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Mini Review Paper

Enhanced Bluetooth Technology to Assist the High Way Vehicle Drivers

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Abstract

In this paper a novel infrastructure is proposed for vehicular communication on highways. And some potential applications of Bluetooth technology aimed to assist drivers are presented. Some special features are added and implemented with the Bluetooth. The challenges and security issues are discussed.

Keyword: Security issues, bluetooth, driver assistance.

Introduction

Modern high-speed motorways and vehicles that drive upon them are becoming increasingly intelligent. In particular, communication devices are being installed in more and more cars and roadside infrastructure components (for example Volkswagen polo car). In the not-too-distant future, traveling vehicles will be able to communicate while forming ephemeral, rapidly changing ad hoc networks. At the same time, they will have direct access to a fixed roadside network infrastructure with information flowing both ways. This network environment motivates the need for an infrastructure that will provide drivers with access to the road map. The resulting enhanced situational awareness has the potential to not only facilitate the decision making tasks of the drivers (e.g., trip planning based on traffic congestion on the road), but also to improve highway safety (by bringing information about catastrophic events and road conditions to the driver's attention). Objective of this paper is to explore the security-related challenges in this envisaged setting using the Bluetooth device. While this paper presents no solid technical results, but it provides a valuable analysis of an environment that is very likely to become real in the near future. In particular, it describes one instantiation of an information infrastructure for highway driver assistance:

Bluetooth Technology

Bluetooth is a communication protocol. It is like a language that devices use to wirelessly communicate between each other. It is in fact based on a Master/Slave operation format. Pico net is a term used to describe a network formed by one device and all other devices detected in its range. In single coverage are around 10 Piconets can co-exist. A master can connect to more than one slave simultaneously. In reality, the master keeps switching between slaves. Bluetooth links two Pico nets to form a larger network. This works over a short range and can be used to establish connections between PDAs, mobile phones, laptops, digital cameras, printers, scanner, and many other electronic gadgets.

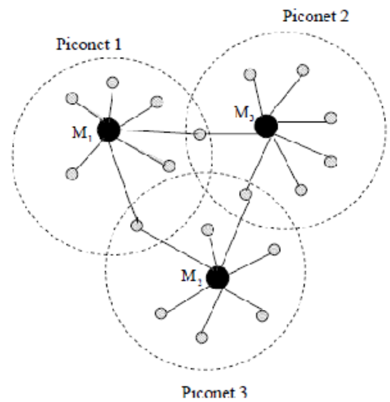

Figure-1
Example of Bluetooth Technology

Bluetooth Operation: In this section, the basic features of a Bluetooth network briefly described. Nodes are organized in small groups called *piconets.* Every piconet has a leading node called "master," and other nodes in a piconet are referred to as "slaves." A node may belong to multiple piconets, and we refer to such a node as a "bridge." A piconet can have at most 7 members. Refer to figure 1 for a sample organization. Every communication in a piconet involves the master, so that slaves do not directly communicate with each other but instead rely on the master as a transit node. In other words, Bluetooth provides a half-duplex communication channel. Communication between nodes in different piconets must involve the bridge nodes. A bridge node cannot be simultaneously active in multiple piconets. It is active in one piconet and "parked" in others. Bluetooth allows different activity states for the nodes: active, idle, parked, sniffing. Data exchange takes place between two nodes only when both are active. Activity states of nodes change periodically. Bluetooth uses frequency hopping spread spectrum in the physical layer. Different piconets use different frequency hopping sequences.

Supposition

The main elements and assumptions of the infrastructure are as follows:

Location awareness: Most of the vehicles are equipped with GPS receivers providing fairly accurate geographical position coordinator. (Note that many SUVs are already being outfitted with GPS receivers). This equipment will assist the drivers in the way of road map.

Ad hoc networking: Many high-end vehicles are already being equipped with sophisticated computing components. These components are interconnected via a LAN. This trend will very likely extend into wireless networking. In particular, the short-range wireless ad hoc networking for inter-vehicle communication will become ever-present.

Traffic Monitoring: A fixed infrastructure comprised of (at least) a number of base stations strategically positioned in close proximity to the highways. It is necessary to facilitate the upload of data from the vehicles. This data can be used for monitoring current traffic conditions, as well as managing traffic. Vehicles elsewhere can also query the fixed infrastructure for trip planning purposes[1].

Database maintenance in corporate Offices: Most of the drivers are escaping after causing the accidents. When Bluetooth sensor equipment is fixed with the device. It will update the location of the vehicle in database. So, the corporate offices can easily trace out the vehicle which is caused the particular accident.

Automatic Mobile switch off System: When take the accident survey most of the accidents are by the mobile phones. Because most of the drivers are using their mobile phones during their driving. This may cause the accidents. In this system when the drivers try to attend the mobile phones during the driving, it will be automatically switched off. So the drivers cannot attend the mobile phones.

Methodology of Vehicular Communication Infrastructure (VCI)

This vehicular communication infrastructure provides numerous possibilities to revolutionize the automotive and transportation industry of the future. For example, data captured by this infrastructure, when properly aggregated, can be fed into the traffic monitoring and flow control system for real-time traffic management. Alternatively, such information can be archived for off-line analysis to understand traffic bottlenecks and devise techniques to alleviate traffic congestion. There are numerous application possibilities and scenarios some of which may spark debates over privacy rights and apprehensions over unnecessary monitoring. However, the only applications considered are of the non-invasive, assistive variety. One of the most important application examples of this infrastructure is "vehicle surrounding awareness" or VSA for short. VSA aims to communicate to each vehicle *vital signs* of other vehicles that are traveling in close proximity. Proximity in this context means the area that falls within direct range of transmission of the wireless networking device found in each vehicle. Such vital signs may include the status of: turn signal indicators, brake application, relative/absolute speed, headlights, etc. It is important to note that all of these signs are, in any case, intended for external display, e.g., the status of the turn signal is always in plain view. In other words, no new information that might be construed as private is intended for communication outside a vehicle. The information collected by VSA will assist the drivers by offering them better awareness of their immediate surroundings as well as of the current and intended behavior of the nearby vehicles. Drivers will be able to better concentrate on the road ahead if they no longer have to look sideways to observe flanking and tailgating vehicles. Also, notorious blind spots can be effectively eliminated if drivers are continuously made aware of the surrounding space. Furthermore, traffic conditions ahead can be observed faster if drivers are warned of braking activity one or two vehicles ahead. Consequently, the VSA to increase highway safety by preventing some accidents.

Another, very different, application has to do with trip planning. It is referred as "traffic condition helper" or TCH for short. In it, vehicles communicate directly to the fixed infrastructure (base stations) and report their vital signs (as above) as well as the speeds of surrounding vehicles. This information is then efficiently gathered and combined into regional traffic snapshot databases. Vehicles, both on and off the highway, can query these databases and obtain immediate information on traffic conditions towards intended destinations. The wired clients, i.e., Internet users at home, can also use this TCH.

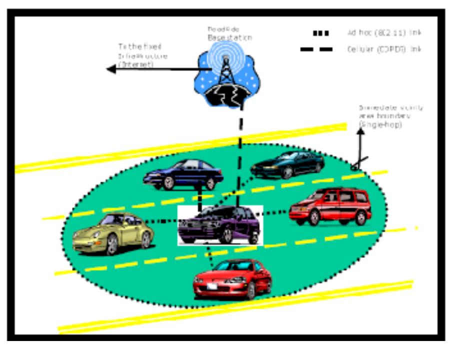

Figure-2
Vehicular Communication Infrastructure

In figure 1 depicts the typical scenario for this system. Several cars travel on a highway while communicating locally, via an ad hoc wireless network, and globally, via a fixed infrastructure wireless network. Each car is equipped with a laptop or PDA and the whole set is equipped with a wireless LAN card (e.g., 802.11) for local communication, and a wide-area wireless device (e.g., a cellular phone) for the connectivity to the infrastructure network. Each car forms, around itself, a *local* area of communication. Cars that are further away, although they may constitute part of a neighbor's local area, are not part of that particular car's communication network. All cars broadcast information Omni-directionally and receive data from all directions. There is no point-to-point communication link. The purpose of the ad hoc network is to impart information, i.e., the car's *vital* signs, to vehicles in close proximity and to receive the same data from them. The information is processed locally to provide the driver with a map indicating the status of each car in the immediate vicinity, e.g., acceleration, turning signal status, braking, etc. A sample VSA screen is depicted in figure 2; it shows some potential vital signs that may be reported.

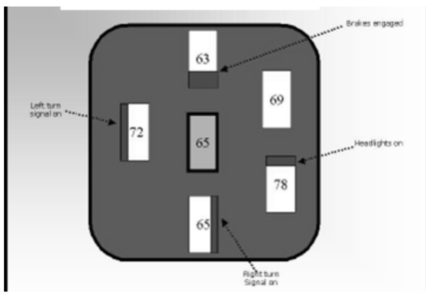

Figure-3
VSA Screen Snapshot

In addition to the local ad hoc network, each vehicle also communicates, at a much lower frequency rate, with the infrastructure network in order to upload its vital signs. This data is used by the infrastructure for maintaining up to- date traffic conditions and for performing traffic management. It also constitutes the highly dynamic database that users (drivers) can query to extract traffic and trip planning information. This refers to the HITCH application mentioned earlier.

In addition to communication and processing devices, each vehicle will also be outfitted with a GPS receiver and sensors that collect information regarding the *vital* signs of the vehicle. Furthermore, each vehicle will have, on each of its four sides, a simple detection device that will monitor the presence (or absence) of another vehicle in the immediate vicinity. This feature is necessary to ensure a safe system that is not prone to the vagaries of wireless communication.

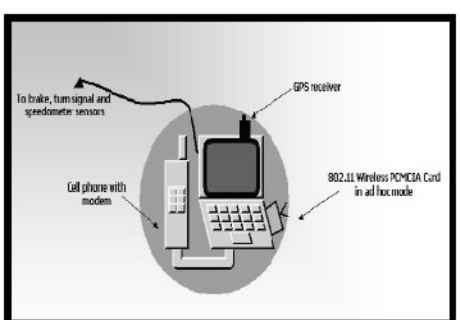

Figure-4
illustrates a sample unit (i.e., laptop or PDA) that will be fitted into each vehicle with its corresponding communication, GPS links and sensor feeds

Challenges

A set of challenges in developing the network and information infrastructure is discussed in this chapter. First and foremost, dealing with an environment is very dynamic and composed of high-motion vehicles. This results in rapidly changing network topologies. In addition, data exchanged between the vehicles is extremely time sensitive. The number of nodes involved is much larger than any system that has been proposed to date (e.g., sensor environments). On the other hand, since the communication devices are mounted in vehicles, the power supply is unlimited. This makes it possible to use fairly large antennas and on-board GPS devices. Also, data is only of interest to a small set of neighboring vehicles. At first, the above appears to simplify the problem since all data is broadcast one hop and no routing is involved. There are, however, some concerns. Primarily, the throughput of the system and the delays involved are important since the data is time sensitive, and in many cases, of urgent nature (e.g., speeding vehicle approaching in left lane). Therefore, the system must be robust and must have the capacity to support the traffic load and its time-critical needs (i.e., how far can the system can be pushed before reaching the point at which chaos prevails and data flow comes to halt). More complex, multi-channel systems that can handle the traffic load and its delay constraints, pose a different set of problems associated with the speed with which vehicles can associate themselves to the different channels and maintain an up to date picture of their surroundings. From the information infrastructure perspective, can be seen as a highly distributed and dynamic database where a large number of data sources (e.g., vehicles) generate vehicular information which is then consumed at different levels of aggregations (i.e., individual vehicle level in the context of VSA applications, and, at a more aggregated form, in TCH applications). The data sources may themselves store information acting as smaller (light-weight) databases, or alternatively, periodically migrate the information to the backbone storage and computation units. The additional intelligence embedded in VSA must be capable of expedited processing of critical path control messages -- information that can impact immediate vehicular control. In conjunction with the selective processing of messages, VSA will implement appropriate information collection policies and algorithms that determine how and when to probe and process incoming and outgoing information. Inter-node VSA interfaces and protocols will allow for customized processing of messages received from other vehicles. VSA-TCH interfaces and protocols will implement techniques to determine the transfer of information between the vehicle and the fixed wired infrastructure. The TCH layer assumes a hierarchical architecture where information flows from the vehicles to databases supported at the fixed infrastructure (reachable through roadside base stations). Information may also flow (at various levels of aggregation) from the infrastructure to the vehicles to support, queries that originate at the vehicles. An example of such a query corresponds to traffic information on a given route. Many aspects of such a query are interesting. First, the infrastructure may attempt to answer such a query based on data cached at the vehicle. Since data cached at vehicles can be rapidly outdated in the dynamic environment, techniques to correlate quality of results based on quality/age of data will need to be developed. If the data does not satisfy the quality requirement of the query, the vehicle will need to communicate with the fixed infrastructure, the base stations and/or other vehicles to get more accurate information. In general, query computation will be shared between the vehicles and the databases residing at the base stations as well as the fixed infrastructure[8-13]. Another interesting aspect of such queries is their continuous nature. Traditionally, a database query is issued explicitly; the database evaluates it and returns all results in one time. In contrast, in the environment a user (e.g., a driver) may monitor events/traffic continuously en-route. Implemented naively, the vehicle will generate a fresh query every time its location changes or an event occurs that changes the result set of the previous query. Given the continuity of motion in space and time, it is possible to optimize such continuous queries extensively[9]. The environment also poses a number of security- and privacy-related research challenges. In particular, vehicle-specific information exchanged as part of VSA or reported as part of TCH must be provided strictly at the discretion of the owner/driver, i.e., participation in inter-vehicle (and vehicle-infrastructure) networking must be voluntary. At the same time, all information provided – whether by the vehicles or by the infrastructure -- must be authentic, i.e., both the source and the integrity of the information must be evident and verifiable. We now consider these challenges in more detail.

Conclusion

In this brief paper a vehicular communication infrastructure is depicted and discussed several unique challenges. Although VCI is a concocted, artificial setting that this technology components needed to make it real are already available. Clearly, this paper presents no actual results: it only scratches the surface of what is promising to be a new and fertile area of research both in networking and security. In future the same system may be developed for moving vehicles.

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References

1. Mewada Shivlal and Singh Umesh Kumar, Performance Analysis of Secure Wireless Mesh Networks, *Res. J. Recent Sci.,* **1(3),** 80-85 **(2012)**

2. Lazaridis I. and Mehrotra S., Quality Aware Query Processing, Submitted for publication **(2002)**

3. Lazaridis I., Porkaew K., Mehrotra S., Dynamic Queries over Mobile Objects, to appear in to the 8th International Conference on Extending Database Technology **(2002)**

4. Boneh D. and Franklin M., Identity-Based Encryption from the Weil Pairing, *in proceedings of CRYPTO'* **(2001)**

5. Lazaridis I., Mehrotra S., Porkaew K. and R. Winkler, Database Support for Situational Awareness, Computer Science Handbook, M.S.Vassilou and T.S. Huang (eds.), Army Research Laboratory **(2001)**

6. Lazaridis I., Mehrotra S., Incorporating Aggregate Queries in Interactive Visualization, 5th Annual Federated Laboratory Symposium **(2001)**

7. Lazaridis I. and Mehrotra S., Progressive Approximate Aggregate Queries with a Multiresolution Tree Structure, 2001 SIGMOD Conference on Management of Data **(2001)**

8. Porkaew K., Lazaridis I. and Mehrotra S., Querying Mobile Objects in Spatio-Temporal Databases, *7th International Symposium on Spatial and Temporal Databases* **(2001)**

9. Mehrotra S., Lazaridis I. and Porkaew K., Situational Awareness over Large Spatio-Temporal Databases, Workshop at the Intersection of Geospatial Information and Information Technology, Computer Science and Telecomm, Board, National Council of Research, **(2001)**

10. Modadugu N., Boneh D. and Kim M., Generating RSA Keys on the PalmPilot With the Help of an Untrusted Server, RSA Data Security Conference **(2000)**

11. Frankel Y., et al., Security Issues in a CDPD Wireless Network, *IEEE Personal Communications,* **(1995)**

12. Molva R., Samfat D. and Tsudik G., Authentication in Mobile Networks, IEEE Network, Internet Public Key Infrastructure, Internet RFCs 2459, 2510, 2511 **(1994)**

13. Rahnema M., Overview of the GSM System and Protocol Architecture, *IEEE communications Magazine* **(1993)**