**System Design Document:**

RF Direction of Arrival System

Dalton Mitchum

Sylvie Sorese

Ryan Clayton

Icon

Description automatically generated

|  |  |
| --- | --- |
| Version | Date |
| V1.1 | 10/01/2020 |
|  |  |
|  |  |

**Contents**

**1 Introduction**

1.1 Purpose and Scope . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

1.2 Project Executive Summary . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

1.2.1 System Overview . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

1.2.2 Design Constraints . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

1.2.3 Future Contingencies . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

1.3 Document Organization . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

1.4 Project References . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

1.5 Glossary . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

**2 System Architecture**

2.1 System Hardware Architecture . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

2.2 System Software Architecture . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

2.3 Internal Communications Architecture . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

**3 Human-Machine Interface**

3.1 Inputs . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

3.2 Outputs . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

**4 Detailed Design**

4.1 Hardware Detailed Design . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

4.2 Software Detailed Design . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

4.2.1 Base Station Subsystem . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

4.2.2 Communication Subsystem . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

4.2.3 Demodulation System . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

4.2.4 Telemetry Subsection . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

4.3 Internal Communications Detailed Design . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

**5 External Interfaces**

5.1 Interface Architecture . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

5.2 Interface Detailed Design . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

**6 System Integrity Controls**

**1 Introduction**

**1.1 Purpose and Scope**

The purpose of the System Design Document is to describe the system requirements, system architecture, human-machine interfaces, detailed design, and external interfaces.

**1.2 Project Executive Summary**

1.2.1 System Overview

The goal of the Radio Frequency (RF) Direction of Arrival System is to design an affordable system that detects the directions of arrival of an RF propagating wave, in the ISM band, with the intention of eventually being used in a classroom setting.

1.2.2 Design Constraints

The project is limited to two major factors, budget and components. The total cost of components shall not exceed $1,500. For the project, the components will be purchased from online vendors if possible. The goal is to avoid constructing components as much as possible so that the project can be recreated by someone else.

**2 System Architecture**

**2.1 System Hardware Architecture**

Insert text here.

Diagram

Description automatically generated

Figure 1. – Block Diagram of System Overview

Shape, polygon

Description automatically generated

Figure. 2 – Basic Antenna Array and Positioning

Diagram

Description automatically generated

Figure. 3 – RF Antenna Switching Layout