**IoT Project Specification Document**

**Name:** Jack Power

**Student No.:** 20080169

**Project Title:** Automatic Guitar Tuner.

**Contents:**

* Introduction

- Project Description

- Context Diagram

* Purpose

- System Purpose

- Subsystems

- Non-Functional Requirements

**Introduction:** A system which allows for a user to select a note and have a plucked string tuned to that pitch, displaying the selection and current pitch to the user during the process.

**Context Diagram:**

Compare Pitch

tensionAdjustment

currentPitch

targetPitch

selection

Convert to Hz

screenFeedback

**Purpose**: A sensor will detect the pitch of the string to be tuned and a motor will adjust the tension until the string is in tune. This allows the user to tune to a range of tunings with ease.

|  |  |
| --- | --- |
| **Name**: | Convert to Hertz. |
| **Description**: | This subsystem will take a note in a pitch class format, e.g E2 , and convert it to Hertz. |
| **Inputs**: | selection – The note selected by the user in a pitch class format. This selection will correspond to a digital displacement of semitones from the pitch standard.  Standard tuning only requires E2,A2,D3,G3,B3,E4, but alternate tunings may be implemented. |
| **Outputs**: | targetPitch – The inputted note converted to Hertz. A digital value which is sent to the subsystem Compare Pitch. |
| **Processing**: | The selection input is accepted and the semitonal displacement from the pitch standard is calculated. The formula , describes the frequency of the targetPitch, where targetPitch, pitch standard (typically ) and semitonal displacement. |

|  |  |
| --- | --- |
| **Name**: | Compare Pitch |
| **Description**: | This subsystem compares the currentPitch against the targetPitch and outputs the tensionAdjustment to be made to the string. |
| **Inputs**: | currentPitch – The frequency of the string in Hz, read from a microphone.  targetPitch - The frequency returned from Convert to Hertz. |
| **Outputs**: | tensionAdjustment – The direction of adjustment to be made to the string. A ternary value which indicates whether the currentPitch is less than, greater than or equal to the targetPitch. |
| **Processing**: | The inputs currentPitch and targetPitch are compared as integers. If currentPitch is less than targetPitch, a value indicating that the tension should be increased is returned. If currentPitch is greater than targetPitch, a value indicating that the tension should be decreased is returned. If currentPitch is equal to targetPitch, the string has been tuned and the system stops. |

**Non-Functional Requirements:**

* The string vibrates audibly for about 2 seconds, the tuner must be able to make multiple analyses of the pitch every time it is plucked to reach and confirm the selected note. This means that the pitch analysis cannot take more than 0.2 secs.
* The required torque to drive the gearing of the machine head is smaller than 0.05Nm.
* The system must be constructed and positioned such that it can clearly pick up the sound of the vibrating string.