INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 5, Issue 2)
Available online at: www.ijariit.com

Automatic opening and closing of railway gates and signaling in railways using IoT

Dinesh Kumar S.
dineshk.shan@gmail.com
Panimalar Institute of Technology, Chennai, Tamil Nadu

Prem Kumar R.
premrasu74@gmail.com
Panimalar Institute of Technology, Chennai, Tamil Nadu

Venkatesan G.
venkatesanvj11@gmail.com
Panimalar Institute of Technology, Chennai, Tamil Nadu

Vinston Raja R.
winstonroja@gmail.com
Panimalar Institute of Technology, Chennai, Tamil Nadu

ABSTRACT

The Internet of Things (IoT) is a group of devices which are connected together in the network. It is used in sound vibrator and ZigBee transceiver which will receive frequency of the vibration and the time from which the train reaches the sensor from the server. In this, we are using a sound vibrator which will detect vibrations from the track and the signal is transferred to the gear motor and the gate will get closed automatically. When the train passes the gate another sound vibration sensor is fixed at another end and it will transfer the signal to the gate and gate will open automatically. Here the additional features added are we can calculate the current speed of the train and we can also track the track damage. The main objective of this work is to provide automatic closing and the opening of gates and railway system. We can avoid careless mistakes done by the gatekeeper and we can reduce manpower in the railway system.

Keywords— *IoT, Zigbee, Sound vibration detecting sensor, Arduino*

1. INTRODUCTION

The railway system is majorly used all over the world and in India. Indian railway system has the largest railway system in Asia. It is the largest network in India. Due to the increase in the fare of buses, many peoples preferred to use railways because of its low fare. It is important for the government to main safe and secure travel to the people. India has a large population too so the use of railways has been increasing day by day.

Therefore, it is important to control the train accidents. Yearly 586 train accidents are happening in India. These train accidents are mainly happening in railway gates and train crossing areas. These accidents are mainly happening in human errors. These accidents cause damage to human lives and railway property. These problems will also reduce the level of railway systems in the world and the people. Internet of Things (IoT) is a group of devices which are connected together to form the network. Nowadays it was widely used in all kind of fields. It is mainly comprising of sensors. So, it can be used here to overcome the problems.

In the proposed system, we have developed a system which will automate the gate operation and the signalling railway. In this, we are using sound vibrator sensor which will be fixed at both arrival and departure sides of the gates. The ZigBee sensor is also fixed along with the sound vibrator sensor which will act as the transceiver.

The sound vibrator sensor will detect the vibration of the track and the ZigBee will transmit the signal to the gate and the alarm in the gate will get activated. The proximity sensor which is fixed in the gate will check for the object in-between the gates. When there is no object the gate will get closed automatically. When there is an object is detected inside the range of the proximity sensor the sensor will send the information straight to the train to stop the train. When the train crosses the gate, there is another sound vibrating sensor is fixed in the track and it will send back the signal to the gate and the gate get opened.

The server interaction will take place in Sound vibrator and the Zig-Bee which has been fixed in the track. When a train is going to arrive that gate, the Server will send the signal to the sound vibrator which comprises of the sound vibration frequency range and the arrival time. The frequency is calculated earlier according to the speed of the train and the arrival time is calculated based on the departure time from the previous station. By this we can also able to calculate the current speed of the train and which time that the train will reach the destination. In this, all the railway gates are connected together so we can avoid accidents.

2. RELATED WORK

Chandrappa SA and his team published a paper based on Automatic and opening of railway gates. They use IF sensor, it is fixed at both end of the gates. When the train arrives, the

train is detected using IF sensors and it will send the signal to the gates and the gate will get closed and vice versa. But it is applicable for a single train and it is very complicated to implement in real time. For multiple trains, we have to fix more IF sensors. They also developed an application for the passenger to see the time when did they reach their destination.

Dr Ramachandra C and his team did a study in this and they proposed Automated Railway system and interlocking system using PLC and SCADA. They established the connection between the train and they use RFID sensors to detect the track damage and it also helps in the interlocking of gates. Even though it is applicable for multiple trains but it is very hard to implement. Because using RFID is quite difficult compared to our idea.

R. Ishima and his team did a study in this and they proposed a paper in the name of A New Signalling System for Automatic Block Signal between Stations Controlling through an IP Network. The Logic Controller (LC), placed in a signal house, exchanges the command and feedback data with the Field Controller (FC), placed near each automatic block signal, through the Ethernet Passive Optical Network (EPON). The system provides sufficient maintenance information through the IP network. They mainly gave the automation for signalling, not for gates.

3. PROBLEM STATEMENT AND OBJECTIVE

3.1 Existing system

The following drawbacks exist in the existing system:

- Existing mechanism is also contained automatic signalling and closing of gates.
- But it is applicable only to a single train.
- For multiple trains, they have to use many sensors.
- So, they are very hard to implement in a railway system.
- Most of them are using circuits, it is very complicated to implement to maintain.
- Wireless is better than the wired mechanism

3.2 Proposed system

To overcome the about defects we have Sound vibrator detector which will sense the arrival of the train by its vibration. So, no circuit is needed here. The ZigBee will act as a transceiver here. The Server will interact with the sound vibrating sensor and the ZigBee sensor. It is applicable for multiple trains. It is quite simple to implement.

The advantages of the proposed system are:

- There is no need for a gatekeeper.
- We can also calculate the time at which the train would reach the destination.
- We can also calculate the current speed of the train.

4. SYSTEM DESIGN AND ANALYSIS

The maximum speed at which the passenger or goods trains can move in India is approximately 91km/hr. and the minimum speed of the train is approximately 59 km/hr.

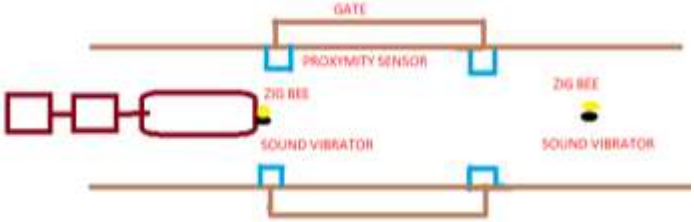

Fig. 1: Diagrammatic representation of railways systems

4.1 Sound vibrator sensor

The sound vibrator sensor will detect the vibrations in the track. The frequency of the vibration is calculated earlier and it was sent to the sound vibrator. The frequency which is calculated is matched with the frequency which has been sent by the server. If any changes are noticed it has been reported back to the server. When the vibration is detected, the ZigBee will transmit the signal to the gate

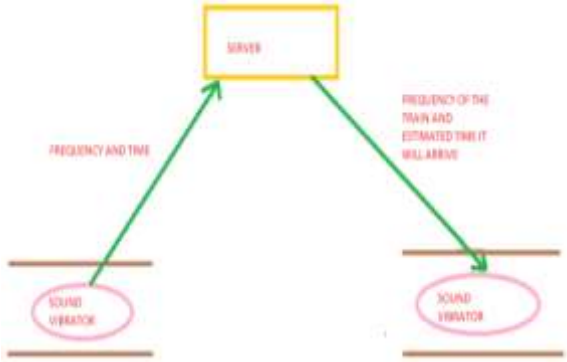

Fig. 2: Simple architecture of interaction between server and sound vibrator

When the train is going to pass through the gate, the server must intimate the sound vibrating sensor that the train with vibration frequency and in this time, it is going to pass. The sound vibration frequency must aware of the frequency range and when the train passes over it, it also wants to calculate the current frequency of the train. It must compare with the frequency which has been sending by the server. The changes must be intimated to the server. The following steps to be followed by the server when the changes are detected in the frequency range:

- If the current vibration frequency of the train is greater than the frequency sent by the server, the server must take that the speed of the train is high than the usual speed and it must intimate to the train driver your speed is high.
- If the current vibration frequency of the train is lesser than the frequency sent by the server, the server must take that the speed of the train is less than the usual speed and it must intimate the server that your speed is low. If you continue this you cannot reach the destination on time.

4.2 ZigBee

The ZigBee will act as a transceiver which will act as a transmitter and receiver. It will transmit signal from sound vibrator to motor. It will act as an intermediate between the sound vibrator and the gear motor. We have chosen ZigBee because for the long transmission it would be better than other sensors

The main features of ZigBee sensors are:

- Low Battery Consumption
- Low cost
- Easy to implement
- ZigBee automatically establishes its network.

4.3 Gear motor

When the signal is received from the Zig-Bee, then the alarm will get activated. One gate will get closed. Then the proximity sensor will get activated and it will check whether an object is present in-between the gate. It will follow the following cases:

Case 1: If there is no object between two gates, other gates will close automatically and the signal to green.
Case 2: If there is an object is present in-between the gates, then the voice message will come "GO BACK TRAIN IS

COMING". If he moves away then the gate gets closed and the train will pass. If not the signal is sent to the train to stop and the signal is turned to red.

4.4. Right sensor

When the train reaches the right sensor, it will also detect the vibrations and it will also transmit it to the gate to open the gate. The server interaction will also take place here. The sound vibrator sensor will send the frequency of the train. Then from this, the server will calculate the current speed of the train in that gate. Then he can also calculate the current time which can be given as input to the other gate sensor (i.e., Left sensor)

The data which is got from this sensor is also used for future reference if it is stored in the database. When we collide all the data of that train we can get the whole train status. By combining all another train, we can get the whole railway system data. So, it can be used to monitor the railway system.

The track damage can also be monitored when the signal is passed in the interval of 5 seconds from the sound vibrating sensor and the gate. When any disturbance or no response signal from the gate is noticed it must be informed to the gate.

It can be mainly used in terrain region to monitor the railway track. If any disaster happens it is very risky to find the defects in the track. So, we can use this method to find the defects. By using this we can also find the damage cost. In mountains whenever the landslide occurs it is quite simple to monitor.

The features of our project are given as follows:

- By using the frequency, we can calculate the speed of the train.
- We can say whether the train will reach the destination in time or not.
- When we implement this all railways are connected and we can easily monitor the railway system.

The data flow diagrams and their process are represented below:

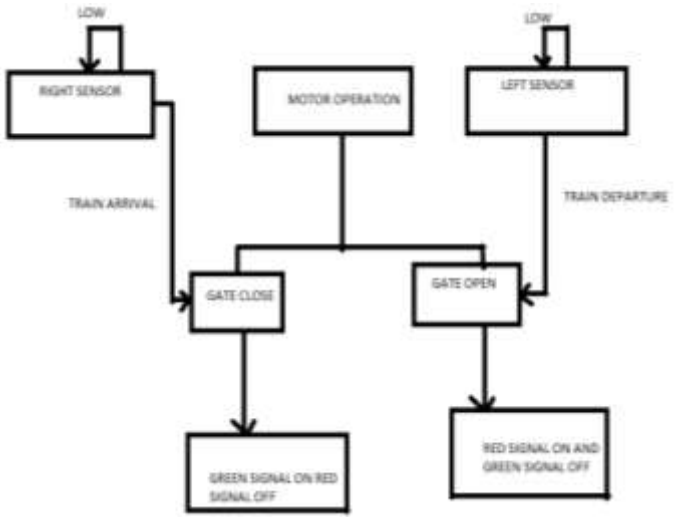

Fig. 3: Data flow diagram

The algorithm for this process is represented below:

Step 1: Start

Step 2: When the signals are received from the server, the sound vibrating sensor which is present on both sides will get activated.

Step 3: When the train crosses the first sensor it will measure the vibration frequency and it will compare with the frequency which has been sent by the server if any changes are noticed it has been sent back to the server.

Step 4: When the vibrations are detected, the ZigBee will transmit the signal to the gear motor and the gate get closed.

Step 5: When it reaches the other side of the gate it will follow the same steps to close the gates.

Step 6: Stop.

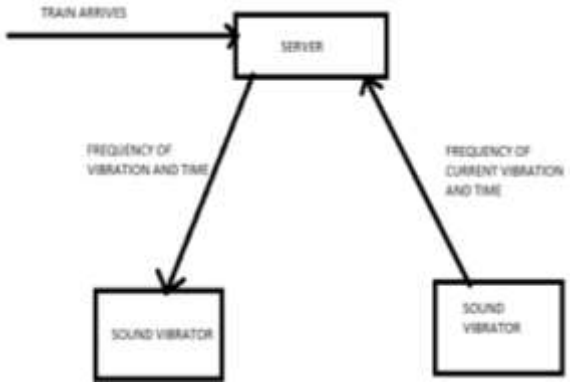

Fig. 4: Algorithm process

The algorithm and steps to be followed are as follows:

Step 1: Start

Step 2: When the server gets about the information about the train, it will send the vibration frequency of the train and the time it will reach the gate is sent to the sound vibrating sensor. The time can be calculated from the departure time of the previous gate.

Step 3: When the sound vibrator receives the information from the server it will be ready. When the train does not reach on time it will also send the signal to the server so that the server will verify the delay.

Step 4: It will also measure the sound vibration frequency of the train and it will compare with the frequency range sent by the server. If any changes are detected it will be intimated back to the server.

Step 5: At another side, the vibrations are measured and its frequency was sent to the server and the time from which the train crossed the station is also sent. It will act as the input time to the next gate left sound vibrator.

Step 6: Stop.

The data flow diagram for the left sensor is represented below:

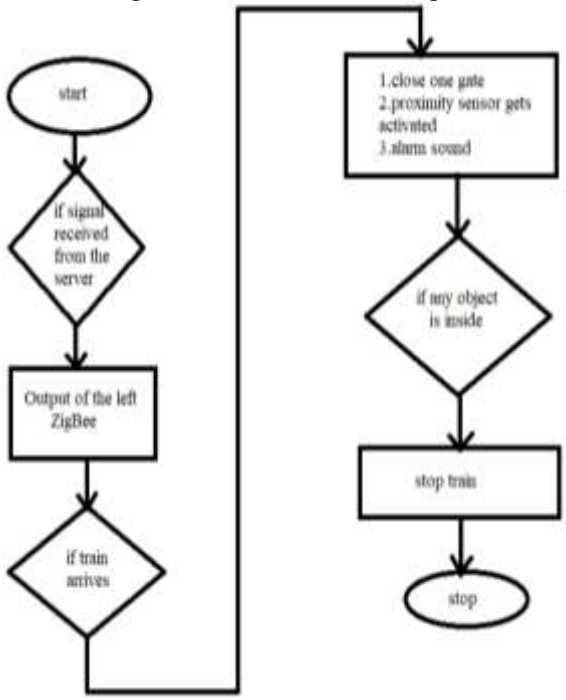

Fig. 5: Data flow diagram for the left sensor

The data flow diagram for the left sensor is represented as follows:

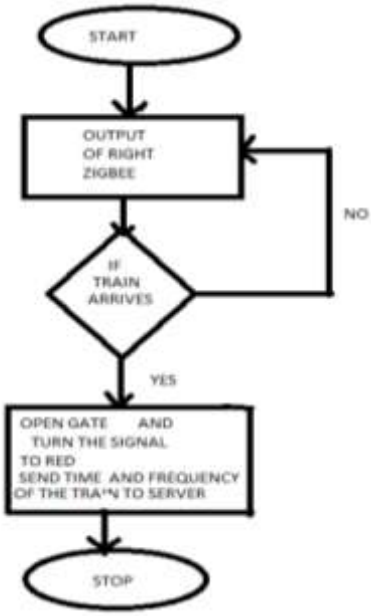

Fig. 6: Data flow diagram for the left sensor

The data flow diagram for the server interaction with the sound vibrating system is:

Fig. 7: Data flow diagram for the server interaction

5. RESULT AND ANALYSIS

We have represented our project in the form of pictures and it is attached below:

Fig. 8: Prototype of the proposed system

When the train arrives, the gate will get closed automatically because of the sound vibration sensor will detect the vibration and the signal was transmitted by ZigBee to the gate. Then the gate will get closed. Then the signal turns to green.

Fig. 9: Prototype of the proposed system

The above picture indicated train arrival. The sound vibrator sensor will get activated.

Fig. 10: Prototype of the proposed system

The above picture indicates the overview of our prototype.

6. CONCLUSION

The automatic opening and closing of railway gates and signalling in the railway system in IoT is a new method and it is also the advanced method which will decrease the manpower in the railway system. It can be implemented anywhere even in the rural area. We are using sound vibrator here so we don't need much hardware components here. We can also reduce manual errors here. The accident rate can be reduced here. For more populated countries like India, automation should be more important. At last, we conclude that our project is more efficient, more reliable and it has a high-performance rate.

7. REFERENCES

[1] International Journal of Research in Advent Technology (IJRAT) (E-ISSN: 2321-9637) Special Issue National Conference "CONVERGENCE 2016", 06th-07th April 2016 Review on Automatic Railway Gate Control. Junaid Khan1, Yogesh L. Mahajan2, Abdullah Faizan3, Prof. Vaibhav S. Yendole4, Prof. Parag R. Jawale5.

[2] Journal of Telecommunications System & Management. Reddy et al., J Telecommun Syst Manage 2018, 7:2 DOI: 10.4172/2167-0919.1000165. Review Article Open Access Safeguard of Railway Crossing Using IoT Bharath Kumar Reddy G1*, Sharath Kumar Reddy G2, Ravinder Reddy R3 and Navya G4.

[3] International Journal on Recent and Innovation Trends in Computing and Communication ISSN:2321-8169 Volume:

4, Issue: 4 IJRITCC | April 2016, Available @ http://www.ijritcc.org Automatic Railway Signalling System Pandurang Bhosale EXTC Department, VOGCOE Aghai, Atgaon,District-Thane, Mohammed Asim Patel EXTC Department, VOGCOE Aghai, Atgaon,District-Thane, Maharashtra, Abhay Shedulkar EXTC Department,VOGCOE Aghai, Atgaon, District-Thane,Maharashtra, Dhananjay Ghussar EXTC Department, VOGCOE Aghai, Atgaon,District-Thane, Maharashtra

[4] Imperial Journal of Interdisciplinary Research (IJIR) Vol-2, Issue-3, 2016 ISSN: 2454-1362, http://www.onlinejournal.in Imperial Journal of Interdisciplinary Research (IJIR) Page 352 Android Based Controller for Railway Gate Crossing Er. Nafisa Mapari1, Shaikh M. Imran2, Nadeem Ashraf3 & Sandesh Chaudhari4 1,2,3&4Dept. of Computer Engineering, M.H. Saboo Siddik College of Engineering, Mumbai, India.

[5] International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 4 Issue 2, February 2015 ISSN: 2278 – 1323 All Rights Reserved © 2015 IJARCET. Sensor-based automatic control of railway gates Karthik Krishnamurthi, Monica Bobby, Vidya V, Edwin Baby.

[6] Automation in unmanned railway level crossing or(s) B. Brailson Mansingh; K.S. Selvakumar; S.R.Vignesh Kumar

[7] Journal of Network Communications and Emerging Technologies (JNCET) Volume 5, Special Issue 2, December (2015) www.jncet.org Automatic Railway Gate Control System Based on RFID, pressure sensor and servo motor Pranav Sharma Student, Department of ECE, BSAITM Rajesh Kumar Asst. Professor, Department of ECE, BSAITM Sarika Asst. Professor, Department of ECE, BSAITM.

[8] International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 2, February 2014 Copyright to IJAREEIE www.ijareeie.com, Automatic Railway Gate Control System Acy M. Kottalil1, Abhijith S2, Ajmal M M3, Abhilash L J.4, Ajith Babu.5.

[9] International Journal of Pure and Applied Mathematics Volume 116 No. 19 2017, 245-249 ISSN: 1311-8080 (printed version); ISSN: 1314-3395 (online version) URL: http://www.ijpam.eu Special Issue design and implementation of automatic railway gate operator 1Vikash Kumar, 2Sandeep Kumar 1Asst Prof, Dept of EEE, Bharath University, Chennai 2Asst Prof, Dept of EEE, Bharath University, Chennai.

[10] International Journal of Mechanical Engineering and Technology (IJMET) Volume 8, Issue 8, August 2017, pp. 1789–1792, Article ID: IJMET_08_08_199 Available online at http://www.iaeme.com/IJMET/issues.asp?JType=IJMET&VType=8&IType=8 ISSN Print: 0976-6340 and ISSN Online: 0976-6359 © IAEME Publication Scopus Indexed. Design and implementation of automatic railway gate operator Vikash Kumar, Sandeep Kumar, Vikash Kumar Singh UG Scholar, Department of EEE, Bharath University, Chennai.

