VOL. 10, NO. 8, MAY 2015 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

www.arpnjournals.com

HANDOFF PERFORMANCE SERVICE AVAILABILITY IMPROVEMENTS IN MIMO ENABLED COMMUNICATION BASED TRAINCONTROL SYSTEM

Vinoth V. and Jeswin Glasdis Brindha C.
Department of IT, Sathyabama University, Chennai, India
E-Mail: vinothcand2000@gmail.com

ABSTRACT

Correspondence based controlling system in the train is a computerized framework which assures the automated process for handling the information. Two remote trains correspondence is utilized here to swap the information in the middle of trains and wayside supplies. Remote neighborhood (WLAN) built CBTC has sway with respect to prepare control execution while taking handoff choices. In this paper, we can plan the Handoff choice approach by in light of the RSSI esteem. The quality of the sign got by every AP (Access Point) is utilized as the metric to choose when to Hand off the signal.

Keywords: communication based train control (CBTC), wireless local area networks (WLAN), transmission control protocol (TCP), received signal strengthiIndicator (RSSI).

1. INTRODUCTION

Here this system utilizes the information correspondences. CBTC is taking into account two critical advancements that checked significantly the improvement of our general public in the most recent century: It is a present day successor of conventional line flagging frameworks that give a constrained control utilizing track circuits, inter-locking and signals. In most CBTC systems, information in the middle of trains and trackside gear's are exchanged bidirectional by remote correspondence systems, for example, worldwide framework for portable correspondences route (GSM-R) and remote neighborhood (WLAN).These systems are used in remote correspondence accessibility and inactivity. While in business remote systems, less administration accessibility and long inertness aids low condition (QoS); here the accessibility will find out the wrecking, impact or even calamitous death toll or resources.

Hence, it is essential to guarantee the remote correspondences are accessible when they are required, and the dormancy is minimized in CBTC systems. The previous WLANS uses the advancements, especially, when a train moves from the boundary of the access point (AP) and gets into the alternative AP with the help of route handoff occurs. The main process of handoff is specifically testing (likewise alluded to as checking); channel exchanging, verification and affiliation. This entire technique may take up to a few hundred milliseconds. The quick development of trains reasons successive handoffs, which could influence the CBTC execution. All the more vitally, customary outline criteria, for example, system limit and correspondence dormancy, are used in existing works in handoff plan. In this paper, we propose to utilize the estimation of RSSI quality for Hand of choice. The AP measures the RSSI estimation of the sign got from the train. In the event that the RSSI quality is lesser than the limit esteem in the sense it will Hand off the sign to the following closest AP to the train as per the heading of development of the train.

2. RELATED WORK

There are a few plans proposed in the writing to diminishing WLAN handoff inertness. Article [2] gives an examination on separation helped handoff, whose system model is cell framework with altered base stations. Remote transfer systems have developed as another manifestation of systems and draw in exploration center, an examination with thought of versatility of the halfway hubs is carried out in this paper. Moreover, in [2] with the separation aided handoff calculation the normal blackout number is expanded, which is a downside.

This is on the grounds that the calculation obliges both separation and RSSI conditions fulfilled to begin a handoff strategy. Fitzmaurice and Mishra *et al.* [10] have illustrated that enormous amount of time period is mainly used during the verification stage. And WLAN here mainly is used for enhancing and improving the growth process. A Sync based Scanning procedure is proposed in [11], in which fits and integrates the period of time taken between the APs and customers. A topological surmising procedure is illustrated in [12] to enhance the examining methodology. A very useful and applicable handoff based system is proposed in [13] which use the components to decrease and lower the deferrals to examine the tests. In [14], a quick right to gain entrance scheme is arranged and is activated by activating a jump solicitation message to the portable destination. Few more plans which utilizes the multi-radio in versatile customers attempting to lessen the WLAN handoff inactivity is carried out here. Adya et al. [15] illustrates a method which permits the convention multiple portable hubs in a cross section system to conceivably make two different remote connections between couples of hubs. This work basically concentrates on enhancing effectiveness of remote lattice systems, which is unique in relation to the CBTC systems.

A. Over view of communication based train system

The CBTC system framework is composed five major parts, which is shown in Figure-3. The automatic

ARPN Journal of Engineering and Applied Sciences

Train subsystem is used to calculate travel time between two trains. The ATO subsystem used to calculate the distance and velocity value for the train. In CBTC framework duplex communication between station connector and train, this is shown in Figure-1. The location and velocity of the train are captured by the Zonal controller. Based on the location and speed the zone controller emits the movement authority signal to each system in the train. The automatic protection system derives the protection point.

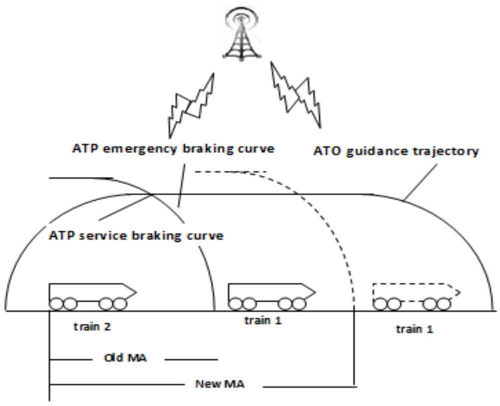

Figure-1. Wireless communication on CBTC efficiency.

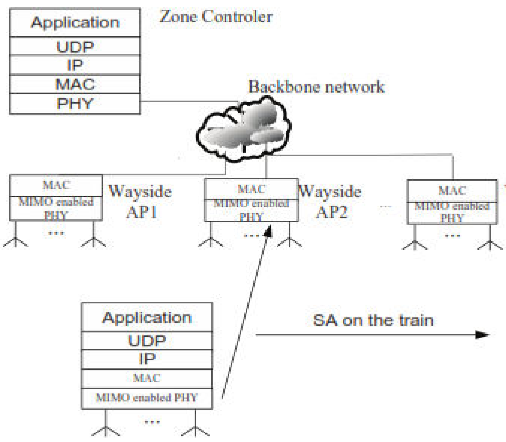

Figure-2. MIMO enabled wireless LANs.

3. PROPOSED MIMO ENABLED WIRELESS LAN FOR CBTC SYSTEM

Since numerous radio wires can attain to much higher information rate contrasted with customary single-reception apparatus frameworks [15]-[18]. CBTC framework the control messages travel in between train ground modules. The control messages enclosed with user datagram protocol, which is shown in Figure-2. The Train travels between number of access points communication delay and packet loss are the important problem which is faced while the train travel across number of access points. The effective handoff decision techniques and adaptation are expected to choose at which time the handoff will happen and what time the handoff will happen and also what are all the parameters are suggested in order to avoid packet loss and communication delay.

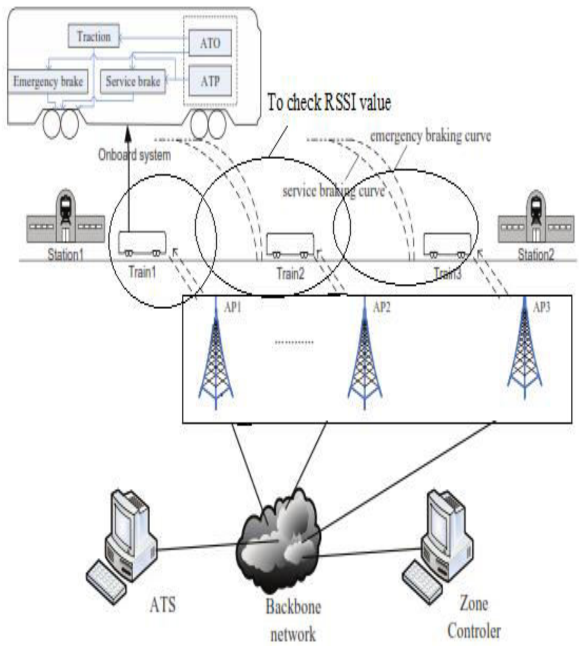

Figure-3. System architecture.

A. Train control model

In the train control model the zone controller sent the authority signal to the automatic Train protection System. The ATP system calculates the breaking point based on the authority signal received from the zonal controller. ATO get the speed and attitude value from the Automatic train protection system and enhanced direction yields the footing charge. It will direct the train to the particular direction.

According to the train states the equation (1) can be formulated as follows,

$$\begin{cases} q(k+1) = q(k) + v(k) * T + \frac{1}{2}\frac{u(k)}{M}T^2 - \frac{1}{2}\frac{w_i(k)+w_r(k)+w_w(k)}{M}T^2, \\ v(K+1) = v(k) + \frac{u(k)}{M} * T - \frac{w_i(k)+w_r(k)+w_w(k)}{M}T \end{cases} \quad (1)$$

Where T is the example rate, which relies on upon the corresponding period, q(k) is the train position at time k, v(k) is the train speed, M is the train mass, WI (k) is the incline safety, we (k) is the bend safety, WW is the wind safety, and u(k) is the train control order from the train controller.

Equation (1) can be revamped as in equation (2) such as,

$$x(k+1) = Ax(k) + Bu(k) + Cw(k) \quad (2)$$

Where x(k)={r(k) v(k)} is the state space, $w(k) = w_i(k) + w_r(k) + w_w(k)$ is the extra resistance acting on the train, equation (3).

VOL. 10, NO. 8, MAY 2015 ISSN 1819-6608
ARPN Journal of Engineering and Applied Sciences

$$\begin{cases} x_c(K+1) = A_c x_c(k) + B_c y(k), \\ u(k) = C_c x_c(k) \end{cases} \quad (3)$$

Where y(k) is the controller data, which incorporates the conditions of the two trains.

B. Semi-Markov decision process (SMDP) modeling

According to this model the ATP system provides breaking point signal to the remaining system so breaking point curve causes the communication delay. The communication delay entirely affects the performance of the system. In order to improve the performance of the system semi markov decision Methodology is suggested semi markov decision process is used to provide decision making criteria. In our proposed methodology suggested for the decision making methodology. Based on this methodology the decision maker will decide when the system changes the state. In our proposed methodology the station authority decide when to handoff the train state, for example p(t)is current state the new state v(t) depends on the p(t).The new state restrict free compared to v(t) and s(t).

C. Activities and state

It is the measured force of a got radio sign. It is executed and broadly utilized as a part of 802.11 guidelines. Gotten force can be figured from RSSI. The AP measures the RSSI estimation of the sign got from the train. On the off chance that the RSSI wort is lesser than the edge esteem in the sense it will Hand off the sign to the following closest AP to the train as per the course of development of the train. In this SMTP model suggest when the train is handover to the next access point.

D. Received signal strength indicator (RSSI) based Handoff Scheme

The acquired signal power calculated by using,

$$RSSI = \frac{P_t\, G_t G_r \lambda^2}{(4\pi)^2 \times d^2 \times L}$$

It is the measured force of a got radio sign. It is executed and broadly utilized as a part of 802.11 guidelines. Gotten force can be figured from RSSI. The AP measures the RSSI estimation of the sign got from the train. On the off chance that the RSSI wort is lesser than the edge esteem in the sense it will Hand off the sign to the following closest AP to the train as per the course of development of the train.
Separation recipe from RSSI esteem,

$$d = \sqrt{\frac{P_t\, G_t G_r \lambda^2}{(4\pi)^2 \times rssi \times L}}$$

4. EXPERIMENTAL RESULTS AND DISCUSSION

In Figure-4 shows the train starts communication with the access point1 based on RSSI value received from the access point1.

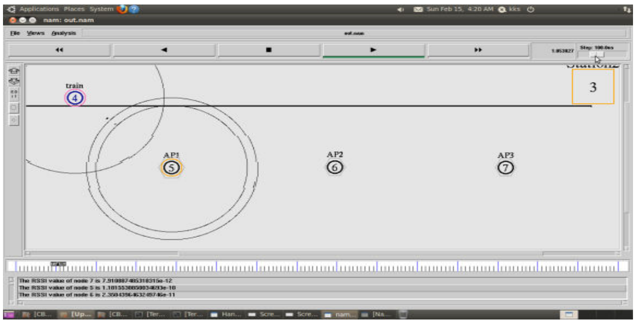

Figure-4. Train starts communication with the Access point1 (RSSI value based).

In Figure-5 shows RSSI signal strength is decreased from the access point1, so at that situation the train handover the signal to the access point2.

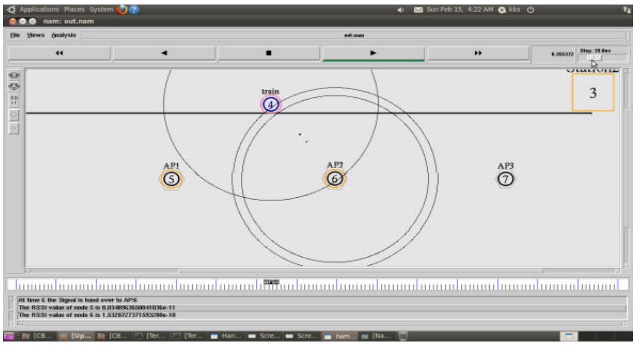

Figure-5. Handover to the Access point2 (RSSI value based).

In Figure-6 shows RSSI signal strength is decreased from the access point2. So at that situation the train handover the signal to the access point3.

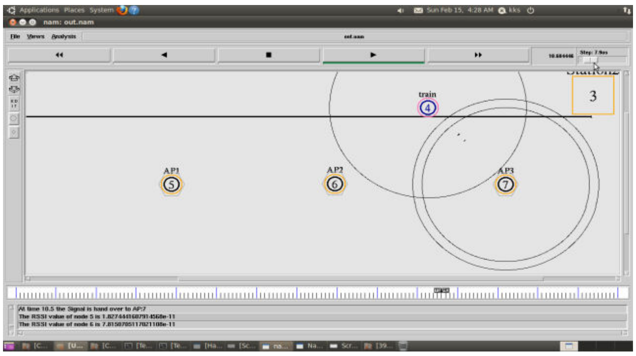

Figure-6. Handover to the access point3 (RSSI value based).

ARPN Journal of Engineering and Applied Sciences

Figure-7. Packet delivery ratio comparision.

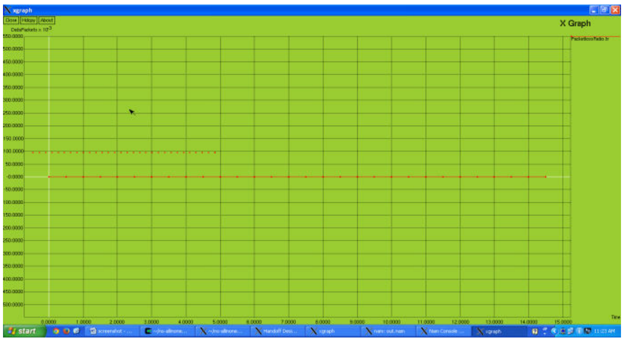

Figure-8. Packet loss comparison.

In Figure 7 and 8 shows how much the aggregate number of the bundle misfortunes, amid the information transmission.

Figure-9. End to end delay comparison.

In this Figure-9 shows how much amount of normal time taken for a bundle to be transmitted from the source to destination.

5. CONCLUSIONS

In this paper to alleviate the effect of remote interchanges on CBTC executions the handoff choice causes the postponed in the correspondence. Numerous existing procedures have proposed to give answer for this. We propose RSSI quality based handoff plan to improve the control execution in CBTC framework. To maintain a strategic distance from overhead the AP measures the RSSI estimations of the sign got from the train. In the event when the RSSI quality is lesser than the edge esteem in such case it will handoff the sign to the following closest AP to the train as indicated by the heading of the development of the train. Our reproduction planned in Ns2 investigates the handoff execution and does the end to end delay measurements.

REFERENCES

[1] R. D. Pascoe and T. N. Eichorn, “What is communication-based train control”IEEEVeh. Technol. Mag., vol. 4, pp. 16-21, December 2009.

[2] H. Dong, B. Ning, B. Cai, and Z. Hou,“Automatic train control system development and simulation for high-speed railways”IEEECircuits and Systems Mag., vol. 10, pp.6-18, June 2010.

[3] Li zhu, F.Richard, Yu.BinNing and Tao Tang “Cross-layer Handoff Design in MIMO-Enabled WLANs for communication Based Train Control Systems” IEEE journal on selected areas incommunications,Vol.30, pp. 719-728, May 2012.

[4] A.Mishra, M. Shin, and W. Arbaugh “An empirical 802.11 MAC layer handoff process” SIGCOMM Comput. Commun. Rev., vol. 33, pp.93-102, April 2003.

[5] S. Eichler, “Performance evaluation of the IEEE 802.11p WAVE communication standard,” in IEEE 66th Vehicular Technology Conference, pp. 2199–2203, October 2007.

[6] J. Gozalvez, M. Sepulcre and R. Bauza, “IEEE 802.11p Vehicle to Infrastructure Communications in Urban Environments” IEEE Communications Magazine, May 2012.

[7] Network Simulator ns-2: http://www.isi.edu/nsnam/ns/.

[8] T. Murray, M. Cojocari, and H. Fu, “Measuring the performance of IEEE 802.11p using NS-2 simulator for vehicular networks,” in IEEEInternational Conference on Electro Information Technology, 2008. EIT 2008, pp. 498–503, May 2008.

[9] IEEE trial-use standard for wireless access in vehicular environments (WAVE)–networking services, IEEE Std 1609.3-2007, pp. c1–87, 20, 2007.

[10] M. Shin, A. Mishra, and W. A. Arbaugh, “Improving the latency of 802.11 hand-offs using neighbor graphs,” in Proc.MobiSys’04, (Boston, USA), pp. 70–83, June 2004.

[11] A. Adya, P. Bahl, J. Padhye, A. Wolman, and L. Zhou, “A multiradiounification protocol for IEEE 802.11 wireless networks,” in Proc. BROADNETS’04, (San Jose, USA), pp. 344–354, October 2004.

ARPN Journal of Engineering and Applied Sciences

[12] F. Yu and V. Krishnamurthy, “Effective bandwidth of multimedia traffic in packet wireless CDMA networks with LMMSE receivers - a cross layer perspective,” IEEE Trans. Wireless Commun., vol. 5, pp. 525-530, March 2006.

[13] H. Dong, B. Ning, B. CAI, and Z. Hou, “Automatic train control system development and simulation for high-speed railways,” IEEE Circuits and Systems Mag., vol. 10, pp. 6-18, June 2010.

[14] X. Zhang, J. Tang, H.-H.Chen, S. Ci, and M. Guizani, “Cross-layerbasedmodeling for quality of service guarantees in mobile wireless networks,” IEEE Commun. Mag., vol. 44, pp. 100-106, January 2006.

[15] A. Veeramuthu, S. Meenakshi, and A. Kameshwaran, "A plug-in feature extraction and feature subset selection algorithm for classification of medicinal brain image data," Communications and Signal Processing (ICCSP), 3rd International Conference, pp. 1545-1551, 2014.