**System Requirements Specification**

**RF Direction Detection**

**CEC/EE 420 Fall 2020**

Team Name: RF Direction Detection Team 2

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**Section 1: Introduction**

System to be Produced:

* The design of an affordable system that detects the direction of arrival of a radio frequency (RF) propagating wave, in the ISM band, with the intention of eventually being used in a classroom setting.

Definitions, Acronyms, and Abbreviations

* AP-S - Antennas and Propagation Society
* CT - Continuous Time
* DoA - Direction of Arrival
* ERAU - Embry-Riddle Aeronautical University
* IEEE - Institute of Electrical and Electronics Engineers
* ISM - Industrial, Scientific, and Medical
* RF - Radio frequency
* SDR - Software Defined Radio

**Section 2: Product Overview**

Assumptions:

* The project will be affordable, well under $1500. It is assumed that the system will detect the incoming signal and process it to determine the DoA

Stakeholders:

* Dr. Eduardo Rojas, an assistant professor of Electrical and Computer Engineering at ERAU, is the customer for the project. Dr. Rojas provided project specifications and requirements that originated from the IEEE AP-S Student Design Contest Array for DoA Detection and Visualization
* Dr. Jianhua Liu, an associate professor of Electrical and Computer Engineering at ERAU, is the professor evaluating SCRUM process of the project
* Justin Parkhurst, an electrical engineering graduate student at ERAU, is our product owner

Event Table:

|  |  |  |  |
| --- | --- | --- | --- |
| Event Name | External Stimuli | External Responses | Internal data and state |
| Starting | Flipping switch on | System initializes procedures to receive and process a signal | Ready to receive signal |
| Receiving | Device generating the 5GHz signal | N/A | Unfiltered and non-amplified CT analog signal |
| Filtering | N/A | N/A | Filtered and non-amplified CT analog signal |
| Amplifying | N/A | N/A | Filtered and amplified CT analog signal |
| Processing | N/A | N/A | Converting analog signal to digital signal |
| Displaying | N/A | Display DoA | N/A |
| Repeating | N/A | Repeat events for a new signal | Receiving |

Case Diagram:

A picture containing box and whisker chart

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**Section 3: Specific Requirements**

* 1. Functional Requirements
     1. The system shall prevent a signal from being detected by more than antenna by using copper deflectors
     2. The system shall be able to receive a 5GHz signal for interpretation using the antenna array
     3. The system shall switch between which antenna is currently inputting data into the system
     4. The system shall filter out noise using the bandpass filters
     5. The system shall amplify the signal through the LNA
     6. The system shall process signal from analog to digital through the SDR
     7. The system shall analyze the signal through the algorithm ran on the computer
     8. The system shall determine the DoA of the 5GHz signal
     9. The system shall display the DoA of the 5GHz signal
     10. The system shall display the characteristics of the 5GHz signal
     11. The system shall repeat the process starting from functional requirement 1 once functional requirements 8 and 9 are met
  2. Interface requirements
     1. The system shall turn on when a switch is flipped to the ON position
     2. The system shall turn off when a switch is flipped to the OFF position
  3. Physical Environment Requirements
     1. The system shall operate outdoors during clear weather conditions
  4. User and Human Factors Requirements
     1. The system setup shall be understood for non-specialists
     2. The system shall operate outdoors during clear weather conditions
     3. The system instructions shall provide detailed, step-by-step instructions for teaching purposes
     4. The system procedure shall be understandable for non-specialists
  5. Documentation Requirements
     1. The documentation shall be understandable to those of at least a high school level of education
  6. Data Requirements
  7. Resource Requirements
     1. The system shall require components that can be purchased from vendors only
     2. The price of components to build the system shall be less than or equal to $1,500
  8. Security Requirements
  9. Quality Assurance Requirements
     1. The system shall not exceed x lbs

**Section 4: Supporting Material**

Model and Simulation of 5G Antenna: Diagram

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Chart

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Switching:

Diagram

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