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Co-Operative Opportunistic Data Broadcasting For Railways Using Rtsu's, Wi-Fi And VANET's

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Abstract

As we have already seen there are many accidents occurring in railways, lots of efforts have been done to avoid the collision between trains. Anti Collision device is also one technique, GPS system also used but not get the proper results. In this paper we propose another technique that is data broadcasting between trains using Wi-Fi technology and also RTSU. In this approach it helps the train to know the location of its own with the help of fixed RTSU, which act as a base station. The locations are stored in the RTSU, driver can see the location LCD screen and also trains contain Wi-Fi enable systems. RTSU's also measure the appropriate speed of the trains. If two trains are in same track then train 1 can send information to train 2 through RTSU and also same information will broadcast to Substations, so that from Substation they can send crossing signal to trains. Train 2 can also slow down the speed when it gets the information from train 1. To broadcast the information using AODV protocol as in VANET's, the moving vehicle is consider as mobile nodes, here moving trains are consider as mobile nodes, using Wi-Fi technology and AODV protocol through RTSU's, the data is broadcasted between trains. The simulation is done by using Network Simulator.

Keywords: *Wireless Fidelity (Wi-Fi), Railway Track Side Unit (RTSU), Ad-hoc On-demand Vector (AODV), Vehicular Ad-hoc Network (VANET's), ISP (Internet Service Provider) NS2 and Global Positioning System (GPS)*

.1. Introduction

The Railway Network is considering as safest and easiest network in early days. But nowadays it is not a safest network because we have already seen many accidents and collision occurs between trains. These accidents occur because drivers not get the proper information about the location. This paper propose an approach that will make use of Wi-Fi technology, RTSU's base station for sending and receiving the information about trains to prevent collision. A computer equipped with Wi-Fi would receive data from RTSU.

The Train will have Wi-Fi enabled computers and find its location with reference to fixed RTSU's base

station placed parallel along the railway tracks. And also driver can send the information about location to another train through RTSU's. RTSU send information to On-Board unit of train using Ad-hoc On Demand vector protocol [1]. Internet service providers provide network connectivity to RTSU and the information is transmitted or received between trains using Wi-Fi technology.

The Wi-Fi system is defined by a group of IEEE 802.11 industry standards. To transfer the information between the trains Ad-hoc routing protocol AODV is used. Wi-Fi can provide the wireless access upto 100-500m. To keep the network connectivity without failed RTSU's are used, RTSU's are deployed parallel along the Railway track. The number of RTSU's is to be deployed depends as per the distance. The driver can send the information to RTSU's and Substation, RTSU's broadcast to another train periodically information is exchanged between the trains.

2. Related Work

As many methods included preventing accidents in railways, like GPS based cab signaling, Block Signaling, Automatic Train Control (ATP) and Railways Collision Avoidance system have been developed and used for avoiding collision but not get the proper result. Train Collision Avoidance system has also developed Anti Collision device. The trains also equipped GPS, so they can calculate their position and calculate how far the other trains will be but system time is not accurate and also GPS receiver technique requires Satellite Communication.

Then Anti Collision Device (ACD) this is embedded type this is a microprocessor and GPS Based system. It can be detected in the range of 3km. Every 3sec it broadcast the message so that other train can calculate the speed of train.

3. Proposed System

In the Proposed system, we used Wi-Fi and RTSU's for data broadcasting between Trains. As we know VANET's [2] Vehicular Ad-hoc Networks moving vehicle is consider

as a mobile nodes. The same technique we use for Railways here moving train is considered as mobile nodes. As mobile wireless devices and networks become increasingly important, the demand for Vehicle-to-Vehicle and Vehicle-to-Roadside or Vehicle-to-Infrastructure Communication will continue to grow. In VANET's Vehicles are considered as a mobile nodes. Vehicles are moving in different way with different velocities only by using RSU and other Ad-hoc routing Protocol we can't provide efficient data broadcasting.

Vehicle to vehicle Communication method is included, a technique called Co-operative opportunistic Ad-hoc routing between the Vehicles using PSR (CORVAN)[3]. In this technique PSR protocol is used which having less overhead, less packet loss and Packet delivery ratio is more efficiency is more. In case if any vehicle which is away from the signal level the other neighbour Vehicle provide network connectivity to the nodes, in this way without network failure an efficient data broadcasting is done between the vehicles.

In trains, it should consist of Wi-Fi enabled system and LCD screen. RTSU's are used as a Base stations ISP's provide internet connection to RTSU's, these RTSU's also measures the appropriate speed of trains and the location is stored in the RTSU's.These RTSU's are located parallel along the Railway track. In case two trains travel in same track train1 can send information to train2 through RTSU's using AODV protocol. Any changes in the network, it is updated and periodically exchanged with all the nodes in the network. In this way information can be exchanged by trains using RTSU's, information like location, position and speed of the trains with each other and they can avoid the collision or prevent accidents between the trains.

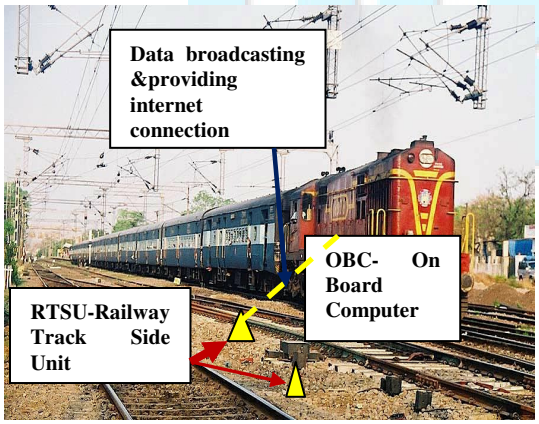

Fig. 1 Data broadcasting for train using Wi-Fi through RTSU's

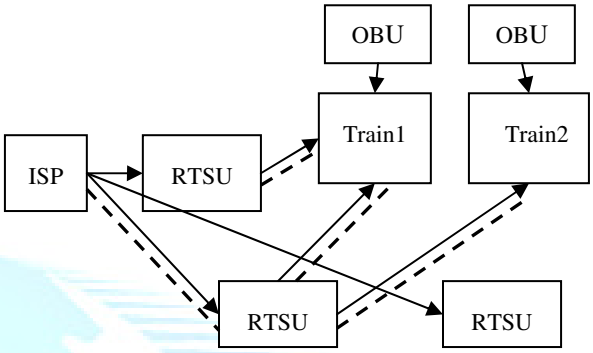

Fig.2 Block diagram of proposed system

As Show in the Block Diagram the first block is Internet Service Providers which provides internet connection to RTSU's. The Second block is RTSU which is a wireless access device act as a base station; it provides internet connection to trains. There are many RTSU's located at the Railway track based on Transmission range. The next two blocks are trains which consist of Wi-Fi enable On-Board Computer (OBC) and LCD screen. RTSU's transfer the data to OBC of the Train and also using RTSU and Ad-hoc routing protocol AODV data can be broadcast from one train to another train.

4. Simulation Process and Result Analysis

The simulation is done by using Network Simulator NS2.35[4]. Network Simulator is a discrete event driven simulator. It is suitable for designing new protocols and comparing different protocols. Network simulator is built using Object oriented methods in C++ and OTCL and for programming Tool command Language is used. NAM (Network Animator) tool is viewing network simulator traces and packet traces.

Table -1: Simulation Parameters

Parameters	Values
Simulator	NS2.35
Protocol	AODV
Antenna	Omni Antenna
Traffic Source	TCP,UDP
Application Agent	CBR
Mobility Model	Random Waypoint

Simulation area	1000*1000
Packet size	512
Channel	Wireless Channel
MAC	802.11

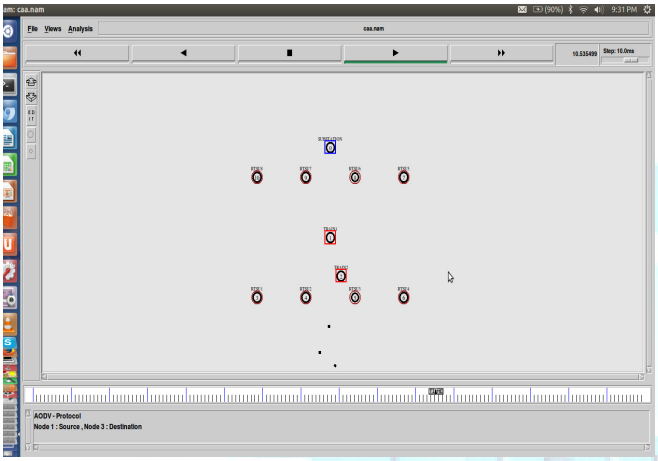

Fig .3 NAM result of Proposed System

The Fig-3 Shows the Network Animator result of the proposed system to evaluate this we used Network simulator NS 2.35 version. The Number of Train set is 2, and 8 RTSU's and one Substation is deployed. The Trains can broadcast their information using RTSU's for transmitting and receiving data AODV protocol is used. To Analysis the Performance of data broadcasting we measure packet delivery ratio, End-to-End Delay and Throughput matrices are used.

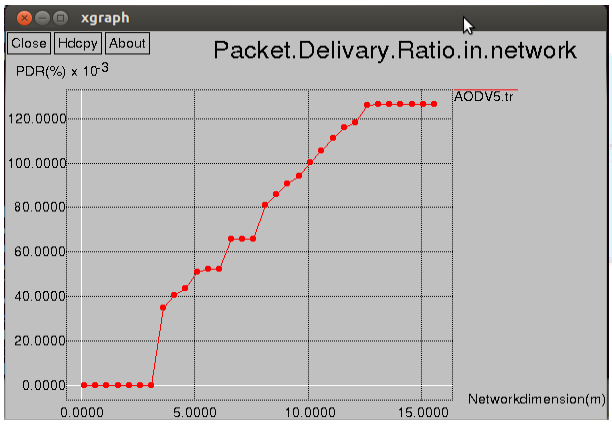

Fig. 4 Packet Delivery Ratio

The Chart-1 shows the Packet delivery Ratio of Proposed system in X-axis Network dimension (m) and in y-axis PDR (%); for each network dimension PDR (%) increases the performance result of PDR is 81.46%. The Chart-2 shows the Throughput X-axis Network Dimension and y-axis Throughput for each network dimension Throughput increases the performance result of Throughput is 468.07Mbps. The Chart-3 shows End-to-End Delay in X-axis Network Dimension (m) and Y-axis delay (ms) the performance result of the delay is 118.45ms.

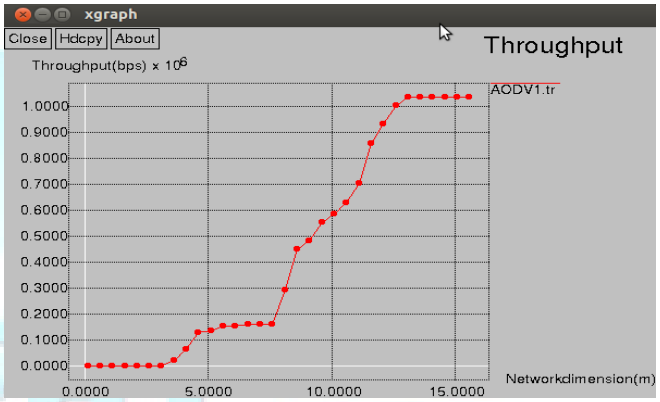

Fig. 5 Throughput

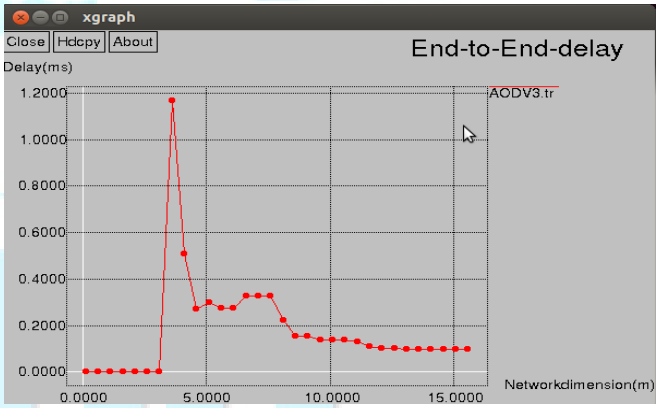

Fig.6 End to End Delay

Table -2: Performance Result Analysis of Proposed System

Parameters	Values
Generated packets	2158
Received packets	1758
Total packet dropped	399
Packet delivery Ratio	81.46%
End-to End Delay	118.45ms
Throughput	468.07Mbps

5. CONCLUSIONS

This paper presents Co-operative data broadcasting between the trains. It is Composed by using three main components RTSU's, Wi-Fi and AODV Protocol for broadcasting the information. By using all these components we can provide efficient Co-operative data broadcasting among trains. They utilize the broadcasting nature of wireless channel. Through RTSU's driver can find location also and also broadcast the information to other train using Wi-Fi and AODV protocol is to broadcast the data between trains. By exchanging the information of trains with each they can avoid accidents.

In Future we can implement to use 5G, so that can provide network connectivity for long distance data transmission and also by using 5G Technologies; we can reduce the number of RTSU's.

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BIOGRAPHIES

Mr. T Kantharaju is currently working as an Associate Professor in ECE department, BIT Institute of Technology, Hindupur. He received B.Tech degree from Sri Venkateswara University, Tirupati, A.P. and M.E degree from University Visvesvaraya College of Engineering, Bangalore University, Bangalore, India. He is pursuing Ph.D in Wireless Networks. His research areas in Wireless Communication & Networking, Satellite Communication, Microwave Engineering, Embedded Systems, Image & Signal Processing, MANET's and VANET's. He is a life time member of ISTE, New Delhi, India.

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