Sure, I can help with that. Here are the contents based on your provided input for each heading:

### 1.5 Referenced Documents

List of references that were referred in this current document needs to be provided. Both external and internal references may be listed out accordingly.

#### 1.5.1 External reference

The references classified as external to LRDE (example – ICD, IRS, DO-178B, DSSD).

#### 1.5.2 Internal reference

The references classified as internal to LRDE.

### 2 System Overview

This section provides a brief overview of the system and its purpose, along with the software to which this document applies. It describes the general nature of the system and software, focusing on data association techniques for multi-target tracking. The system receives radar plots, groups them into clusters, performs clustering of plots with respect to tracks, generates hypotheses for each cluster, computes joint and marginal probabilities, and determines the best hypothesis for target plot association using techniques like improved JPDA, GNN, and PDA.

### 3 Document Overview

This section summarizes the purpose and contents of this document, describing any security or privacy considerations associated with its use. The document outlines the system's data association techniques, including clustering, hypothesis generation, and probability computation, and details how various data association techniques are implemented and configured.

### 4 Overall Description

This section describes the product being built, its context within a larger system, and how the software integrates into this bigger system. It includes a block diagram of the entire system and a Context Diagram (Level 0, Data Flow Diagram DFD) that captures all external subsystems and data flows between them and the system.

#### 4.1 Product Perspective

This section provides a detailed perspective of the product, highlighting its interfaces, and explaining how it fits into the larger system.

##### 4.1.1 System Interfaces

This section describes the various interfaces the system interacts with.

###### 4.1.1.1 Larger System Description (or simply System Description)

This subsection describes the context of the subsystem (whose software is the scope of the document) within a larger subsystem. If any existing document contains this information, a reference can be made to the same. However, a concise description inline in the document will help readers correlate quickly.

###### 4.1.1.2 Description of System whose software in scope (or simply, Subsystem Description)

This subsection describes the context in which the software is being developed. It should provide an overview of how other components of the system interact with the software, detailing the system's data association techniques for multi-target tracking, including:

- Grouping plots into clusters.

- Receiving radar plots.

- Performing clustering with respect to tracks.

- Generating possible hypotheses for each cluster.

- Computing joint and marginal probabilities for each hypothesis.

- Finding the best hypothesis for target plot association.

- Implementing data association using improved JPDA, GNN, PDA, and other techniques.

- Receiving configuration from HMI.

- Generating plots for various data association techniques.

Here are the contents for the sections based on your input:

### 4.2 Product Functions

Description: This subsection should describe a summary of the major functions that the software will perform. These functions will be derived directly from higher-level specifications. For this system, the main functions include:

- Grouping radar plots into clusters.

- Receiving radar plots and processing them.

- Performing clustering with respect to existing tracks.

- Generating possible hypotheses for each cluster.

- Computing joint and marginal probabilities for each hypothesis.

- Identifying the best hypothesis for target plot association.

- Performing data association using techniques like improved JPDA, GNN, PDA, and others.

- Receiving configuration inputs from HMI (Human-Machine Interface).

- Generating plots for various data association techniques.

### 4.3 User Characteristics

Description: This subsection should describe user characteristics for each mode of the product. It should include:

- The class of the user (e.g., system operators, analysts, engineers).

- The skill set required for each user class.

- The familiarity and experience required to effectively use the system.

- User class determination for each mode of the system.

### 4.4 Constraints

This subsection of the SRS/SRD should provide a general top-level description of any items that will limit the developer’s options. Detailed constraints will be addressed as various requirements in later chapters. The top-level constraints may include:

- Regulatory policies.

- Hardware limitations (e.g., signal timing requirements).

- Memory constraints.

- Interfaces to other applications.

- Parallel operation.

- Audit functions.

- Control functions.

- Higher-order language requirements.

### 4.5 Assumptions and Dependencies

Description: This section should identify dependencies on external products and assumptions about their availability. For this system, dependencies might include:

- Availability of radar plot data.

- Integration with existing tracking and analysis systems.

- Required hardware and software resources.

- Dependencies on external libraries or frameworks for implementing data association techniques.

### 5 Specific Requirements

This section of the SRD should contain the entire software requirement. Throughout this section, every stated requirement should be externally perceivable by users, operations, or other external systems.

#### 5.1 Required States and Modes

If the CSCI (Computer Software Configuration Item) is required to operate in more than one state or mode having requirements distinct from other states or modes, this paragraph shall identify and define each state and mode. Examples of states and modes might include:

- Initialization mode.

- Normal operation mode.

- Data processing mode.

- Error handling mode.

- Maintenance mode.

Here’s how you can fill out the specified sections based on the provided content:

### 5.2 Functional Requirements

This section describes the specific functional requirements for the system, including detailed descriptions of the software's functionalities.

#### 5.2.1 Plot Clustering

- \*\*Description\*\*: The system shall group radar plots into clusters based on their spatial and temporal proximity.

- \*\*Inputs\*\*: Radar plots with associated timestamps.

- \*\*Outputs\*\*: Clusters of radar plots.

- \*\*Functionality\*\*: The system will use clustering algorithms to group radar plots into clusters. Each cluster represents a set of plots that are likely associated with the same target or event.

#### 5.2.2 Radar Plot Reception

- \*\*Description\*\*: The system shall receive radar plots from external sources.

- \*\*Inputs\*\*: Radar plots data stream.

- \*\*Outputs\*\*: Received radar plots.

- \*\*Functionality\*\*: The system will receive radar plots and prepare them for subsequent processing steps, such as clustering and hypothesis generation.

#### 5.2.3 Clustering with Respect to Tracks

- \*\*Description\*\*: The system shall perform clustering of plots with respect to existing tracks.

- \*\*Inputs\*\*: Radar plots, existing track data.

- \*\*Outputs\*\*: Clusters of plots aligned with existing tracks.

- \*\*Functionality\*\*: The system will consider existing tracks when clustering plots, ensuring that clusters are consistent with ongoing tracks.

#### 5.2.4 Hypothesis Generation

- \*\*Description\*\*: The system shall generate possible hypotheses for each cluster of plots.

- \*\*Inputs\*\*: Clusters of radar plots.

- \*\*Outputs\*\*: Possible hypotheses for target associations.

- \*\*Functionality\*\*: The system will create hypotheses based on the clusters, representing potential associations between radar plots and targets.

#### 5.2.5 Joint Probability Computation

- \*\*Description\*\*: The system shall compute joint probabilities for each hypothesis.

- \*\*Inputs\*\*: Hypotheses, radar plots, and track data.

- \*\*Outputs\*\*: Joint probabilities for hypotheses.

- \*\*Functionality\*\*: The system will calculate the probability of each hypothesis considering all relevant data.

#### 5.2.6 Marginal Probability Computation

- \*\*Description\*\*: The system shall compute marginal probabilities for each hypothesis.

- \*\*Inputs\*\*: Hypotheses, radar plots.

- \*\*Outputs\*\*: Marginal probabilities for hypotheses.

- \*\*Functionality\*\*: The system will calculate the probability of each hypothesis in isolation, considering only the cluster data.

#### 5.2.7 Best Hypothesis Selection

- \*\*Description\*\*: The system shall find the best hypothesis for target plot association.

- \*\*Inputs\*\*: Joint and marginal probabilities.

- \*\*Outputs\*\*: Best hypothesis for target plot association.

- \*\*Functionality\*\*: The system will select the hypothesis with the highest probability as the best fit for associating radar plots with targets.

#### 5.2.8 Data Association Techniques

- \*\*Description\*\*: The system shall perform data association using improved JPDA (Joint Probabilistic Data Association), GNN (Global Nearest Neighbor), PDA (Probabilistic Data Association), and other techniques.

- \*\*Inputs\*\*: Radar plots, track data, clustering results.

- \*\*Outputs\*\*: Associated targets and tracks.

- \*\*Functionality\*\*: The system will apply various data association techniques to ensure accurate and reliable target tracking and plot association.

#### 5.2.9 Configuration from HMI

- \*\*Description\*\*: The system shall receive configuration parameters from the Human-Machine Interface (HMI).

- \*\*Inputs\*\*: Configuration settings from HMI.

- \*\*Outputs\*\*: Configured system parameters.

- \*\*Functionality\*\*: The system will accept and apply configuration parameters received through the HMI to tailor its operation.

#### 5.2.10 Plot Generation for Data Association Techniques

- \*\*Description\*\*: The system shall generate plots for various data association techniques.

- \*\*Inputs\*\*: Data association results, configurations.

- \*\*Outputs\*\*: Plots illustrating the effectiveness of different data association techniques.

- \*\*Functionality\*\*: The system will create visual plots to represent the performance and results of various data association techniques.

### 5.3 External Interface Requirements

#### 5.3.1 User Interfaces

- \*\*Description\*\*: User interfaces will include displays and controls for interacting with the system.

- \*\*Functionality\*\*: Users will be able to view radar plots, configure settings, and visualize data association results.

#### 5.3.2 Hardware Interfaces

- \*\*Description\*\*: The system will interface with radar hardware to receive data and may require specific hardware configurations.

- \*\*Functionality\*\*: Proper hardware interfaces will be established to ensure seamless data transfer between the radar systems and the software.

#### 5.3.3 Software Interfaces

- \*\*Description\*\*: The system will interface with other software components for data integration and analysis.

- \*\*Functionality\*\*: Interfaces will be provided for integration with external software and data sources.

#### 5.3.4 Communication Interfaces

- \*\*Description\*\*: The system will use communication protocols to exchange data with other systems.

- \*\*Functionality\*\*: The system will support necessary communication protocols for data exchange, including networking and data formats.

### 5.4 Performance Requirements

#### 5.4.1 Speed and Latency

- \*\*Description\*\*: The system should process radar plots and perform clustering, hypothesis generation, and data association in real-time or near-real-time.

- \*\*Requirements\*\*: Processing times should meet real-time constraints to ensure timely target tracking and data association.

#### 5.4.2 Accuracy

- \*\*Description\*\*: The system should accurately cluster radar plots, generate hypotheses, and compute probabilities.

- \*\*Requirements\*\*: High accuracy is required for reliable target tracking and association.

#### 5.4.3 Reliability

- \*\*Description\*\*: The system should be reliable and robust, with minimal downtime or errors.

- \*\*Requirements\*\*: The system should handle edge cases and ensure consistent performance under various conditions.

### 5.5 Design Constraints

#### 5.5.1 Regulatory Constraints

- \*\*Description\*\*: The system must comply with relevant regulatory standards and guidelines.

- \*\*Requirements\*\*: Adherence to standards related to radar data processing and tracking systems.

#### 5.5.2 Hardware Constraints

- \*\*Description\*\*: The system must operate within the limitations of available hardware resources.

- \*\*Requirements\*\*: Efficient use of hardware resources to ensure optimal performance.

#### 5.5.3 Software Constraints

- \*\*Description\*\*: The system must be compatible with existing software frameworks and libraries.

- \*\*Requirements\*\*: Integration with specified software environments and adherence to software compatibility guidelines.

### 5.6 Other Requirements

#### 5.6.1 Security

- \*\*Description\*\*: The system should ensure the security and privacy of radar data and processing results.

- \*\*Requirements\*\*: Implement appropriate security measures to protect data and maintain system integrity.

#### 5.6.2 Maintainability

- \*\*Description\*\*: The system should be maintainable and support easy updates and modifications.

- \*\*Requirements\*\*: Design and documentation should facilitate ease of maintenance and upgrades.

#### 5.6.3 Usability

- \*\*Description\*\*: The system should be user-friendly and intuitive for operators and analysts.

- \*\*Requirements\*\*: Provide clear and accessible interfaces and functionality to enhance user experience.

Here is the combined content from your initial inputs and the provided image:

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### Data Association Techniques for Multi-Target Tracking

- It shall group the plots into clusters.

- It shall receive radar plots.

- It shall perform clustering of plots with respect to the tracks.

- It shall generate possible hypotheses for each cluster.

- It shall compute joint probabilities for each hypothesis.

- It shall compute marginal probabilities for each hypothesis.

- It shall find the best hypothesis for target plot association.

Further:

- It shall perform data association using improved JPDA, GNN, PDA, and other techniques.

- It shall receive configuration from HMI.

- It shall generate plots for various data association techniques.

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### 5.2.3 Operational Requirements

\*\*Description:\*\* This subsection should describe the features that needed to be used, when system is in operation. This may include, monitoring of inflow and outflow of data, usage data, and resource utilization data and taking appropriate action to keep the system running in healthy state.

\*\*Example:\*\* The Radar signal processor shall incorporate IBIT and CBIT so that health monitoring is carried out and appropriate system recovery mechanism is built in.

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### 5.3 CSCI Interface Requirements

This paragraph shall specify the requirements, if any, imposed on interfaces to the CSCI. If such requirements are to be imposed, sub-sections under section 3.3 list the interfaces and related details to be considered.

#### 5.3.1 Internal Interfaces

\*\*Description:\*\* This subsection should describe each internal interface within the CSCI like configuration, initialization and operation and timing aspects.

#### 5.3.2 External Interfaces

\*\*Description:\*\* This subsection should describe each interface like configuration, initialization and operation and timing aspects. If an external document describes the interface aspects of the subsystems (like IRS), link to such document may be provided. If these details are provided in detail in section 2, this can be mentioned in this section and skipped.

#### 5.3.3 Hardware Interfaces

\*\*Description:\*\* This subsection should describe the hardware components of the system with which the software is interacting with. The details include:

a. Configuration Characteristics

b. Number of Ports

c. Processors (Restricted Instruction Sets, if needed)

d. Communication Devices

e. I/O Devices

f. Percentage of Utilization of various resources

#### 5.3.4 Software Interfaces

\*\*Description:\*\* This subsection should describe the pre-built software components like library;

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If there are any further details or modifications you need, please let me know!