

Project Statement & Goal

- Issue**
Traditional beacon systems at Hytek only provide basic visual signals and do not identify issues, notify support teams, or track response times. Communication delays and slow issue resolution increase downtime and reduce manufacturing efficiency surface-finishing operations.
- Goal**
Develop a rugged, touchscreen-enabled smart beacon system to improve operator communication, issue tracking, and real-time support response.

Objectives

- Four-state** beacon system:
 - Normal Operations
 - Reduced Capacity
 - Down
 - Support Needed/Routine Maintenance
- Touchscreen UI** for issue reporting and support team selection.
- Real-time alerts** through email, Microsoft Teams, and SMS.
- Database logging** for issue history, response times, and operational analysis.
- Durable industrial design** resistant to chemicals, moisture, vibration, and impact.
- Modular mounting** and scalable architecture for future facility-wide deployment.

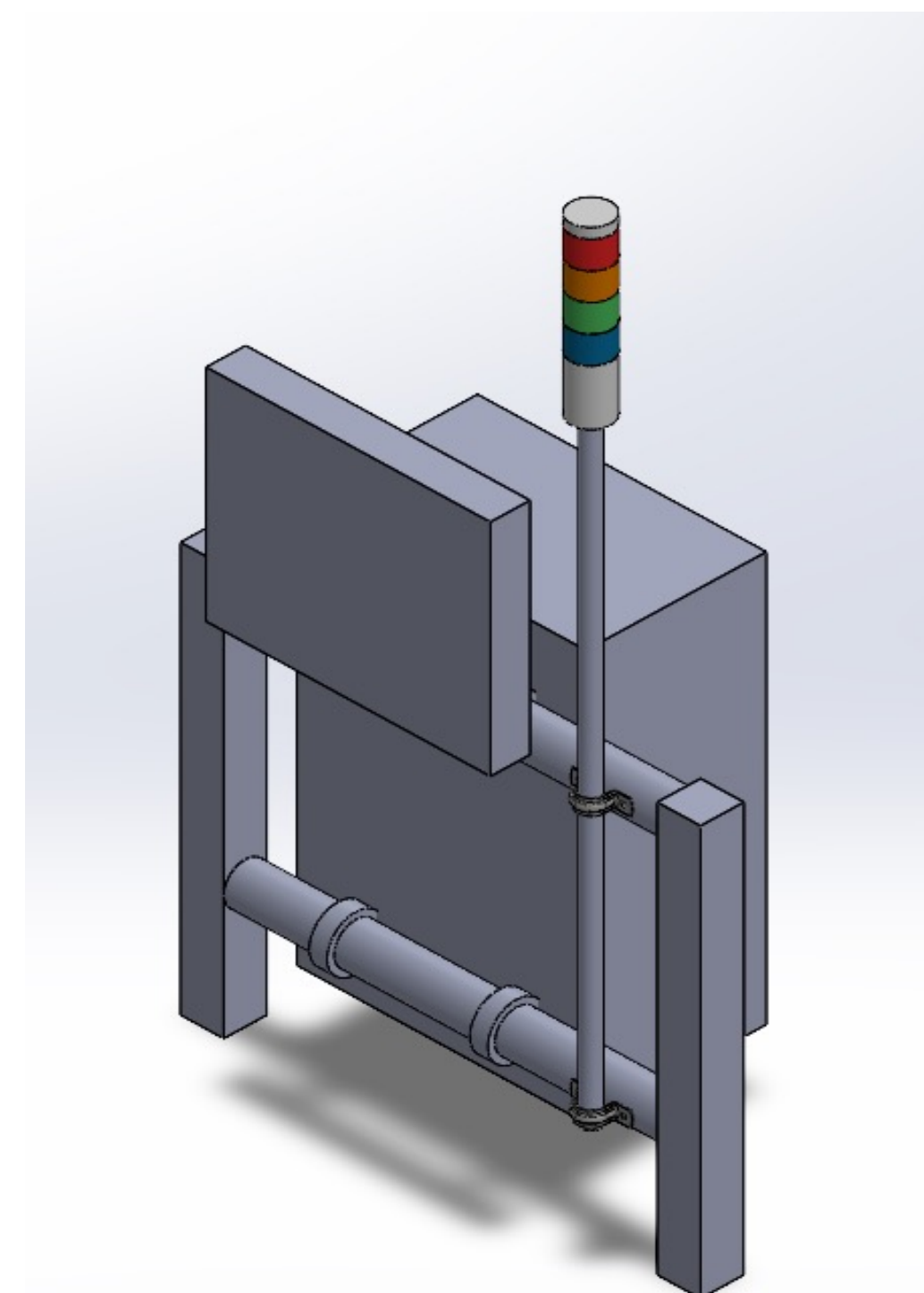


Figure 1. CAD model of Smart Beacon System

Environmental Constraints

- Junction box protection** shields electronics from the plant's harsh operating environment.
- Sealants** prevent moisture buildup in gaps and exposed connection points.
- Talk about wire-
- Single Ethernet cable** provides both device power and server connectivity, reducing extra wiring and trip hazards.
- Secure wiring connections** reduce failure risk from vibration, stress, and rough environmental conditions.

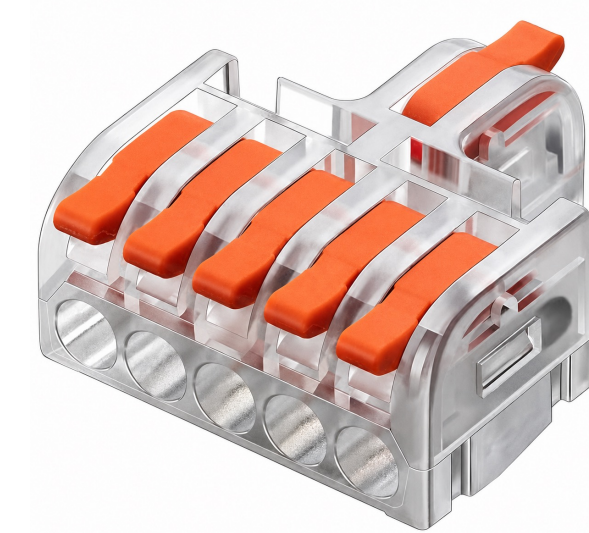


Figure 2. Wire connectors for secure and reliable connections [1]



Figure 3. Junction Box [2]

System Design

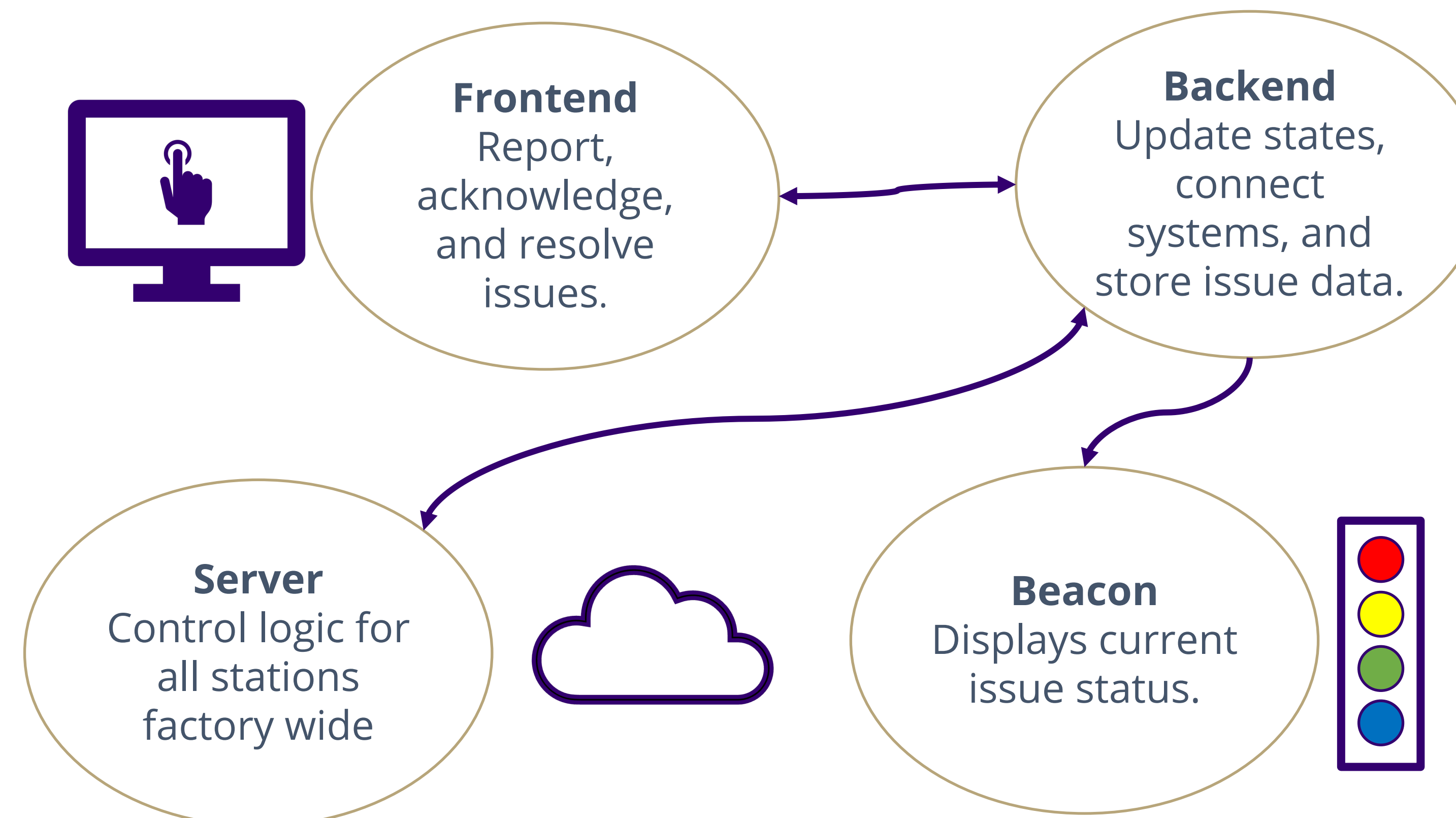


Figure 4. Smart Beacon System design interaction

User Experience Overview

- Designed touchscreen UI** for operators, maintenance, and managers.
- Simplified issue reporting** with team routing and issue logging.
- Added badge-scan login** for faster operator access.
- Synced tank colors** with physical beacon states.
- Included scalable features** like auto logout, tank pages, and status indicators.
- Optimized touchscreen** use for operators wearing gloves.

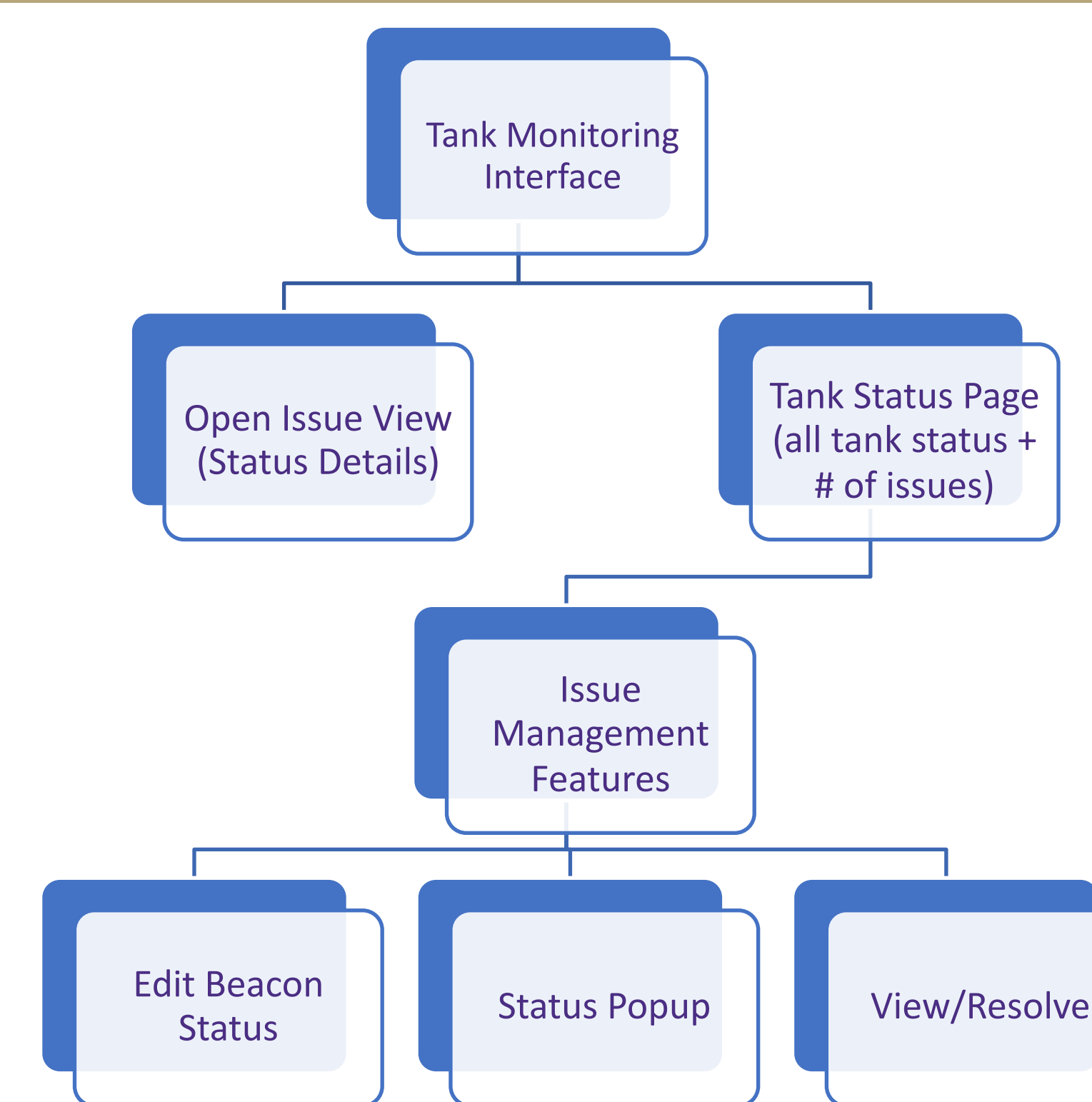


Figure 5. UIUX tank monitoring design flow

Floor Operator View

- Beacon stack(s)
- Tank(s) that are specific to the chosen beacon stack
- View the issues that were created under a specific tank
- Create issue(s) then waits for a supervisor to approve of the issue(s)



Figure 6. Final operator process workflow

Support Staff View

- Same access as supervisors, without issue approval/edit permissions.
- Technicians are notified after supervisor approval, unless called in emergency.
- Only assigned team members can resolve issues.

Supervisor View

- Includes all support staff functions plus supervisor controls.
- Issues appear only after supervisor approval.
- Can edit, escalate, approve, or close issues.
- Access additional teams including Lab, Quality, and Engineering.

Feature/Access	Operator	Support Staff	Supervisor
Require VSM approval	✓	X	X
Receive notifications	X	✓	✓
Resolve issues	X	✓	✓
Edit Issues	X	X	✓
Approve issues	X	X	✓
Level 2 support	X	✓	✓

Table 1. User View Comparisons

Conclusion

- Improved communication, coordination, and issue tracking** on industrial treatment lines through a centralized smart beacon monitoring system.
- Integrated industrial beacon hardware with a touchscreen** kiosk for real-time issue reporting, team notifications, and issue tracking.
- Designed with **usability, scalability, durability, industrial safety**, and future PLC integration.

Future Work

- Create server-side API endpoints
- Integrate additional beacons across production lines for full-scale facility deployment.
- Support future PLC integration as factory automation expands.
- Develop real-time alerts for employee personal devices.
- Deploy complete alert system into facility operations.

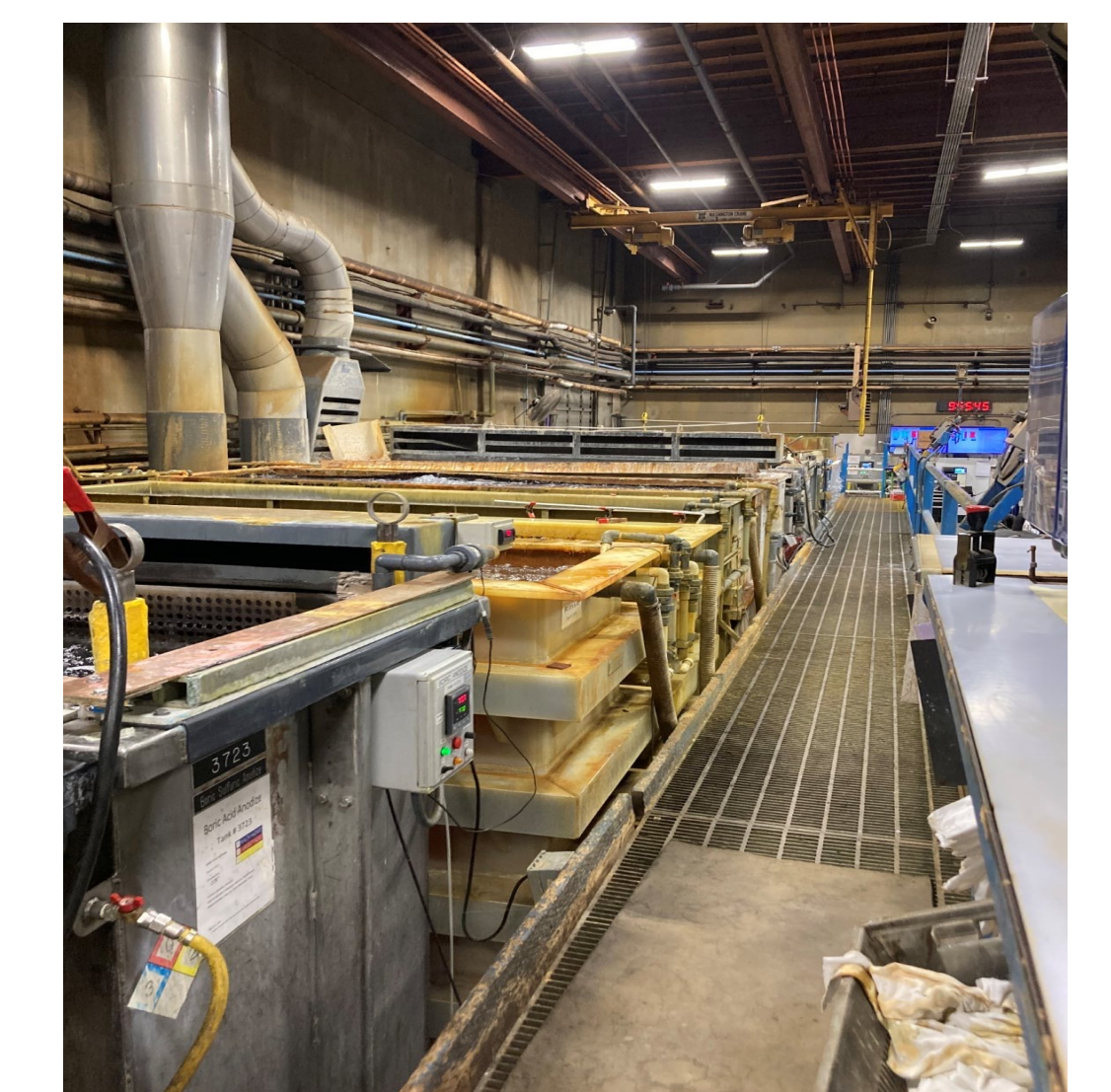


Figure 7. Industrial treatment line environment

References, and Acknowledgments

U.W. Faculty: Payman Arabshahi Teaching Assistant: Zach Hao
 [1] GKEEMARS, "Mini Wire Splicing Connector DIY Connectors 1 in 3 out Clear Cover," photograph. [Online].
 [2] Amazon: Steel Electrical Junction Box [https://www.amazon.com/Electrical-Enclosure-Waterproof-Dustproof-Universal/dp/B0D958QBYT?th=1]