Human Machine Interface for Remote Sensing

Overview
Alcoa Inc. uses an automated system in which corrosive chemicals are filled into a storage tank and are then used during the painting of aluminium process. This system does not allow for operators to be able to monitor the status of the tank. The team was tasked with making improvements to this system which would allow for operators to safely and remotely monitor the current level of chemicals within the tank.

Objectives
- Integrate a Human Machine Interface (HMI) into the established system, which contains an ultrasonic sensor for measuring the liquid level.
- Have HMI display messages alerting the operator to the current state of the tank, e.g. “tank filling” or “tank ready for use.”
- Design a fail-safe to prevent the over-filling of the tank.
- Create a small-scale model of entire system to demonstrate its operation.

Approach
- Performed a visit to Alcoa’s Lancaster, Pa site to see the current system in place.
- Researched various HMI’s to determine one with best compatibility with Flowline EchoPod ultrasonic sensor.
- Researched ladder logic and functional block diagram programming which is needed to program the HMI.
- Researched operation of relays, necessary for inputs and outputs on HMI.
- Simulated our HMI program in function block diagram software.
- Designed fail-safe, using floating-level sensor, to diverge power from system when liquid level reaches the maximum height of tank.
- Purchased the materials and components for building of the small-scale model.
- Integration and testing of all parts of completed model.

Outcomes
Results of this project allow Alcoa to:
- Improve upon a vital system for their aluminium painting process/
- Provide a safer environment for their operators and facility.
- Monitor levels of corrosive chemicals inside tank from a remote location.
  - Remote monitoring of tank saves operators time.

Figure 1: Small-scale model of improved system