Software Requirements and Specifications

**Project Name: SPARQ: Spark-powered Audio Recognition and Querying**

**Aligned SDG: 11. Sustainable Cities and Communities**

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**References**

# Introduction

The subsections under this section are a brief overview of the Software Requirements and Specifications (SRS) document for the application program titled “**SPARQ: Spark-powered Audio Recognition and Querying**”. The document highlights various tools, methodologies, techniques and approaches that have been used for the completion of the program.

## Purpose and Intended Audience

This document provides a software requirements specification (SRS) for above mentioned project. The purpose of the system is that it can detect the sound of sparks from raw audio data. It is made with the intention of it being:

* A provision containing a brief overview of the application to individuals.
* A means of communication between the team members and the mentor.
* A documented assistance with frontend, backend, software design and quality control tasks.
* A document highlighting the validating system testing activities.
* A document that visualizes supporting Verification and Validation activities.

## Project Scope

This application has the scope of being a platform for individuals who gets a response in case of any spark detection. The individual can be from any background, including industrial, domestic, or any other research-orientated group.

* With the usage of this application, individuals get a notification in case of any sparks which can lead to any property damage/loss of life or any machine damage.
* Currently, the built of the application is for domestic usage only, however it has the potential and the scope to scale into an enterprise edition, wherein it shall be usable by communities and industries for more large-scale tracking of spark detection, if there are any.

## Terms, Definitions, and Acronyms

This document is prepared according to the IEEE SRS Standards and uses technical terminology, different formats of text and abbreviations to provide clarity and distinction to its readability.

* **Bold** text refers to headings
* **SRS:** Software Requirement Specification
* **SPARQ:** Spark-powered Audio Recognition and Querying
* **Project:** refers to the application program that helps in detection of spark from raw data and using machine learning to help the user to take any safety measures in case of a higher spark.

## References

* IEEE Recommended Practice for Software Requirements Specifications by IEEE Computer Society (20 October 1998)
* [IEEEXplore-SRS-template.pdf](file:///C:\Users\hi\Downloads\IEEEXplore-SRS-template.pdf)

# Overall Description

This section provides a background for the requirements in the making of the application program to make it layman friendly while also as a stencil for the development team to stick to (in the preparation of the project).

## Product Perspective

This application helps users to get notified in case of any spark in their surroundings. It can lead to the development of a spark sound event detection system. The application will be connected to users through an app.

* The giveaway of this segment is that it uses Waveform analysis for classification to perform its main functionality, which is to help the user save any machinery or any property from getting damaged. The target audience for our application are people in domestic, industrial sectors, or researchers.

Payment

Processing

## Product Features

This section discusses some of the features that define the many functionalities of the application program. They are listed as:

* Consists a simple user interface:
* The interfaces shall involve a Graphics User Interface, which contains
* Textboxes
* Pushbuttons
* The language of the User Interface will be English and English transcript to represent numerical figures.
* Standard screen format with fixed design (font, color patterns, page layout etc.) will be used throughout interfaces.
* Consists of simple dashboard showing real-time spark detection.
* Visualization tools powered by Python to make the data comprehensible and flexible to train the system to max the accuracy.
* Quick Response System – user gets notified immediately by an app when spark is generated.
* SparkFun RedBoard Artemis ATP – record and classify spark sound with the board.
* Arduino Due – to control the electric spark generation.
* SparkFun Micro OLED Breakout (Qwiic) – employing an OLED screen to display classification results.
* App can be installed in the device with an Android Package (APK)
* The application program is a mobile application that is compatible with Android OS.

## User Classes and Characteristics

There is only one main class of users for the application program, while keeping in mind its built to domestic level only.

1. Users: Users must scan the QR code which is placed on the device, ensuring that users get a notification whenever a spark is generated.

## Operating Environment

The operating environment for application would be the SparkFun RedBoard Artemis ATP board which detects the spark and sends the notification to the user using an app.

The application shall run with any android device compatible with current android version.

## Design and Implementation Constraints

* Requires a well-fitted broadband/internet connection always.
* Interface is available only in English.
* Uses a QR based registration system that notifies the users who will be restricted only to a limit.
* Can operate and provide its functionalities only for the users registered using the QR code.
* Has compatibility restrictions wherein it is compatible only with Android OS.

## Assumptions

* Every user shall be having the appropriate hardware and software components as per the requirements.
* App should be perfectly installed though Android Package (APK)
* Every user must scan the QR code in order to get notified.
* All variables will be flexible with Waveform Analysis for classification used for Spark sound detection.

# Specific Requirements

This section features key requirements that the application program must fulfill.

## Functional Requirements.

The application has various performative functionalities to it, which shall include the following:

* Users can access the notifying system which uses SparkFun RedBoard Artemis ATP board to recognize and classify sound data.
* The system should be able to integrate the Artemis board with the user’s device through the app.
* Users can receive notifications from the mobile app (Android) when spark is detected.

## Non-Functional Requirements

* The application shall be: Reliable: manages to become convenient and helpful to detect any spark activities
* Scalable: the program carries potential to scale to enterprise level and until then it can allow usage for limited users.
* User-friendly: simple yet robust
* Accurate
* Maintenance-free: does not require any kind of maintenance, is completely stand-alone

## External Interface Requirements

While keeping in mind the possibility of the application being enterprise-appropriate, each individual, belonging to either of the user classes, shall have a distinctive access to this platform, paired with unique IDs to access. Other interfaces described below are:

### User Interfaces

\*Refer to section 2.2 Product Features\*

### Hardware Interfaces

\*Refer to section 2.2 Product Features\*

### Software Interfaces

There are various tools and techniques that shall be used for the creation of this project. The tools that will be using majorly are:

* Python 3, Java should have a local programming environment set up on your computer.
* Jupyter Notebook/PyCharm or any python console.
* Eclipse/IntelliJ or any other Java console – to create an app which can connect to BLE devices through QR code.
* Microsoft Excel: to store the user data in a structured format, and increased readability of .csv files via Python.
* ZXing: a library for barcode and QR code scanning.
* Android Studio: official IDE for app development
* Modules to be installed: Scikit-learn, CNN, seaborn, Pandas, NumPy, Tenserflow, Keras, PySerial
* Audacity: A free and open-source digital audio editor and recording application software which has features like noise reduction.
* Arduino BLE

### Logical Database Requirements

The database used in the application is: (example)

* Microsoft Excel
* MySQL
* MongoDB
* SQLite

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