

## ABSTRACT

The significant increase in the use of trains as a mode of transportation in recent years shows rapid development, both in passenger numbers and advances in construction technology. However, reliance on imported trains poses a risk to domestic technological innovation, product competitiveness, and sovereignty of the products used. To overcome this challenge, prototyping of the ATP (Automatic Train Protection) system is the focus in improving the operational safety of railways.

In developing the ATP system, a comparison was made with existing solutions such as TPWS, AWS, PTC, and ETCS to understand their *advantages* and *disadvantages*. Based on the evaluation, ETCS was chosen as the standard for ATP system development due to its reliability and effectiveness. The application of ETCS is expected to bring innovation and progress in the domestic railway industry. The proposed prototype train automatic protection system utilizes FMCW radar, block detection, and an integrated *on-board* system.

It is designed with safety, efficiency, and sustainability in mind. This approach is expected to improve the operational efficiency of the train braking system, ensure compliance with safety standards, and provide a solution that can be integrated with existing train systems. Analysis of the proposed solutions showed that designing a system that combines speed radar, RFID *tags* and an odometer was considered the most optimal solution. This system provides a higher level of accuracy in data presentation, providing a basis for decision-making regarding speed reduction on trains.

Keyword : *RFID Reader, FMCW Radar, Speed Modeling, Braking Control, ATP*