

SMART MUSIC PLAYER

Requirement Specifications

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**VERSION HISTORY**

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| --- | --- | --- | --- |
| **Version** | **Change description** | **Person** | **Date** |
| 1.0.0 | Initial draft | Duc Nguyen | 07.10.2019 |
| 1.1.0 | Instructor suggested changes | Minh Nguyen | 08.10.2019 |
| 1.2.0 | Add Accpetance Criteria | Duc Nguyen | 08.10.2019 |
| 1.2.1 | Fill in missing data at 6.4.3, 7.1.2 and 7.4.2; grammar check | Minh Nguyen | 08.10.2019 |
| 1.3.0 | Add Feasibility Assessment, Reference Documents | Duc Nguyen | 09.10.2019 |
| 1.3.1 | Add AES reference; grammar check | Minh Nguyen | 11.10.2019 |
| 1.3.2 | Add SFTP as file transfer protocol. Small change in scope. | Minh Nguyen | 25.10.2019 |
| 1.3.3 | Minor wording changes, remove device mockup | Hien Tran | 25.10.2019 |

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# Introduction, Scope and Requirements Defintion

## Introduction

The purpose of this System Requirements Specification (SRS) document is to establish the functional requirements of the Smart Music Player Project.

## Scope

This document will cover hardware and software requirements for the portable device, Android application and cloud application. It does not concern the deployment of the system.

## Requirements Definition

The purpose of this section is to outline what the project team defines to be a good requirement.

### Characteristics of a requirement

All requirements should share the following characteristics:

* Unitary - The requirement should address one and only one thing.
* Complete - The requirement is fully stated in one place with no missing information.
* Consistent - The requirement does not contradict any other requirements.
* Non-Conjugated - The requirement should not be conjugated. Example: “The postal code field must validate American and Canadian postal codes” should be written in two requirement statements.
* Traceable - The requirement meets all or part of a business need as stated by the stakeholders and authoritatively documented.
* Current - The requirement has not been made obscure by the passage of time.
* Feasible - The requirement can be implemented within the constraints of the project
* Unambiguous - The requirement is concisely stated without recourse to technical jargon, acronyms, or other esoteric verbiage.

### Requirements Terminology

The purpose of this section is to define the wording that will be used in our requirements document.

* Shall - The statement is a hard requirement. It is absolutely not negotiable, and the requirement statement must be met by the team. This corresponds to critical and high, levels 1 and 2, priorities.
* Will - There is intent by our team to meet this statement. This corresponds to medium, level 3, priority.
* Should - This word, or the adjective “Recommended”, means that there may be valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course. This corresponds to low and future, levels 4 and 5, priorities

# Product Concept

This section describes the overall concept of the Smart Music Player by giving a brief and concise description of the purpose and audience.

## Purpose and Use

Smart Music Player is a portable device so that can be embedded on any moving system. The main function is to play music based on weather. The users can setup the device and control the music player manually via built-in buttons and via an Android Application.

## Intended Audience

Smart Music Player will be widely targeted towards those who travelling to different locations and wants to enjoy different types of music without having to search and choose existing playlists.

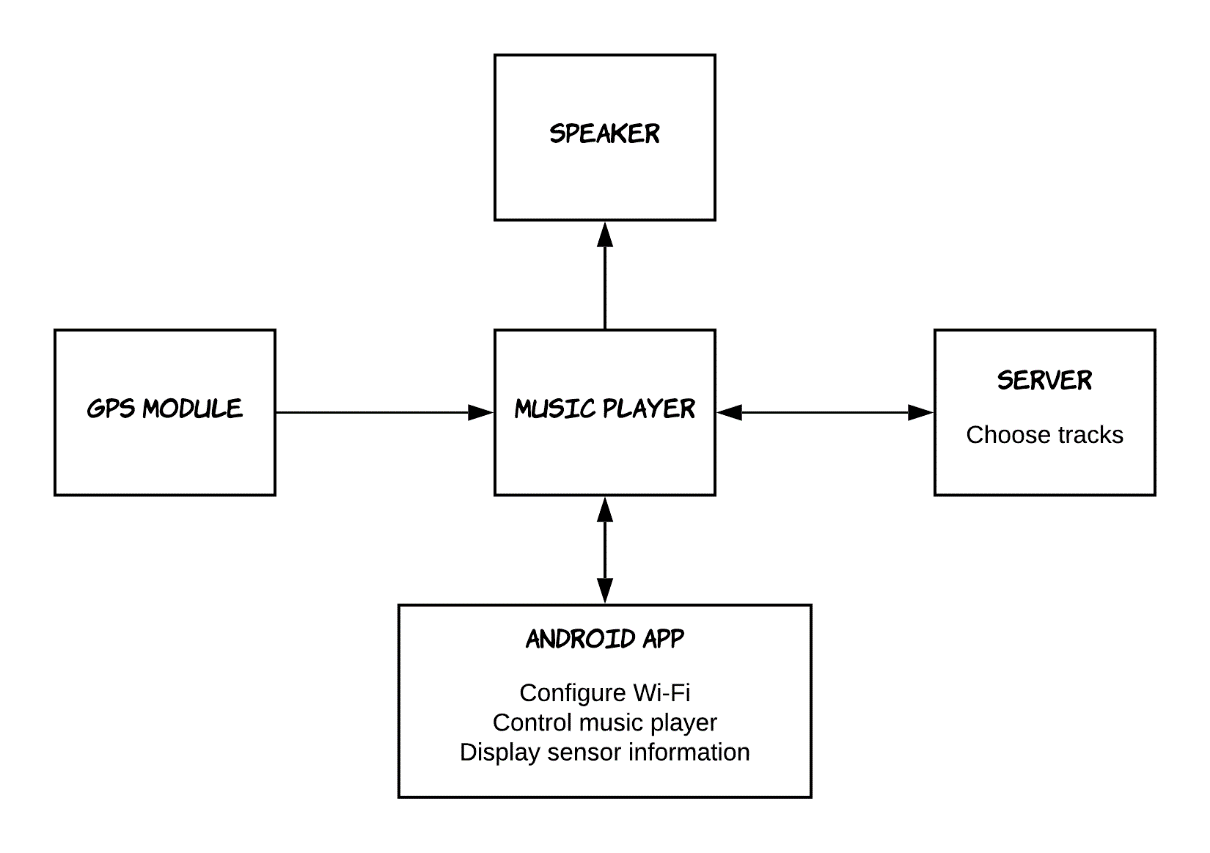
# Product Description and Functional Overview

Smart Music Player is a portable music player with build-in GPS module detecting the location of the user. Based on detected weather, music tracks will be chosen by the server and sent to the music player.

An Android application will be provided to control the music. The Android mobile device connects to the music player over a Bluetooth connection. This interface will be used to configure the Wi-Fi connection of the music player, and control the music player.

The music player communicates with the server via Wi-Fi connection.

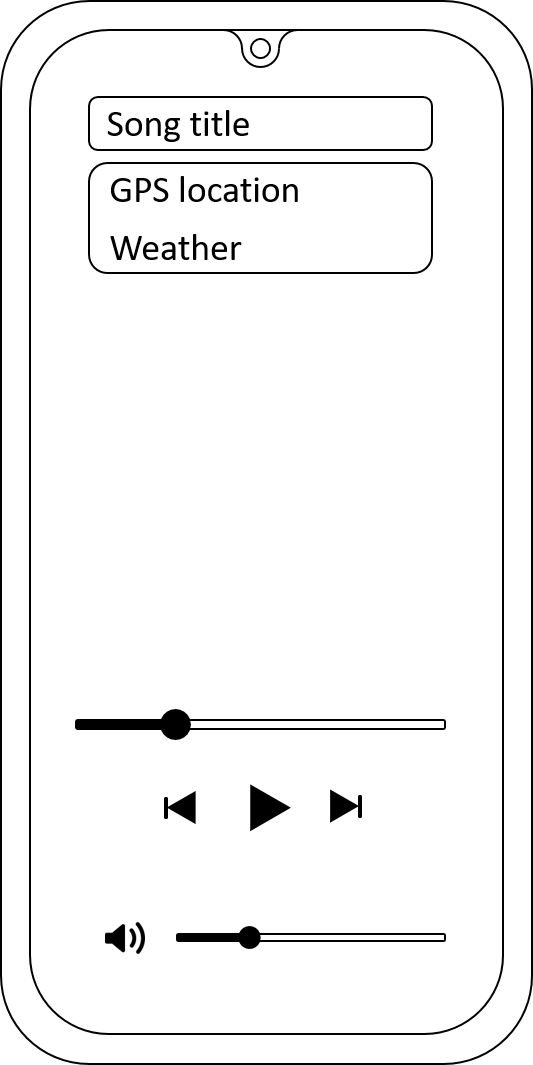
Figure 1 describes the overview on the whole system.



**Figure 1.** System Overview

The music player shall have physical buttons to switch on/off and to control the music. There are also micro USB to recharge the device’s battery and one 3.5 audio output to external speaker.

Figure 2 provides a mockup of the user interface on Android phone. The mobile will connect to the music player via Bluetooth Link.



**Figure 2.** Android App Mockup

# Customer Requirements

This following section will detail the existing customer requirements. They should clearly define the restrictions and expectations set forward by the customer and give a clear definition of what the end product will be capable of performing. Some of these requirements are, but not limited to acquire GPS data, detect current location weather, send data to server to make music decision, and audio playback.

## Acquire GPS Data

### Description

The product shall have a hardware module that will return the current GPS location.

### Source

None

### Constraints

Processing power of the system in used

### Standards

EIA/JEDEC Standard JESD22-A113-B / Level 3

### Priority

1 – Critical

## Cloud Server

### Description

A server shall be available for the product to communicate to over Wi-Fi connection, receiving the GPS location, getting the weather at the location, choosing the music tracks and sending back metadata of the chosen music tracks.

The server will also host all the music tracks for the device to download. The file transfer which will ensure the transfer of the file and the security of the communication

### Source

None

### Constraints

None

### Standards

None

### Priority

1 – Critical

## Secure Cloud Communication

### Description

The communication from the device to the server shall be secured using HTTPS and SFTP.

### Source

None

### Constraints

None

### Standards

### TLS 1.2 for HTTPS

SSH 2.0 for SFTP

### Priority

1 – Critical

## Play Music

### Description

The product shall be able to play music through an external speaker.

### Source

None

### Constraints

Support waveform audio file format (WAV) at 320kps bitrate, 16-bit bit depth and 44100 Hz sample rate

### Standards

None

### Priority

1 – Critical

## Mobile Android App

### Description

We shall write an application in C++ that reads the transmitted data from the Bluetooth module, processes the data, and displays the information to the user in a visually stimulating fashion.

The mobile application is also used to configure the Wi-Fi connection of the product and control the audio playback.

### Source

None

### Constraints

Only writing application for devices running Jellybean OS up to Pie OS

### Standards

Bluetooth V4.0

### Priority

2 – High

## Secure Bluetooth Communication

### Description

The communication from the product to the Android device shall be secured using Advanced Encryption Standard (AES) with a 16-byte pre-shared key.

### Source

None

### Constraints

None

### Standards

AES

### Priority

2 – High

## Control Audio Playback

### Description

There shall be build-in buttons on the device to control the audio playback.

### Source

None

### Constraints

Control for play/pause, volume up/down, skip audio.

### Standards

None

### Priority

2 – High

# Packaging Requirements

This section describes the packaging requirements for the product. Packaging requirements include a user manual, server software, and application store submissions

## User manual

### Description

The system shall be packaged with a user manual explaining how to use the music player.

### Source

The project’s team

### Constraints

None

### Standards

None

### Priority

1 – Critical

## Cloud Software

### Description

The project team will develop a cloud software to host music tracks, metadata and process GPS data with the help of a third party API.

### Source

The project’s team

### Constraints

None

### Standards

None

### Priority

1 - Critical

## App Store Submissions

### Description

The Android application should be made available to Android market.

### Source

The project’s team

### Constraints

Time and licensing requirements

### Standards

None

### Priority

3 - Medium

# Performance Requirements

This section describes the performance requirements for the product. Performance requirements include connecting time, reliable data transfer, Android version compatibility, and multi-threading.

## Connecting time

### Description

The system should be connected to the mobile device via Bluetooth in a short amount of time. The ideal connecting time should be no more than one minute.

### Source

The project’s team

### Constraints

None

### Standards

None

### Priority

3 – Medium

## Reliable Bluetooth Data Transfer

### Description

The system shall have a high success rate on bluetooth connection. System should implement error detection, receiver feedback, and retransmission to the receiver.

### Source

The project’s team

### Constraints

None

### Standards

None

### Priority

1 – Critical

## Android Version Compatibility

### Description

The system shall be compatible with Jellybean OS up to Pie OS.

### Source

The project’s team

### Constraints

None

### Standards

None

### Priority

2 – Critical

## Multi-threading

### Description

The system should be multithreaded to insure high speed data conveyance.

### Source

The project’s team

### Constraints

Processing power of the system in used

### Standards

None

### Priority

3 – Medium

# Acceptance Criteria

These acceptance criteria will be verified in the verification stage of Smart Music Player project. These items are critical to the success to the Smart Music Player project.

## Verify that location output is accuracy

### Requirement(s) addressed

4.1-Acquire GPS Data

### Verification Procedure

The data acquired from the GPS module will be compared against the exact coordinate of the measuring location

## Verify that the system can play music

### Requirement(s) addressed

4.4-Play Music

### Verification Procedure

The music playback will be tested with local music file on the device.

## Verify that audio playback control is functional

### Requirement(s) addressed

4.7-Control Audio Playback

### Verification Procedure

The audio playback control will be tested with local music file on the device.

## Verify that data is carried over to the central server successfully

### Requirement(s) addressed

4.3-Secure Cloud Communication, 4.6-Secure Bluetooth Communication, 6.2-Reliable Data Transfer

### Verification Procedure

The data acquired received at the server will be compared against the data sent from the device

## Verify that the mobile data output is accurate

### Requirement(s) addressed

6.2-Reliable Data Transfer

### Verification Procedure

The output displayed the mobile application will be compared against the output on the server.

## Verify that the Android application is compatible

### Requirement(s) addressed

6.3-Android version Compatibility

### Verification Procedure

The Android application will be tested on different Android OS versions.

# Feasibility Assessment

## Cost Analysis

The main cost associated with this project will have to deal with the hardware. The current plan is to actually design and develop a printed circuit board to integrate into an existing system. If budget does not allow for a full printed circuit board, a bread boarded prototype will be produced. All other costs should be considered to be time related instead of monetary-based. The following table gives a bare bones initial estimate of the potential costs associated with the project. This estimate is broken down into a both a low and high end cost estimate.

**Cost Estimates**

|  |  |  |
| --- | --- | --- |
| Component | Low End Cost | High End Cost |
| Central Unit/ Udoo Neo | €40 | €60 |
| GPS Module | €20 | €120 |
| Sound card | €10 | €40 |
| Hardware Enclosure | €20 | €50 |
| Wiring and Connections | €10 | €20 |
| Circuit Board | €15 | €50 |
| Rechargeable Power Supply | €10 | €30 |
|  |  |  |
| Total | €125 | €370 |

**Table 1.** Cost Estimates

## Size Estimate - Lines of Code (LOC)

To estimate the size of the project based on lines of code (LOC), we first broke down and estimated the size of each individual aspect of the project. The following table gives a rundown of the size estimation for each component.

**Size Estimation - LOC**

|  |  |  |
| --- | --- | --- |
| Component | Low Estimate | High Estimate |
| Central Unit/ Udoo Neo | 4500 | 9000 |
| Android Application | 1000 | 2000 |
| Server Software | 1000 | 2000 |
|  |  |  |
| Total | 6500 | 13000 |

**Table 2.** Size Estimation - LOC

# Reference Documents

## Internal Documents

## Industry Standards

In the event of a conflict between a referenced document and this document, the requirements in this document shall take precedent.

### Global Positioning System

<https://en.wikipedia.org/wiki/Global_Positioning_System>

### WAV Audio format

<https://en.wikipedia.org/wiki/WAV>

### Udoo Neo Development Board

https://www.udoo.org/udoo-neo/

### Bluetooth V4.0

https://en.wikipedia.org/wiki/Bluetooth#Bluetooth\_4.0

### Wi-Fi Connection

https://en.wikipedia.org/wiki/Wi-Fi

### Advanced Encryption Standard

https://en.wikipedia.org/wiki/Advanced\_Encryption\_Standard

**APPENDIX**

**List of Acronyms**

GPS - Global Positioning System

SRS - Systems Requirement Specification

TLS - Transport Layer Security

AES - Advanced Encryption Standard

WAV - Waveform Audio File Format

SFTP – SSH File Transfer

SSH – Secure Shell