vehicles are becoming a promising technology for security, management of traffic, monitoring and controlling of pollution, and numerous other road safety and traffic applications. Due to this a lot of data is generated that must be shared between communication parties efficiently. A major load is caused on the network infrastructure because of all this generated data, and the main aim of the network infrastructure is to provide constant services to the users. Thus, in order to manage the load on the network in such situations, a new scheme is proposed which suggests to cache frequently accessed contents at particular locations such as vehicles and RSUs so that data can be accessed from either local cache or RSU cache without the need to flood requests for the required data in the whole network thus reducing the delay and ultimately increasing the throughput.

2007 T. Taleb, E. Sakhaee, A. Jamalipour, K. Hashimoto, N. Kato, and Y. Nemoto, "A stable routing protocol to support its services in vanet networks "

There are numerous research challenges that need to be addressed until a wide deployment of vehicular ad hoc networks (VANETs) becomes possible. One of the critical issues consists of the design of scalable routing algorithms that are robust to frequent path disruptions caused by vehicles' mobility. This paper argues the use of information on vehicles' movement information (e.g., position, direction, speed, and digital mapping of roads) to predict a possible link-breakage event prior to its occurrence. Vehicles are grouped according to their velocity vectors. This kind of grouping ensures that vehicles, belonging to the same group, are more likely to establish stable single and multi hop paths as they are moving together. Setting up routes that involve only vehicles from the same group guarantees a high level of stable communication in VANETs. The scheme presented in this paper also reduces the overall traffic in highly mobile VANET networks. The frequency of flood requests is reduced by elongating the link duration of the selected paths.

2006., Raya, M., Papadimitratos, P. and Hubaux, J.-P. " Securing Vehicular Communications ". IEEE Wireless Communications Magazine

Special Issue on Inter-Vehicular Communications, 2006.,The road to a successful introduction of vehicular communications has to pass through the analysis of potential security threats and the design of a robust security architecture able to cope with these threats. In this paper, we undertake this challenge. In addition to providing a survey of related academic and industrial efforts, we also outline several open problems.

4. Conclusion

VANET Technology with GPS uses for crime investigation. Now days Digital Forensic is field uses specially GPS devices for collection of data. GPS extracts all related data of vehicles like Google Map, Routing information, Calling Details, Contacts, Current location of vehicles etc. This Devices Communicate with satellite and extract the information.

Using this information we handle the crimes related to vehicle like accidents, false messages etc.

By using this technology we can control the crime which is happen on road.

For growing Digital Forensic Field GPS Technology with VANET plays very important role.

5. References

[1] http://www.forensicswiki.org/wiki/ Global_Positioning_System

[2]file:///home/computer/Desktop/research%20papers/GPS%20Digital%20Forensics%20Services|%20GPS%20Forensics%20|%20Gillware.html

[3] P N Ramakrishnan,"Forensic Analysis of Navigation System (Gps) –A Case Study", Journal of Forensic Sciences & Criminal Investigation,voluume - 7 Issue - 4 February 2018

[4] Mehaffey Joe (2007) Automobile Navigation GPS features.

[5] US Department of Transportation, National Highway Traffic Safety Administration, "Vehicle safety communications consortium," http://www-nrd.nhtsa.dot.gov/pdf/nrd

[6]. A. Takahashi and N. Asanuma, "Introduction of Honda ASV-2 (Advanced Safety Vehicle-Phase 2)," in Proceedings of the IEEE Intelligent Vehicles Symposium, Detroit, USA, Oct. 2000, pp. 694–701.

[7] S. Biswas, R. Tatchikou, and F. Dion, "Vehicle-to-vehicle wireless communication protocols for enhancing highway traffic safety," Communications Magazine, IEEE, vol. 44, no. 1, pp. 74–82, Jan. 2006.

[8]. T. Taleb, E. Sakhaee, A. Jamalipour, K. Hashimoto, N. Kato, and Y. Nemoto, "A stable routing protocol to support its services in vanet networks," Vehicular Technology, IEEE Transactions on, vol. 56, no. 6, pp. 3337–3347, Nov. 2007

[9]. H. F. Wedde, S. Lehnhoff, and B. van Bonn, "Highly dynamic and scalable vanet routing for avoiding traffic congestions," in Proceedings of the fourth ACM international workshop on Vehicular ad hoc networks (VANET07). New York, NY, USA: ACM, 2007, pp. 81–82.

[10]. Z. Niu, W. Yao, Q. Ni, and Y. Song, "Dereq: a qos routing algorithm for multimedia communications in vehicular ad hoc networks," in Proceedings of the 2007 international conference on Wireless communications

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and mobile computing (IWCMC07). New York, NY, USA: ACM, 2007, pp. 393–398.
[11]. R. He, H. Rutagemwa, and X. Shen, "Differentiated reliable routing in hybrid vehicular ad-hoc networks," May 2008, pp. 2353–2358.
[12]. H. Kim, J. Paik, B. Lee, and D. Lee, "Sarc: A street-based anonymous vehicular ad hoc routing protocol for city environment," in Proceedings of the 2008 IEEE/IFIP International Conference on Embedded and Ubiquitous Computing (EUC08). Washington, DC, USA: IEEE Computer Society, 2008, pp. 324–329.
[13]. T. Kitani, T. Shinkawa, N. Shibata, K. Yasumoto, M. Ito, and T. Higashino, "Efficient vanet-based traffic information sharing using buses on regular routes," May 2008, pp. 3031–3036.
[14]. R. Morris, J. Jannotti, F. Kaashoek, J. Li, and D. Decouto, "Carnet: A scalable ad hoc wireless network system," in Proceedings of the 9th ACM SIGOPS European workshop: Beyond the PC: New Challenges for the Operating System. ACM Press, 2000, pp. 61–65.
[15] Wedde,Horst, Lehnhoff, Sebastian and Van Bonn, Bernhard. **"**Highly Dynamic and Scalable VANET Routing for Avoiding Traffic Congestions". International Conference on MobileComputing and Networking. 2007.\
[16] T. Camp and B. Williams. "Comparison of broadcasting techniques for mobile ad hoc networks". In Proceedings of The Third ACM International Symposium on Mobile Ad Hoc Networking and Computing (MOBIHOC 2002), Lausanne, Switzerland, Jun 2002
[17] Perkins, C.E. Adhoc Networking. s.l. : Addison Wesley, 2001.
[18] http://www.car-to-car.org/index.php?id=8
[20] http://books.google.com/books?id=9fUchlgTXDQC=9
[21] http://www.voanews.com/content/vehicles-may-soon-be-talking-to-each-other/1886895.html
[22] A VANET Scenario – city traffic communications, [Online].Available: http://www.car-to-car.org/index.php. [Accessed: May-2013].
[23] Sampigethava, L., Huang, M. and Poovendran, K. Matsuura, K. Sezaki."CARAVAN: Providing Location Privacy for VANET". Proceedings from the 3rd international workshop on Vehicular networks. 2006.\
[24] Raya, M., Papadimitratos, P. and Hubaux, J.-P. **"**Securing Vehicular Communications".IEEE Wireless Communications Magazine. Special Issue on Inter-Vehicular Communications, 2006.
[25] Dornbush, S. and Joshi, A. StreetSmart Traffic: "Discovering and Diseminationg Automobile Congestion using VANET". Vehicular Technology Conference. 2007, pp. 11-15.