# ABSTRACT

Trains are an ideal system for automation because they use a fixed guidance system, and their acceleration and braking can be predicted. Their position is detected, their direction is confirmed, and their timing is controlled. All of these factors make the automation of train control a relatively straightforward task.

In this research, the design and simulation of an automatic railway system will be conducted. The FSM system will assist in implementing Fail-Safe, which will complement the interlocking system in signaling and provide sufficient safety measures for this study. Two miniature HO scale (1:87) trains will be used, each with two stations and two tracks at each station, two locomotives, and Infrared sensors as train detectors. There will be four controllers in total, with two used as masters in the signaling system and two used as slaves to control the movement of the trains.

The results of the train control system using two locomotives have worked well, utilizing Master-Slave communication, with one master in the signaling system and two slaves in each train. The average response time for data transmission from master to slave 1 is 2.17 seconds, and for slave 2, it is 2.16 seconds. The data transmission from slave 1 to master, heading to slave 2, takes 3.11 seconds, and from slave 2 to master, heading to slave 1, takes 3.13 seconds. The trains can run on straight tracks with a maximum speed of 0.28 m/s for train 1 and a minimum speed of 0.22 m/s. For train 2, the maximum speed is 0.26 m/s, and the minimum speed is 0.21 m/s. The travel time for train one from station A1 to B1 and vice versa is 9.87 seconds, while from station A1 to B2 and vice versa is 10.02 seconds. The travel time for train 2 from station A2 to B2 and vice versa is 10.57 seconds, and from station A2 to B1 and vice versa is 11.13 seconds. Based on the results of the average response time, travel time, and speed, the design of the automatic railway system has achieved a 100% success rate in the interlocking system, with well-functioning train control.

**Keywords**: Infrared Sensor, Interlocking System, Automatic Train System, Railway Signaling, Master-Slave.