

ABSTRACT

The proposed solution to prevent the train derailment is a Load Cell-Based IoT Instrumentation System. This system aims to reduce the risk of accidents by efficiently monitoring the load imbalance on the train. It utilizes an accurate HM9B Load Cell sensor to measure load, the data obtained is amplified through an amplifier, and converted into digital data by an Analog-to-Digital Converter (ADC). The STM32F103C8 microcontroller and Visual Studio software are used to process and visualize data through a GUI interface.

Development also includes a web-based *monitoring* application that enables real-time *monitoring* of load and safety, including features for tracking location, time, and N1 and N2 calculations in data analysis. System testing on three main sub-systems, including calibration and signal amplification for accurate load measurement, real-time load *monitoring* system integration, and *Load Cell* sensor casing testing in extreme weather conditions.

The test results identified the merits and limitations of each sub-system, but this solution provides a solid basis for *monitoring* and measuring rail loads. Further development is expected to improve the performance and reliability of this system in supporting safety and efficiency in train operations.

Keywords: train, IoT, *Load Cell*, load monitoring, instrumentation system, graphical user interface.