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Review Article

Location Area Routing Mechanism-Review

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Abstract

Road safety has become an important issue and gained much attention for many years. The absence of driving ethics and scant regard for traffic rules coupled with problems of inadequate infrastructure and ever increasing number of vehicles leads to testing the patience of drivers. This has led to an increased number of traffic accidents and collisions. It is at this point that we need a system which is minimally invasive however completely independent and capable of taking decisions based on its initial system training and envelope boundaries. Here I have presented a review of different routing protocols which can be used for Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) communication. I shall also discuss further the need of localization techniques to get the exact location of the cars through GPS and localization and once we get exact location we can check for traffic details to avoid congestion and find the shortest path from source to destination which will save our time. This will be realized by doing node to node and node to infrastructure communication.

Keywords: *Vehicle to vehicle communication, Vehicle to infrastructure communication, Localization, GPS, Congestion*

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1. Introduction

Computer networks and networking have grown rapidly during the last few decades. They evolved to serve basic user needs such as file and printer sharing, video conferencing and more. At present, Internet is regarded as a basic necessity of any modern society. Internet is an example of computer networks, and is considered to be the largest network of all. At the beginning of networking technology, computers shared files and printers mainly with computers from the same manufacturer. But this problem was solved by introducing the Open Systems Interconnection (OSI) reference model by the International Organization for Standardization (ISO). The OSI model was meant to help vendors create interoperable network devices and software in the form of protocols so that networks from different vendors could work with each other. Internet Protocol (IP) is the most widely used network layer protocol for interconnecting computer networks. Intra domain routing protocols, also known as Internet Gateway Protocols (IGP), organize routers within Autonomous Systems (Ass). Nowadays, the most widely used intra domain routing protocols are Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP), Routing Information Protocol (RIP) but when we move towards mobile ad-hoc networks, the mobile nodes are free to move independently in any direction i.e. there is no need for established infrastructure. Since vehicles are non-deterministic random variables, the concept of wired protocols cannot be implemented when routing principles are applied to the mobile nodes. This provides us with the requirement of working with on demand protocols such as AODV (Ad-hoc on Demand Distance Vector Routing) for route discovery and route maintainenace while Dynamic Source Routing (DSR) concept will be used when congestion creeps into the network.

It is necessary to measure the performance of the network before deploying these protocols into navigation systems and hence quantitative metrics such as convergence activity, end-to-end delay, packet delay and loss, throughput all need to be monitored for system performance degradation.

For this we will perform Location Area Routing (LAR) for which we will require Global Positioning System (GPS) which uses between 24 and 32 Medium Earth Orbit satellites that transmit precise microwave signals. This enables GPS receivers to determine their current location, time and velocity. The result is provided in the form of a geographic position - longitude and latitude - to, for most receivers, within an accuracy of 10 to 100 meters. To get more accurate result we need to perform localization of GPS data using KALMAN filter then by using LabVIEW we will create a GPS module data acquisition interface and link the decoded longitude and latitude information to Google Earth to locate actual positions. Once we get exact location of nodes we can find shortest path by using shortest path algorithm. Then we will do system modeling and designing using OPNET which is a network modeler through which one can design any kind of network model and then can simulate it.

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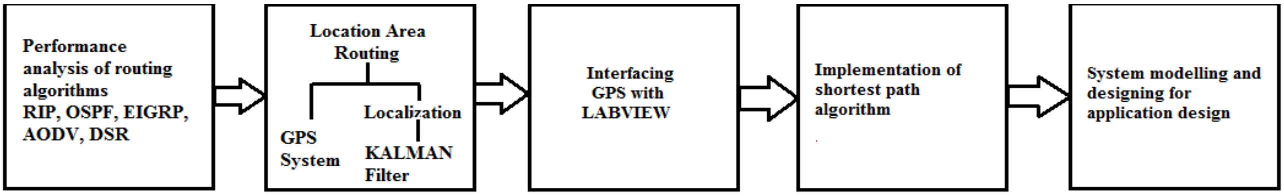

Figure1: System Block Diagram

2. Overview of RIP, OSPF, EIGRP, AODV, DSR

Routing Information Protocol (RIP)

RIP is a Distance vector routing protocol. It's metric is the number of jumps and the maximum number of jumps is 15.RIP send updates after every 30 seconds and it generates great amount of traffic of network with updates and it is not necessary that it will always selects the fastest route for the packages.

Enhanced Interior Gateway Routing Protocol (EIGRP)

The Enhanced Interior Gateway Routing Protocol (EIGRP) is an advanced communications protocol that helps automate routing decisions on a computer network. Contrary to other well-known routing protocols, such as routing information protocol, EIGRP only shares information that a neighboring router would not have, rather than sending all of its information. EIGRP is optimized to help reduce the workload of the router and the amount of data that needs to be transmitted between routers.

Open Shortest Path First (OSPF)

OSPF is an interior gateway protocol that routes Internet Protocol (IP) packets solely within a single routing domain (autonomous system). It gathers link state information from available routers and constructs a topology map of the network. The topology determines the routing table presented to the Internet Layer which makes routing decisions based solely on the destination IP address found in IP packets. OSPF was designed to support variable-length subnet masking (VLSM) or Classless Inter-Domain Routing (CIDR) addressing models. OSPF detects changes in the topology, such as link failures, and converges on a new loop-free routing structure within seconds. It computes the shortest path tree for each route using a method based on Dijkstra's algorithm, a shortest path first algorithm.

Adhoc on Demand Distance Vector Routing Protocol

In AODV, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts a request for connection. Other AODV nodes forward this message, and record the node that they heard it from, creating an explosion of temporary routes back to the needy node. When a node receives such a message and already has a route to the desired node, it sends a message backwards through a temporary route to the requesting node. The needy node then begins using the route that has the least number of hops through other nodes. Unused entries in the routing tables are recycled after a time. When a link fails, a routing error is passed back to a transmitting node, and the process repeats.

Dynamic Source Routing Protocol

This protocol uses a reactive approach which eliminates the need to periodically flood the network with table update messages which are required in a table-driven approach. In a reactive (on-demand) approach such as this, a route is established only when it is required and hence the need to find routes to all other nodes in the network as required by the table-driven approach is eliminated. The intermediate nodes also utilize the route cache information efficiently to reduce the control overhead.

3. Location Area Routing

The location update procedure allows a mobile nodes to inform the network, whenever it moves from one location area to the next. Nodes are responsible for detecting location area codes. When a node finds that the location area code is different from its last update, it performs another update by sending to the network, a location update request, together with its previous location, and it's Subscriber Identity.

GPS Mapping

A GPS receiver calculates its position by precisely timing the signals sent by GPS satellites high above the Earth. Each satellite continually transmits messages that include

- The time the message was transmitted
- Satellite position at time of message transmission

The receiver uses the messages it receives to determine the transit time of each message and computes the distance to each satellite using the speed of light. Each of these distances and satellites' locations defines a sphere. The receiver is on the surface of each of these spheres when the distances and the satellites' locations are correct. These distances and satellites' locations are used to compute the location of the receiver using the navigation equations. This location is then displayed, perhaps with a moving map display or latitude and longitude

Localization using Extended KALMAN Filter

Localization is an important functionality for navigating mobile nodes. However, the data obtained from GPS is sometimes uncertain and or even momentarily unavailable. Hence through localization using Extended Kalman filter we can reduce range of error from 3-10 meters to 2-8 cm of error.

4. LabVIEW

LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a system-design platform and development environment for a visual programming language. Here using LabVIEW software we will create a GPS module data acquisition interface and will link the decoded longitude and latitude information to Google Earth to locate actual positions.

The programming language used in LabVIEW, also referred to as G, is a dataflow programming language. Execution is determined by the structure of a graphical block diagram (the LabVIEW-source code) on which the programmer connects different function-nodes by drawing wires.

These wires propagate variables and any node can execute as soon as all its input data become available. Since this might be the case for multiple nodes simultaneously, G is inherently capable of parallel execution. Multi-processing and multi-threading hardware is automatically exploited by the built-in scheduler, which multiplexes multiple OS threads over the nodes ready for executions.

5. Related Work

A distributed adaptive opportunistic routing scheme for multihop wireless ad hoc networks is proposed in (Abhijeet A. Bhorkar, Mohammad Naghshvar, Tara Javidi and Bhaskar D. Rao, 2012). The proposed scheme utilizes a reinforcement learning framework to opportunistically route the packets even in the absence of reliable knowledge about channel statistics and network model. Comparison and evaluation of the performance of routing protocols like RIP, EIGRP, OSPF based on technical background is explained in (Sheela Ganesh Thorenoor, 2010). In this author presents the implementation decisions to be made when the choice is between protocols that involve distance vector or link state or the combination of both. Author analyse the network in terms of network convergence activity, network convergence time, CPU utilization, throughput, queuing delay and network bandwidth utilization, the global, node and link statistics are to be chosen.

In (Mittal S and Kaur P, 2009) Performance comparison AODV, DSR routing protocol for mobile Ad-hoc networks is presented as a function of pause time by using QualNet Simulator from Scalable Networks to perform the simulations. Performance evaluation of AODV, DSR is evaluated based on Average end to end delay, TTL based hop count and Packet delivery ratio. AODV, DSR have been proposed to solve multi hop routing problem in adhoc networks and analyzed the performance of routing algorithms under various network conditions such as streaming MPEG4 traffic, realistic environment, security attacks, resiliency under the range

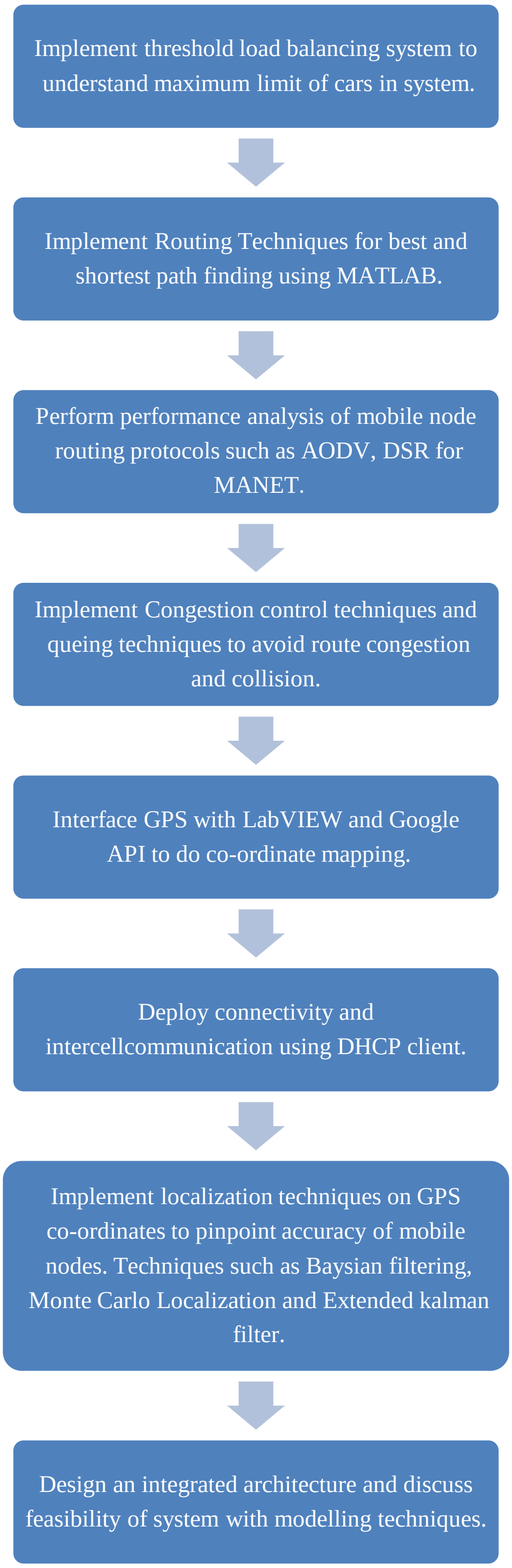

Figure 2: System Flow

attack, and network load deviation in (Geetam Singh Tomar, Tripti Sharma, Debnath Bhattacharyya and Tai-hoon-kim, 2011) Analyzed performance using average throughput and average end to end delay when number of nodes, and also their mobility, is varied. For node movement, a popular model, random waypoint is considered while Constant Bit Rate (CBR) traffic pattern is assumed in (Veena Anand and Suresh Chandra Gupta, 2012). The performance of MANET routing protocols AODV, DSR using different Traffic classes CBR, VBR and combined CBR/VBR traffic has been investigated in terms of different metrics such as Average energy consumption, Average throughput and Normalized routing load in (Qutaiba Razouqi, Ahmed Boushehri, Mohamed Gaballah and Lina Alsaleh, 2012). The taxonomy for congestion control algorithms in VANETs is presented based on three classes, namely, proactive, reactive and hybrid in (Mohammad Reza Jabbarpour Sattari, Rafidah Md Noor and Hassan Keshavarzm, 2012). Comparison and evaluation of the performance of routing protocols like AODV and DSR for VANETs is explained in (XIONG Wei and LI Qing-Quan, 2008). Survey and classification of various decentralized methods to control the load on the radio channels and to ensure each vehicle's capacity to detect and communicate with the relevant neighboring vehicles, with a particular focus on approaches based on transmit power and rate control are explained and open research challenges that are imposed by different application requirements and potential existing contradictions are also discussed in (Miguel Sepulcre, Jens Mittag, Paolo Santi, Hannes Hartenstein and Javier Gozalvez, 2011).

The objective of this project is to evaluate routing performance of RIP, EIGRP, OSPF, AODV and DSR in order to obtain convergence from dynamic routing to mobile ad-hoc network on the basis of performance quantitative metrics such as convergence activity, end-to-end delay, packet delay variation, jitter, traffic loss and throughput and by scaling the parameters of above routing protocols in such a way that we can use it for navigation systems, congestion control and collision avoidance.

Conclusion

We will be comparing the routing protocols RIP, OSPF, EIGRP, AODV, DSR and will analyzed the differences in their performance to show convergence from dynamic routing to mobile ad-hoc network.

These performance evaluations are also necessary to devise the new routing protocols for VANETs such as in future we can implement vehicle to vehicle and vehicle to infrastructure communication.

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