Structural Health Monitoring of the Griffith Footbridge Using LoRaWAN Technology

Jessy Barber

Bachelor of Electrical & Electronics Engineering (honours)

School of Engineering and Built Environment

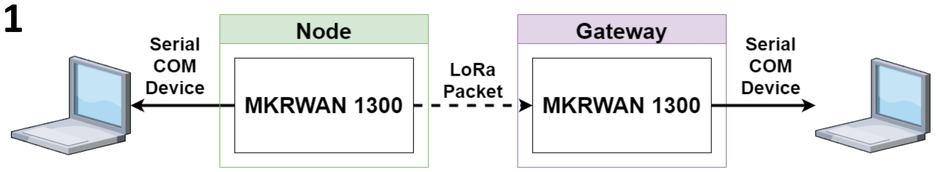
Griffith UNIVERSITY

Introduction

- LoRaWAN is an emerging technology providing a low-power, long-range communication protocol operating on the ISM radio band.
- This project uses the AU915 Frequency sub band 2 (916.8MHz – 918.2MHz), OTAA and the LNS secure sub protocol.
- The main objective is to deploy a full LoRaWAN IoT architecture to monitor the maximum acceleration and maximum frequency of the Griffith footbridge over time.

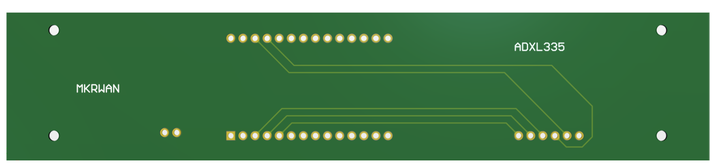
System Design

Prototype 1



Prototype 2

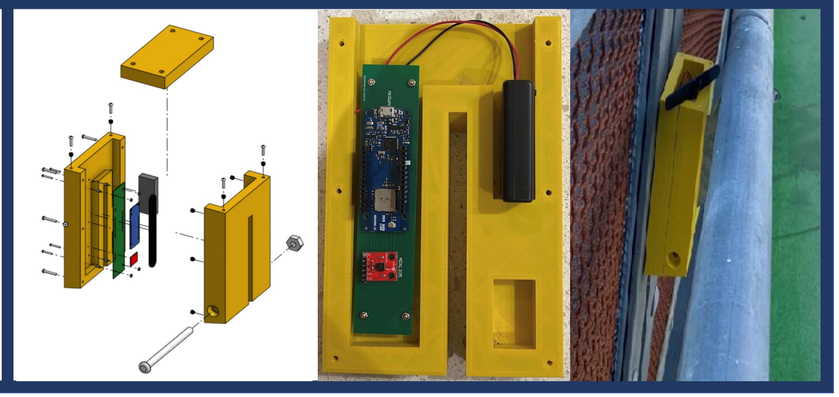
PCB Design



- Carrier board for MKRWAN1300 & ADXL335
- Size: 147.6 mm x 31 mm x 0.4 mm
- 4 x enclosure mounting holes
- Trace width: 0.254mm

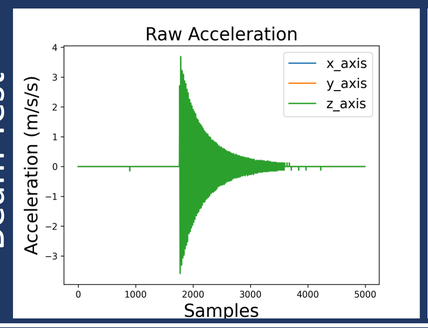
Enclosure Design

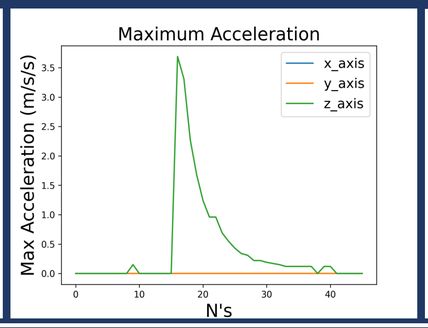
- Approved PETG 3D Filament
- Designed to sit behind handrail
- Size: 20.5 cm x 13.6 cm x 7.1 cm
- 2 x AAA batteries: 3.0 V, 1250 mAh
- Current draw: 23.8 mA -> 52.5 h

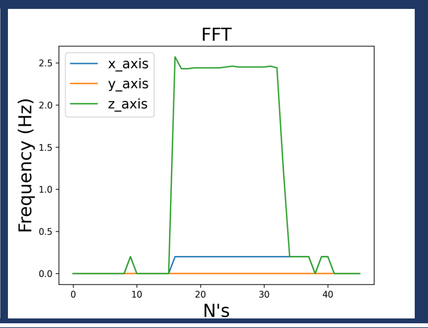


Results

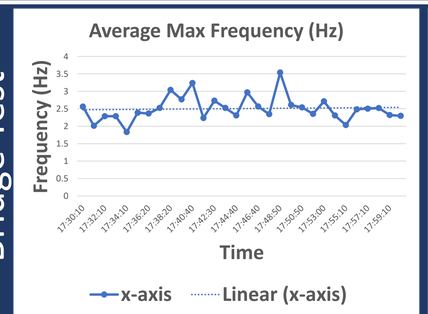
Beam Test

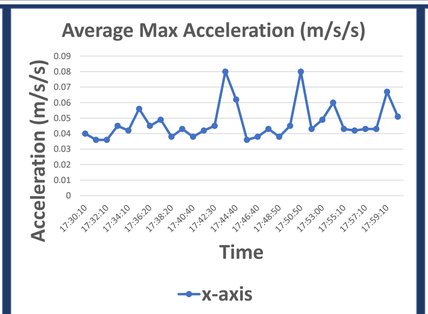


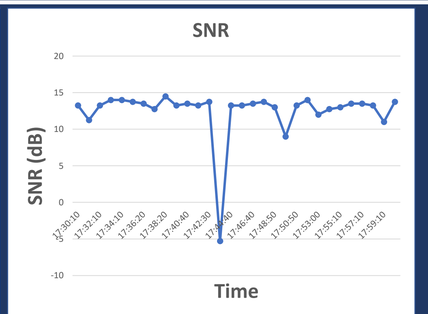




Bridge Test







Conclusion

- ✓ Reproduced FE simulation first mode frequency in beam experiment
- ✓ Validated documented first mode flexural frequency in bridge test
- ✓ Successfully demonstrated a full LoRaWAN IoT implementation
- ✓ Discovered areas of improvement for future IoT deployment
- ✓ Identified through SNR and RSSI that the antenna was too weak for long-range communication
- ✓ Demonstrated LoRa as an effective communication protocol for structural health monitoring of the Griffith footbridge