

Individual Weekly Report

Name: Aysen De La Cruz

Team: Bray IIoT Smart Solution

Date: 04/14/2025

Current Status

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

Task	Status	Time Spent
This weekend, I worked on minor changes to our poster	Completed	1 Hrs

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




TEXAS A&M UNIVERSITY
Engineering

Bray IIoT Smart Solution

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Booth Number: 409



TEXAS A&M UNIVERSITY
Department of Computer
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Problem Definition

The main problem Bray is facing 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 detect and report fugitive emissions coming from the valve or nearby equipment.

Methodology

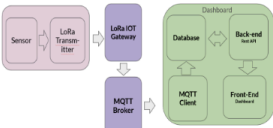
In the long term, Bray would like the smart valves to be able to detect hazardous gases in the environment around the valve. Due to the safety implications with testing such systems, it was decided that a Co2 sensor would be used as a proof of concept. This would be accomplished in two main phases:

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 were to demonstrate calibration on startup and continuous reading during operation.

- Power supply (battery used in production device)
- LoRa transmitter board
- Torque bracket simulator
- LoRa antenna
- Co2 sensor
- LoRa gateway
- 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 at a set time interval the web interface



Figure 4. Updated dashboard

Firmware challenges

One of the main challenges in the project was working with the existing firmware, which wasn't designed to support additional sensors. The firmware remained in a low-power mode, waiting for torque data to be sent, and only woke up, returning control flow to the user, when it received UART packets from the torque sensor on a separate board.



Figure 5. CO₂ over time chart

As major modifications were beyond the scope of this project, the solution to this issue was to use a torque bracket simulator that sent data from a simulated valve actuation at set time intervals.

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 operators 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 machine learning models to predict future valve failures

References

1. Ansan, 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 The Intelligent Oil Field With Management and Control using IIoT (Industrial Internet of Things). IEEE.

Acknowledgements

Raul Garcia, Oscar Manzano, Previous capstone team

2. What problems did you run into? What is your plan for them?

None. I was able to work on everything I needed this week due to everything being mostly busy work.

3. What is the current overall project status from your perspective?

We noticed one last feature at the expo this Thursday that we thought would be worth adding, which could be done in a day, so after that, we are done and will move on to finalizing things like code documentation, testing, and final presentations.

4. How is your team functioning from your perspective?

Our team functions well, now that most work is done, the work can be split up nicely and evenly, so not too much conflict.

5. What new ideas did you have or skills did you develop this week?

I think over the last week I was able to develop my presentation skills. The CS showcase really helped me freshen up on presenting to a bigger audience.

6. Who was your most awesome team member this week and why?

My most awesome teammate was Matthew, who printed the poster, as well as worked really hard on it.

Plans for Next Week

What are you going to work on this next week?

Im going to implement the last feature we need, as well as refactor the firmware and get it ready to send to Bray.