Abstract

In this final task research, an investigation was conducted on a wireless Weigh-in-Motion (WIM) system based on a single accelerometer sensor axle detection. The proposed solution will result in an accurate real-time axle identification while reducing complexity and costs associated with traditional WIM systems by using cheap MEMS accelerometer with the digital signal processing technique. The performances of the systems were tested in trials conducted using two different truck types at varying speeds of 10, 15, and 20 km/h under conditions of vibration capture when the vehicles were traveling over a specially constructed pavement. A data processing pipeline, comprising normalization, audio filtering, and peak detection methods, was developed to identify axles. The conclusion was that the whole system's average accuracy was found to be only 32.32% which is optimal at medium speeds and under the "tire-on-top" dataset. Nevertheless, issues such as susceptibility to noise, low sampling frequency, and variable vibration patterns affected detection accuracy. This research highlights the promise of accelerometer-based WIM systems as a viable option for traffic monitoring. The research wraps up by pinpointing areas for enhancement, such as the development of advanced algorithms and hardware optimization, to improve system reliability and applicability in various future implementation scenarios.

Keywords: Weigh-in-Motion, Accelerometer, Digital Signal Processing, Axle Detection