



## Kavach: Automatic Train Protection System

**For Prelims:** Train Collision Avoidance System, Kavach Technology, Radio Frequency Identification.

**For Mains:** Infrastructure, Mobilisation of Resources, Significance of Train Collision Avoidance System.

### Why in News?

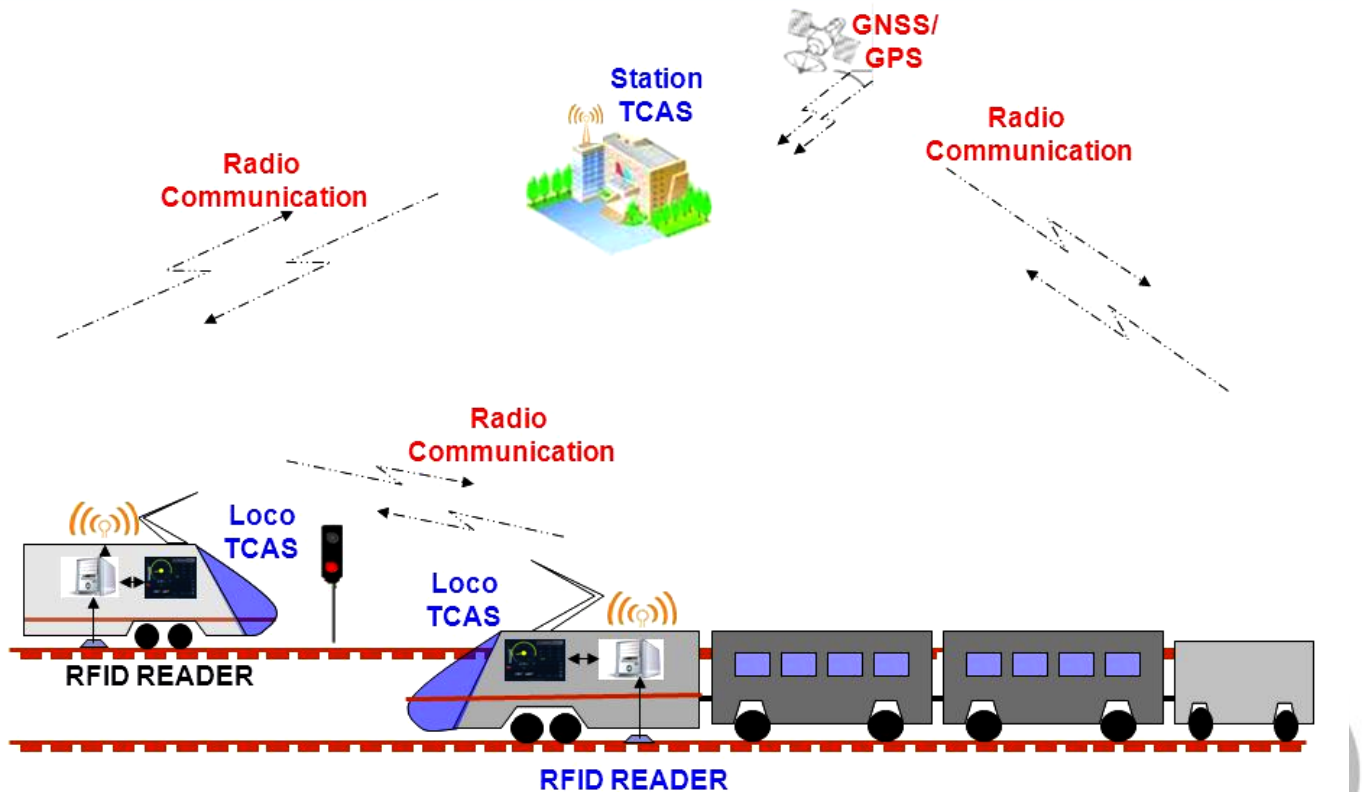
Recently, the Indian Railways tested '**Kavach**'-Automatic Train Protection System by making two trains move towards each other at full speed.

- The Kavach system was announced in the [2022 Union Budget](#) as a part of the [Atmanirbhar Bharat initiative](#). Around 2,000 km of rail network is planned to be brought under the indigenous system **to enable safety and capacity augmentation** in 2022-23.

### What is Kavach?

- It is India's own **automatic protection system**, which is in development since 2012, under the name **Train Collision Avoidance System (TCAS)**, which got rechristened **Kavach** or "**armour**".
- It is a set of **electronic devices and [Radio Frequency Identification \(RFID\)](#) devices** installed in locomotives, in the signalling system as well as the tracks.
- They connect to each other **using ultra high radio frequencies to control the brakes** of trains and also alert drivers, all **based on the logic programmed into them**.
  - TCAS or Kavach **includes the key elements from already existing, and tried and tested systems** like the European Train Protection and Warning System, and the indigenous Anti Collision Device.
  - It will also carry features of the **high-tech European Train Control System Level-2 in future**.
- The current form of Kavach adheres to the highest level of safety and reliability standard called **Safety Integrity Level (SIL)4**.
  - **SIL** comes from two voluntary standards used by plant owners/operators **to quantify safety performance requirements for hazardous operations**.
  - There are four SIL Levels (1-4). A higher SIL Level means **a greater process hazard and a higher level of protection required**.
- In the **new avatar, India wants to position Kavach as an exportable system**, a cheaper alternative to the European systems in vogue across the world.
- While now Kavach uses **Ultra High Frequency**, work is on to make it compatible with [4G Long Term Evolution \(LTE\)](#) technology and make the product for global markets.
- Work is on to make the system such that it can be compatible with other already installed systems globally.

# TCAS - System configuration



## What is the Significance?

- **Safety:**
  - The Kavach system will help **prevent accidents on rail tracks like collision of trains.**
  - Once the system is activated, all trains within a 5-km range will halt to **provide protection for trains on adjacent tracks.**
    - Currently, the loco-pilots or assistant loco-pilots have to look out for caution signs and signals.
- **Cost:**
  - It will only cost Rs 50 lakh per kilometre to operate in comparison to about Rs 2 crore worldwide.
- **Communication:**
  - It will also include stationary equipment to gather signalling inputs and relay them to a central system to **enable seamless communication with the train crew and stations.**

## What are the Initiatives Related to Railways?

- [Overhead Traction System](#)
- [Railway Energy Management Company Limited](#)
- [Transit Oriented Development](#)
- [National Rail Transportation Institute](#)

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