

Autonomous Livestock Management System

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Introduction

The current livestock management systems require constant supervision and care for the animals. This requires, cleaning, feeding, and waste management, The scope of this project is to improve this process by creating a fully autonomous system where the ranch is self-sufficient.



Figure 1. Exterior and Structure of Barn

Background/Purpose

This system was created to create a more efficient, safe, and sustainable functional process. There is machinery/robots already created, but they are not all interconnected and work together autonomously and simultaneously. This automated system minimizes product waste and increases efficiency by decreasing time to accomplish tasks.



Figure 4. CAD Model Representation

Methods/System Design

The design of this system heavily relied on the cows "internal clock", where cows can comprehend a schedule and stick to it like knowing it's feeding time. The system design required sequential logic (processes/protocols) more so than unique decision making, since a rancher would normally go through a routine. Functional block diagrams display the path each section of the barn that is automated and the decisions made within each path.

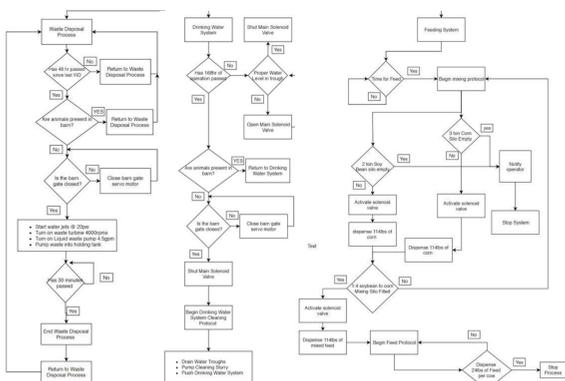


Figure 2. Functional Block Diagrams of the Feeding, Cleaning, and Waste Management Protocols

Results

This project was greatly successful in creating and demonstrating a full integrated livestock management system. The PLC programming showed consistent successful outcomes which tested the functionality and processes in a sequential manner, as ladder logic functions were used. This PLC code was effective in controlling an autonomous livestock system with various instrumentation.



Figure 5. Interior of Barn with Plumbing/Internal Processes



Figure 3. PLC Ladder Logic on SLC500

Recommendations/Conclusion

As a recommendation, when ordering materials/designing subsystems, it is imperative to think of all parts/components working functionally together, not independently.

Acknowledgments

Meeting outside of the course time given and time management was very important for this project's success.

References

Oberschätzl, Rosemarie, and Bernhard Haidn. "DLG Expert Knowledge Series 398: Automatic Feeding Systems for Cattle." DLG E.V. - DLG Expert Knowledge 398: Automatic Feeding Systems for Cattle, DLG E.V. Competence Center Agriculture and Food Business, July 2014, www.dlg.org/en/agriculture/topics/expert-knowledge/dlg-expert-knowledge-398-automatic-feeding-systems-for-cattle/.