Protocol Enhancement of Vehicle Collision Avoidance System in Networks

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Abstract— In most of the automobile system avoiding collision is a critical issue. A "Vehicle Collision Avoidance System" in an automobile system is a safety system that is designed to reduce the chances of collision .Collision avoidance is one of the most important issues in controlling vehicles automatically .The job of driving vehicles can be made easier by the use of these system, as well as these system ensures to manage the traffic efficiently with road safety .In this paper we consider a VANET scenario for road side safety and to solve the emergency situation. To improve the performance for large scale network having large traffic and communication between vehicles is done by using routing protocol .Here we introduce a PUMA protocol and compare its results. Also we apply Genetic Algorithm on this protocol for the path optimization to achieve maximum results. By varying number of vehicles (nodes) mean throughput, mean delay, jitter, PDR has been calculated. In this paper application and future scope of VANETs is also introduced.

Keywords—: VANET, PUMA Protocol, V2V, Genetic Algorithm, ITS.

I.   INTRODUCTION

As traffic is increasing on road now days, vehicle safety is a big issue. These days vehicular communication is becoming popular. There are special form of networks which enable communication among roads with no need of infrastructure i:e; wireless networks and these networks are known as VANETs. VANETs are basically type of ad hoc networks .These networks are basically used for communication purpose on highways or in the urban environment as they are reliable. For specific need or situation these networks are created from the concept of establishment of a network of cars as they are ad hoc networks. In VANETs fast moving vehicles have fixed movement along the path, so they are known as distributed networks. For safety and comfort for passengers these networks are used. Safety of passengers is improved by sharing emergency and safety data among vehicles example; safety applications like emergency warning system, road condition and traffic sign violation warning. Traffic efficiency and passenger comfort are improved by these networks. The network V2V communication is implemented to identify the safe path [3] .In VANETs fast moving vehicles have fixed movement along the path, so they are known as distributed networks. For safety and comfort for passengers these networks are used. Safety of passengers is improved by sharing emergency and safety data among vehicles example; safety applications like emergency warning system, road condition and traffic sign violation warning. Traffic efficiency and passenger comfort are improved by these networks [4].There are some features that discriminate them from other Ad hoc networks (high speed, no battery constraints, and limited movement, reliable).In wireless networking, VANET communication has recently become an increasingly popular research these days. For the passenger's safety and comfort the goal of VANET research has to develop vehicular communication system to enable a quick and efficient distribution

of data. Due to collision of vehicles in everyday life, a lot of people die due to accidents. VANETs provide two types of communication, inter vehicle (V2V) communication, vehicle to infrastructure (V2I).In V2V[6],using short range communication services like Wi-Fi and WAVE, nearby vehicles transmit or receive data .A special electronic gadgets are used by vehicles that allows them to receive or relay messages. In V2I, communication of vehicles is done with nearby road infrastructure unit (RSU) using Wi-Fi hotspot or long range communication technology so that data will be exchanged. Because of Intelligent Transportation System provide strong technical supports for vehicles using wireless channel to deliver traffic safety information, road status information, large scale networks, fast moving nodes, frequent changing topology structure, node shift dynamic regularity enhancement and easily divided networks, VANET are widely used in Intelligent Transportation System(ITS).Some new routing protocols arise at historic moment because of demand and characteristics of VANET network. Compression technique such as AODV is used for improving the speed of communication and recovering the data loss [10].

Problems associated with road traffic are due to the increase of number of vehicles on road .For smooth flow of traffic efficient monitoring of vehicles is done .Vehicle collision[7] detection and congestion control are to be done .For collision free traffic many technologies are in action. Vehicle collision Prediction System which is based on VANETs [8][9] solves the issue of collision avoidance .Intelligent control unit (ICU) and vehicle to vehicle communication is used which predict the probability of collision at highways [1].For the improvement of traffic situation in urban environment ant colony optimization is used. Based on ant colony optimization (ACO) a Dynamic Travel Path Optimization System (DTPOS) for the prediction of best path to a given destination is used .In this system , number of factors are taken into consideration such as average travel speed, average time taken by the cars for waiting and the number of cars that are stopped in a queue. The DTPOS has the advantage that in urban cases it greatly reduces the average travel time of cars and when compared to similar models where cars select their path without ACO, mean travel time is improved by 47 percent. When the previous path replacement is applied to DTPOS results the percent is improved by 56 percent [2]. However Dedicated Short Range communication (DSRC) control channel (CCH) for safety in VANETs can also be used to avoid vehicle collision[11].

II.   BACKGROUND

2.1 ROUTING IN VANETs : For communication router play an important role.RSU acts like a router because of high coverage. Routing protocol for VANET can be decided on the basis of following condition: a) Distance of Route b)Geographical Area c) Emergency Situation d)Topology Selection e)Coverage Area

On the basis of position acquiring and route update method VANET routing protocol has been categorized:

Position based RP
Topology based RP
Broadcast based RP
Geo Cast based RP
Cluster based RP

2.2 PUMA PROTOCOL

PUMA stands for "Protocol for Undefined Multicasting through Announcement". PUMA operates on multicast routing not on unicast routing that is generally working on mesh networks and is independent routing protocol. In PUMA protocol initialization is done by receiver. As PUMA is based on Multicast Announcement (MA), it forwards packets from multicast sender within multicast group to destination and there is no flooding of packets. In PUMA one of the node is elected as core node and other nodes are informed of the elected node. PUMA is contains group_id, distance to core, latest announcement send by the parent and while announcement has been sent, it notifies other nodes. As PUMA is a mesh based routing protocol, it is capable of collecting many receivers together and has many paths to reach destination.[12] demonstrates that PUMA is more adaptable regarding multicast bunch size and more strong when join breakage increments than other multicast steering conventions, for example, MAODV. [12] Additionally saw that PUMA gives higher parcel conveyance proportion free from number of multicast gatherings, number of senders, and number of recipients, versatility and movement load. PUMA can give high bundle conveyance proportion Swith less control parcel overhead when contrast with other multicast directing conventions, for example, ODMRP and MAODV. Some of the advantages of this protocol are–high delivery data ratio, limited control over head.

2.3 GENETIC ALGORITHM

In the computer science field of artificial intelligence, genetic algorithm (GA) is a search heuristic that mimics the process of natural selection. This heuristic (also sometimes called a Meta heuristic) is routinely used to generate useful

solutions to optimization and search problems. Genetic algorithms belong to the larger class of evolutionary algorithms (EA), which generate solutions to optimization problems using techniques inspired by natural evolution, such as inheritance, mutation, selection, and crossover. Genetic algorithms find application in bioinformatics, phylogenetic, computational science, engineering, economics, chemistry, manufacturing, mathematics, physics, and other fields. In a genetic algorithm, a population of candidate solutions (called individuals, creatures, or phenotypes) to an optimization problem is evolved toward better solutions. Each candidate solution has a set of properties (its chromosomes or genotype) which can be mutated and altered; traditionally, solutions are represented in binary as strings of 0s and 1s, but other encodings are also possible. The evolution usually starts from a population of randomly generated individuals, and is an iterative process, with the population in each iteration called a generation. In each generation, the fitness of every individual in the population is evaluated; the fitness is usually the value of the objective function in the optimization problem being solved. The more fit individuals are stochastically selected from the current population, and each individual's genome is modified (recombined and possibly randomly mutated) to form a new generation. The new generation of candidate solutions is then used in the next iteration of the algorithm. Commonly, the algorithm terminates when either a maximum number of generations has been produced, or a satisfactory fitness level has been reached for the population.

A typical genetic algorithm requires:

1) A genetic representation of the solution domain,

2) A fitness function to evaluate the solution domain.

A standard representation of each candidate solution is as an array of bits [13].].Arrays of other types and structures can be used in essentially the same way. The main property that makes these genetic representations convenient is that their parts are easily aligned due to their fixed size, which facilitates simple crossover operations. Variable length representations may also be used, but crossover implementation is more complex in this case. Tree-like representations are explored in genetic programming and graph-form representations are explored in evolutionary programming; a mix of both linear chromosomes and trees is explored in programming. Once the genetic representation and the fitness function are defined a GA proceeds to initialize a population of solutions and then to improve it through repetitive application of the mutation, crossover, inversion and selection. Operators are adaptive heuristic search algorithm premised on the evolutionary ideas of natural selection and genetic. The basic concept of GA is designed to simulate processes in natural system necessary for evolution, specifically those that follow the principles first laid down by Charles Darwin of survival of the fittest. As such they represent an intelligent exploitation of a random search within a defined search space to solve a problem.

III.   SIMULATION

Simulation Tool: Matlab Version 7.11.0584(R2010b), 64-bit(win64) has been used for simulation. By varying number of nodes for different scenarios like Urban and Rural areas PUMA protocol has been simulated with GA model or algorithm to expand system reliability in terms of the probability of effective gathering of the packet and the delay of emergency messages in a harsh vehicular environment. Executions Metrics like mean delay, mean throughput, PDR, available energy, jitter and packet loss has been computed by changing no of vehicles (nodes).

Steps for the stimulated work have been mentioned below:

Step 1: Generate VANET Scenario using MATLAB

Step 2: Implementation of PUMA Protocol

Step 3: Generate Load on Each Node

Step 4: Implement Energy Efficient Algorithm using GA

Step 5: Route Selection

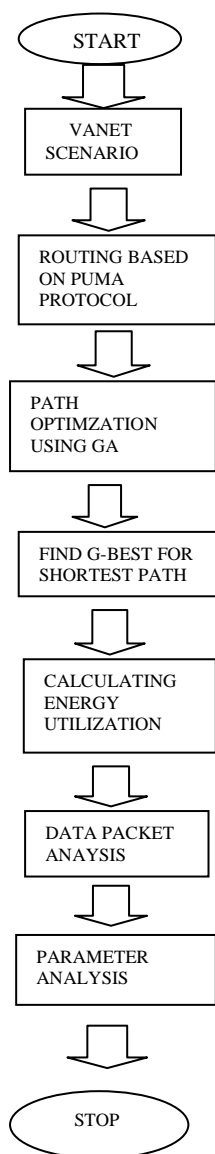Step 6: To Evaluate Parameters such as Throughput, Packet Delivery Ratio (PDR), Delay and Jitter**.**

Figure 3.1 Proposed Flowcharts

IV.   SIMULATED RESULTS

In this section, parameters like throughput, Delay, jitter, PDR and efficiency has been evaluated using proposed PUMA protocol with GA model for path optimization with the previous protocol BCO_CBLR, BCO_HCR. Comparison between the two is implemented below:
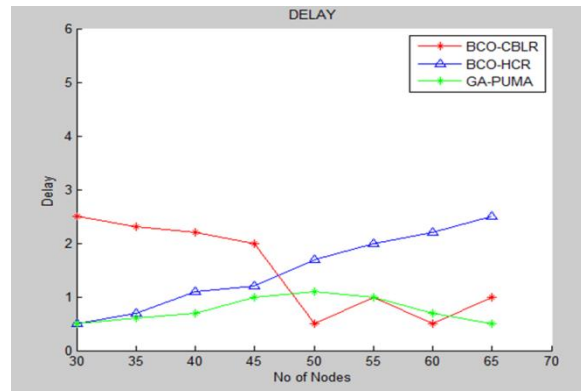
Figure 4.1: Comparative Analysis of Delay.

Fig 4.1 shows the comparison delay between BCO-CBLR, BCO-HCR and GA-PUMA protocol. Initially for 30 nodes BCO-HCR delay is increasing as the number of nodes is increasing and in BCO-CBLR the delay increases but as the number of nodes increases the delay is getting less. But after applying GA-PUMA protocol delay is much less than the above used techniques.
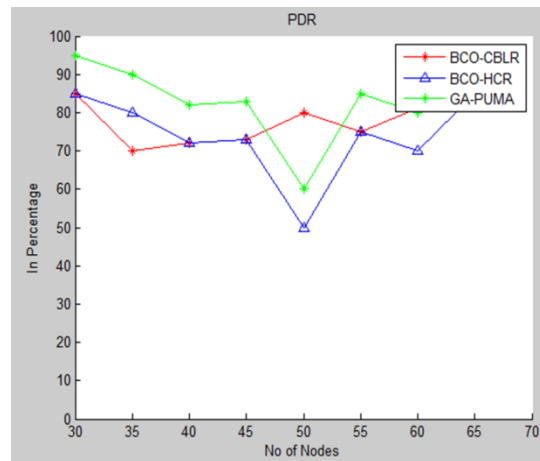

Figure 4.2: Comparative Analysis of Packet Delivery Ratio.

Fig 4.2 shows the Packet Delivery Ratio of both protocols which has been calculated in percentage. In BCO-HCR, PDR goes low for 50 nodes but in case of BC0-CBLR PDR increases at 50 nodes. By using of GA-PUMA, PDR decreases at 50 nodes but after increasing the number of nodes PDR increases with a high percentage.
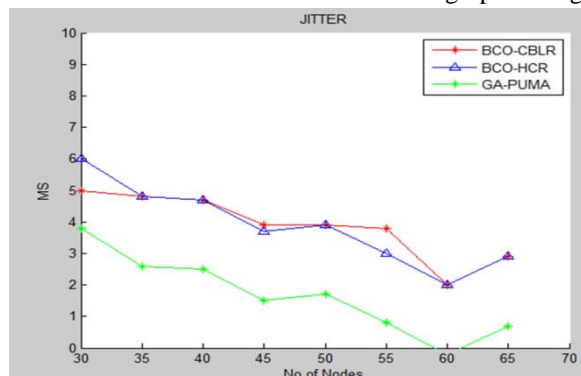

Figure 4.3: Comparative Analysis of Jitter.

Fig 4.3 shows the jitter in milliseconds for the protocol .Jitter is nothing but a packet inter arrival time which can be calculated using starting time of packet and actual received time at the destination. After applying optimization technique jitter is less.
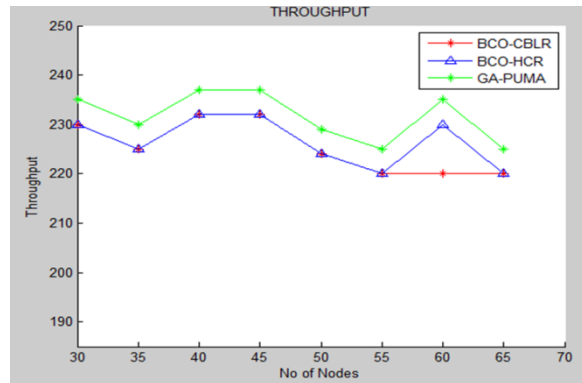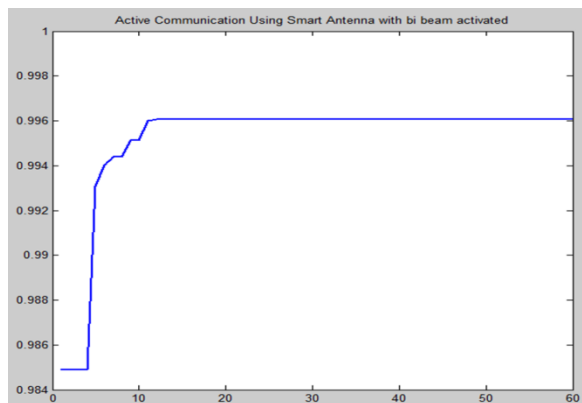

Figure 4.4: Comparative Analysis of Throughput

Figure 4.5: Improved Efficiency using Proposed Algorithm

V. CONCLUSION.

By varying number of nodes for different scenarios like Urban and Rural areas VANET scenario has been developed in which PUMA protocol has been implemented with GA (Genetic Algorithm) to expand system reliability in terms of the probability of effective gathering of the packet and the delay of emergency messages in a harsh vehicular environment and shortest path is optimized without much loss of data. In this paper, efficiency is improved using GA (approx.100%) .Executions Metrics like mean delay, mean throughput, PDR, available energy, jitter and has been computed by changing no of vehicles (nodes)

VI. FUTURE WORK

For further extent of this work, instead of genetic algorithm a new artificial intelligence can be utilized for better selection of the antenna. Furthermore to discover still unnoticed vulnerabilities and attacks of PUMA and give a strong PUMA against different sorts of inner attacks. Likewise plan to learn about the security   issues of tree-based multicast steering convention like MAODV with a specific end goal to propose a novel secure multicast tree based routing protocol in VANET

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