

ABSTRACT

The railway transportation system plays an important role in driving the economy and community mobility. However, its operations still face the risk of accidents, especially at level crossings, which are often caused by human error. The development of transportation infrastructure in Indonesia, including the construction of fast trains and LRT, demands improved efficiency and safety. Therefore, an railway detection system is needed for rail inspection vehicles (Lori) to minimize risks and enhance transportation safety. This study aims to develop a prototype detection system for railway tracks using camera technology and image processing methods. The system uses a Z-Cam E2-M4 camera to capture rail images, which are then processed using an Nvidia Jetson Xavier NX Developer Kit. The image processing includes segmentation, edge detection using the Canny algorithm, and Hough Transform to identify rail lines. The optical flow method is implemented to analyze visual movement and ensure system consistency. The test results show that the system can detect railway tracks with an average accuracy of 84.9%, with the highest accuracy reaching 96.7%. Accuracy is calculated based on the combination of the number of lines detected and the orientation stability of the rail lines. The system was implemented using the Qt5 development environment for real-time visualization in every processing stage, including displaying the Region of Interest (ROI), segmentation and edge detection (Bird Eye View), overlay of detected rail lines, optical flow visualization, and flow graph display and detection accuracy. Although the system shows promising performance, this prototype still needs to be improved in terms of speed and more accurate actuator commands for determining rail direction and lane detection. This research contributes to the development and safe railway inspection system.

Keywords: *Track Detection, Image Processing, Nvidia Jetson Xavier NX, Z-Cam E2-M4, Canny Edge Detection, Optical Flow.*