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# A REVIEW ON RAILWAY SAFETY SYSTEM

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**ABSTRACT**

*In last years, various accident took place in railway. Some of were due to human error but we could not say that all accidents took place due to human error. Accidents may takes place due to bend in track, due to high speed at turning, fire, fog, due to two trains on same track and much more. It is also not possible to prevent from these accidents but we can minimize them using some safety devices. Because the safety in railway is concerned with the protection of life and property through regulation, management. For the purpose of safety Indian Railway has separate section in every department and each executive department responsible for running the trains must own the task of monitoring safety. The prime objective should be to prevent accidents and for this purpose exact technical work needed. The public is made more aware of their role in improving Railway Safety through distribution of posters and pamphlets, plays, advertisements in the local media like NEWS channels, serials, cinema slides etc. Regular reviews of the rules and systems of working are conducted with a view to improving safety as well as efficiency. Purpose of this research paper is provide a brief knowledge about the safety devices that are currently used by us or will be used in future.*

## I. INTRODUCTION

Safety is the paramount responsibility of each and every Railway employee. Individual executive and technical departments look after and are accountable for safety within their own departments. The Safety department assists the management in monitoring the implementation of safety measures on the Railways and in developing the safety record. The department keeps check whether the safe transportation of men and material. They conducts inspections to determine if the rules and procedures governing the running of trains are being followed, and maintains link with all departments concerned with train operations. The safety department regularly gets inquiries conducted into accidents and monitors the follow up action that results from such inquiries.

Safety Inspection and for that matter all inspections are to be conducted meaningfully and not only to detect the shortcomings and failures at the individual levels but more importantly at the system and procedure level. Continuous introduction of new technologies in all fields connected with train running viz. Track, Loco, Signalling, etc. calls for up gradation of knowledge and procedures. Inspecting officials can play very important role in this manner. The exhaustive check lists of various safety inspections and short-cuts prepared by Safety Department are contained in this Safety report. It will go a long way in ensuring that quality of inspections of Officers and Supervisors of all Departments connected to running of trains is of very high order.

Some of the safety devices are mentioned in this research paper. These are

- Axle Counter

- Patrolling
- Dead Man Vigilance System
- Anti-Collison Device
- Fire proof coaches
- Fire and smoke detection device
- Remote Sensing and Graphic Information System

## II. AXLE COUNTER

The first US patent for an axle counter was filed on 3 June 1960 by Ernst Hofstetter and Kurt Haas. Axle counting initially started with treadle-like (pedal like) mechanisms. They consisted of a mechanical contact device mounted on the inside of the foot of rail, the wheel flange running over the device actuated a lever. However they were susceptible to errors and were replaced in Europe at the end of the 19$^{th}$ Century by Hydraulic Rail Contacts. Hydraulic rail contacts were actuated by the deflection of the rail caused by axle load running over the tracks. The first cylinders were filled with mercury and then later hydraulic oil was used. They were then replaced by pneumatically operated switching elements. In pneumatic axle counting systems, pistons were actuated by specific loads and speeds. They proved limited in application, and therefore from the 1950s onwards were replaced by magnetic contacts. Up until that point, Track Circuits always had a big edge when it came to reliability. Magnetic contacts were the first contactless switching devices. They were known as "axle counting magnets".

### 2.1 Introduction

An axle counter is a device on a railway that detects the passing of a train between two points on a track. A counting head (or 'detection point') is installed at each end of the section, and as each train axle passes the counting head at the start of the section, a counter increments. A detection point comprises two independent sensors therefore the device can detect both the **direction and speed** of a train by the order and time in which the sensors are passed. As the train passes a similar counting head at the end of the section, the counter decrements. If the net count is evaluated as zero, the section is presumed to be clear for a next train. This is carried out by safety critical computers called '**evaluators**' which are centrally located, with the detection points located at the required sites in the field. The detection points are either connected to the evaluator via dedicated copper cable or via a telecommunications transmission system. This allows the detection points to be located significant distances from the evaluator.

**Fig. 2.1: Axle Counter [1]**

### 2.2 Applications:

- Track vacancy detection
- Railway crossing
- Switch protection in rail yards

- **Track vacancy detection:**

The most common use for axle counters is within railway signalling for track vacancy detection. This is a form of block signalling, which does not permit two trains to be within the same block at the same time. This decreases the chance of collision due to railways being divided into blocks and also ensures there is always enough space between trains to allow one to stop before it hits the one in front.

- **Railway crossings:**

Axle counters are also used for the switching on and switching off of railway crossings. Closing the crossing to pedestrian and motor vehicles when the presence of a train is detected, and allowing them to open back up when the successful traverse of the train has been recorded.

- **Switch protection in rail yards**:

Axle counters are used in rail yards to detect train cars as they are sorted. They are placed on the track before each switch and on each track that exits the switch. Rail yard management software uses occupancy data from the axle counters to lock in switches and prevent cars from being routed to tracks that are occupied by other cars.

### 2.3 Advantages and disadvantages

**Advantages:**

- Unlike track circuits, axle counters do not require insulated rail joints to be installed. This avoids breaking the continuity of long welded rails for insulated joints to be inserted.
- Axle counters are particularly useful on electrified railways. Axle counters require no bonding and less cabling in comparison to track circuits, and are therefore generally less expensive to install and maintain.
- Axle counters are also useful in instances where there are issues with water on the track. Generally wheel sensors work under water.
- Axle counters are used in places such as wet tunnels (such as the Severn Tunnel), where ordinary track circuits are unreliable.
- Axle counters are also useful on steel structures (such as the Forth Bridge), which may prevent the normal operation of track circuits if insulating the rails from the structure proves impracticable.

**Disadvantages:**

- Axle counters may 'forget' how many axles are in a section for various reasons such as a power failure. A manual override is therefore necessary to reset the system. This manual override introduces the human element which may be unreliable.
- **An accident** occurred in the **Severn Tunnel** and is thought to be due to improper restoration of an axle counter. This, however, was not proven during the subsequent inquiry. In older installations the evaluators may use eight-bit logic, causing numerical overflow when a train with 256 axles passes the axle counter. As a result, this train will not be detected. This imposes a length limit of 255 axles on each train. Modern systems are not restricted by train wheel numbers.
- **Electromagnetic brakes**

- Magnetic brakes are used on high speed \ higher speed trains (maximum speed greater than 160 km/h (99.4 mph)). These are physically large pieces of metal mounted on the bogie of the vehicle, only a few centimetres above the track. They can sometimes be mistakenly detected by axle counters as another axle. This can happen only on one side of a track block, because of magnetic field curvature, defects of track geometry, or other issues, leading the signalling system into confusion and also requiring reset of the detection memory. The modern axle counters are **'Eddy Current'** brake proof and the magnetic effect of the braking system described above is overcome, therefore count information remains stable even when a vehicle fitted with magnetic brakes is braking whilst traversing the rail contacts of a detection point.

### 2.4 Installation method:

The two main methods of mounting an axle counter is firstly drilling through the rail, this is seen as time consuming and possible damaging to the rail. However this eliminates the need for leveling which can help reduce maintenance costs.

The second is a rail mount, which clamps to both sides of the rail from underneath it. This can be seen as quicker and easier to mount in the right conditions, but can mean more often checks needs to be made to ensure the correct positioning.

## III. PATROLLING OF THE RAILWAY LINE

**3.1 Types of Patrolling:** The following are the types of patrolling in trend:

- Keyman's daily patrol
- Gang patrol during abnormal rainfall or storm
- Night patrolling during monsoon
- Security patrolling during civil disturbances and for movement of VIP specials
- Hot weather patrolling for long welded rails/ continuous welded rails
- Watchmen at vulnerable locations.

#### 3.1.1Keyman's Daily Patrol

Every portion of the permanent way shall be inspected daily on foot by the keyman of the beat in which the portion of the track falls. Provided that the interval between such inspections may, under special instructions, issued by Chief Engineer be increased to once in two days in the case of specified section of lines with light and infrequent traffic.

#### 3.1.2Gang Patrol during Abnormal Rainfall or Storm

In the event of abnormal rainfall or storm during day or night, the Mate should, on his own initiative organize patrolling over the length affected, independently of other patrolling, if any being done. This patrol should, in case of heavy rainfall, restrict its inspection to known points of danger, such as cutting or culverts likely to flush, banks affected by tanks likely to breach / violate and bridge approaches. In case of high winds, the patrolman should inspect the length of track likely to be fouled by falling of tree.

**3.1.3Night Patrolling during Monsoon**

During the monsoon, certain section of the railway line, as may be specified, shall be patrolled to detect damage by flood, such as breaches, settlements, slips and scours and immediate action taken to protect trains, when so warranted.

**3.1.4Security Patrolling during Civil Disturbance and on Special occasions**

On apprehension of a civil disturbance, the Divisional authorities should contact the local civil authority and arrange, as circumstances may warrant for security patrolling of the railway line. This may be arranged on the pattern of the monsoon patrolling with modifications, as deemed necessary, in consultation with civil authorities. Security patrolling on special occasions should be carried out according to the special instructions issued by the administration. The primary duty of the patrolman employed on Security patrolling shall be to protect trains against any condition of danger, such as tampering with track or obstruction placed on line.

**3.1.5Hot weather Patrolling for LWR/CWR**

Hot weather patrol is carried out when the rail temperature increases. The patrolling should be done in accordance with the provisions of manual of Long Welded Rails.

**3.1.6Watchmen at vulnerable locations**

In addition to patrolmen, stationary watchmen are posted at known or likely locations of danger or trouble.

## 3.2 Equipment and duties of patrolmen

- **Equipment of Patrolmen**

(1) Each patrolman shall be provided with the following equipment and such other, as may be prescribed by special instructions:

(a) One staff.

(b) Number plate 15 cm. Square

(c) 12 fog signals in a tin case.

(d) Two tricolour hand signal lamps.

(e) Protective clothing according to local dress regulations.

(f) One match box.

(g) Two red flags and one green flag (in daytime patrolling).

(h) Patrol book in a tin case.

(i) One three cell Electric torch,

(j) Whistle thunderer.

(k) One haversack/back pack.

(2) Three flare signals (fusees) on double/ multiple lines, and automatic block territories and one fusee on single line sections.

(3) Where patrolling is undertaken in pairs or stationary patrol consists of two men, the equipment need not be duplicated but the additional patrolman will be provided with an extra hand signal lamp, whistle thundered and protective clothing.

- **Duties of Patrolmen**

(1) The duties of a patrolman shall be as follows:

(a) Apprehend damage to line when

(i) The flood exceeds danger level at any of the bridges.

(ii) When there is damage to the protection work or on approaches even before danger level is reached.

(iii) The water on one side of the embankment is at a much higher level than on the other side.

(iv) When any obstruction such as a fallen tree is blocking the water-way of a bridge.

(v) The track shows signs of a settlement.

(b) When no danger is apprehended, stand on the left hand side facing the train and exhibit his number plate, turning the light of his lamp on to it, so that the number can be seen from the passing train. He should also blow the whistle, when the engine and the brake-van of the train pass him.

(c) Obtain the signature of the Station Master/ Block Hut-in-charge on duty at the Station/ Block Hut concerned for his arrival and departure and exchange patrol books with adjacent patrolmen.

(d) Exchange the reports as to the conditions on their beats with adjacent patrol men and stationary watchmen on the way.

(e) Get instructions from drivers who may report a condition of danger at a kilometrage and proceed to the place indicated and take necessary measures.

(2) It is of supreme importance that patrolmen and watchmen thoroughly understand what they have to do in the event of emergency. Every effort should be made to instruct and drill the men in their duties. In the event of an emergency the patrolmen should devote their whole time and energy to the protection of the line and summoning of assistance.

### 3.3 Action When Damage is observed

In the event of any portion of the line being breached or otherwise unsafe for traffic then the patrolmen shall proceed in direction of train showing the danger signals (red flag during day and red light during night) and when at 600m from the point of danger place one detonator on to the rail track. Then he proceed to a distance of 1200 M. from the point of danger where he would place three detonators on the rail about 10 metres apart on alternate track. If there is no train on route then he inform to nearest station master and further action is taken by railway officers.


**Fig. 3.1 : Detonator [9]**

## IV. DEAD-MAN'S VIGILANCE DEVICE

### 4.1 Introduction

A dead-man's vigilance device is a railroad safety device that operates in the case of incapacitation of the engineer. It is a hybrid between a dead-man's switch and a vigilance control. The main safety failing with the basic dead-man's control system is the possibility of the operating device being permanently held in position, either deliberately or accidentally. The dead-man's vigilance device was developed to detect this condition by requiring that the dead-man's device be released momentarily and re-applied at timed intervals. It include following steps:

- Modern practice

- Reset signal
- Warning and braking

**4.1.1Modern practice**

Modern locomotive practice is to incorporate the dead-man's and vigilance functions under the control of the alerter or the event recorder. This enables more sophisticated monitoring of the driver's alertness. The vigilance control cycle time can then be speed dependent, varying inversely to train speed in order to reduce the distance the train may travel before a non-response is detected and acted upon.

**4.1.2Reset signal**

In addition to the dead-man's pedal or button, the reset signal can also be any one of a number of train handling control actions already monitored by the event recorder. These include a change of throttle position, brake or horn operation, all indications that the driver is actively controlling the train.

**4.1.3Warning and braking**

If the timer period is allowed to expire a visual and audible warning is given by the alerter or similar warning device. If the operator fails to acknowledge the warning, a penalty brake application results.

## 4.2 Working

**Fig. 4.1: Dead man's vigilance pedal [9]**


**Fig. 4.2 : Dead man's vigilance working [9]**

- This system also known as Operator Presence Control System (OPC).
- This system increase train safety by monitoring the train driver's consciousness at all times.
- When the driver experiences a loss of consciousness, death or any other physical issues preventing him to react. In practice this is done by monitoring driver's activities. Activities may be:
- Change in speed of train
- Give horn
- Apply brake for a moment
- Push a dedicate vigilance pedal / button
- If driver does not activate the pedal within time period, a blinking light will notify him.
- Now the driver has 5 second to perform activity.
- If no action is taken by driver then an alarm bell ring will be heard as a second level of alarm. (If wireless communication is available then an alarm can be sent to wayside.
- For additional safety, automatic braking is also triggered.
- If speed of train is 10 kmph (minimum set speed), then this system is not active.

## V. ANTI-COLLISION DEVICE (ACD)

### 5.1 Need of ACD

The ACD Network is a train collision prevention system patented by **Konkan Railway Corporation Limited** (A Public Sector Undertaking of Ministry of Railways, Government of India). ACDs have knowledge embedded intelligence. They take inputs from GPS satellite system for position updates and network among themselves for exchanging information using their data radio modems to take decisions for timely auto-application of brakes to prevent dangerous 'collisions', thus forming a '**Raksha Kavachtm**' (meaning a '(Train) Safety shield').

ACDs fitted both in Locomotive and Guard's Van of a train act as a **watchdog** in the dark as they constantly remain in lookout for other train bound ACDs, within the braking distance required for their relative speeds.

### 5.2 Introduction

Anti-Collision Device (ACD) is a fully integrated Electronic Control System designed to minimize collisions and increase safety on Railway system. It is a non-signaling system and provides additional cover of safety in train operations to prevent dangerous train collisions caused due to human errors or limitations and equipment failure. ACD system does not interfere with normal working of train operations. Being the non-signaling and inter locking system it does not replace any existing signaling and interlocking system and does not alter any procedures of train operations in vogue. Network of Anti -Collision Devices (ACDs) are provided comprising of a variety of devices such as onboard (Mobile) ACDs for Locomotives and Guard vans and track-side (Stationery) ACDs, Level Crossing ACDs, Loco Shed ACDs, Sensor based ACOs and ACO Repeaters.

**Table 5.1 : Accident case due to collision of train [9]**

| Date | Train Name | People dead/ injured |
|---|---|---|
| 14 Dec 2004 | Jammu tawi Express with Amritsar Passenger near Mamun village Panjab. | 36 |
| 2 Jan 2010 | Lichchavi express hit Magadh Express, Near Etawa (due to dense fog) | 10 people and 1 driver injured |
| 2 Jan 2010 | Goraklhdham Express with Prayagiri Express at Kanpur (due to dense fog). | 10 dead 51 injured |
| 19 July 2010 | Banga express hit Vanachal express behind Santhia station | 66 |
| 26 May 2014 | Gorakhdham Express with Stationary local train at Sant Kabir Nagar (UP) | 22 |

All these work on the principle of distributed control systems. All ACDs along the ACD route communicate with each other through radio communication when they are within a radial range of at least 3 kms. On board computers use inputs from Global Positioning System (GPS) for determination of train location, speed, course of travel and time. Both mobile and stationary components of ACO system exchange information and take decisions based on train working rules and embedded software to apply brakes automatically without any input from the users. If two ACOs are deemed to be at a risk of collision, the ACD system activates automatic braking operation to prevent collisions. Loco ACO is designed to interface with various types of braking system of locomotives. System provides audio-visual "Train Approach" warning to road users at level crossings.

More than 2,000 Anti Collision Devices have already been installed over 2,700 Route Kms of track on Indian Railway system out of which about 1900 Route Kms are on North east Frontier Railway and balance are on Konkan Railway. Further proliferation 0of this safety device on the balance BG network of Indian Railways is being planned.

### 5.3 Technology used in ACDs:

The heart of the ACD is an **Intel 80386 processor** that uses the DM& PM617 Intel chipset. It [ACD] has an integrated digital radio modem and works on the VxWorks Real Time Operating System (RTOS). Raja ram adds, VxWorks, as a platform, is most suitable for real time applications.

### 5.4 The working of ACDs in Indian Railways is described as:

It receives the information being send by other ACD range within range 3 Km. this information also send to the computer control units (C.C.U.) for processing all receiving the information from the other ACD and the data from the GPS receiver. The C.C.U unit take a design for apply either a normal & emergency break or the locomotive break as the case may be. This is active with the help of the auto breaking unit of the loco on board mobile loco ACD and guard room ACD have both a GPS receiver and radio trans receiver. The GPS receiver received the data from the satellite and radio trans receiver communicate with the other GPS. Within range of 3.Km. the tracks side and sates nary module.

### 5.5 Applications:

I. ACDs can be implemented in railways to prevent collisions and to decrease the timing between two consecutive trains running one after another.

II. It can be used in heavy vehicles like cranes, earthmovers etc to prevent accidents and for their safe working in public places.

III ACDs can be used as a tracking device.

## VI. FIREPROOF COACHES

### 6.1 Construction

The Rail Coach Factory (RCF) at **Kapurthala** in **Punjab** had started manufacturing fireproof coaches in April 2012. The railways intends to replace all outdated and general coaches with fireproof coaches. Fireproof coaches made of stainless steel have been produced on trial basis. Their design and other safety measures have been approved by technical experts. Under the new design, approved by the board, the curtains and other fittings inside the AC coaches are fire resistant. These fireproof coaches are being made of superfine stainless steel.

Railways have attempted to enhance fire-worthiness of coaches by using fire retardant furnishing materials to reduced effect of fire. Specifications for such furnishing materials have been periodically reviewed to incorporate fire retardant parameters in line with UIC (International Union of Railways) and other international norms. All new manufacture of coaches /periodical overhauling of existing coaches is being carried out with fire retardant specifications of the furnishing materials wherever condition based

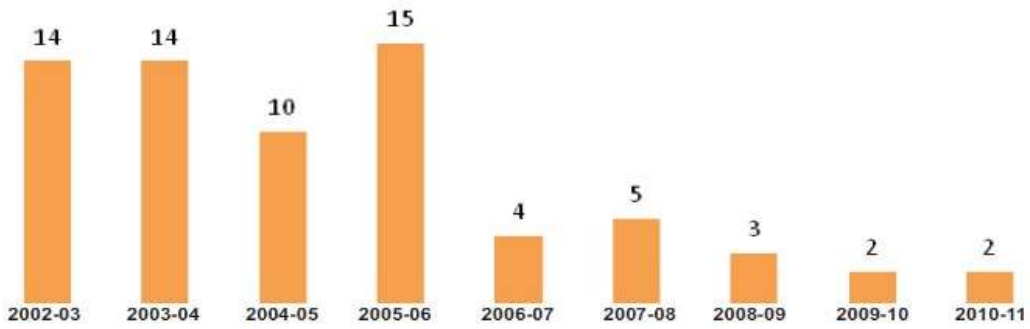


**Fig. 6.1 : Fire accidents cases in Indian Railway [ 10 ]**

replacements are warranted. Besides, fire extinguishers are being provided in all air-conditioned coaches, second class-cum-guard and luggage vans, pantry cars and train locomotives.

**Table 6.1 : Fire accidents cases in Indian Railway [ 9 ]**

| Date | Train Name | People died/ injured |
|---|---|---|
| 18 April 2011 | Mumbai Rajdhani Express (2 coaches) near Ratlam | 0 |
| 12 July 2011 | New Delhi Patna Rajdhani Express near Delhi | 0 |
| 22 Nov 2011 | Howarah Dehradun Express | 7 |
| 30 June 2012 | Delhi Chennai Tamilnadi Express | 35 died / 55 injured |
| 30 July 2012 | Chennai Tamilnadu Express near Nellore, Andra Pradesh | 47 died / 25 injured |
| 16 Oct 2012 | Falaknuma Passenger near Tuljapur in Maharastra | 0 |
| 30 Nov 2012 | GT Express | 0 |
| 2 Nov 2013 | Alapuzha-Dhanbad express, near Gotlam in Vizianagaram district | 10 died / 21 injured |
| 28 Dec 2013 | Hazur Sahib Nanded express caught fire near Kothacheruvr in Anantapur district of Andhra Pradesh | 26 died / 10 injured |
| 8 Jan 2014 | Bandra Dehradun Express | 9 |

The official said 40 such coaches have so far been rolled out from the RCF. These coaches are similar in look and design to the LHB German coaches being used in the Rajdhani and Shatabdi Express trains across the country.

According to sources, the stainless steel coaches would be used in mail and express trains. Railways has started using stainless steel coaches in Rajdhani and Shatabdi Express trains on trial basis. Adding that decision has been taken to indigenously manufacture bogies to reduce the making cost of such coaches. The German LHB technology used in manufacturing air-conditioned coaches is quite expensive. The indigenous technology with slight modifications is likely to reduce the manufacturing cost by about 40%, compared to the cost of production of one LHB coach, sources said.

At present, the east central railway (ECR) has more than 2,500 coaches, including AC and sleeper ones, which need immediate replacement to maintain full proof safety.

## VII. FIRE AND SMOKE DETECTION SYSTEM:

### 7.1 Introduction

A pilot project for provision of comprehensive fire and smoke detection system had been taken up in the New Delhi - Bhubaneswar Rajdhani Express, said a senior Railway Ministry official.

Besides, one LHB (Linke Hofmann Busch) rake in New Delhi-Jammu Tawi Rajdhani train and one AC double decker rake running between Kachiguda-Tirupati/Guntur have also been provided with such a system. "Based on the feedback from pilot project, railways has sanctioned for extended field trials in 2750 coaches.

According to Railway Ministry data, in the year 2012-13, nine fire accidents took place on trains. The declining trend is continuing in the next year and till January 31, 2017 there has not been a single case of fire accident on train. Improved materials for electrical fittings and fixtures such as MCB (Miniature Circuit Breaker), light fittings, terminal boards, connectors etc., are being used progressively by railways to prevent fire incidents. Railways have given detailed instructions to zonal railways for observance of safe practices in handling of pantry cars and for ensuring periodical inspection of electrical and LPG (Liquefied Petroleum Gas) fittings in the pantry cars. Frequent drives against carrying of inflammable/ dangerous articles in trains as well as station premises are also being undertaken.

### 7.2 Integrating smoke detection with the HVAC

Placing aspirating smoke detection in the plenum of the HVAC system offers many advantages:

- Installing the detector within the plenum ensures a relatively stable operating environment, with constant temperature and humidity.
- The return air filter of the HVAC system removes dust and lint from the air before it reaches the smoke detector. This reduces maintenance.
- The HVAC system acts as a turbo-charged smoke delivery system. This ensures that air samples are collected from all areas of the rail car.
- Access to the detector is simple. Opening the HVAC plenum allows direct access for maintenance.
- The smoke detection system is completely concealed and one less target for vandals

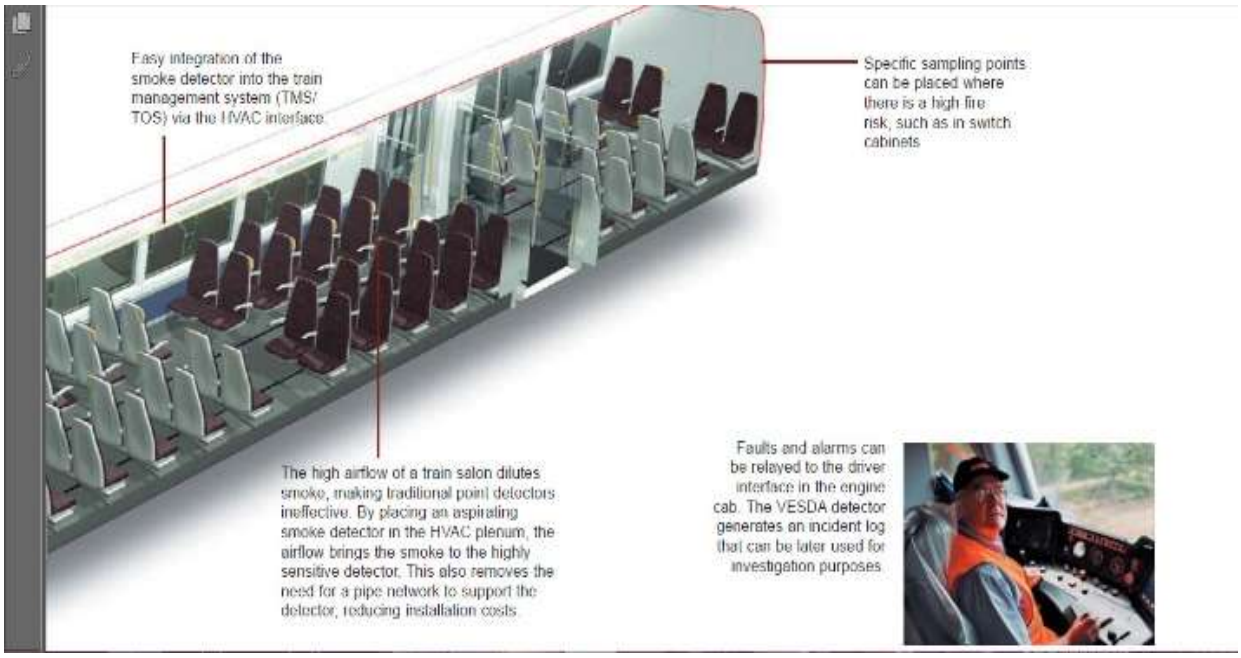


**Fig. 7.1 : Working of Fire and smoke detection [11]**

### 7.3 Why VESDA (very early smoke detection apparatus)

VESDA high sensitivity aspirating very early warning smoke detection systems lead the world, with over 185000 detectors installed worldwide.

**Comprehensive product range**: meets varied application needs

**Fault tolerant and reliable:** reduces false alarms and cost of ownership

**World's widest sensitivity range:** VESDA can trigger a response appropriate for the level of fire threat

**Recognized as the global benchmark technology:** have confidence that you are getting the latest, proven technology.

## VIII. REMOTE SENSING AND GRAPHIC INFORMATION SYSTEM

### 8.1 Introduction

The Memorandum of Understanding (MoU) was signed in the context of Railway Minister's special mention in the Rail Budget speech made in the Parliament on February 29, 2016 regarding geospatial and enhanced use of Space technology in various sectors of governance. A Memorandum of Understanding (MoU) was signed between the Indian Railways and the Indian Space Research Organisation (ISRO) on March 17, 2016. The memorandum of understanding was signed with a view to use best technologies in many areas of its operations for the benefit of its passengers and was regarding 'Effective Use of Space Technology in Remote Sensing and Graphic Information System (GIS) based Governance Application for Indian Railways'.

"We will undertake a massive exercise of GIS mapping of the entire rail route and assets including buildings, land, workshops and other facilities in the network using geospatial technology," said a senior Railway Ministry official involved with GIS mapping project. Geospatial technology involves GPS (global positioning systems), GIS (geographical information systems), and RS (remote sensing).

ISRO conducts 1st satellite-based warning system trial for Railways CRPF ropes in ISRO for GIS data of Naxal-hit areas. India plans to launch 30 satellites over the next decade. The official said geospatial services will be available from satellite-assisted navigational support through the GPS aided geo augmented navigation (GAGAN) system of ISRO.

### 8.2 Background:

Currently, Indian Railways is using Space technology for providing connectivity to Passenger Reservation System (PRS) counters and Unreserved Ticketing System at remote and non-rail head locations, Emergency Communication using Satellite phones from disaster sites, Global Positioning System (GPS) for various applications like Remote Monitoring of Locomotives, Passenger Information System in Mumbai Sub-urban trains and synchronized clocks & Wi-Fi facility in selected Rajdhani Express trains.

Indian Railways to tie up with ISRO for enhanced safety, efficiency. The technology is also expected to be used for tracking trains for disseminating information about their movement on real time basis which will be a great help to passengers.

### 8.3 Benefits:

- The MoU will facilitate getting images and communications through the satellite system. While the images will help in mapping the area, communications will enable the introduction of wi-fi service in trains in a larger way.
- The technology will come in handy at the time of accidents when it can be used to insure the exact location of trains and the topography.
- Besides, it will also help railways in developing solutions for safety at unmanned level crossings with remote sensing facility.
- Safety at unmanned level crossings is a cause of serious concern for railways and the public transporter is exploring various ways to address the issue.
- Remote sensing system can be used to warn road users by activating the hooters before the arrival of trains at unmanned level crossings.
- The satellite images will also be used for geo-fencing of stations for paperless ticketing system.
- Geo-fencing is a virtual barrier which uses the global positioning system (GPS) or radio frequency identification (RFID) to define geographical boundaries.
- Railways have started the paperless tickets in unreserved segment for suburban services in Delhi, Mumbai and Chennai.
- As per the plan, railways have decided to go paperless with regard to monthly season tickets and platform tickets.
- The technology is also expected to be used for tracking trains for disseminating information about their movement on real time basis which will be a great help to passengers. Currently train movements are tracked manually.

## REFERENCES

[1] www.ijera.com, Vinay Polepalli, M Anil Kumar / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 3, May-Jun 2013, pp.439-448

[2] Ali Zamani, Ahmad Mirabadi "Optimization of Sensor Orientation in Railway Wheel Detector, Using Kriging Method " E-mail: ali_zamani@rail.iust.ac.ir/mirabadi@iust.ac.ir Received September 2nd, 2011; revised October 21st, 2011; accepted November 21st, 2011

[3] www.Indianrailways.com

[4] www.Railwaywebpages.com

[5] http://www.konkanrailways.gov.in

[6] http://www.rediff.com/anti_collision_devices.html

[7] http://www.hindustantimes.com/ACD.html

[8] Times of India

[9] www.rdso.Indianrailway.gov.in

[10] www.xtrails.com/vesda-vlq

[11] www.researchgate.net

[12] Biswajit Ghosh, Vishal Kumar, Sonal Kumar Keshri, Abhisek Roy "An Effective Approach of Prevention of Collisionin Railway network" International Journal of Advanced Research in Computer and Communication Engineering Vol. 3, Issue 6, June 2014

[13] James T. Trumpbour, Bronx, N. Y. ,UNITED STATES PATENT OFFICE "DIAPHRAGM FOR RAILWAY COACHES", Application March 7, 1934, Serial No. 714,43

[14] Ch.Sindhura and B.R.B.Jaswanth "Implementation of Modern Vigilance Control Device Using GSM and GPS Technology", International Journal of Latest Trends in Engineering and Technology (IJLTET)