System Requirements Specification

for

Audio Surveillance System

**Version 1.0 approved**

**Prepared by Zachary Tauscher, Jacob Attia, Caleb Leeb, and Jaclyn Welch**

**Embry Riddle Aeronautical University Senior Capstone Design I**

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**Revision History**

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| --- | --- | --- | --- |
| **Name** | **Date** | **Reason For Changes** | **Version** |
| Initial Draft | 9/28/21 | Proposal of Draft Document | 0.0 |
|  |  |  |  |

# Introduction

## Purpose

The purpose of this document is to identify the requirements of a system which provides positional and identifying information on people within a room based solely on the audio data received by several arrays of microphones placed within the room. There are two experimental designs which are proposed by this document, each with their own unique requirements, which will be specified in this document below. However, for the most part these requirements and basic statements of intent are shared between the two designs. This product will encompass the scope of single-room surveillance and will be built to function in environments with common sources of background noise.

## Document Conventions

For future reference within this document, all mentions of the first experimental product design, multiple arrays placed at disjointed points in a room connected via wireless connectivity modules, will be referred to as "Design A”. The second design, consisting of a ring of microphone arrays to be modularly placed at a central point within a room, will be referred to as "Design B”.

## Intended Audience and Reading Suggestions

This document is intended to be read and reviewed by the product owner (Dr. Qi Cheng), the customer (Dr. Ilhan Akbas), and to be contributed to and continually modified by all members of the development team: Jacob Attia, Caleb Leeb, Zachary Tauscher, and Jaclyn Welch.

For those readers unfamiliar with general concepts of machine learning, audio processing, or triangulation, reviewing the included documents for reference before identifying the scope of this project may be helpful. For readers with a sufficient background in these concepts who feel comfortable with an integrated approach of these subjects to further surveillance, the following section regarding the product scope may be of more relevance.

To any reader of this document whose intention is to continue development in the pursuit of future research, both the product perspective (2.1) and our analysis models used (Appendix B) are of particular interest.

## Product Scope

The product is not intended to cover more than a single room, and its scope is not to encompass more than positional information in more than two dimensions, as a more labor-intensive, intrusive, and indiscreet method of setting up a room would have to be employed to simulate three dimensions, robbing the product of any viable use case.

## References

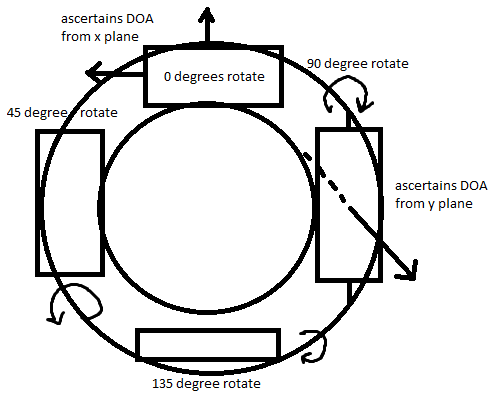
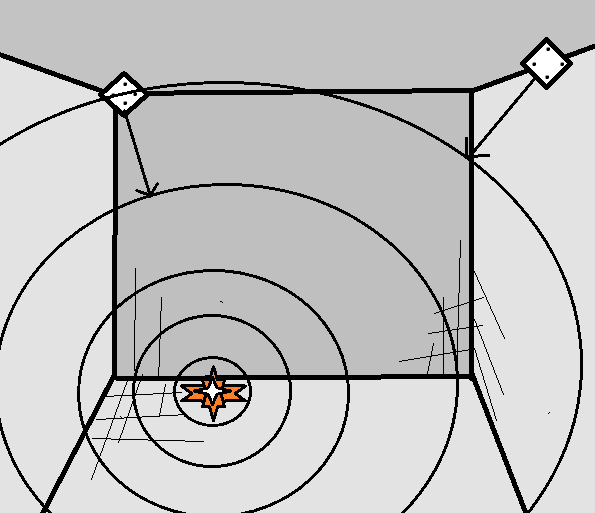
The following link: https://github.com/karatekidcaleb/CS490-Option-2-Audio/ will take the reader to the GitHub repository in which reside all source code and build-relevant working directories. As our product’s software is not currently maintained or protected by any license, redistributors and those intent on modification can expect to follow guidelines relevant to the GNU Lesser General Public License 3.0. For those interested in some literature relevant to the formation of this product’s research and a cursory literature review, please refer to the references to prior research in this AoC detailed later in 2.1.

*<List any other documents or Web addresses to which this SRS refers. These may include user interface style guides, contracts, standards, system requirements specifications, use case documents, or a vision and scope document. Provide enough information so that the reader could access a copy of each reference, including title, author, version number, date, and source or location.>*

# Overall Description

## Product Perspective

*<Describe the context and origin of the product being specified in this SRS. For example, state whether this product is a follow-on member of a product family, a replacement for certain existing systems, or a new, self-contained product. If the SRS defines a component of a larger system, relate the requirements of the larger system to the functionality of this software and identify interfaces between the two. A simple diagram that shows the major components of the overall system, subsystem interconnections, and external interfaces can be helpful.>*

Design A Design B

## Product Functions

*<Summarize the major functions the product must perform or must let the user perform. Details will be provided in Section 3, so only a high level summary (such as a bullet list) is needed here. Organize the functions to make them understandable to any reader of the SRS. A picture of the major groups of related requirements and how they relate, such as a top level data flow diagram or object class diagram, is often effective.>*

* The product must be able to discern what types of sound are coming in (such as footsteps, normal conversation)
* The product must be able to determine the location of the incoming sounds relative to the room that the microphones are set up in
* The product must be able to display the types of sound heard to a user of the product
* The product must be able to display the location to a user of the product, using X/Y coordinates

## User Classes and Characteristics

*<Identify the various user classes that you anticipate will use this product. User classes may be differentiated based on frequency of use, subset of product functions used, technical expertise, security or privilege levels, educational level, or experience. Describe the pertinent characteristics of each user class. Certain requirements may pertain only to certain user classes. Distinguish the most important user classes for this product from those who are less important to satisfy.>*

## Operating Environment

*<Describe the environment in which the software will operate, including the hardware platform, operating system and versions, and any other software components or applications with which it must peacefully coexist.>*

## Design and Implementation Constraints

*<Describe any items or issues that will limit the options available to the developers. These might include: corporate or regulatory policies; hardware limitations (timing requirements, memory requirements); interfaces to other applications; specific technologies, tools, and databases to be used; parallel operations; language requirements; communications protocols; security considerations; design conventions or programming standards (for example, if the customer’s organization will be responsible for maintaining the delivered software).>*

Considering that our team must submit a budget for this product for approval, it is likely that the hardware used will be limited according to its cost.

## User Documentation

*<List the user documentation components (such as user manuals, on-line help, and tutorials) that will be delivered along with the software. Identify any known user documentation delivery formats or standards.>*

## Assumptions and Dependencies

*<List any assumed factors (as opposed to known facts) that could affect the requirements stated in the SRS. These could include third-party or commercial components that you plan to use, issues around the development or operating environment, or constraints. The project could be affected if these assumptions are incorrect, are not shared, or change. Also identify any dependencies the project has on external factors, such as software components that you intend to reuse from another project, unless they are already documented elsewhere (for example, in the vision and scope document or the project plan).>*

# External Interface Requirements

## User Interfaces

*<Describe the logical characteristics of each interface between the software product and the users. This may include sample screen images, any GUI standards or product family style guides that are to be followed, screen layout constraints, standard buttons and functions (e.g., help) that will appear on every screen, keyboard shortcuts, error message display standards, and so on. Define the software components for which a user interface is needed. Details of the user interface design should be documented in a separate user interface specification.>*

## Hardware Interfaces

*<Describe the logical and physical characteristics of each interface between the software product and the hardware components of the system. This may include the supported device types, the nature of the data and control interactions between the software and the hardware, and communication protocols to be used.>*

## Software Interfaces

*<Describe the connections between this product and other specific software components (name and version), including databases, operating systems, tools, libraries, and integrated commercial components. Identify the data items or messages coming into the system and going out and describe the purpose of each. Describe the services needed and the nature of communications. Refer to documents that describe detailed application programming interface protocols. Identify data that will be shared across software components. If the data sharing mechanism must be implemented in a specific way (for example, use of a global data area in a multitasking operating system), specify this as an implementation constraint.>*

## Communications Interfaces

*<Describe the requirements associated with any communications functions required by this product, including e-mail, web browser, network server communications protocols, electronic forms, and so on. Define any pertinent message formatting. Identify any communication standards that will be used, such as FTP or HTTP. Specify any communication security or encryption issues, data transfer rates, and synchronization mechanisms.>*

# System Features

*<This template illustrates organizing the functional requirements for the product by system features, the major services provided by the product. You may prefer to organize this section by use case, mode of operation, user class, object class, functional hierarchy, or combinations of these, whatever makes the most logical sense for your product.>*

## System Feature 1

*<Don’t really say “System Feature 1.” State the feature name in just a few words.>*

4.1.1 Description and Priority

*<Provide a short description of the feature and indicate whether it is of High, Medium, or Low priority. You could also include specific priority component ratings, such as benefit, penalty, cost, and risk (each rated on a relative scale from a low of 1 to a high of 9).>*

4.1.2 Stimulus/Response Sequences

*<List the sequences of user actions and system responses that stimulate the behavior defined for this feature. These will correspond to the dialog elements associated with use cases.>*

4.1.3 Functional Requirements

*<Itemize the detailed functional requirements associated with this feature. These are the software capabilities that must be present in order for the user to carry out the services provided by the feature, or to execute the use case. Include how the product should respond to anticipated error conditions or invalid inputs. Requirements should be concise, complete, unambiguous, verifiable, and necessary. Use “TBD” as a placeholder to indicate when necessary information is not yet available.>*

*<Each requirement should be uniquely identified with a sequence number or a meaningful tag of some kind.>*

REQ-1:

REQ-2:

## System Feature 2 (and so on)

# Other Nonfunctional Requirements

## Performance Requirements

*<If there are performance requirements for the product under various circumstances, state them here and explain their rationale, to help the developers understand the intent and make suitable design choices. Specify the timing relationships for real time systems. Make such requirements as specific as possible. You may need to state performance requirements for individual functional requirements or features.>*

## Safety Requirements

*<Specify those requirements that are concerned with possible loss, damage, or harm that could result from the use of the product. Define any safeguards or actions that must be taken, as well as actions that must be prevented. Refer to any external policies or regulations that state safety issues that affect the product’s design or use. Define any safety certifications that must be satisfied.>*

## Security Requirements

*<Specify any requirements regarding security or privacy issues surrounding use of the product or protection of the data used or created by the product. Define any user identity authentication requirements. Refer to any external policies or regulations containing security issues that affect the product. Define any security or privacy certifications that must be satisfied.>*

## Software Quality Attributes

*<Specify any additional quality characteristics for the product that will be important to either the customers or the developers. Some to consider are: adaptability, availability, correctness, flexibility, interoperability, maintainability, portability, reliability, reusability, robustness, testability, and usability. Write these to be specific, quantitative, and verifiable when possible. At the least, clarify the relative preferences for various attributes, such as ease of use over ease of learning.>*

## Business Rules

*<List any operating principles about the product, such as which individuals or roles can perform which functions under specific circumstances. These are not functional requirements in themselves, but they may imply certain functional requirements to enforce the rules.>*

# Other Requirements

*<Define any other requirements not covered elsewhere in the SRS. This might include database requirements, internationalization requirements, legal requirements, reuse objectives for the project, and so on. Add any new sections that are pertinent to the project.>*

**Appendix A: Glossary**

*<Define all the terms necessary to properly interpret the SRS, including acronyms and abbreviations. You may wish to build a separate glossary that spans multiple projects or the entire organization, and just include terms specific to a single project in each SRS.>*

**Appendix B: Analysis Models**

*<Optionally, include any pertinent analysis models, such as data flow diagrams, class diagrams, state-transition diagrams, or entity-relationship diagrams*.>

**Appendix C: To Be Determined List**

*<Collect a numbered list of the TBD (to be determined) references that remain in the SRS so they can be tracked to closure.>*