Project Plan

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Spectrum Analyzer Analysis Tool

Members: Ryan O'Connor, Richard Lutheringhauser, Nathan Reed, Dinesh Sekar, Ayorinde Lawani

Client: 402 SWEG Robins AFB

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1. INTRODUCTION

This Project Plan describes the scope, context, stakeholders, activities, resources, schedule, constraints, risks, quality goals, and processes. It is intended to provide a guide to how development work will be managed.

The objective of this project is to design and implement a software system that leverages machine learning tools and algorithms to process MP4 videos and extract information from them. The system is intended for a Windows 10 desktop environment and will be developed with the Python programming

2. PROJECT OVERVIEW

2.1 Scope

2.1.1 Identification

Identification Software Name: Spectrum Analysis Tool "SAT"
Version: 1.0.0

2.1.2 System Overview

This system has a working title of "Spectrum Analysis Tool" (SAT). This software aims to solve the problem of technicians having to manually review spectrum analyzer footage for hours on end to gather data. Instead, the SAT will analyze the footage in just minutes, saving time and resources. The analysis tool converts MP4 video footage into actionable data all within a Windows 10 environment.

This software is currently in its developmental stages and is currently sponsored by the company 402 SWEG Robins AFB. The target users will be RF engineers, researchers, and other technicians who work with the spectrum analyzer machine. Development is led by our student team consisting of 5 members. Deployment is local, with cloud-based considerations for the future. Key associated documents include the User Manual and Developer Documentation.

2.1.3 Document Overview

This Project Plan serves as a comprehensive guide for the development and implementation of our spectrum analysis tool (SAT). It outlines the project's scope, objectives, stakeholders, resources, schedule, constraints, and more, ensuring all team members are aligned in their roles and responsibilities. In terms of security and privacy, the document doesn't contain sensitive information, but all involved parties are expected to respect its contents and not share externally without prior approval.

2.2 Background, Objectives, and Scope

The RF analysis process in many industries remains manual, making it time-consuming and prone to human error. Videos specific to our project are upwards of 8 hours long; currently our client doesn't have an automatic system to perform the analysis. Recognizing this gap, the objective of the "Spectrum Analysis Tool" (SAT) is to provide a software product that provides improved methods for RF analysis. Our target users are radio frequency engineers, technicians, and researchers. The scope of our project encompasses the design, development, and testing of our software solution. We will emphasize accuracy of the analysis, ease of use, and operational efficiency. his paragraph shall describe the background, mission or objectives, and scope of the current system or situation.

2.3 Operational Policies and Constraints

Our team will attempt to adhere to best coding practices and quality assurance standards related to the tools we are using. All new features will undergo testing in some form of isolation before being merged with the main

project. We will constantly be testing the application to optimize the speed of the video processing and signal analysis. A constraint the team faces is the limited familiarity with Python and machine learning techniques, which are essential for this project. Although our software solution is intended to operate on the Windows 10 platform, we believe that our final product will be cross-platform. As long as a user has an environment capable of running Python programs, they should be able to use our product. Further research and development will be conducted for this feature.

2.4 Users or Involved Personnel

Radio Frequency Analysts/Engineers/Technicians/Researchers are the primary users targeted to operate this software solution for the purpose of extracting and analyzing radio frequency signals.
If the client chooses to use the software in a production capacity, they may choose to employ some form of IT support to assist if any issues arise with the software in the future.

3. DEVELOPMENT BACKGROUND/APPROACH

The development will be carried out on a Windows 10 platform, leveraging Python as the primary programming language, utilizing libraries such as OpenCV for image and video processing. The team comprises five individuals with roles distributed amongst development, analysis, quality assurance, and project management. We're employing an Agile methodology, with two main milestones before the final deliverable.

3.1 High Level Estimates

Effort: Approximately 600 hours across all phases.
Lines of Code: Estimated 1,500-2,000
Documentation: Approximately 100 pages, including user manuals and technical documentation.
Test Cases: About 150 test scenarios covering various use cases.

3.2 Key Contacts and Stakeholders

Team Leader: Ryan O'Connor, roconno8@students.kennesaw.edu || 706-834-2702
Client Contact: Elizabeth Dayton, elizabeth.dayton@us.af.mil || 478-926-2638
Project Coordinator: Nasiya Sharif, nrahman1@kennesaw.edu || 470-578-5572

4. FEATURES, PRIMARY DELIVERABLES, AND EXTERNAL COMMITMENTS

4.1 Feature List

Video Input: Support for MP4 files.
Frame-by-frame RF signal analysis.
User Interface: Interactive controls such as pause/resume, set/unlock ROI.
Data Output: Conversion to numeric format and CSV export.

4.2 Customer Deliverables

Group 6: Submit Project Plan Due on Sep 20, 2023 11:59 PM	Not Submitted	- / -	
Group 6: Submit Mid-term deliverable Due on Oct 4, 2023 11:59 PM	Not Submitted	- / 100	
Group 6: Submit Design Document Due on Oct 25, 2023 11:59 PM	Not Submitted	- / -	
Group 6: Submit Test Document Due on Nov 27, 2023 11:59 PM	Not Submitted	- / -	
Group 6: Submit Code (preliminary version) Due on Dec 3, 2023 11:59 PM	Not Submitted	- / -	
Group 6: Submit Final Presentation and Demo Due on Dec 5, 2023 11:59 PM	Not Submitted	- / 100	
Group 6: Submit final version of all deliverables Due on Dec 6, 2023 11:59 PM	Not Submitted	- / -	
Submit your peer evaluation Due on Dec 6, 2023 11:59 PM	Not Submitted	- / 100	

5. PROJECT SCHEDULE

Date (YYYY-MM-DD)	Milestone/ task	Deliverable	Remarks
2023-09-20	Milestone 1, Project Plan	Prototype with basic RF signal extraction	Development phase
2023-10-4	Milestone 2, Midterm Deliverable	Advanced features with UI improvements and data output	Beta testing phase
2023-12-5	Milestone 3, Presentation of Final product	Final Product Version 1.0, User Manual, Developer Document	Official release

6. PROJECT RESOURCE REQUIREMENTS

6.1 Staffing/ Skill Requirements

Role: Team Leader
Critical Skills: Project management, Team coordination, Stakeholder communication
Skill Gaps: Some experience in Python but may require deeper knowledge for technical troubleshooting.

Role: Development Lead
Critical Skills: Software architecture, Code review and optimization, Mentoring and guiding developers
Skill Gaps: Limited exposure to machine learning and AI concepts.

Role: Developer (3 members)
Critical Skills: Python programming, Integration of external libraries, Debugging and testing
Skill Gaps: New to Python's advanced features. Limited experience in machine learning and AI

6.2 Plan to Fill Skill Gaps

Advanced training and tutorials on Python
Researching more about machine learning and AI
Performing code reviews regularly
Seeking a mentor when needed

7. DEPENDENCIES AND CONSTRAINTS

7.1 Dependencies and Constraints

Python Libraries:

- **cv2**: OpenCV is used for image and video processing tasks such as reading video frames, converting color schemes, image thresholding, morphological operations, and contour detection.
- **numpy**: Essential for numerical computing in Python, it's being used for array operations in your code.
- **matplotlib**: Primarily utilized for visualizing data and debugging by displaying images and plots.
- **pyautogui**: Used for automating keyboard and mouse events.
- **time**: Provides various time-related functions. In the context of your script, it appears to be used for adding delays.
- **os**: Allows interaction with the operating system, used for file and directory operations.

External Dependencies:

- **Video Files**: The software depends on MP4 video files as input.
- **Desktop or Laptop w/ Windows 10:** The code is intended to run on Windows 10, implying a dependency on this operating system's environment and compatibility.

Constraints:

Time constraints, skill gaps, development environment and testing tools, video constraints like quality and length, also constrained by the capabilities of our tools.

8. PROJECT CONFIGURATION AND DATA MANAGEMENT

8.1 Configuration Management

Source Code Management:

- **Tool:** GitHub
- **Description:** A platform for version control allowing collaboration among developers.
- **Purpose:** Track and manage changes to the codebase, facilitate code reviews, and manage collaborative efforts.
- **Feature Branching:** Developers will create a branch from the main repo and experiment with new features and bug fixes; after review changes will be merged to main branch.

Environment Configuration:

- **Local Development:** PyCharm and VSCode configured with necessary extensions/plugins for Python development.
- **Testing Environment:** Developers will be conducting testing on their local machines.
- **Production Environment:** Windows 10

Documentation Management:

- **Tool:** Microsoft Teams
- **Description:** Platforms for documenting software architecture, designs, user manuals, and other relevant documentation.
- **Purpose:** Ensure team members and stakeholders have access to updated and relevant information about the software.

Change Management:

- **Tool:** Trello
- **Description:** Visual tool for managing tasks and changes.
- **Purpose:** Prioritize, track, and manage changes, features, and bugs

9. PROJECT PROCESS

9.1 Software Life Cycle Model

Tools and Platforms:

- **Trello:** For Kanban-style project management, task tracking, and progress visualization.
- **GitHub:** Source code management, version control, and collaboration.
- **Microsoft Teams:** Team communication, meetings, and documentation sharing.

Components of the Agile Approach

- Backlog Creation
- Sprint Planning
- Daily Stand-up Meetings (via MS Teams)
- Development & Collaboration
- Review & Feedback
- Retrospective
- Documentation

Deadlines and Milestones:

- **2023-09-20, Milestone 1:** Focus on setting up the initial development environment, finalizing the Project Plan, and creating a prototype with basic RF signal extraction. This is the foundational development phase.
- **2023-10-04, Milestone 2:** Incorporate advanced features, prioritize UI improvements, and work on data output capabilities. This is also the Beta testing phase, where preliminary testing and feedback collection occur.
- **2023-12-05, Milestone 3:** All features should be finalized and polished by now. Complete the User Manual and Developer Document, finalize testing, and fix any remaining issues. Prepare and present the final product, marking the official release of Version 1.0.

10. GLOSSARY

AI: Artificial Intelligence - A branch of computer science that aims to create systems able to perform tasks that would normally require human intelligence. These tasks include problem solving, understanding natural language, recognizing patterns, and making decisions.

CI: Continuous Integration - A software development practice in which code changes are automatically built and tested before merging to the main branch.

CV: Computer Vision - A field of computer science that enables machines to interpret and make decisions based on visual data (like images and videos).

GitHub: A platform for version control and collaboration that allows developers to review, manage, and store their code.

OpenCV: Open Source Computer Vision Library - A library of functions mainly aimed at real-time computer vision.

RF: Radio Frequency - Electromagnetic wave frequencies that lie in the range extending from below 3 kilohertz to about 300 gigahertz.

ROI: Region of Interest - A specified area of an image or frame that the algorithm focuses on for processing.

SCM: Source Code Management - Tools and practices to manage and track changes to source code over time.

Trello: A collaboration tool that organizes projects into boards, lists, and cards to prioritize and manage tasks.

SAT: Spectrum Analysis Tool; the working title of our project.

11. CHANGE RECORD

Date	Change Request #	New Issue #	Description	Reason	Modified By
(Entries will be added as changes occur.)					