

# **Software Requirements Specification**

**for**

## **Spectrum Analyzer Analysis Tool**

**Prepared by:**

**Masood Afzali**

**Ashly Altman**

**Brooke Ebetino**

**Tyler Haley**

**Joey Thompson**

**Software Engineering Capstone**

**Dr. Yan Huang**

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# Table of Contents

<b>Table of Contents .....</b>	<b>ii</b>
<b>1. Introduction.....</b>	<b>1</b>
1.1 Scope .....	1
1.2 Overview .....	1
1.3 Definitions and Acronyms.....	1
<b>2. Overall Description .....</b>	<b>2</b>
2.1 User Classes and Characteristics .....	2
2.2 Operating Environment .....	2
<b>3. System Features .....</b>	<b>2</b>
3.1 Video Processing for Identifying Spectral Waves .....	2
3.1.1 Description .....	2
3.1.2 Stimulus/Response Sequences .....	2
3.1.3 Functional Requirements.....	2
3.2 Color Filtering to Isolate Areas of Interest .....	2
3.2.1 Description .....	2
3.2.2 Stimulus/Response Sequences .....	2
3.2.3 Functional Requirements.....	3
3.3 Wave Characteristic Analysis.....	3
3.3.1 Description .....	3
3.3.2 Stimulus/Response Sequences .....	3
3.3.3 Functional Requirements.....	3
3.4 Output as a CSV File .....	3
3.4.1 Description .....	3
3.4.2 Stimulus/Response Sequences .....	3
3.4.3 Functional Requirements.....	4
<b>4. Quality Attributes .....</b>	<b>4</b>
4.1 External Qualities .....	4
4.2 Internal Qualities .....	4
4.3 Quality Prioritization .....	4
4.4 Other non-functional requirements.....	4
<b>5. Summary.....</b>	<b>5</b>

# 1. Introduction

This project aims to develop a cross-platform software application that can perform frequency and amplitude analysis on input video files. The program will analyze a video of a screen of a spectrum analyzer from a local folder and write a descriptive CSV file containing a timestamp, center frequency, minimum amplitude, maximum amplitude, and center amplitude.

*The project stakeholders include:*

- 5 Kennesaw State University student developers
- Professor Yan Huang
- Robins AFB, the customer.

*The development team consists of:*

- Team Lead: Joey Thompson
- Frontend/Packaging Lead: Ashly Altman
- Backend Lead: Brooke Ebetino
- Testing Lead: Tyler Haley
- Documentation Lead: Masood Afzali

## 1.1 Scope

The SpecVidAnalyzer is designed to analyze spectrum videos. It will read the video files, extract the plot points for the graph and calculate data values based on this reading. It will then log this data into a separate CSV. The goal of the project is to make an automated wave spectrum analysis. The benefits of this are that it will simplify and speed up the process of reading a spectrum analyzer.

## 1.2 Overview

This document is a Software Requirement Specification document for the video-based spectrum analyzer application to be developed by the project team. The spectrum analyzer will have an outline of desired characteristics to be kept in mind during development of the project to ensure design meets desired stakeholder requirements. The desired program should run faster than real-time analysis of the video file input, with final speed dependent on the capabilities of the host machine running the program, and to be able to process .mp4 files as input for analysis.

## 1.3 Definitions and Acronyms

**SpecVidAnalyzer:** Software developed for real-time video spectrum analysis.

**NumPy:** Python library for large, multi-dimensional arrays and matrices.

**OpenCV:** Library for real-time computer vision applications.

## **2. Overall Description**

### **2.1 User Classes and Characteristics**

The user class for the project is electronics engineers and researchers at Robins Air Force Base who will use the system to analyze signals and systems in video footage. The users will need the program to improve upon the alternative of a person viewing the video input in real-time and recording data by hand. This gives requirements of reliability and efficiency.

### **2.2 Operating Environment**

The software will be developed for stand-alone use on a Windows 10 computer. The project will be deployed onto computers at Robins Air Force Base in Warner Robins, Georgia, with the possibility of being implemented at other military installations as desired, Air Force or otherwise. Due to the classified nature of a client in the military sector, information concerning the potential application operating environments is somewhat limited.

## **3. System Features**

### **3.1 Video Processing for Identifying Spectral Waves**

#### **3.1.1 Description**

The application should be able to identify the spectral wave on screen so that it can be isolated in order to extract relevant characteristics for further application and user analysis.

#### **3.1.2 Stimulus/Response Sequences**

1. User places an .mp4 file to be analyzed into the designated folder.
2. User begins the analysis process.
3. Application will examine the frame of the video file and identify the wave based on color contrast.

#### **3.1.3 Functional Requirements**

- The program shall be able to identify the output of a spectrum analyzer displayed on a video capture via camera.

### **3.2 Color Filtering to Isolate Areas of Interest**

#### **3.2.1 Description**

After identifying the spectrum wave to be analyzed, the application will isolate the image via a color mask in order to make analysis easier.

#### **3.2.2 Stimulus/Response Sequences**

1. User places an .mp4 file to be analyzed into the designated folder.

2. User begins the analysis process.
3. Application will examine the frame of the video file and identify the wave based on color contrast.
4. An image mask will be applied to isolate relevant areas for easier analysis.
5. The masked image will be displayed to the user as the application runs.

### 3.2.3 Functional Requirements

- The program shall use the information gathered about the location and color of the displayed wave in order to mask the irrelevant areas of the video being analyzed in order to allow for analysis of relevant wave characteristics.

## 3.3 Wave Characteristic Analysis

### 3.3.1 Description

The application will use the masked image for further analysis, extracting the desired qualities of the wave on each frame for the end user.

### 3.3.2 Stimulus/Response Sequences

1. User places an .mp4 file to be analyzed into the designated folder.
2. User begins the analysis process.
3. Application will examine the frame of the video file and identify the wave based on color contrast.
4. An image mask will be applied to isolate relevant areas for easier analysis.
5. The application will determine minimum power, maximum power, amplitude, and frequency of the center peak of the wave for each frame.
6. Repeat step 5 for each frame in the video

### 3.3.3 Functional Requirements

- The program shall analyze the masked image to derive relevant characteristics that are desired as output.
- The program shall record the timestamp for each frame analyzed
- The program shall determine the minimum power
- The program shall determine the maximum power
- The program shall determine the amplitude of the wave
- The program shall determine the center frequency of the wave

## 3.4 Output as a CSV File

### 3.4.1 Description

The application will organize the analyzed characteristics of the wave displayed on the input video into a timestamped CSV file for future analysis by users.

### 3.4.2 Stimulus/Response Sequences

1. User places an .mp4 file to be analyzed into the designated folder.
2. User begins the analysis process.

3. Application will examine the frame of the video file and identify the wave based on color contrast.
4. An image mask will be applied to isolate relevant areas for easier analysis.
5. The application will determine minimum power, maximum power, amplitude, and frequency of the center peak of the wave for each frame.
6. Repeat step 5 for each frame in the video
7. Video analysis has completed
8. Wave characteristics will be written into a timestamped CSV file

### **3.4.3 Functional Requirements**

- The program shall output data regarding the desired characteristics of the wave to analyze (minimum power, maximum power, amplitude, and center frequency)
  - If data cannot be read for a frame due to the absence of a wave image on screen, output should be 0

## **4. Quality Attributes**

### **4.1 External Qualities**

- Easily usable
- Efficiency
- Accuracy
- Reliability

### **4.2 Internal Qualities**

- Maintainable
- Understandable
- Portable

### **4.3 Quality Prioritization**

1. Efficiency
2. Accuracy
3. Portable
4. Reliability
5. Understandable

### **4.4 Other non-functional requirements**

- Reliable
- Easily usable
- Performance (speed)

## **5. Summary**

The SpecVidAnalyzer project aims to provide a practical solution for frequency and amplitude analysis of spectrum analyzer videos. Developed by Kennesaw State University students for use at Robins Air Force Base, the software is designed to automate a process traditionally done manually, potentially saving time and reducing errors. It analyzes video files, extracts key data, and records this information in a CSV format.

The project, guided by specific requirements and stakeholder needs, emphasizes reliability, efficiency, and user-friendliness. While it's tailored primarily for military use, its potential extends to other fields requiring similar analysis. As it progresses, the team will focus on refining its features and ensuring it meets the operational needs of its intended users.