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# COLLISION AVOIDANCE OF TRAINS BY CREATING MUTUAL COMMUNICATION USING EMBEDDED SYSTEM

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**ABSTRACT:** Railway is an Eco-Friendly and Popular mode of Transport in most major cities of the World. One of the most widely used and comfortable nodes of transportation system is train. As the railway network is considered to be the safest and easiest network. More than 10 billions of people and 1050 millions of freight travel by train annually. Railway Transport is indispensable in modern day life, both for business and private users. Nowadays, rail networks across the world are getting busier with trains travelling at higher speeds and carrying more passengers and heavier axle loads than ever before. The combination of these factors has put considerable pressure on the existing infrastructure, leading to increased demands in inspection and maintenance of rail assets. But nowadays, it is not that much safer as the lot of accidents occur due to improper communication among the network , wrong signalling , worst weather condition, immediate route change. The train driver doesn‟t get proper information on time and before time so that the hazardous condition can occur. While maritime and air transport are already benefiting from collision avoidance application based on infrastructure less communications. We propose this system to avoid train collision by using zigbee protocol, in this system provide communication between trains to avoid same track collisions, by transmitting every train travel on track id to other trains, if two trains come into same track alert train driver and stop train as a distance.

***KEYWORDS:*** *Microcontroller, sensor, track switches, bomb detector, fire alert, zigbee technology.*

## I.INTRODUCTION

Rail transports are facing major challenges in our day to day life. On other hand, it must meet the needs of citizens for quality of moving easily while, on the other, it must provide a valid alternative to other nodes of transport against a backdrop of rising fuel prices and the increasing importance of the effect of transport on the environment. In conventional system the nodes are activated manually, which could lead to human error.In our proposed idea portrays to avoid accidents in the railway system. The railways provide an eco friendly, economical and popular means of transportation in many parts of the world. Being the second largest in rail network, the main priority of our nation, India is to make it a safe and reliable mode of transportation. The past has witnessed a number of train accidents due to reasons such as human error, machine failures etc. Train collisions have created doubts about its reliability, causing loss of precious human life. Also the Indian Railways spends a huge amount over these disasters. All of these conclusively points towards the need for a reliable, stable and economical means of train collision avoidance system, also easy in its implementation. A number of anti collision devices have been developed over the years yet a stable system has not come into implementation. The Anti Collision Device based on GPS and Microprocessor. GPS used to track the train current position but weather conditions might make information gathered to be incorrect. The ACD system is found to be ineffective because it does not considering any active inputs from existing Railway sign system. Geographical sensors have additionally been used that makes use of satellite for communication making the system complicated to implement. In this proposed system we develop a train collision avoidance and speed reduction system using the RFID and ZIGBEE technologies integrated with the embedded system. RFID is used to sense the track information which is communicated among the trains by ZIGBEE technology. ZigBee technology was selected as a communication device because of its highly scalable, self-healing, low power and its unique radio properties. Also other features such as supporting large number of nodes, deployment is easy, very long battery life, secure, low cost and can be globally used and therefore one of the best wireless communications for embedded system. This communicated information is then processed by the microcontroller and it gives instructions to take actions such as speed reduction, train stoppage.

In this system to prevent the collision between the trains by using zigbee protocol. It may helps to save the human life from accidents by implement this paper in railway transport. By implementing this automatic system which could avoid human error.In this research paper, every train send its track id to near trains, if the one train goes in a first track, the signal is given to the other train, if any other train come in same track and it also send first track to other, then two trains receives same track id then alert two train drivers and

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stop train at a distance to avoid train collisions, which could immediately stop the train. The proposed system is used to protect the accidents between the trains automatically which helps for safety purpose by using buzzers, switches, microcontroller, LCD,MAX-232 Serial communication, Bomb detectors, Temperature Sensor, DC Motor, Motor drive, Zigbee transmitter and receiver. The novel system is implemented with the support of embedded processor and the simulation is achieved through Keil C software and results are discussed.

***A. Present Perspective Indian***

Railways are the world's second-largest railway, with 6,853 stations, 63,028 kilometers of track, 37,840 passenger coaches and 222,147 freight cars. Annually it carries some 4.83 billion passengers and 492 million tons of freight cars. Of the 11 million passengers who climb aboard one of 8,520 trains each day, about 550,000 have reserve d accommodations.

***B. Train Collisions***

Collisions are the most dreaded accidents. It is very difficult to stop such collisions because of speed of moving trains, which need a lead distance to stop. Collisions happen due to human errors and/or faulty equipment. Two types Head-On. Rear-End-Collisions A head-on collision is one where the front ends of two ships, trains, planes or vehicles hit each other, as opposed to aside-collision or rear-end collision.. With rail, a head-on collision often implies a collision on a single line railway.

***A .Detection of Cracks***

This system for detecting the railway tracks and avoidance of collision in the tracks. The proposed Solution is based on IR Rays & Sensors.

***B. Anti collision Device (ACD)***

The Anti-Collision Device (ACD) is a self-acting microprocessor-based data communication device designed and developed by Kankan Railway. The system consists of Loco ACD with a console (message display) for the driver (in each Loco Engine), Guard ACD with remote (fitted in Guard Van), Station ACD with console (fitted in Station Masters' Cabin), Manned and Unmanned Gates ACD with hooters and flashers (in each location) and Repeater ACDs (fitted at locations having obstructions in radio communication such as hilly areas) which work in concert to prevent the following kinds of collisions and accidents like

a. Head on collisions,

b. Rear end collisions,

Collisions due to derailment, Collisions at the level crossing gates.

***C. Related Methods***

GPS based Cab Signaling, Block Signaling, Automatic Train Control (ATP), and Railway Collision Avoidance System (RCAS) and have been developed and used for avoiding collision and for getting proper communication, but not that much worth. Train Collision Avoidance System (TCAS) has also developed recently and Anti collision Device (ACD) is being developed and will be used till December 2013.

## II.PROPOSED EMBEDDED SYSTEM DESIGN VIEW

The proposed system is used to protect the accidents between the trains automatically which helps for safety purpose by using buzzers, switches, microcontroller, LCD,MAX 232 serial communication, Bomb detectors, Temperature Sensor, DC Motor, Motor drive, Zigbee transmitter and receiver.

***A. Train Module-1***

In our proposed idea portrays to avoid accidents in the railway system.In this system to prevent the collision between the trains by using zigbee protocol. Zigbee is the newest and provides specifications for devices that have low data rates, consume very low power and are thus characterized by long battery life. Other standards like bluetooth and IRDA address high data rate applications such as voice, video and LAN communications. The technology is intended to be simpler and cheaper than other WPANs such as bluetooth. The most capable zigbee node type is said to require only about 10% of the software of a typical bluetooth or wireless internet node.It may helps to save the human life from accidents by implement this paper in railway transport. By implementing this automatic system which could avoid human error. In this research paper, every train send its track id to near trains, if the one train goes in a first track, the signal is given to the other train, if any other train come in same track and it also send first track to other, then two trains receives same track id then alert two train drivers and stop train at a distance to avoid train collisions, which could immediately stop the train.

**A. Train Module-1**

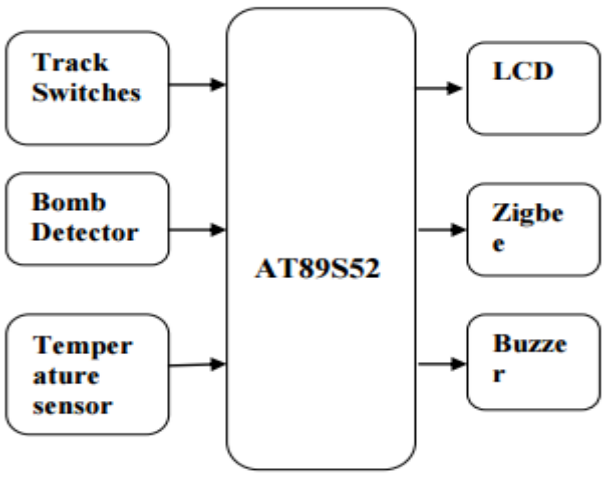


Fig- (c) Train Module-1

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**B. Train Module-2**

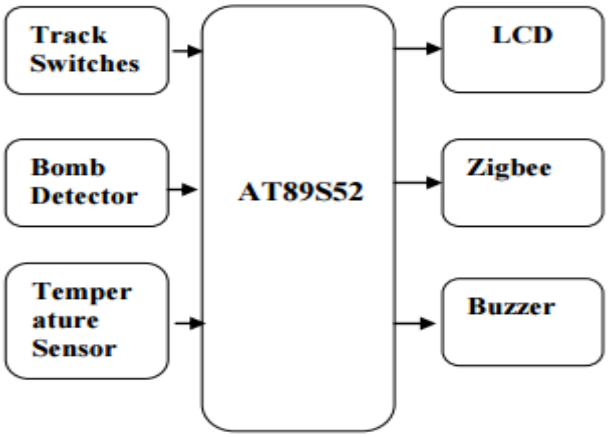


Fig-(d) Train Module-2

**C. Zigbee Technology**

Zigbee is a specification for a suite of high level communication protocols used to create personal area networks built from small, low-power digital radios. Zigbee is based on an IEEE 802.15 standard. Though low-powered, Zigbee devices often transmit data over longer distances by passing data through intermediate devices to reach more distant ones, creating a mesh network; i.e., a network with no centralized control or high-power transmitter/receiver able to reach all of the networked devices. The decentralized nature of such wireless adhoc networks make them suitable for applications where a central node can't be relied upon Zigbee is used in applications that require a low data rate, long battery life, and secure networking. Zigbee has a defined rate of 250 k bit/s, best suited for periodic or intermittent data or a single signal transmission from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range wireless transfer of data at relatively low rates. The technology defined by the Zigbee specification is intended to be simpler and less expensive than other WPANs, such as Bluetooth or Wi-Fi. Zigbee networks are secured by 128 bit symmetric encryption keys. In home automation applications, transmission distances range from 10 to 100 meters line-of-sight, depending on power output and environmental characteristics.

***D. Bomb detector***

Metal detectors depend on detecting one of several effects that can be observed when a metal object influences the magnetic field surrounding a coil of wire carrying an alternating current. The principal effects are: the pattern of the magnetic field surrounding the coil will be altered and the inductance of the coil will change. The various types of metal detector devised exploit these changes, electronically detecting the alteration induced in the coil by the metallic object. Nonmetallic objects or material can also affect the coil in similar ways

***FEATURES***

1. Good sensitivity
2. Excellent stability
3. Good pinpointing ability
4. Loudspeaker output
5. Simple construction and set up
6. Tuning allows for ground
7. Low cost

Most IB "Induction Balance" (IB) metal detectors operate at a frequency between 85 kHz and 150 kHz. The „VLF" types operate at frequencies around 4 - 6 kHz, a frequency range which penetrates all types of soil quite well. "Pulse Induction" detectors employ coils in the search head that are set up in much the same manner as the IB detector.

E. Temperature sensor There are so many kinds of sensors. Sensors Applications covers all major fields of applications. In this paper we are controlling temperature (physical parameters), for this purpose LM35 temperature sensor used to measure the temperature. The LM35 thus has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1⁄4°C at room temperature and ±3⁄4°C over a full −55 to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The experimental set up of transmitter and receiver in Train module as shown in figures (e) and (f).

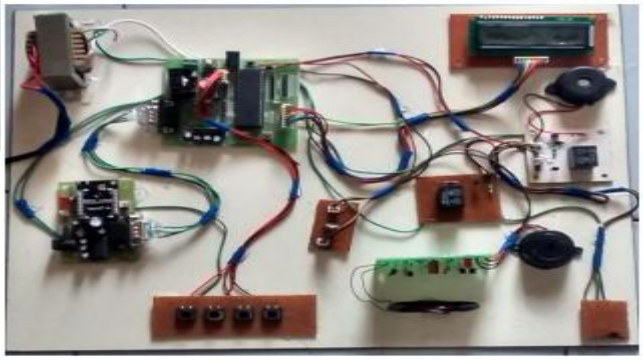

Fig-(e) Transmitter

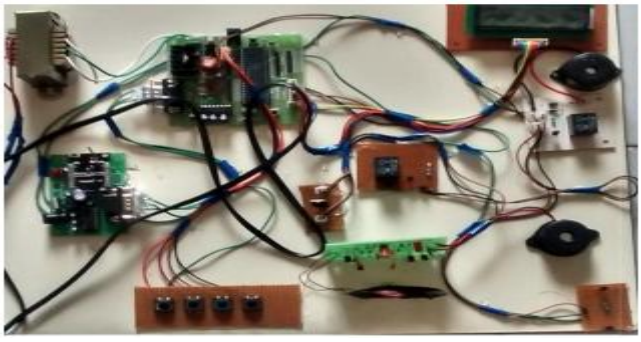

Fig-(f) Receiver

## III.WORKING METHODOLOGY

The proposed system uses RFID, ZIGBEE network and microcontroller along with display to provide the collision avoidance and speed reduction mechanism.The train position is monitored using the RFID technology. The use of RFID system is very efficient and important factor is their cheap availability. Also they require minimum infrastructure maintenance and this helps an easy development of the infrastructure. The RFID system provides a safe and a secure system. The RFID reader senses the RFID cards and receives data such train number, speed and direction in which the train is travelling. When the train approaches a bend, just before a few meters the train will be sensed on the basis of the unique code which is predefined in RF tag fixed to the train. When train crosses the RF transceiver system located near the track before the bend, the radio frequency wave that is transmitted continuously polarizes the tag and receives a response wave that has the information about the bend. This information is fed up to the microcontroller interfacing system and monitored by the software, which takes a prompt decision and controls the speed of the train. This system also prevents the collisions between the trains. The track and train detail sensed by the RFID reader is given to the microcontroller which transmits the information through ZIGBEE resulting in the communication among the trains in the vicinity. ZigBee coordinator which will form ZigBee networks will be present in each railway control station. Each train will have ZigBee routers which would join the ZigBee networks. Routers are used to extend the network. Thus a mesh network is called a self-healing network where the different devices perform the routing in the network and if one node fails another node can be used for delivery. The microcontroller compares the data from the RFID reader and the ZIGBEE transmission to check if any two trains are in the same track. In case where two trains in close vicinity are in the same track the microcontroller gives the input to the driver system which results in stopping the train and thereby preventing any collision.

## IV. FUTURE SCOPE

By using zigbee it covers up to 1km, whereas by using Wi-Fi we can cover over long distances.So that we can easily avoid the accidents and can have the safest mode of transportation. While rail continues to be one of the safest modes of transportation, the overall safety has not significantly improved since the Railway Safety .Continuous improvement is important to achieving a better safety record. Certain accident categories have seen little improvement in accident rates over time, while others are worsening and have the potential to negatively affect public confidence in the railway system.

## V. CONCLUSION

In this paper, a design for automatically averting train collisions have been designed and 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. We believe that success depends on both the railway industry and the regulator working together to achieve that common goal.

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