Water Level Detector Proof of Concept (PoC)

Submitted to Aliaxis

Authors:

Yunbo Hu

Damian Lee

Hawon Ryu

Aldonza Watt

Team 16

Date: 26th April, 2024.

Abstract

This project, commissioned by Aliaxis, involves an analogue system designed to detect water level in a water tank. The system consists of a vertical probe, a transmitter and a receiver. The transmitter transmits a signal to the receiver using red light. The report comprehensively elaborates the water level probe and the designs of both the transmitter and the receiver. This report also outlines the evaluation of the prototype, its range, stability, and accuracy.

Table of contents

1. Introduction
   1. Client requirements
   2. Design tools and methodology
2. Water Level Probe
   1. Operation principles
   2. Optimised configuration
   3. Accuracy
3. Transmitter and Receiver
   1. Design of transmitter
   2. Minimization of signal loss
   3. Maximization of range
   4. Design of receiver
   5. Signal capture arrangement
4. Recommendations
   1. Battery
   2. Solar charging system
   3. Other recommendations
5. Conclusions

References

Bibliography

Appendix A – Bill of materials

Appendix B – Solar energy calculations

Introduction

Our client, Aliaxis, requested an analogue system designed for detecting the water level of the water tank. Our goal for this project is to maximise the range of the transmission between the transmitter and the receiver, and minimise the signal loss during the transmission. For this project, there is no constraints in size and budget of the analogue system design, however, there are requirements that were requested by the client.

Client requirements

Our team has asked for a few requirements for the design of the project. This involves accuracy, compliance, system stability, transmission (Tx) range and battery life.

Accuracy: We conducted an analysis to determine the accuracy needed by the system sensor converting the water level values into electronic measurements.

Compliance: Device must transmit data without RF emissions to avoid the system needing to meet and be tested to the international standards.

System stability: We are expecting that the system measurement is stable enough to be used as an input.

Transmission (Tx) Range: We expect that the transmission range can be as far as possible to transmit the signal from the transmitter to the receiver.

Battery life: We will determine the power requirements for a solar charged battery.

Design tools and methodology

In this project, our team used software for designing and simulating. FEMM was used to simulate the dielectric material of the water level probe, we compared the accuracy of the probe using 2 different materials. In addition of using software for design tools, we used LTSpice to simulate the circuit for the transmitter and receiver of the project, with

1. Water Level Probe
   1. Operation principles
   2. Optimised configuration  
      We were given 2 options for the dielectric material of the probe, silicone rubber and polyvinyl chloride (PVC). After using the
   3. Accuracy