

Wireless Joint Monitoring System for Safety of Highway Bridges

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Joint Monitoring Practice



Figure 1. Damage in Expansion Joints

- Method used to monitor any defects or changes to the expansion joint.
- Proper maintenance can lower risk of failure and increase safety for users.
- Various systems on different types of bridges.
- Several monitoring system in Asia and Europe

Practice in New England: DOT Survey

- Temperature variation can cause structural changes in New England climates
- Survey from DOTs from Connecticut, Massachusetts, New Hampshire, Rhode Island, and Vermont
- Survey through Google Form

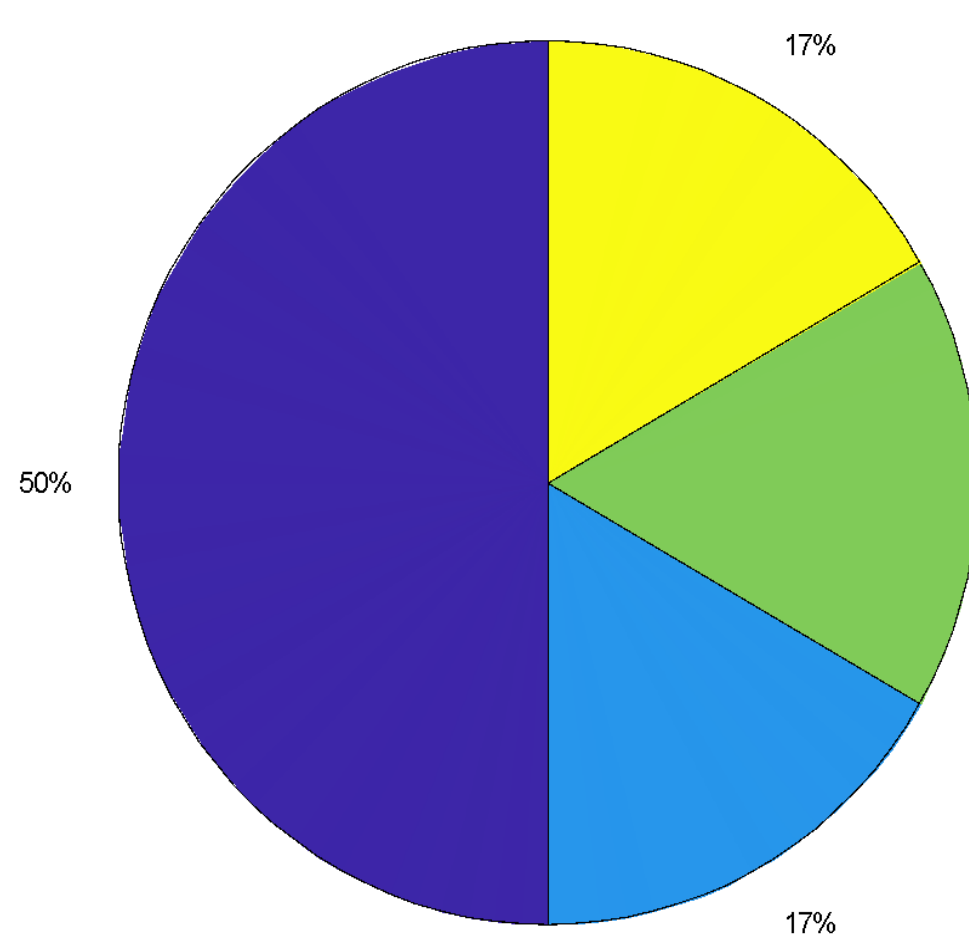
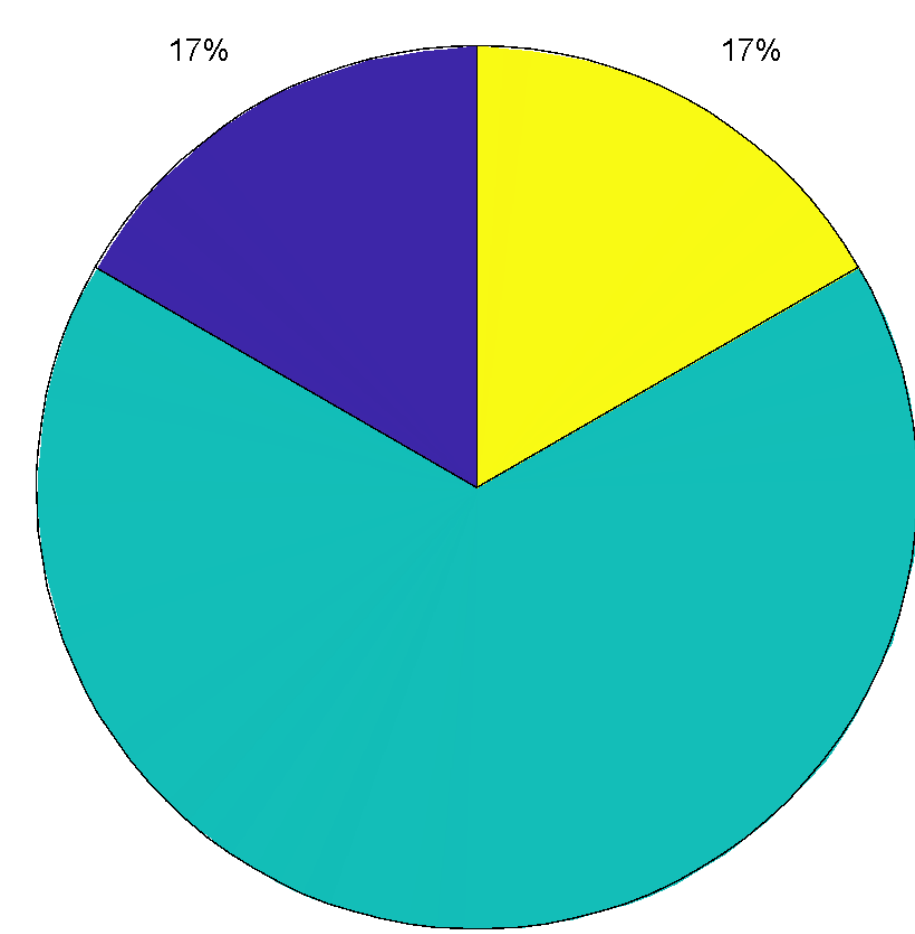
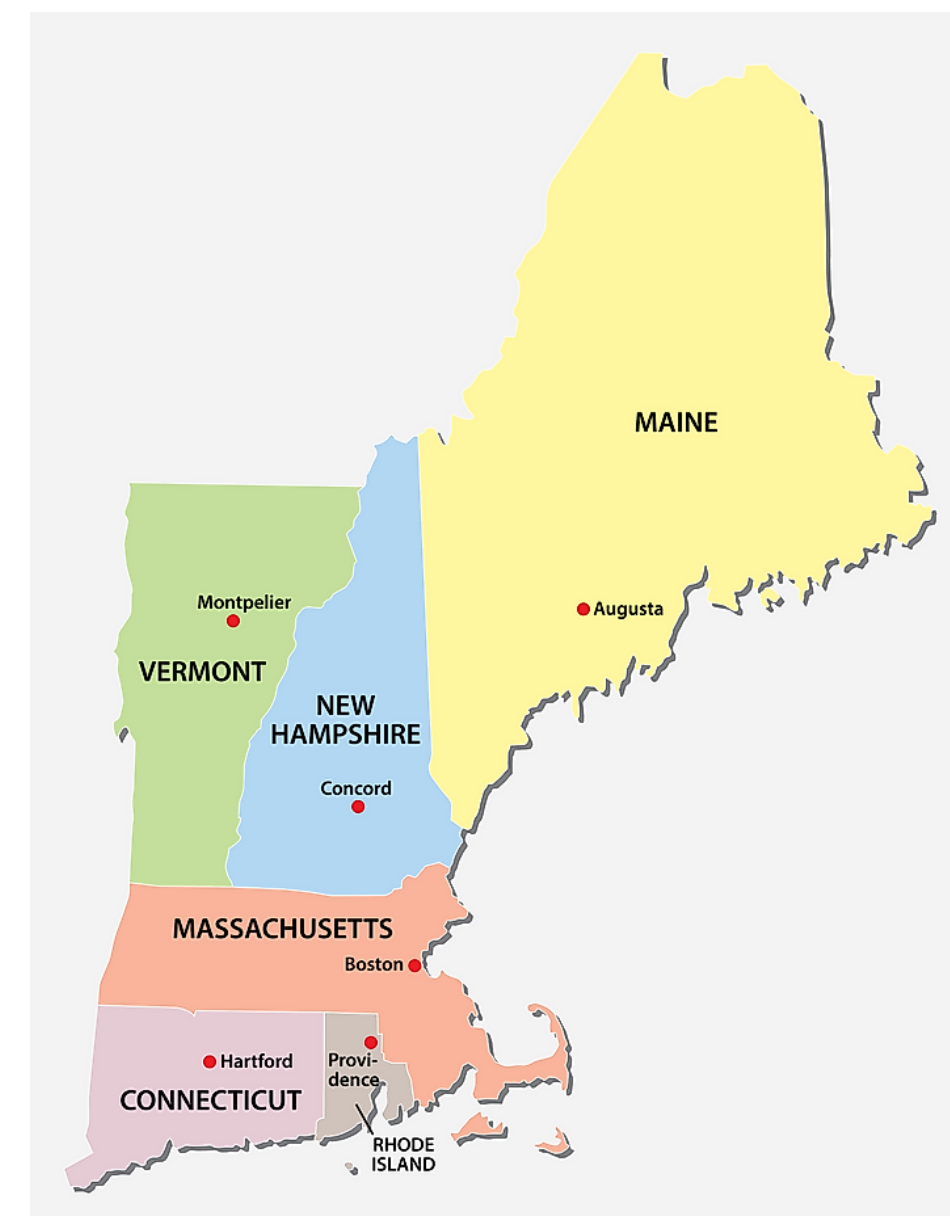


Figure 2. Survey Results (a) How often do you conduct bridge inspection? (b) Joint monitoring practice in your institution?

Sensor Development

- Arduino board samples data from its attached sensors and transmit it to CC2650 through wired serial communication.
- CC2650 read sensor data from serial and transmits the 6TiSCH gateway through wireless IEEE 802.15.4e radio.
- 6TiSCH gateway either stores the data in a local server or upload to it a cloud server through the Internet.
- Users access the local or cloud server and export data.

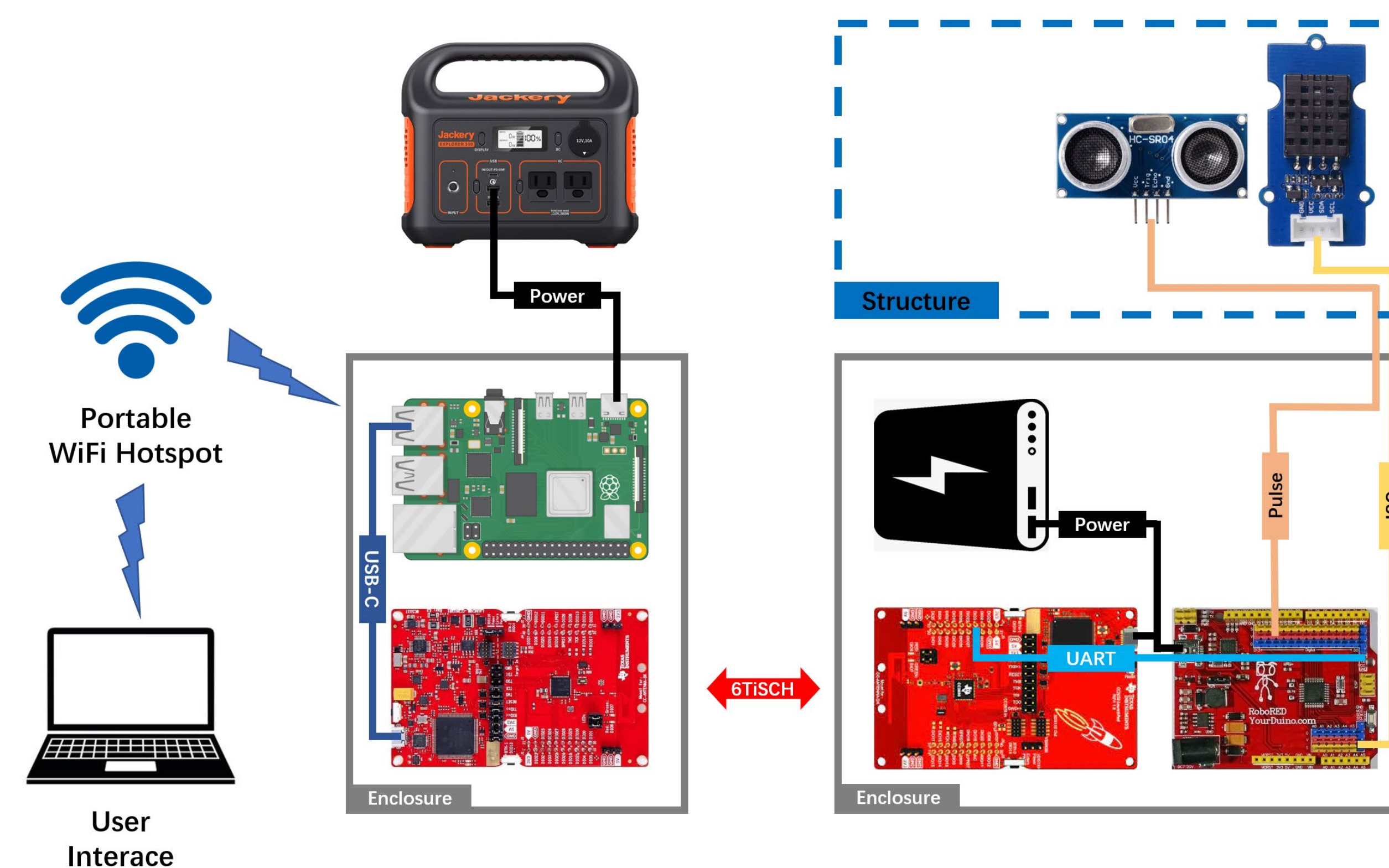
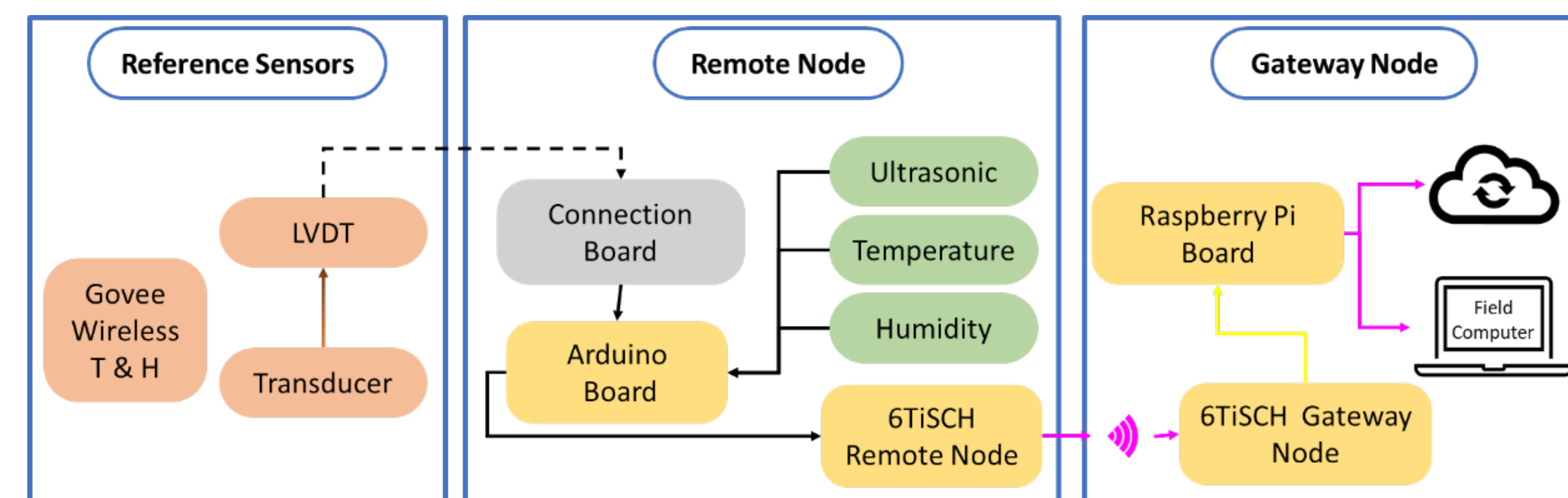


Figure 3. Sensor Schematics: Connection chart



Figure 4. Deployed devices are protected by sealed enclosures

Bridge Deployment

- 2 span steel girder bridge with concrete deck
- 195 Tolland Turnpike and Storrs Road, CT
- Crosses Willimantic River
- Built in 1959
- Total length: 151.9 ft
- Max span length: 74.2 ft
- Bridge 01531



Figure 5. Testbed Bridge in Tolland, CT

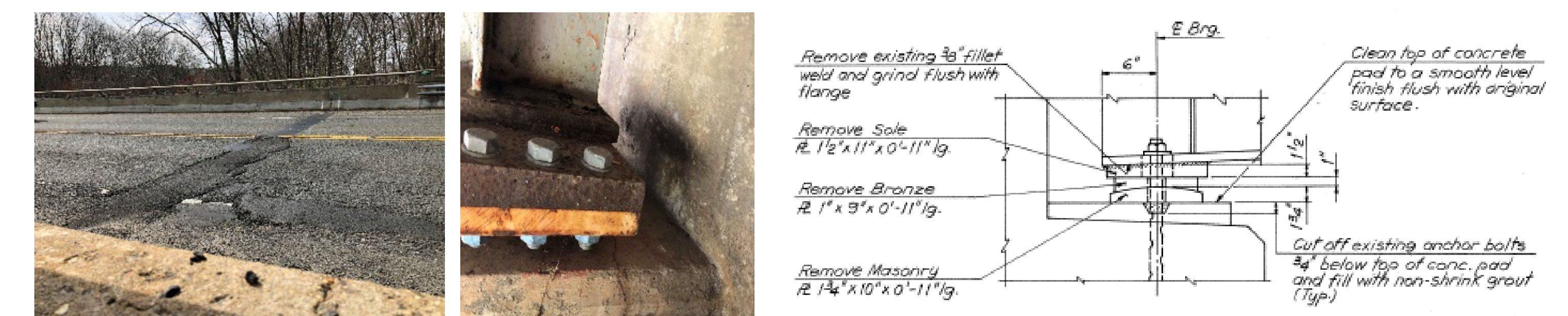


Figure 6. Expansion Joint Information

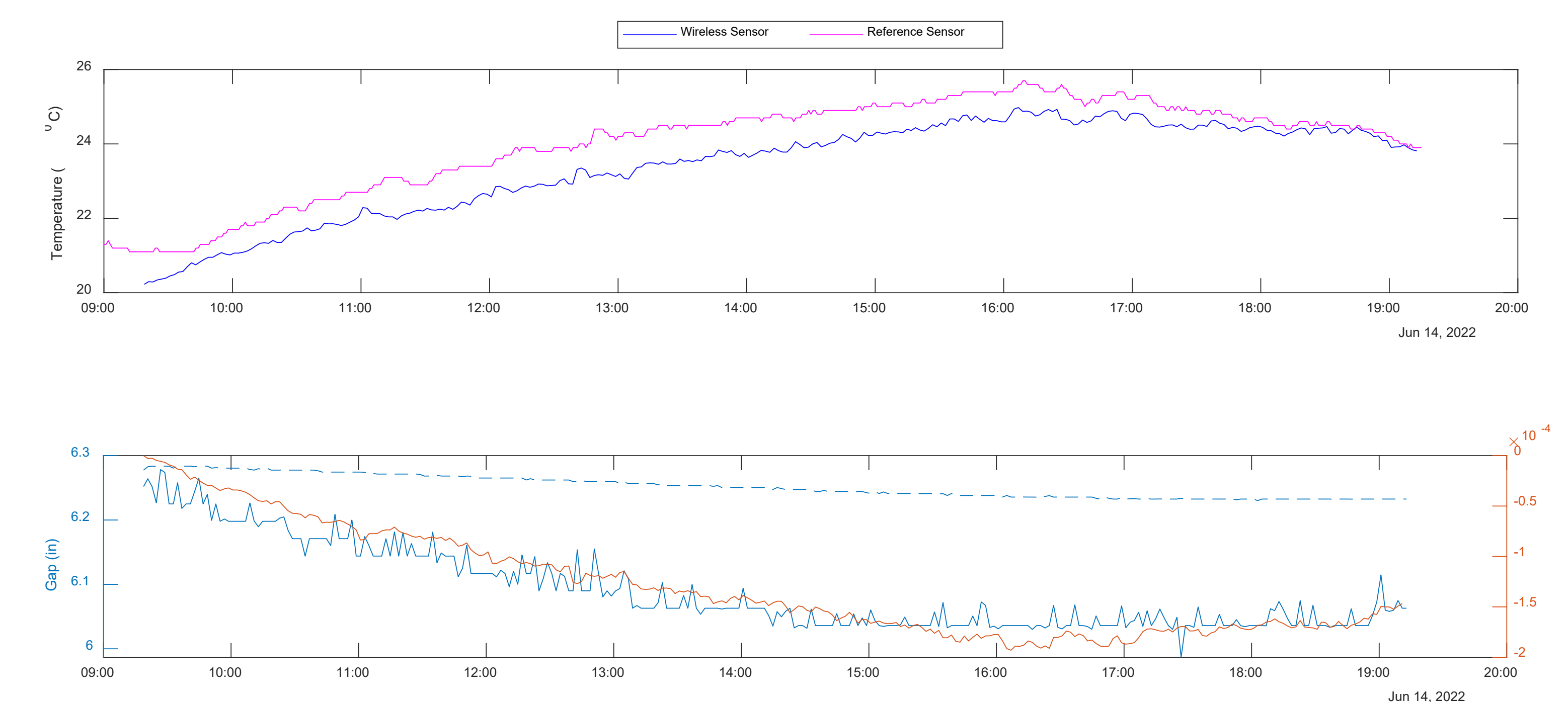


Figure 7. Day-long Measurement: top – temperature, down - displacement Measurement from LVDT and Wireless Ultrasonic Sensor