# Individual Weekly Report

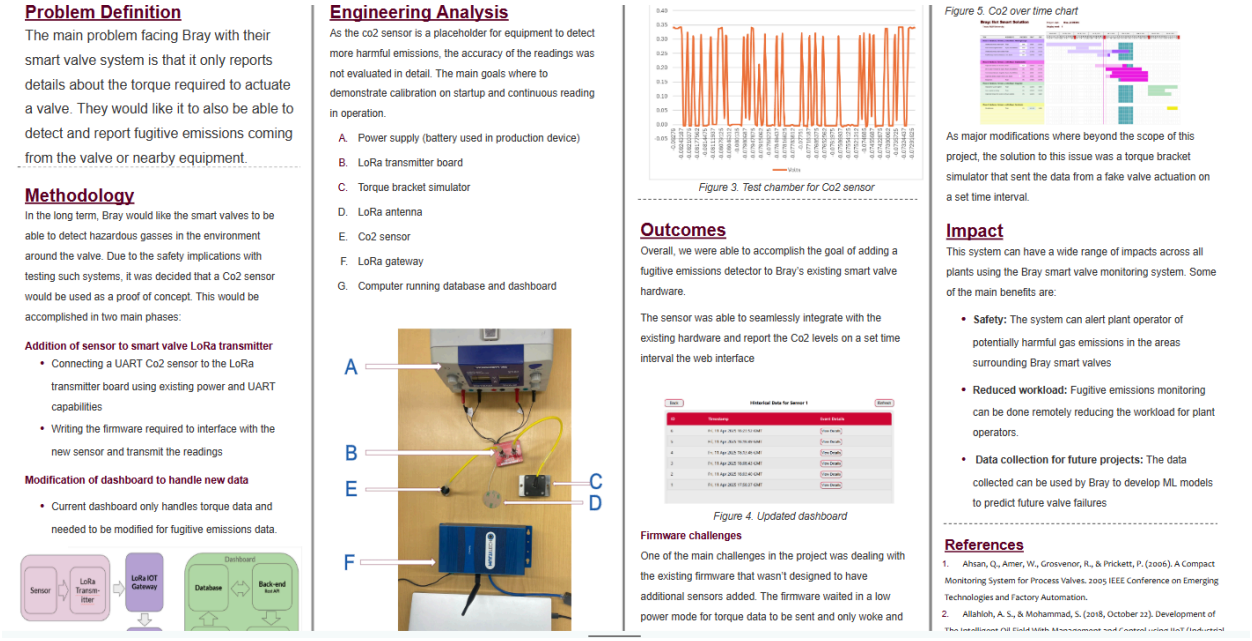
**Name: Matthew Livesay**
**Team:** Bray
**Date:** 4/14/25

## Current Status

1. What did you **personally** work on this past week?

| Task | Status | Time Spent |
|---|---|---|
| Poster | Small image tweaks still needed, | 4 hrs |
| User study | About half done | 2 hrs |
| End to end testing of project | Still needs front end tweaks | 2 hrs |
| Built testing chamber | Ugly but works | 30 min |

Include **screenshots/graphics** to illustrate what you did this past week:



### Problem Definition

The main problem facing Bray with their smart valve system is that it only reports details about the torque required to actuate a valve. They would like it to also be able to detect and report fugitive emissions coming from the valve or nearby equipment.

### Methodology

In the long term, Bray would like the smart valves to be able to detect hazardous gasses in the environment around the valve. Due to the safety implications with testing such systems, it was decided that a Co2 sensor would be used as a proof of concept. This would be accomplished in two main phases:

**Addition of sensor to smart valve LoRa transmitter**

- Connecting a UART Co2 sensor to the LoRa transmitter board using existing power and UART capabilities
- Writing the firmware required to interface with the new sensor and transmit the readings

**Modification of dashboard to handle new data**

- Current dashboard only handles torque data and needed to be modified for fugitive emissions data.



### Engineering Analysis

As the co2 sensor is a placeholder for equipment to detect more harmful emissions, the accuracy of the readings was not evaluated in detail. The main goals where to demonstrate calibration on startup and continuous reading in operation.

A. Power supply (battery used in production device)
B. LoRa transmitter board
C. Torque bracket simulator
D. LoRa antenna
E. Co2 sensor
F. LoRa gateway
G. Computer running database and dashboard





*Figure 3. Test chamber for Co2 sensor*

### Outcomes

Overall, we were able to accomplish the goal of adding a fugitive emissions detector to Bray's existing smart valve hardware.

The sensor was able to seamlessly integrate with the existing hardware and report the Co2 levels on a set time interval the web interface



*Figure 4. Updated dashboard*

**Firmware challenges**

One of the main challenges in the project was dealing with the existing firmware that wasn't designed to have additional sensors added. The firmware waited in a low power mode for torque data to be sent and only woke and

*Figure 5. Co2 over time chart*



As major modifications where beyond the scope of this project, the solution to this issue was a torque bracket simulator that sent the data from a fake valve actuation on a set time interval.

### Impact

This system can have a wide range of impacts across all plants using the Bray smart valve monitoring system. Some of the main benefits are:

- **Safety:** The system can alert plant operator of potentially harmful gas emissions in the areas surrounding Bray smart valves
- **Reduced workload:** Fugitive emissions monitoring can be done remotely reducing the workload for plant operators.
- **Data collection for future projects:** The data collected can be used by Bray to develop ML models to predict future valve failures

### References

1. Ahsan, Q., Amer, W., Grosvenor, R., & Prickett, P. (2006). A Compact Monitoring System for Process Valves. 2005 IEEE Conference on Emerging Technologies and Factory Automation.
2. Allahloh, A. S., & Mohammad, S. (2018, October 22). Development of

Computer Engineering Students

Tasks:

- View sensor event details
- Sort data by event ID
- View one of the specific events with the torque data graph
    - What is the max torque?
- Refresh the Sensor event details page
- Find the summary graph sections with “Battery Voltage” and “Max Torque” Graph

## Pre-Study Q

**What features do you expect in a monitoring dashboard with torque data and co2 emissions?**

- Sam- Current percentage, clear color indicators indicating health or warnings, historical data, reports page
- Pravar- Clear graphs, term definitions available, relevant information on what good valve health
- Chris- Dangerous level indications, Historical data
- Will- lots of data available immediately
- David- Visually distinctive data
- Kevin- Threshold settings of what is “good”, alert systems, and real-time updates, neat graphs, csv export option
- James- current sensor data, thresholds of quality, historical data
- Easton- detailed sensor data readings, danger indications, alerts
- Alex- alerts, historical data, sensor data graphs

## Post Study Qs

**How easy was it to navigate the dashboard? (Scale: 1-5)**

Number of instances


2. What problems did you run into? What is your plan for them?
    a. Challenges with getting the data from the database to display on the front end properly. Just need to spend some more time working on it.

3. What is the current overall project status from your perspective?
    a. Firmware and data transmission is working well, still need to get the front end working (Abdiel should have it today). I also developed the demo that will be done in the various

expos.

4. How is your team functioning from your perspective?
    a. Not working as well. I think some of the teammates think that they've done their fair share of the work and now are not working nearly as much on the project.

5. What new ideas did you have or skills did you develop this week?
    a. Learned about end to end testing and integration. Learned a lot about how gasses are measured in the atmosphere and how to convert

6. Who was your most awesome team member this week and why?
    a. Abdiel for working a lot in the front end issues that we are encountering. Alex is also spending a lot of time working on the MQTT issues and in general supporting the team a lot with the user studies and report elements.

**Plans for Next Week**

Finalize the poster
Present at the CS capstone fair
Finish user studies
Demo to Bray sponsors