## **1.1** **Problem Statement**

What problem is your project trying to solve? Use non-technical jargon as much as possible.

We are trying to replicate and provide the means to manipulate the distortion created by a vacuum tube amplifier. Musicians often use “sound effect” devices to manipulate sound coming out of an instrument. Vacuum tube amplifiers are said to produce a unique type of distortion which many people have grown to appreciate. Our project will attempt to provide a solid state design to replicate this type of distortion at a lower price. We will also attempt to provide the means to manipulate the distortion so that musicians may use our device as more than a simple amplifier.

## **1.2** **Requirements & Constraints**

List all requirements for your project . This includes functional requirements (specification), resource requirements, qualitative aesthetics requirements, economic/market requirements, environmental requirements, UI requirements, performance requirements, legal requirements, maintainability requirements, testing requirements and any others relevant to your project. When a requirement is also a quantitative constraint, either separate it into a list of constraints, or annotate at the end of requirement as **“(constraint)**”. Other requirements can be a single list or can be broken out into multiple lists based on the category.

For functional requirements, we are tasked with constructing a circuit that can replicate/improve upon the audio signal distortion introduced by a vacuum tube using solid state components to reduce cost and increase reliability. This distortion replication can be achieved either through digital signal processing, through a microprocessor contained within the device, or through purely analog solid state Integrated Circuit components. The device should also have interfaces with most types of instruments in order to maximize the potential user base. This will include standard analog audio formats (i.e. XLR, 3.5 mm, ¼ inch) as well as ports for MIDI interfacing. The device should also have an easily comprehensible user interface attached to the device in order to minimize the difficulty of changing settings on the fly, while also having a more in-depth interface when attached to a computer for building custom settings.

## **1.3** **Engineering Standards**

What Engineering standards are likely to apply to your project? Some standards might be built into your requirements (Use 802.11 ac wifi standard) and many others might fall out of design. For each standard listed, also provide a brief justification.

Midi-USB Protocol

AES3 Digital Audio Protocol

IEC 60958/AES14 Analog Audio Protocol (¼ inch & XLR analog input/output)

IEEE 315 Specifications for Electrical Design Documentation

IPC-2221 General Specifications for PCB design

IPC-2222 Specifications for PCB design related to high-frequency signal processing

## **1.4** **Intended Users and Uses**

Who benefits from the results of your project? Who cares that it exists? How will they use it? Enumerating as many “use cases” as possible also helps you make sure that your requirements are complete (each use case may give rise to its own set of requirements).

The intended user base will mainly consist of musicians who may use our device to manipulate the sound of their instruments. Another user base may be those who like the sound of vacuum tube amplifiers, but may not have the disposable income to justify the purchase of such a system.