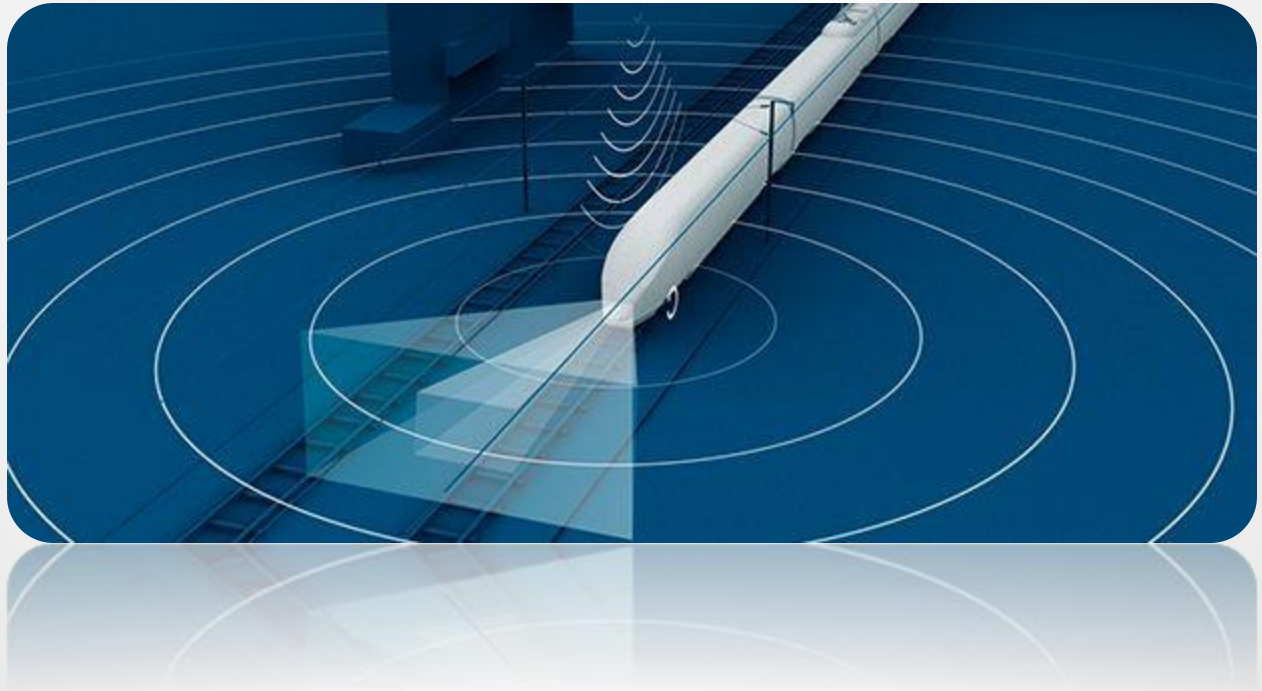
TRAIN COLLISION AVOIDANCE SYSTEM (TCAS)

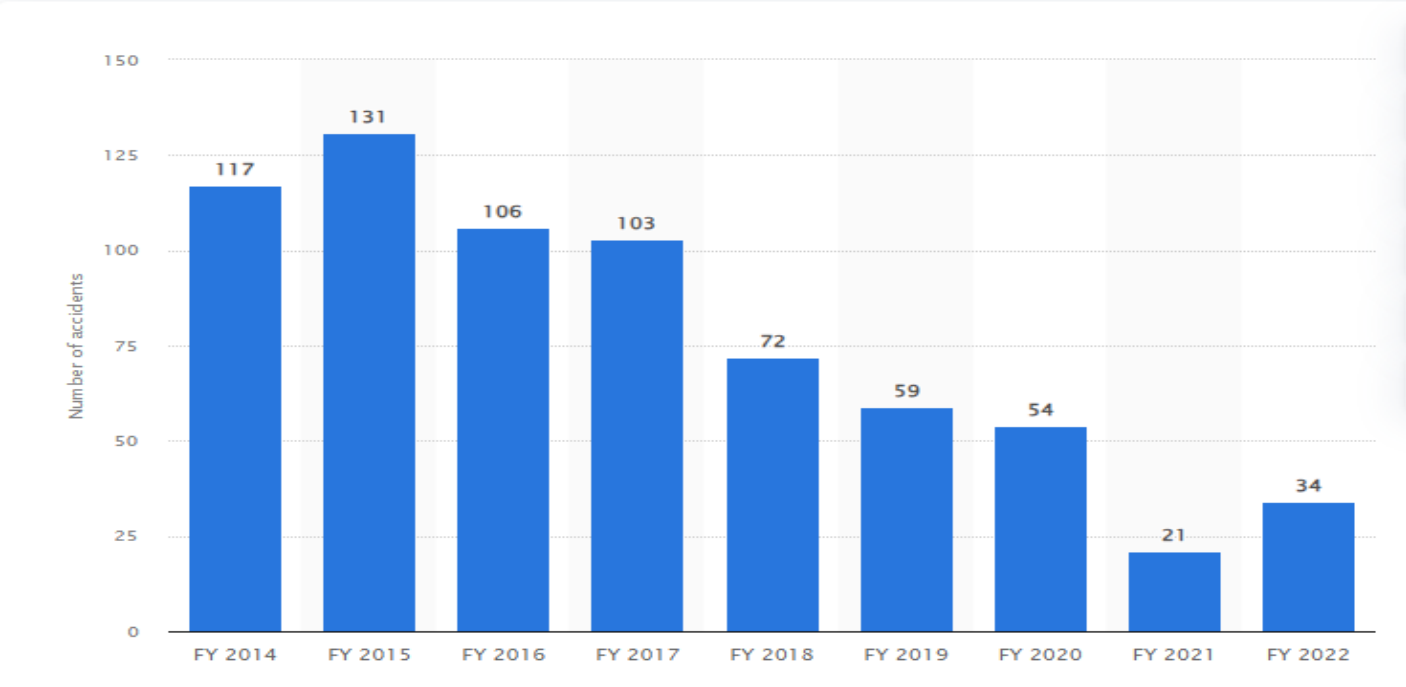


Contents

Introduction

- Rail transport plays a vital role in modern transportation networks.
- However, ensuring the safety of railway operations is paramount.
- This presentation introduces a comprehensive Train Collision Avoidance System (TCAS) designed to mitigate collision risks and enhance railway safety.
- Through advanced sensor integration, data processing, and decision-making algorithms, TCAS aims to detect and prevent potential collisions between trains, obstacles, and pedestrians on railway tracks.

Literature Survey



The number of train accidents across India was 34 at the end of financial year 2022..

Research Gap

- Train collision avoidance systems (TCAS) represent a critical component of railway safety infrastructure. However, despite significant advancements in technology, several key gaps remain in current implementations:
- Limited Sensor Accuracy
- Processing Speed
- Decision-Making Complexity
- Regulatory Compliance Challenges
- By developing more adaptable TCAS solutions, we can mitigate the risks associated with train collisions and accidents.

Problem Statement

- **Human Casualties**:
- The primary concern in railway accidents is the potential loss of human lives and injuries to passengers, railway staff, and bystanders.
- **Property Damage**:
- Collisions and derailments can result in extensive damage to rolling stock, infrastructure, and surrounding property.
- **Service Disruptions**:
- Railway accidents often lead to service disruptions and delays, impacting commuter trains, freight services, and intercity travel.

Proposed Methodology / Solution

- Arduino Uno is used as the main controller of the Train Collision Avoidance System.
- A PIR sensor continuously monitors the railway track for obstacles.
- The sensor output is processed by the Arduino in real time.
- When an obstacle is detected, the train is stopped using a servo motor.
- A buzzer is activated to generate an audible warning signal.
- An LED provides a visual alert indicating a dangerous condition.
- A 16×2 LCD displays warning messages such as **“!!! WARNING !!!”** and **“Object Detected”**.
- When the track is clear, the train resumes normal operation.
- A startup self-check ensures proper functioning of system components.

Experimental Results

- An IR was employed as a proximity switch to warn individuals when a train was approaching from a distance of approximately **500 meters away**.
- Their IR sensor automatically blinks a red light and makes a buzzing sound when something blocks it.
- On a railway track, it uses this sensor to find the train.
- It can greatly reduce railway accidents, resulting in a smoother operation of the railway and more financial success for the railway industry.

Conclusion & Future Work

- The goal of this project was to develop to help raise the bar for rail track safety and prevent train accidents at low power and reasonable price.
- The result shows that the dependability of railway safety systems will increase thanks to this brand-new, cutting-edge technology.
- The train collision avoidance system can be further developed to include GPS technology and wireless communication.
- Kavach is a cab signalling train control system with anti-collision features. It starting in 2012, by the Indian Railways Research Designs and Standards Organisation (RDSO) under the name of TCAS.

References

- Dhiraj Sinha, Farhan Feroz. Obstacle Detection on Railway Tracks Using Vibration Sensors and Signal Filtering Using Bayesian Analysis, IEEE Sensors Journal Vol. 16, Issue. 3, Feb.1, 2016.
- S. Ramesh “Detection of Cracks and Railway Collision Avoidance System”, International Journal of Electronic and Electrical Engineering ISSN 0974 -2174 Volume 4, Number 3 (2011), pp. 321-327.
- Sarath Chandran. P, Karthika. M “IOT Based Accident Prevention and monitoring System In Railways” International Journal of Advanced Research Trends in Engineering and Technology (IJARTET) VOL. 5, Special Issue 5, March 2018 .
- On Railway Track for Avoiding Accidents” International Journal of Pure and Applied Mathematics. Vol 118 No 24 2018. ISSN: 13143395

Thank You

Q/A