ABSTRACT

Banten province bridge damage according to data from the Directorate General of Highways, Ministry of Public Works and People's Housing, throughout the year 2018, the length of bridges in Indonesia reached 3,077,159.9 km. The condition of bridges is as follows: 57.20% are in good condition, 31.35% are in fair condition, 8.57% are slightly damaged, 1.68% are heavily damaged, and 1.21% have collapsed. This study aims to design wireless Bluetooth Low Energy sensor network hardware with bridge vibration based on the ARM Cortex-M.

The research stages include designing the hardware board layout and implementing firmware onto the STM32 Nucleo hardware board. Calibration testing is conducted by measuring the acceleration along each axis while in alignment with the Earth's gravitational pull. The combination of X, Y, and Z axes results in acceleration measurements of +1 g and -1 g due to gravity. A total of 100 data points are collected for each condition and presented in a table with 10 data points.

The average error for the X+ axis is 0.008%, and for the X- axis, it is 0.001%. The average error for the Y+ axis is 0.009%, and for the Y- axis, it is 0.006%. The average error for the Z+ axis is 0.02%, and for the Z- axis, it is 0.015%. Testing of the Bluetooth radio's Receive Signal Strength Indicator (RSSI) yielded the following results: -70 dBm for a distance of 3 meters, -77 dBm for a distance of 7 meters, -80 dBm for a distance of 11 meters, and -89 dBm for a distance of 15 meters. Delay testing for Bluetooth communication showed average delays of 1.5 seconds at a distance of 3 meters, 3.7 seconds at a distance of 7 meters, and 4.1 seconds at a distance of 11 meters. Bluetooth communication is influenced by the distance and obstacles in the surrounding environment. The farther away and the more obstacles present, the greater the transmission delay.

Keywords: Bridge, Wireless sensor network, RSSI (Receive Signal Strength Indicator), Bluetooth Low Energy, delay.