ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

Railnet Infrastructure Generation Using Sumo

Surjit Paul, Sanjay Kumar`

M.Tech Scholar, Department of Computer Science and Engineering, NIT Jamshedpur, Jharkhand, India

Associate Professor, Department of Computer Science and Engineering, NIT Jamshedpur, Jharkhand, India

ABSTRACT*:* Rail Network is more comfortable and affordable communication system because of that,people prefer to opt, train journey rather than road and air journey. Hence, to provide better service to the passengers there is huge scope of improvement in trainscheduling and providing services like paid and free services to the passenger. At present, due to the advent of wireless technology, the RAILNEThas great potential of upgrading the existing passenger facilities and service provided to the passengerswhile on the move.RAILNETcan be equipped with GPS based on board unit (OBU) equipments, wireless based equipments andvarious different sensors for efficient communication withinthe train and with other trains on the railway track or outside the railway track. In theRAILNET,there may be three different types of basic communication like train-to -train communication (T2T), Train to TSU (Track Side Unit) Communicationand intra train communication between one coach to another coach. There may be different types of services incorporated in future in the trains through GPS and wifi network and outside the trains through fixed infrastructure like Track Side Unit (TSU) ubiquitously. GNSS (Global Navigation Satellite System) may also be used to trackthe geographic location of the train for its different types of application. This paper is aimed topropose a RAILNET service infrastructure and simulate it through SUMO. It also implementsan efficient rail signaling for proper scheduling of the trains therebypreventing train delays, train accident, etc. particularly in Indian scenario.

KEYWORDS- RAILNET, OBU, T2T, TSU, GNSS.

I. INTRODUCTION

At present in the Indian scenario, the railway is the cheaper and commonly used system for the passengers going for a long journey. In the present scenario, the scheduling of the trains is not so efficient due to that many times the train delay occurs and passengers have to face inconvenience. To reduce the delay, proper infrastructure equipped with present wireless technology, information & communication technology (ICT) and GPS based system is the current requirement. Information sharing is also easily possible within the train and outside the train in the proposed architecture. The advancement and wide deployment of wireless communication systems have transformed human lifestylescomfortable and sustainable.

In the proposed RAILNET infrastructure allowsdifferent types of communication like i) train-to-train ii) train-to-TSU iii) coach-to-coachiv) train to static cloud and v) global communication with the outside world through TSU. TSUs are connected with trains via wireless communications and with each other via a wired network alongside the track. It is expected that future trains will be equipped with advanced resources such as powerful computing and storage devices, and sensor nodes [1]. GPS based OBU (On Board Unit) can be used to communicate with other nearby trains to provide information about the track condition, signalling and condition of over-head-electrification (OHE) wire.Train to train communication can be used for different services like emergency services, food service, internet service, etc.Train to TSU communication may be used for services like medical, ambulance, break-down, fire station, police service, derailment and track related problems. Intra train communicationmay facilitate passengers to get services within the train like entertainment, food, doctor, emergency services like fire, breakdown, station information, theft, alarming for fire, mishap and robbery, etc. RAILNET can also be utilized global cloud serviceswhen it is required and static cloud services while they are in the yard.Trains having cloud services can provide services like IaaS, PaaS, SaaS, etc. to the passenger of the consumer train on pay as you go model.The rest of the paper is organized as follows: Related Work is presented in section II.A brief overview of RAILNET infrastructureand present railway system architecture is presented in section III. In section IVdeals with generation of proposed RAILNET architecture and implementation of signaling using SUMO.Section V deals with conclusion and future work.

II.RELATED WORK

The passengers demand on railway transportation is expected to significantly increase in future.Hence scheduling of the trains in order to have travelling time becomes the challenging optimization problem. SIMARAIL, in which train traveling in the Iranian railway network are modeled using the discrete-event simulation approach [2].A coarse overview of the microscopic traffic simulation package SUMO, has been presented in [3]. Further information can be obtained via the project's website [4].Vehicular cloud infrastructure with traffic light according to the proposed protocol using SUMO is discussed in [5]. CROWN, a novel cloud service discovery protocol for VANETs in which STARs were introduced as mobilecloud servers that offer their services to other vehicles [6].

III. OVERVIEW OF RAILNET

In the proposed architecture, the RAILNET isequipped with wireless communication service infrastructure, wherein trains are equipped with GPS based OBU toprovide information about the train and approaching train towards it to the train passengers,driver and guard. It will also provide information like speed,time delay,priority ofapproaching and going ahead trains running on the same track to avoid any chaos like an accident,emergency route change due to a mishap. Coaches of the trains are also equipped with sensor devices to alert the driver to take necessary actions.There are three types of communication in RAILNET, i)train to train ii) train to TSU and iii) coach to coach communication.In case of train to train communication, sharing of information like track condition, weather condition, landslide and earthquake alert, signalling and OHE wire status and maintaining the time delay between trains for synchronization, etc. can be easily and efficiently provided between trains throughGPS based OBU. Train to train communication provides emergency services like ambulance,entertainment, food service, internet service,medical service, etc.Train to TSU communication is required for services like medical, ambulance, break-down, derailment and track related problems. The intra train communication is between one coach to another coach. Coaches are equipped with radio frequency identification (RFID), GPS and wifi network. RFID will help to track the location of the coach and wifi network will help coaches to coach communication, which will help passengers to get services within the train like doctor,station information,emergency service forfire, breakdown, theft and robbery. Trains are connected to each other through an ad-hoc network. Nodes have high mobility and network topology are also rapid changes over time. Real time data exchange is performed among the moving trains and fixed infrastructures.Network size is not fixed, it may be increased or decreased depend on traffic density.

Fig 1 Present scenario of railway system

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

Fig 1 shows the current railway infrastructure scenario of Indian railway which is based on semi automatic system. Trains are operated according to manual as well as the semiautomatic signaling system. Due to non automation there is limited scope of passenger services within the coach, outside the coach, train to train, train to station and train to global internet services.

Fig 2 Proposed RAILNET infrastructure

Fig 2 shows the proposed RAILNET infrastructure scenario by incorporating different types of wireless equipments , GPS system ,different types of sensors, cloud etc.

IV. IMPLEMENTATION OF RAILNET

A.Generation of RAILNETArchitecture

The RAILNET consists of rail infrastructure, rail signal and TSU.Trains are equipped with RFID, GPS based OBU and wifi network. Rail signaling and controlling of train movements are there in the proposed architecture. Generated RAILNET architecture is shown in the fig 3. In the given figure rail infrastructure, rail signals, platforms and TSU of a railway yard are shown.

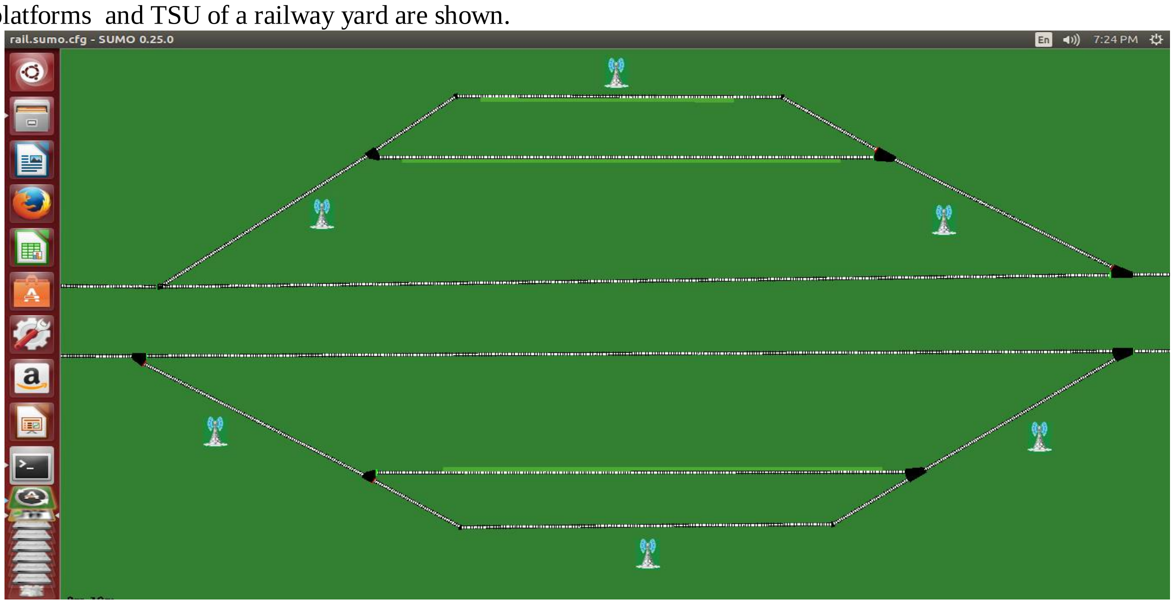

Fig 3Generated RAINETinfrastructure using SUMO

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

B. **Services Proposed in the RAILNET Architecture**

In RAILNET, services will be provided through wifi network and TSU. Coaches are equipped with sensors and wifi network. Each coach can track the request of the other coaches. If the requested service is available inside the train then it fulfills the request otherwise it will contact to TSU. Cloud computing has a facility to compute and store information without any fixed infrastructure for a client.There are basically two types of services i) Paid services and ii) Free services. In case of paid service passengers can ask for internet service during travelling and it will be provided to the concerned passengers as pay as you go model. Free services like Ambulance service, Police service, Route information, Next Station Information, nearby tourism spot information, information about the train going inside, etc. are provided by the government to assist the administration for better and quicker services to the passengers.

C. **Simulation of RIALNET of the proposed architecture**

Simulation of RAILNET is shown in fig 4. Here we have shown the train movements according signal logic and designing logic for optimized delay of trains, synchronization between trains for avoiding chaos and halting of trains at the platforms. GNSS (Global Navigation Satellite System) is used for finding its position on different geographical position in case of any adverse condition.

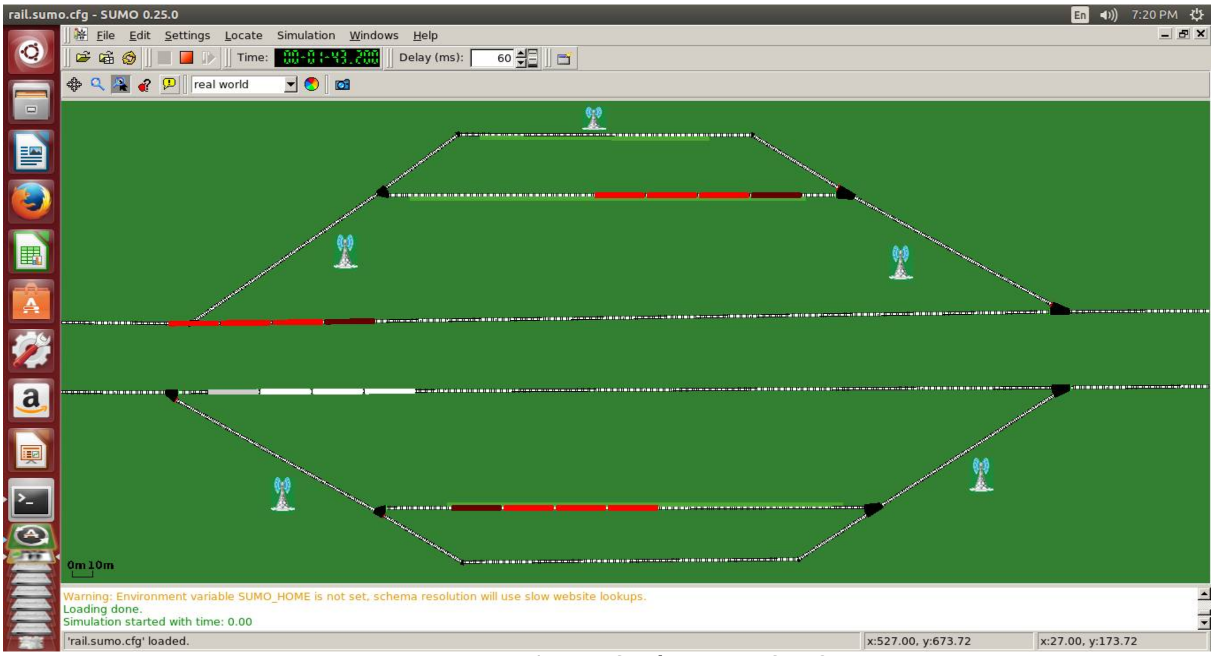

Fig 4RAILNET Simulation using SUMO

The development of RAILNET infrastructure,rail signal programs or algorithms for making traffic lights adapt to the current traffic is one of the main applications for microscopic traffic flow simulations.The first investigations were performed by implementing the traffic light algorithms to evaluate directly into the simulation’s core [3].

A SUMO network file has the railway tracks, rail signal and train halting yard i.e platform and intersections the simulated vehicles run along or across. At a coarse scale, a SUMO network is a directed graph. Nodes, usually named "junctions" in SUMO-context, represent intersections, and "edges" tracks or roads. Note that edges are unidirectional. Specifically, the SUMO network contains the following information:

- Every track (edge) includes the position, shape and speed limit.
- Rail Signal logics referenced by junctions.
- Junctions, including their right of way regulation,connections between tracks at junctions (nodes).

ISSN(Online): 2320-9801
ISSN (Print) : 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 5, May 2016

V. CONCLUSION AND FUTURE SCOPE

RAILNET supports various facilities like smart rail traffic management to improve better services and avoidance of the train accidents. It will providethe services ubiquitously as per request of the rail clients like train passenger, driver, station master and chief controller. In this paper RAILNET infrastructure creation, rail signaling and train movement synchronization of the a model station are being presented using SUMO. For future work, We will study the improvement of service infrastructure of RAILNET and devising an efficientrouting protocol for scheduling inRAILNET.

REFERENCES

[1] S. Olariu, I. Khalil, M. Abuelela, "Taking VANET to the clouds",International Journal of Pervasive Computing and Communications,Vol. 7, No. 1, pp. 7-21, 2011.
[2] Arman Sajedinejad, Soheil Mardani, Erfan Hasannayebi et Al, "SIMARAIL: SIMULATION BASEDOPTIMIZATION SOFTWARE FOR SCHEDULING RAILWAY NETWORK", IEEE,pp 3735 -3746, 2011
[3] Michael Behrisch, Laura Bieker, Jakob Erdmann, Daniel Krajzewicz, "SUMO – Simulation of Urban Mobility" SIMUL: The Third International Conference on Advances in System Simulation, pp 63-68, 2011
[4] D. Krajzewicz and M. Behrisch, L. Bieker, J. Erdmann, SUMO homepage. [Online]. Available: http://sumo.sourceforge.net/, accessed January 26, 2011.
[5] Amit Kumar Amar, Sanjay Kumar "Vehicular Cloud Traffic Infrastructure Generation Using SUMO" International Journal of Innovative Research in Computer and Communication Engineering, Vol.4,Issue 1, page 385-393, 2016.
[6] Khaleel Mershad and Hassan Artail, "A Framework for Implementing Mobile Cloud Services in VANETs" , IEEE Sixth International Conference on Cloud Computing, pp 83-90, 2013
[7] Md Whaiduzzaman , MehdiSookhak , AbdullahGani, RajkumarBuyya "A survey on vehicular cloud computing" Journal of Network and Computer Applications journal homepage: www.elsevier.com/locate/jnca, pp. 325–344, 2014.
[8] R. Buyya, C. Yeo, and S. Venugopal, "Market-oriented cloud computing:Vision, hype, and reality for delivering it services as computing utilities," in High Performance Computing and Communications, 2008. HPCC'08.10th IEEE International Conference on. IEEE, pp. 5–13, 2008
[9] http://www.dlr.de/ts/en/desktopdefault.aspx/tabid-9883/16931_read-41000/

BIOGRAPHY

Surjit Paulis an M.Tech scholar of Department of Computer Science and Engineering, National Institute of Technology, Jamshedpur, India. He qualified UGC-JRFand his area of research is mobile computing, VANET, Cryptography and Network Security.

Sanjay Kumar is an associate professor of Department of Computer Science and Engineering at National Institute of Technology, Jamshedpur, India. His area of research are mobile computing, parallel computing and VANET.