International Journal of Scientific Engineering and Applied Science (IJSEAS) – Volume-7, Issue-9, September 2021
ISSN: 2395-3470
www.ijseas.com

ANALYTICAL STUDY ON INDIAN RAILWAY NETWORK:ANTI COLLISION SYSTEM

Sayantani Nayek[1], Swagata Ghoshal[2],Riya Chowdhury[3],Arunima Marik[4],Moupali Roy[5]
1,2- B.Tech Student, ECE, Narula Institute of Technology
3- Assistant Professor, ECE, Narula Institute of Technology

Abstract: Indian railway is the world's fourth largest railway network in the world.The main reason of train accident occurs due to the human errors or mechanical fault in train or tracks or in the signaling system.There are many types of collision such as head-on collisions, rear end collisions, and side collisions. In this paper we will discuss about how to reduce head on collision on the same track. We can easily avoid this type of unexpected collision by using collision detection technology. Here we established a communication system between two trains by using transmitter and receiver section with the help of railway track. By using this technology, we can easily find out the obstacle and gradually slow down the speed of train.

Keywords: Track, TDR Instrument, Arduino Uno, RX Module, TX Module.

Introduction: Indian Railways has the world's fourth largest railway network in the whole world. Almost around 2.5 crore passengers use Indian railways transports every day. But in these days' railway accidents are increasing day by day in India and the damages due to these accidents are very high, but most of the accidents are created due to human errors. From the previous research articles, we get a prior knowledge of the uses of microcontroller system, sensor, motor driver etc. In this paper, we work on it by using of Amplitude Shift Keying modulation and demodulation technique. The train transmits the signal through the transmitter and other train receives the same signal through the receiver. Whatever we have to transmit, we have to use the Arduino software. Our article is based on using transmitter and receiver, connected by wire through track to avoid collision between two trains in the same track. The goal of the proposed system is to identify the obstacle and make a train slow from it's normal speed.If two trains are running on the same track then it will be helpful and we can conrol the collision between two trains.

Literature review: Railway preferred the expensive mode of transportation over all the other means. When train is running in its initial stage and if it senses any object in front it, the obstacle sensor can sense the object. Timely breaks then applied to stop the train .This is the process to avoid train accidents in this proposed system [1].In 2012, we got the concept of Zigbee based collision avoidance system for railway from simulation of Zigbee based tacks for collision detection and avoidance for railway traffic paper [2] and in the same year an another concept has proposed in advanced pre warning system based on TPWS and ACD system. This proposed system uses RFID, FLIR cameras and other embedded systems [3]. In 2013, a

RFID based railway track finding system has been proposed in Railway Track Finding System with RFID Application paper. In this system RFID tags and reader are attached in the engine and tracks.so train engine automatically get the data and detect it [4] and in the same year wireless sensor networks based anti-collision system has been proposed which contains zigbee module, microcontroller for monitoring the zigbee module, train motor, LCD display, sensors and a part of internal memory. The design of the proposed system is low and this system reduces collisions between opposite directional trains on the same track[5] .In 2014,a proximity sensor based collision detection system has been proposed in this paper on an AVR hardware platform which contains proximity sensor, ADC, ATMEGA board, motor driver circuit, DC motor and LCD [6] and in the same year an Android based kit of anti-collision system has been proposed which contains MEMS sensor, ultrasonic sensor, ARM7 LPC2148 microcontroller, GPS and GSM. In this proposed system the microcontroller which basically sense any object in the track before 2 feet is getting connected with the GSM under 3 volts power supply and when the ultrasonic sensor identifies any object in the track it uses sound waves travel to sense the object. When the sensor detects any object, driver gets warnings by means of alarm to stop the train [7]. In 2015, collision avoidance of trains by creating mutual communication using embedded system has been proposed in this paper. This proposed system is used to avoid the collision between two trains automatically using switches, buzzers, microcontroller, LCD, MAX 232 serial communication, bomb detectors, temperature sensors, DC motor, motor drive, zigbee, transmitter, receiver [8]. In 2016, we got the idea of anti-collision system where the system is designed by novel microcontroller based system using RFID, GPS and an RF transmitter/receiver module to detect possible collision and to inform drivers when trains travel on the same track Smart Train Collision Detection System using a Microcontroller paper [9] and in this year an another idea has proposed in Identification of Train Collision Avoidance Based on Sensor paper where Train Tracking Chip(TTC) and Train Identification Chip(TIC) modules are using to sense the presence of trains on the same track [10].In 2017 D.Kiran Kumar proposed an idea in his paper An Anti-Collision Strategy For Wheels On Tracks where Anti-collision system is a self-acting Micro-processor-based data communication device developed by Kankan railway. The signals in the moving trains are transmitted with the GSM network towards the stationary trains on a single track and also to the TTCS [11].In 2018,an avoidance of train collision through android system integrated with ultrasonic and MEMS sensor inbuilt in train has been explained in the paper of Object Detection and Collision Avoidance with Train using GSM [12] and in the same year an another concept has been proposed in train anti-collision system using PIC microcontroller, GSM modem, gas sensor, temperature sensor, motor driver, DC motor, LCD display, buzzer, resistors, capacitors and diodes. In this proposed system if the sensor detects any object in the same track a SMS is send to the registered number and the buzzer will turn on to inform passengers as well as driver at the same time. And then the stepper motor will turn on to pull the chain and the train will be stopped [13].

System and Circuit Design:-To avoid Head on collision between two trains, we want to make a communication system between them by using Amplitude Shift Keying modulation and demodulation

process. Both transmitter and receiver section is present in Amplitude Shift Keying modulator and demodulator circuit. The train transmits the signal through the transmitter and other train receives the same signal through the receiver. After generating the modulating signal through Amplitude Shift Keying modulation, whatever the data we have to transmit, we need the help of Arduino Software to upload the whole data(code)into the Arduino board. This data will transmit through the transmitter section of Amplitude Shift Keying modulation, whatever we have received after performing the Amplitude Shift Keying demodulation technique, we have to upload the whole data in another Arduino board through the Arduino IDE software. We can see in the serial monitor of two Arduino board that the data is transmitted or not from the transmitter section and received or not from receiver section at the same time. Then we use TDR instrument to measure the time it takes for the pulse to return. The TDR measures the time between release and return of the low voltage pulse from any reflections. By measuring the time and knowing the propagation velocity of the pulse, the distance to the reflection can be calculated.

The formula for determining the distance is:

l = t x v/2, where ‘l’ is length,‘t’ is time and ‘v’ is velocity.

After verifying the distance between two trains, the driver can easily stop the train by keeping safe distance to avoid the collision.

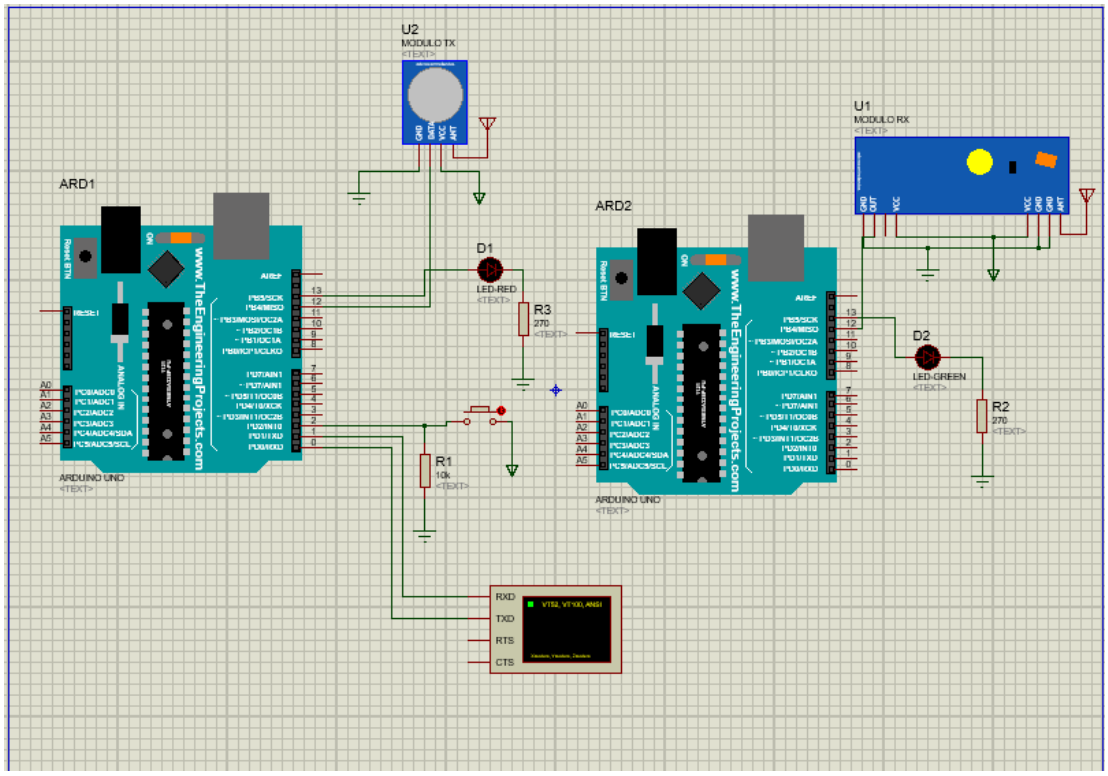

FIG 1- Circuit Diagram of ASK Modulation and Demodulation technique

Testingand Result Analysis: We have designed the Amplitude Shift Keying modulator and demodulator circuit.

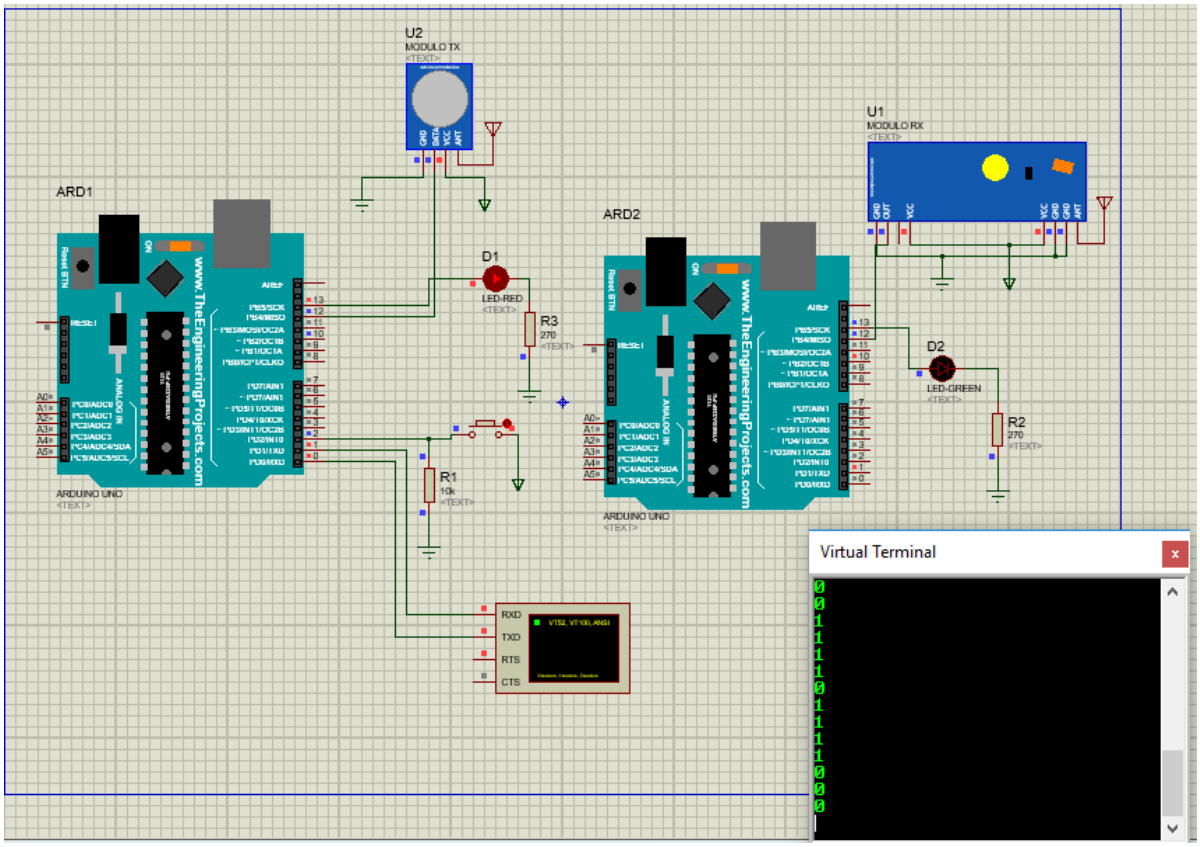

FIG 2- Result analysis of ASK Modulation and Demodulation technique

Work plan & Future scope:

To avoid Head on collision between two trains,we want to make a communication system between them by using Amplitude Shift Keying modulation and demodulation process. Both transmitter and receiver section is present in Amplitude Shift Keying modulator and demodulator circuit. The train transmits the signal through the transmitter and other train receives the same signal through the receiver. After generating the modulating signal through Amplitude Shift Keying modulation, whatever the data we have to transmit ,we need the help of Arduino Software to upload the whole data(code)into the Arduino board.This data will transmit through the transmitter section of Amplitude Shift Keying modulation, whatever we have received after performing the Amplitude Shift Keying demodulation technique, we have to upload the whole data in another arduino board through the Arduino IDE software. We can see in the serial monitor of two Arduino board that the data is transmitted or not from the transmitter section and received or not from receiver section at the same time. Then we use TDR instrument to measure the time it takes for the pulse to return.

The TDR measures the time between release and return of the low voltage pulse from any reflections. By measuring the time and knowing the propagation velocity of the pulse, the distance to the reflection can be calculated.

The formula for determining the distance is:

$l = t \times v/2$, where 'l' is length,'t' is time and 'v' is velocity.

After verifying the distance between two trains, the driver can easily stop the train by keeping safe distance to avoid the collision.

In future, we wish to make communication using sound signal. When trains are passing on the track, they create a sound if we measure the velocity of the sound in track such that solid medium then we can find out the distance by multiplying time and velocity.

- **Limitation:** In rural area there were no signal control cabin so we can use this system. According to previous articles they used different types of sensors and microcontroller but these sensors are not suitable for turning railway track or foggy weather. We can't use wireless communication system because trains from another track also receive the same signal.

  In Indian railway track there are no track number if there is any track number we can easily find out the exact position of train.

Conclusion: In this project, an anti-collision system for trains have been designed, this innovative technique of early sensing of any possible collision scenario and avoiding it thereof, we demonstrate that it is possible to improve the overall safety of the railway system in India. This paper ensures the recent technology with cost effective. By this project train collision is stopped.Many human lives can be saved if this system is implemented.

Reference:

1.Sayali R. More, Ruchira J. Rout, Rasika K. Tandel, Snehal D. Yendhe, "Intelligent Railway Crossing Gate Control withHigh Speed Anti-Collision Alerting System", International Journalof Computer Applications (0975-8887)

2.Arun.P, Saritha.s,Madhukumar.S, "Simulation of Zigbee based for Collision Detection and Avoidance for Railway Traffic", Special Issue of International Journal of Computer Application (0975-8887) on Advanced Computing and communication Technologies for HPC Application-ACCTHPCA,June 2012.

3.Uvaraja S., Raghav Prashanth, "Advanced Pre-Warning System (Railways)", IACSIT International Journal of Engineering and Technology", volume-4, Issue-2, April, 2012.

4.Anand Kr.Gupta,Sushant Katiyar,Nitin Kumar, "Railway Track Finding System with RFID Application", International Journal of Computer Application(0975-8887),volume 83-N0.7,December 2013.

5.Mr.N.Sambamurthy, Sk.HasaneAhammad, "Prevention of Train Accidents Using Wireless Sensor Networks", International Journal of Research in Engineering Research and Applications(2248-9622), volume-03, Issue-6,Nov 2013.

6.Anish Kumar, Ramandeep Singh, "Automatic collision detection for an autonomous robot using proximity sensing technology on an AVR hardware platform", International Journal of Research in Engineering and Technology (2319-1163), volume-03, Issue-06, June 2014.

7.S. Balaji, I.Sahanaz Begum, R.Lavanya, K.Chitharthani, "Object Collision Avoidance With Train Using Android Based Kit(OAK)", International Journal of Research in Engineering and Technology(2319-1163), volume-03, Issue-07,May 2014.

8.K.Kathirvel, S.Palaniappan, "Collision Avoidance of Trains by Creating Mutual Communication Using Embedded System",International Journal of Computer Science and Mobile Computing (2320-088x), volume-4, Issue 4, April 2015.

9. DoganIbrahim, "Smart Train Collision Detection System using a Microcontroller", International Journal of Computer Application (0975-8887), volume 152-No.2, October 2016.

10.M.Mallikarjuna, M.Swetha, "International Journal of Advanced Technology and Innovative Research", ISSN 2348-2370, Vol.08, Issue.24, December-2016, Pages: 4616-4620.

11. Kiran KumarSurekha, "An Anti-collision Strategy for Wheels onTracks", International Journal of Innovative Technology and Research, volume No.5, Issue No.1, December-January 2017,5533-5535.

12. Bishnu Deo Kumar, Anil Kumar Gupta,Alok Ranjan, "Object Detection and Collision Avoidance with Train using GSM",International journal of Engineering Technology Science and Research,ISSN 2394-3386,Volume 5,Issue 5,May 2018.

13. SalunkeTejaswini, WabaleNayan, Gade Komal, Prof. A.R Kadu, "Automatic Railway Train Safety System", International Journal for Innovative Research in Science &Technology, volume-04, Issue-9, February,2018.