**SMART SOLUTIONS FOR RAILWAYS**

**LITERATURE SURVEY**

# *ABSTRACT:*

Even with the best plans in place to prevent train accidents, many still occur worldwide. This research presents a method for preventing train collisions by utilising an automatic control built into the trains. In the proposed study, we incorporated concepts such pre-crashing using RFID(Radio-Frequency Identification)sensors and ultrasonic sensors to select an array of commands that would be executed in accordance with the conditional algorithm programmed in the microcontroller. Additionally, an EPM would be used to reduce the motor's speed. Due to its complete automation and low cost, this system will be more effective.

# *INTRODUCTION:*

For the middle class and lower class people to travel in high security and sophisticated locomotions, we wanted to be a part of our environment by bringing about some change and advancement. The train is the most popular mode of transportation, and it's not just for people; trains are also utilised to convey products. However, due to crowding, Indian railways are unable to properly accommodate passengers. According to statistics, railroad traffic accidents are the largest cause of death by injury (two train collision each other).

Accidents can be caused by a variety of factors, including inadequate training or experience, cell phone use while driving, inexperienced drivers, drunk driving, deplorable conditions of railroad tracks, overloading in train cars, and poor traffic management. In this survey study, we explore a few methods for identifying railway accidents and offer a solution. Rear end crashes occur mainly due to obstacle and crack in tracks. Recent statistics show that a significant portion of train accidents are caused by improper railroad track surveillance.

Five elephants were struck by a railway that was travelling at a fast pace in the Bihar state forest in February. When trains collided in June of last year, the Indian railway minister felt bad. It represents the highest rate of injuries, which is 22%, and also the highest proportion of loss of life, which is 28%, although having a reasonable incidence of 2% deaths compared to all other types of crashes. A great deal of work has gone into creating an algorithm for smart railway automation systems (ASRS). A sophisticated application called an intelligent in railways transportation system (IRTS) promises to offer services and safeguard people's lives both inside and outside of the railway. Because incidents in the semi-automated railway system currently in place happen quite regularly, we wish to make some changes and make them effective so that they become a requirement and a law for practice.

After the introduction of the smart train, which includes a lot of new technology, many proposals have been put out for critical advancements in the system-building process intended to improve travel quality of life. A system based on vision and video processing has been developed that could use a camera to take video images and extract characteristics for locating obstacles and observing how obstacles behave around them in order to make inferences about how to avoid acids. Live camera that uses an EPM module to analyse the video's images to identify obstacles and delivers a warning when it notices an automatic engine breaking.

This study's primary objective is to provide the groundwork for the development of intelligent rail automation systems that can detect high-risk cars ahead, determine their relative distance and speed, and warn the driver of potential collisions. The strategy we recommended will prevent all collisions on the railway network.

# EXISTING WORKS:

[1]**Journal Name:**. “Integrating automatic verification of safety requirements in railway interlocking system design”, The 6th IEEE International Symposium on High Assurance Systems Engineering (HASE’01), Washington, USA 2011.

**Author Name:**POOVIZHI S

The sensors are made up of a transistor, an Op-amp, a handful of resistors, and a few IR leds. A wireless sensor network (WSN) is a network of autonomous sensors-equipped devices that is spatially distributed and wireless. This WSN technology offers distributed nodes and wireless communication to the wired world. The 900 MHz frequency used by the wireless protocol is chosen based on the needs of the application. The protocol uses 2.4 GHz radios that are compliant with IEEE 802.15.4 or IEEE 802.11 (Wi-Fi) standards. The issues that train passengers encounter are numerous. One of them is the absence of water in the train, travellers taking long distance trains must either travel with a meagre supply of water or without any at all. The availability of seats in trains is another issue. To purchase tickets for the train they want to take, passengers must wait in line for a very long time. It will be quite difficult for a passenger to go by train if there is nowhere for them to sit. For operation, the IR module uses 358 comparator ICs. When it detects an IR frequency, the sensor's output changes to logic 1, otherwise to logic 0. Leds can be used to examine the sensor's state, and no further hardware is needed.This means there are no open seats for incoming guests. The availability of seats for new customers is indicated if the IR led did not detect any reflected signal. Normally, the output pin is low.The receiver LED will be off even though the IR LED is continuously transmitting since there is nothing to reflect back to the IR receiver owing to an obstruction. The IR receiver's output decreases when an obstruction is encountered. The obstacle surface reflects the IR signal. Thecomparator's output will be driven low as a result. The LED's cathode is then linked to this output, which causes it to illuminate.

[2] **Journal Name:**. “Real-time rail head surface defect detection: A geometrical approach,” in Proc. IEEE Int. Symp Indust. Electron., 2009.

**Author Name:** Pranav

Using an ultrasound testing approach to find the rail track's defects using an ultrasonic distance metre. When a crack is found, the appropriate coordinates are transmitted to the nearby station. The GPS and GSM module are used to record and transfer the coordinates. The best way for locating small cracks and determining their rate of expansion is the ultrasonic technique. At regular periods, the growth rate can be observed. A fracture detection non-destructive system is used. Non-destructive testing technique is one of the procedures that aid in the inspection of material without doing any damage. NDT is a popular technique for maintaining materials without addressing the fundamentals of the material. NDT is a popular technique for maintaining materials without addressing the fundamentals of the material. Due to the diverse behaviours that ultrasonic waves exhibit in various material qualities, they are heavily utilised in this technology. ultrasonography is used. Every area of the permanent way is examined every day on foot. Gang patrol during unusual rainfall, night patrol during the monsoon, hot weather patrol for welded track, security patrol, watchmen at susceptible areas, and cold weather patrol are some of the patrolling types. Gang patrol during rain should have an effect on the length, which should be affected. It operates apart from other patrolling. The meteorological department sends out telegrams to warn people about storms and heavy rain. Watchmen and Gang members are on high alert and ready to start patrolling. Security patrols are conducted to safeguard trains from track tampering and obstructions on the route, as well as to find rail track faults using an ultrasonic testing technology. When a crack is found, the appropriate coordinates are transmitted to the nearby station. The GPS and GSM module records and transmits the coordinates. The best system is the ultrasonic approach, which can even find little cracks and estimate how quickly they will spread. Following multiple measurements made at regular intervals, the growth rate can be determined. Non-destructive testing technique is one of the processes that aid in material evaluation without doing any damage. NDT is a popular technique for maintaining materials without addressing the fundamentals of the material. Because ultrasonic waves exhibit a variety of behaviours in different material characteristics, they are often used in this procedure. When an ultrasound wave signal travels from one distinct medium to another, some of the signal energy travels over to the other medium while the remaining energy is reflected back.

[3]**Journal Name:**. “Safety verification for train traffic control communications”, IEEE journal on selected areas in communications, vol. Sac4, no. I, 2012

**Author Name:** Bharti.S.Dhande ,Utkarsha S.Pacharaney

The most common level crossing controllers and train tracks to use IR sensors and the internet of things  In India, the means of transportation is widely employed. It is  a form of transportation that encounters a  any difficulties brought on by human mistakes, like  level cross collisions, broken-down vehicle collisions  follow etc. a level crossing or a road intersection  a railway line ,which calls  for human coordination,  the absence of which results in accidents, as well as the  A primary issue with railroad analysis is detection. the position of the crack. If this issue is if not contained at an early level, they could a lot of derailments with significant loss of life life and possessions. In the conventional system, the gatekeeper is responsible for controlling level crossings. The gatekeeper receives instructions from the control room via telephone at the majority of the level crossings. However, the likelihood of manual error at these level crossings is considerable and risky without actual knowledge of the train schedule. Accidents on the railroad could result from delayed gate opening and shutting. The concept of railway gate automation and crack detection system has been modified by employing IR sensors and IOT technology, which performs automatic gate operation and aids in identifying broken track, in order to eliminate human errors during the operation of gates and derailment. In this system proposal, an LPC2148 microcontroller was used.It is a small microprocessor with low power requirements. LPC2148 are perfect for applications where downsizing is a major need, such as access control systems, because to its small size and low power consumption. It has numerous UARTs, SPI, SSP, and I2C serial communication interfaces in addition to a USB 2.0 Full Speed device. It has 8 kb to 40 kb of on-chip SRAM. Devices are therefore excellent candidates for communication gateways. In this paper, we make a suggestion. Before beginning the rail-way line scan as part of the crack detection system, the robot is programmed to self-calibrate the IR transmitter and receiver. The robot must wait a certain amount of time after calibration for the GPS module to begin reading the correct geographic coordinate. The idea behind this crack detection is that the amount of light that reaches the IR receiver is inversely proportionate to the crack's intensity. The IR transmitter and receiver will be mounted on the rail in a straight line. When the transmitter's light does not hit the receiver during operation, the device does not detect a crack. And when the receiver receives light from the transmitter. We employed a GPS receiver, whose purpose is to obtain the most recent latitude and longitude information, so order to determine the train's current location in the event of crack detection.

[4]**Journal Name:**. Safety verification for train traffic control communications

**Author Name:** G.Tarnai

In this study, it is suggested that RFID-based chip cards be read and scanned at a distance using a technique called distance readability. Potential free riders can be effectively caught using the distance reading. Distance scanning by itself will be unable to ascertain the precise number of free riders, but a second technique to count the population of an area is recommended. This research proposes a method to identify free riders early on based on the insight of merging the two technologies (RFID distance scanning and People thermal image counting). This paper's focus will be on the structure and architecture required to record Faredodger's study, which will be put to use to run tests in an experiment to confirm the presumptions.

[5]**Journal Name:** .Autonomous railtrack inspectionusing vision based system,” in Proc. IEEE Int. Conf. Comput. Intell. Homeland Secur. Pers. Safety, 2009

**Author Name:** Smita S. Bhavsar

RFID method to prevent aircraft collision the railway transportation network is thought to be the safest and simplest network, however it is no longer that much safer since numerous crashes and accidents happen due to poor network communication, incorrect signalling, bad weather, and sudden changes in track or route. Due to the speed of moving trains, which necessitates a lead space for stopping, it is exceedingly challenging to prevent such collisions. Around the world, there have been several train accidents. According to a CNN IBN India story dated September 2011 Human mistake accounts for 85% of train accidents, either the driver or the main control room before a collision. There is currently no way to prevent train collisions. ACD (anti-collision device) system-based solutions have been put into place by Indian Railways. Due to their design concept of using GPS for track recognition and having a high implementation cost, they have inherent issues in the Station portion and close to mountains. My system, which relies on RFID, ARM Controller, and GSM to assist solve the aforementioned issues, uses automated surveillance to help eliminate train accidents. Each train reads and transmits its track id to surrounding trains in this system, which assigns a track id to each train track. if there are two trains travelling at the same time.

[6] **Journal Name:**. Crack Detection System For Railway Track By Using Ultrasonic And Pir Sensor” IJAIC-2014

**Author Name:** Shiladitya Ghosh, PallabDasgupta, Chittaranjan Mandal, AlokKatiyar

The authenticity of the movement authorities provided by the control centre will have a big impact on the automatic train controller system. A Radio Block Centre (RBC) in the European Train Control System (ETCS) is in charge of issuing movement permits to all trains that are under its control in a fashion that ensures the train’s safe movement. In ERTMS/ETCS Level-1, the RBC receives train position data via train detection equipment; however, in Levels 2 and 3, the train itself uses its on-board radio to transmit its position. Obtaining formal proof that the method for granting movement authorization is safe is necessary due to the rising complexity of train movements across locations, which necessitate greatly variable speed profiles at various times in time. The core of this framework is a verification engine that demonstrates that, given an inertial model of the train, the RBC's movement authorizations guarantee that the movements of the trains satisfy all restrictions. The presented model does not take into account every component of the total ETCS system. European Railway Traffic Management System is referred to as ERTMS. For the two trains that we have taken into account as being a component of the system, we define two distinct models. The basic design of both trains is the same. A crucial step in assuring the general security of automatic train control systems is the formal verification of the movement authorities provided by the track-side radio control block (RBC).

[7] **Journal Name:** “Solid-state interlocking(SSI): an integrated electronic signaling system for mainline railways”, IEE proceedings, 2012.

**Author Name:** A. .H. Cribbens

In the fast developing country, people are facing many accidents; it would be indesirable for any nation to losing their life for unwanted cause. Railways are one of the important transports in India. There is a need for manual checking to detect the crack on railway track and always railway personnel takes care of this issue, even though the inspection is made regularly. Sometimes the crack may unnoticed . Because of this the train accident or derailment may occur. In order to avoid this situation and automate therailway crack detection has been proposed. Here ultrasonic sensor is used to detect the crack in the railway track by measuring distance from track to sensor, if the distance is greater than the assigned value the microcontroller identifies there is a crack, also it tells the exact location of the crack by the formula “DISTANCE=SPEED\*TIME”. While the checking process is going on, the train may approach, it is identified by the vibration sensor and gives alert to the microcontroller, there by shrinks the size of the robot between the two tracks. After the train has crossed it returns to its normal position and continue its checking process.

[8] **Journal Name:** “Characterisation of defects in the railhead using ultrasonic surface waves,” NDT & E Int., vol. 39,no. 6, pp. 468–475, 2006.

**Author Name:** R. Edwards, S. Dixon, and X. Jian.

The Indian Railways has one of the largest Railway networks in the world, crises- crossing over 1,15,000 km in distance, all over India. However, with regard to reliability and passenger safety Indian Railways is not up to global standards. Among other factors, cracks developed on the rails due to absence of timely detection and the associated maintenance pose serious questions on the security of operation of rail transport. A recent study revealed that over 25% of the track length is in need of replacement due to the development of cracks on it. Manual detection of tracks is cumbersome and not fully effective owing to much time consumption and requirement of skilled technicians. This project work is aimed towards addressing the issue by developing an automatic railway track crack etection system integrating an infrared red (IR) crack sensing module and a communication module based on GSM technology by which information about the location of the crack can be conveyed to a central location enabling the immediate attention and intervention of maintenance personals.

[9]**Journal Name:** “Ultrasonic characterisation of defects in rails,” Insight, vol.44, no. 6, pp. 341–347, 2002.

**Author Name:** R. Clark, S. Singh, and C. Haist.

In India, as most of the commercial transport is carried out through the rail network, problems with this network can be highly damaging to the economy, regardless of the social consequences of loss of life or limb. I have. This white paper proposes an inexpensive yet robust solution to the railway breakage detection problem. The method is simple in idea, but completely new and unique in the sense that it has not been tested to date. This paper describes the technical and design aspects in detail and also provides a proposed robust crack detection algorithm. The paper also presents details of his RRCDS implementation results using simple components such as a GPS module, a GSM modem and an LED-LDR based crack detector assembly. The proposed scheme is modeled for robust implementation in the Indian scenario.

[10]**Journal Name: “**Development of a machine vision system for inspection of railroad track”.

**Author Name:** S.Sawadisavi , J.Edwards, E.Resend, J.Hart, C.Barkan, and N.Ahuja.

In European cities, the majority of the public transit infrastructure is easily accessible. The majority of the train stations are positioned in an open and "gate-free" environment, easy available to everyone and hence presents possible problems in the system. Due of this, fare dodging boarding a tram or train without purchasing a ticket is simple. This study proposes a conceptual framework and architecture to detect and track passengers using an RFID distance scan in conjunction with people counting methods, with the goal of capturing free riders in an early stage. It is a ticketing system based on RFID that utilises a OV-Chip card is a smartcard. The findings demonstrate that using an alternative system architecture increase in getting free trips inspectors are at a far early stage.

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| **S.No** | **Year** | **Paper name** | **Basic concept** | **Advantage** | **Disadvantage** |
| 1. | 2017 | Automatic Water level monitoring and Seat availability details in train using Wireless Sensor Network | Float water sensor, IR sensor, UART, Wireless Mesh Sensor Network | Water management maintained by sensor.IR sensor is used to check seat availability | It requires low power supply for functioning and the performance is very high. |
| 2. | 2013 | Evolution of Railway Track Crack Detection System | GPS module; GSM modem; Ultrasonic distance meter | The presented system helps to detect the flaws in the rail track using ultrasound testing method | The certain proportion of the signal energy propagates over to the other medium, at the same time the remaining energy gets reflected back |
| 3. | 2015 | Unmanned Level Crossing Controller and Rail Track Broken Detection System Using IR Sensors and Internet of Things Technology | GSM modem, GPS module , IR transmitter and Receiver, Internet of Things technology | Unmanned gate crossing controller system used FM communication system and its having high performence | the level crossing at a distance of 1km. so there will be lot of time required |
| 4. | 2012 | Safety verification for train traffic control | RFID based | Distance traveled is effectively used | While distance scanning alone will not be able to determine the actual number of free riders |
| 5. | 2016 | Train Collision Avoidance System by Using RFID | RFID Tag, RFID Reader, GSM Module, Surveillance system based on ARM Controller and Android Device. | the main control room or driver before collision happen | it is not that much safer as the lot of collisions and accidents occur due to improper communication among the network, wrong signalling |
| 6. | 2016 | Formal verification of movement authorities in a Automatic train control system | track-side Radio Control Blocks (RBC) | RBC needs to consult the interlocking logic | RBC is to mediate between trains in terms of their Movement Authority (MA). |
| 7. | 2017 | Automotive Crack Detection for Railway Track Using Ultrasonic Sensors | Ultrasonic sensor is used to detect the crack in the railway track by measuring distance from track to sensor, | The auto crack detection method is more efficient in the technical field , Quick response is achieved | IR Sensor range IS .7 to 300 micrometers |
| 8. | 2015 | Automatic Railway Track Crack Detection System | addressing the issue by developing an automatic railway track crack detection system integrating an infrared red (IR) crack sensing module | crack is detected | It is not fully automatic |
| 9. | 2014 | Robust Railway Crack Detection Scheme (RRCDS) Using LED-LDR Assembly | robust solution to the problem of railway crack detection utilizing | cost effective | In this the range IR sensor is very less. |
| 10. | 2009 | Passenger Monitoring Model for Easily Accessible Public City Trams/Trains | public transportation, train, tram, passenger monitoring, passenger control, RFID distance Reading, ticket control, RFID ticket inspection. | It's possible to travel cross country with a single public transportation card, using Transport systems of several transport operators. | Applicable only for passenger monitoring |

***CONCLUSION:***

By using this self-driving car Purpose of Track Inspection and Cracking have a significant impact on detection Track maintenance helps with this Most train accidents were avoided. Areas without manual inspection Possible, deep coal mines, like mountains Regions and dense forest areas are It's easy with this vehicle. by using this railway vehicle Inspection and crack detection and automation SMS will be sent to a predefined phone number Each time the vehicle sensor detects a crack, or deformation. This is maintenance and Track condition monitoring no error occurs, Tracks in good condition, prevent trains Accident on a very large railway line Self-driving car developed for crack detection so that he can recognize the crack, or Track deformation when modified with Time reduces train accidents.

# *REFERENCES* :

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[4]G.Tarnai, “Safety verification for traintraffic control communications”, IEEE journalon selected areas in communications, vol. sac-4,no. I, 2012.

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[9]R. Clark, S. Singh, and C. Haist, “Ultrasonic characterisation of defects in rails,” Insight, vol.44, no. 6, pp. 341–347, 2002.

[10]S.Sawadisavi J.Edwards, E.Resend, J.Hart, C.Barkan, and N.Ahuja ,“Development of a machine vision system for inspection of railroad track,” in Proc. Amer. Railway Eng. Maintenance way Assoc. Annu. 2012.