TEAM NOVA ELITE

CSCE 4901 – Computer Science Capstone

Requirements Specification 2/29/2016

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Introduction

This document is a Requirements Specification deliverable created to compile the requirements and discuss the strategies, tools, and methods to be used towards building and completing the application. Team Nova Elite is the team behind the construction of the proposed project and will also be tasked with refining the base product and any extra details that arise throughout development.

The Team consists of the following members who each currently attend the University of North Texas in pursuit of a degree in Computer Science: Jason Hoang, Imran Akhtar, Kai-Chuan Chan, and Sabrin Thamed. We will use this project as an opportunity to learn more knowledge and skills about our science along with how to produce an application that is useful in the real world. Team Nova Elite is dedicated to ensure that the final base product is fully functional within the time given to complete the project.

The rest of the requirements specification document will serve as a tentative list of the main requirements for the project. It will go into further detail about each requirement, how they affect the field of education, and address the issues involved for producing each requirement. Each requirement is also subject to change throughout development based on any issues encountered or change in ideas or need by the client.

Description of the Project:

This project consists of a teacher app and student apps that communicate directly with each other, giving the teacher the ability to guide the students who spread across the marching field/rehearsal room via a single device and allowing students to ask questions and take notes with ease. The program will focus on compiling all of the paperwork, sheet music, and coordinate sheets involved with students learning, rehearsing, and performing a marching band show onto their own personal devices and tablets. This will make the process of teaching easier and help the students stay organized with all of their papers. All apps will also have access to vital learning tools for a performing ensemble so that the students can practice with the app on their own. These apps will be designed for marching bands across the United States, but they can be adjusted to satisfy other indoor rehearsals for any type of ensemble.

The Purpose of the Project:

Team Nova Elite is tasked with producing an application that serves a portion of the general public. The students who were assembled for this team are working together for the first time in their careers and therefore have put together a list of objectives for the team to achieve alongside producing the main application:

- Build an application that serves music educators in the field of marching band at a high and efficient level.
- Form an inviting and hard working environment for each member of the group to feel comfortable working with and complete a successful project.
- Produce and understand the other side to producing an application of this scale in terms of documentation and compiling all of the other team members' work and data.
- Strive for punctual completion of each requirement and feature of the project with the initial focus on functionality.
- Learn and be comfortable with new IDEs and programming languages that are commonly used in the field.

The Client:

The client in question is a young North Texas band director named Chantal Hoang, who has high level experience and knowledge about the marching band. She has served as a member of the Carolina Crown and the Blue Devils Drum and Bugle corps in 2013 and 2014 respectively. Both of these drum corps are among the many professional marching bands in the world and in both of the years that our client has marched, she went to the world championships and won first place with both groups. Alongside Chantal's world championship wins, she has worked on staff with multiple band programs in the North Texas area teaching younger high school students about the art and physicality of marching band. Having recent knowledge of marching band on both sides of the field, the student and the teacher, Chantal is a highly qualified client to help develop this project within the current generation of teaching marching band.

Possible Stakeholders:

Other possible clients that would be interested in this project would be other high school and college band directors within the State of Texas and/or the United States. These directors would make good use of this application as the industry is beginning to move distribution of music to digital for ease of access and while at the same time trying to cut down on the amount of paper that each organization uses. Especially during the marching season where both music and coordinate sheets need to be printed out almost every day for each student to learn new music and new marching drill. The application will also help with communication between the teacher and the students across the field for when ensembles need to rehearse drill that spreads the students to the far reaches of the field.

Students also fall into the pool of possible stakeholders as the project also serves to help progress their education with the marching band efficiently. The project will implement tools for the student to use for practice anywhere they can be with the app. Whether they are practicing their marching band stuff at home, in the band hall, in a practice room, or on the marching field, the app will have the necessary tools for them to be successful.

Project Constraints:

Some of the constraints that the team will encounter and overcome throughout the development of this project:

- Time constraint of approximately 3 months to learn, build, and complete a fully functioning prototype for the project.
- Scheduling constraint due to having to build and develop the project alongside a full college level semester. Not all team members will be able to meet and work together at reasonable and convenient times.
- Limited to the number of tablets and uniform devices to test and produce the application onto.
- Constrained by the amount of knowledge available to research and apply towards the development of the project.
    - This includes how to implement the decryption and translation of MusicXML into the app and the output files from a program like pyware.
- Feature constraints due to the level of difficulty in producing an application that operates with music files and drill coordinate files used by various music education software for marching bands.
    - Such as the use of MusicXML and pyware.

Naming Conventions and Definitions:

Here is a brief list of words and naming conventions that are used throughout this document and fall under the subject of marching band.

Coordinate Sheet – This is a document given to each student with their own list of coordinates of where to stand on the marching field. The sheet gives front-to-back and side-to-side coordinates along with the amount of time it should take for the student to march from their initial coordinate to the next.

Music Sheet – This is just a piece of music that has been divided by instrument and given to each student according to their instrument assignment. The music may be split into several sheets depending on how long the overall length of the piece.

Set – This term is used to specify a single coordinate tuple within the coordinate sheet.

Metronome – This is a music education tool used to keep students playing in time and together within the ensemble. It also helps students while practicing at home to stay in tempo with the music.

Pitch Tuner – This is another music education tool that is used to correct the tonal pitches of each instrument and to allow the student to see how they need to adjust to match the perfect pitch.

Marching Field – This is a naming convention used for the fields that the marching band usually practices and performs on. These fields can range from a painted football field onto concrete or grass, or the use of an actual football stadium.

Relevant Facts and Assumptions:

This is a list of facts and assumptions about the project that have an effect on the development of the project and the overall final product within the hands of the client.

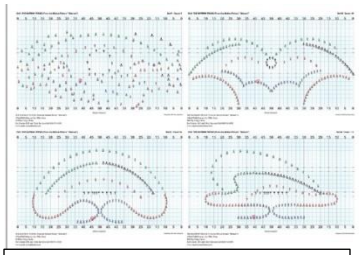
- The average marching band consists of at least two band directors, a few minor staff members, and about 50-200 marching students. Therefore, the application must be able to support a handful of teacher applications connected to several student applications.
- Within a standard marching show, there exists at least one coordinate sheet for every piece of music being played.
- Marching bands usually utilize a pencil to make special markings on each of their music or coordinate sheets.
- Most high school students in this generation will have access to a mobile device for school related activities.
- The average marching band can use up to $20,000 in paper and printing alone each year.
- Most marching band directors need to stand within the stadium box or a practice field tower to see the overall picture that the ensemble is making on the field and to hear the music from the proper angle. Therefore, they are not able to communicate with each student as easily as they would prefer to direct clear instructions across the field.

Scope of the Work

Current Situation:

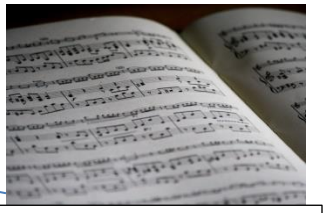
The current situation consists of the average marching band using stacks of printing paper to provide music and coordinate sheets to their students and teachers in order to produce a proper marching band show on the field. The project being developed for this situation will ease the use of paper and ultimately cut down the costs of printing and paper usage for each organization. The application will also remove the use of full paper binders on the field by replacing with accessible mobile devices such as a tablet or a cell phone. These devices will serve to help both the students and the teacher learn and rehearse on the marching field efficiently without the abundant use of loose paper being flipped for each piece of music or new coordinate sheet.

Work Context Diagram:



Coordinate sheets

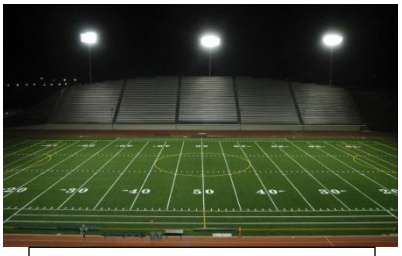
Printer



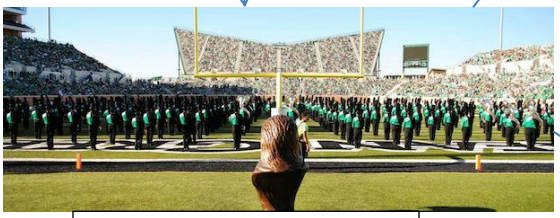
Sheet Music

Marching instruments

Compilation of music, marching drill, and music education tools for efficient marching band rehearsal.



Marching field



Students

Communication between the director and the students.

Band Directors

Music Education Tools

Business Event List:

1. Student is assigned a new coordinate sheet to use and records it into their application.
2. Student downloads a new piece of music.
3. Student marks their music.
4. Student edits their coordinate sheet.
5. Student Logs into the application.
6. Teacher takes attendance for rehearsal.
7. Teacher needs to notify a student.
8. Student needs to notify a teacher.
9. Student or teacher needs to change the music or coordinate sheet.

Simple Business Use Cases:

1. Student is assigned a new coordinate sheet to use and records it into their application.

   Input: marching coordinates from the sheet, any director's or student's notes, and music matchup details.

   Outcome: The student inputs and records all of their marching coordinates set by set into the application for their own studying. Writing down each set specifically will help them to memorize efficiently, while also being able to take notes about each set and connect them to the music with ease.
2. Student/Teacher downloads a new piece of music.

   Output: the downloaded music is accessible from the user's application database and can be outputted to the device's screen.

   Outcome: The user can easily download a new piece of music that they need from the school's application database and view it on their personal devices without the need for printing paper.
3. Student marks their music.

   Input: The student makes direct and physical markings with a digital pen onto their music.

   Outcome: These markings are saved into a separate file from the original so that the student can go back to the clean version. The student can also make such markings to help with rehearsal and practice techniques.
4. Student edits their coordinate sheet.

Input: Student makes a change to their coordinate sheet which is inputted into the application's database.

Outcome: The student is able to alter their rehearsal materials immediately in order to keep up with the ever changing marching show. This also takes away the need for printing brand new coordinate sheets with only a few changes.

5. Student Logs into the application.

   Input: Student inputs their credentials into the application in order to log in to the system.

   Outcome: Login status is recorded for the teacher to use for rehearsals.

6. Teacher takes attendance for rehearsal.

   Output: The login status for each student is viewable to the teacher on an attendance page within the teacher application.

   Outcome: With this tool, the teacher can take attendance with ease for the rehearsal alongside being able to send notifications to each student through the attendance list.

7. Teacher/student needs to notify a student/teacher.

   Input: Teacher/student ID is automatically recorded into the notification being sent along with any information that needs to be passed along to through the system to send the notification appropriately. The message, or purpose of notification, is also sent.

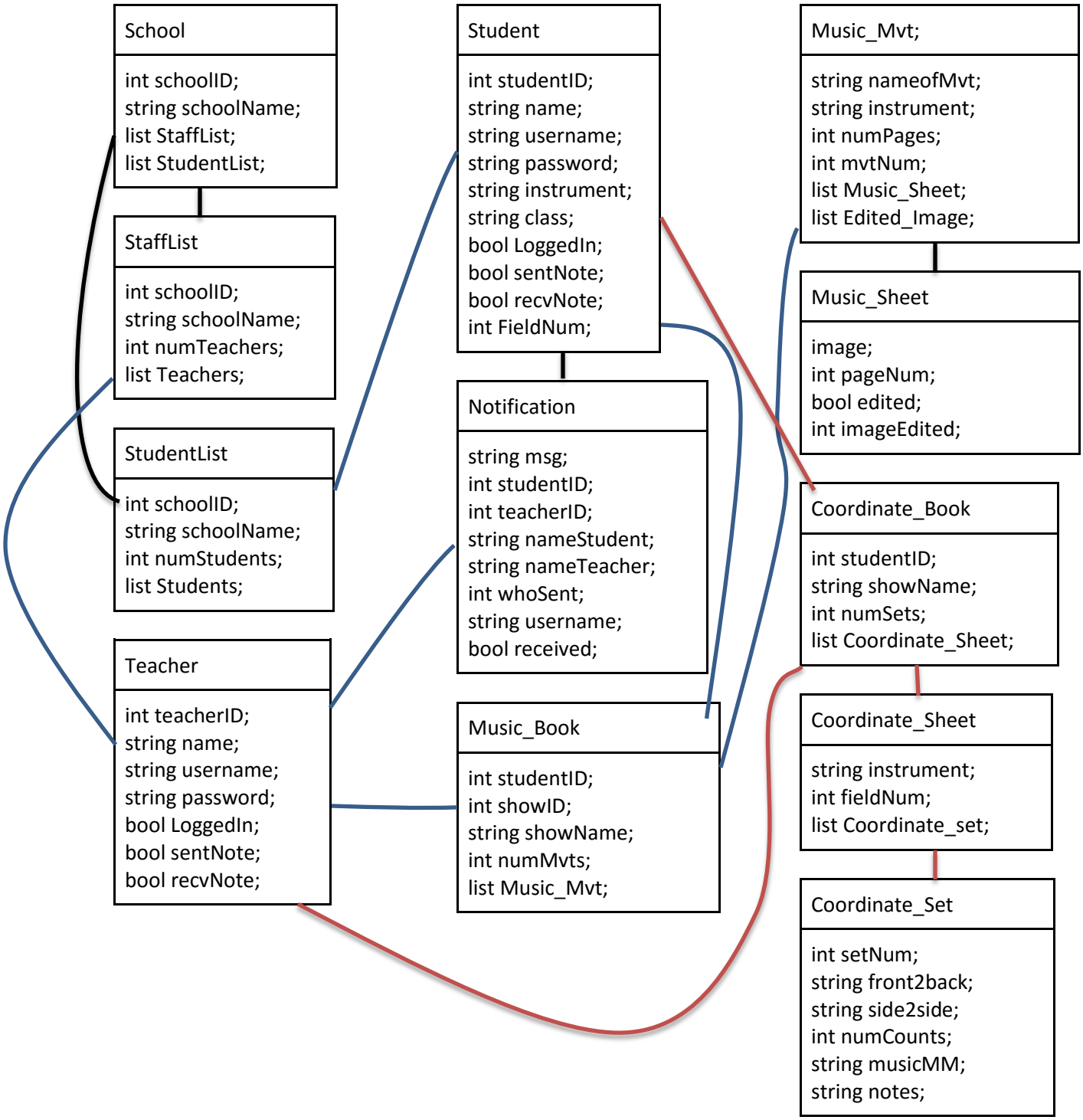
   Outcome: The receiver is notified appropriately and efficiently for them to take action. The system also notifies whether or not the receiver has seen the notification or not for clearer communication between the two users.

8. Student or teacher needs to change the music or coordinate sheet.

   Input: The user chooses a new piece of music or coordinate sheet by accessing the appropriate menu that outputs the list of each item within their current database that they can view. The user then selects the item that they want to view.

   Outcome: The application outputs to the screen the item that the user selected to view on their screen. This removes the need for the user to flip through several pages of paper searching for the item that they need.

Business Data Model (Classes):



The Scope of the Product:

Product Use Case List

Student Application:

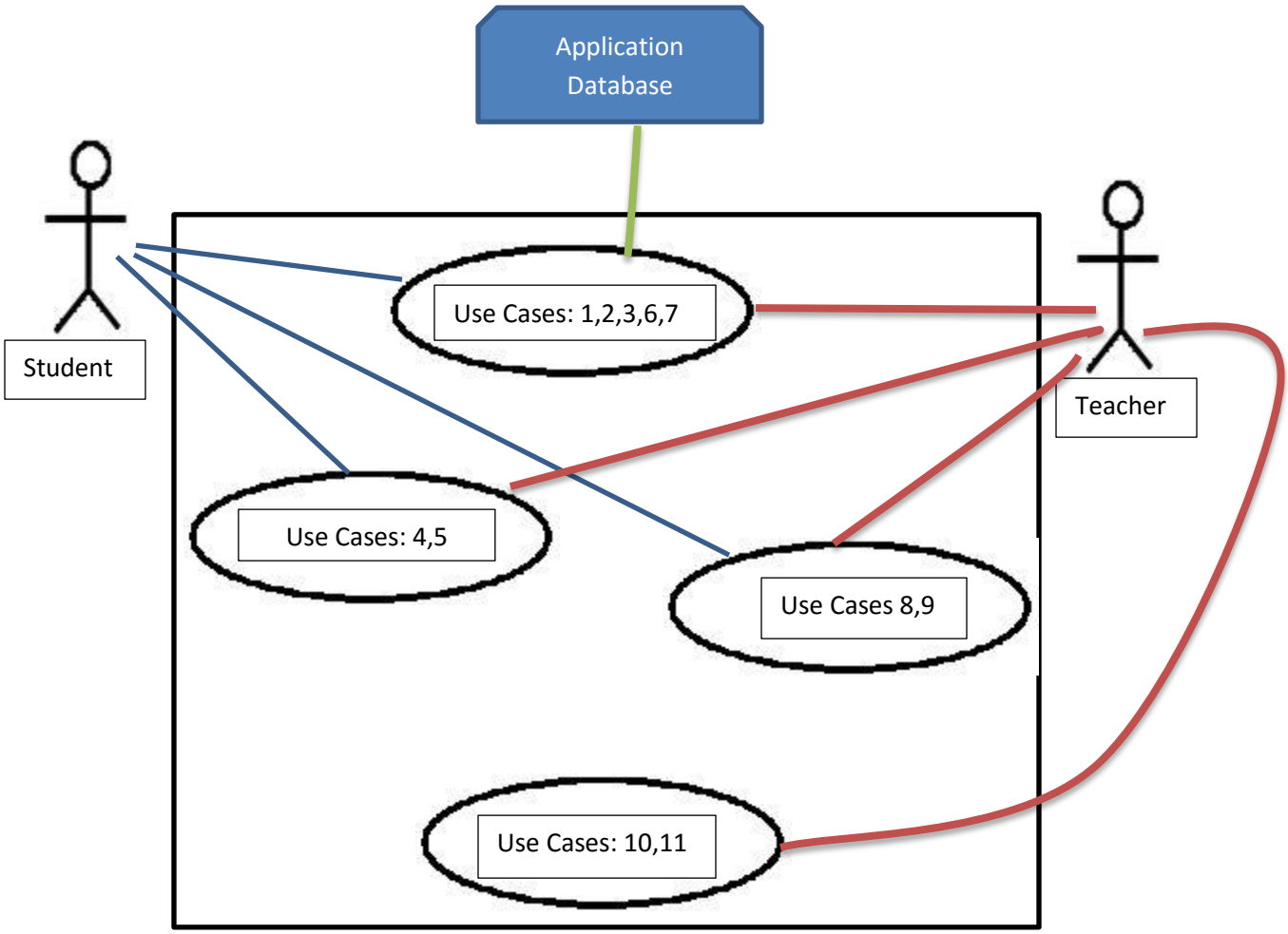
1. Login to the system.
    a. Sets student variable to "logged in" for attendance use.
2. Logout of the system.
    a. Sets student variable to "logged out" for attendance use.
3. Store and pull files and data from a database.
    a. This consists of storing coordinate sheets and music markings into the application's data base for the student's use.
    b. Also pulls any recorded data and downloaded/edited music sheets onto the screen.
4. View specific coordinate sheets.
    a. The product is able to switch between different coordinate sheets with ease.
5. View specific pieces of music.
    a. The product is able to switch between different music sheets with ease.
6. Mark edits onto digital music sheets.
    a. The product allows for the user to mark edits onto the music and save these edits as new picture of the music for the student's rehearsal use.
7. Edit coordinate sheet tables.
    a. The product allows for the user to make edits to the coordinate sheet data tables and save these edits directly to the application database for the student to retrieve during rehearsal.
8. Student sends notifications to the teacher.
    a. Student sends help notifications to any teacher capable of picking up the notification. A specific message may be implanted into the notification.
9. Use music educational tools.
    a. The student can use educational tools such as the metronome or the pitch tuner for personal practice or on the field adjustments.

Teacher Application:

1-9 Same as student except using teacher materials.

10. Take attendance of students.
    i. The application will take the teacher to an attendance page for the teacher to view who all is logged into the system during rehearsal and who is not.
    ii. This application page will also allow the teacher to send notifications directly to the students by selecting the specific students.
11. Add/remove students to the roster.
    i. The attendance page will also have options for the teacher to add or remove students from the roster when needed.

Overall Product Use Case Diagram:



Functional Requirements

Here is a list of all of the Major requirements needed for application completion and full functionality.

Requirement #:	Event/BUC/PUC #:	Description:	Functionalities:
1 – Database	1,2,3,6,7	The product will need to store data to a database and pull data from the data base.	a. Pull accounts from and save accounts to the roster. b. Needs to pull from the database: coordinate sheet data and digital pieces of music. c. Needs teacher and student identification
2 – Login	1,2	The product will need to login/logout a user into the system and record the login status of the user.	a. Pulls login credentials from the database. b. Logs into either student or teacher application. c. Then pulls up a new screen for the user to choose between main screens(music, coordinates)
3 – Music	3,4,6	The product will need to pull and display digital music onto the screen and allow the user to take notes and make edits directly onto the music for rehearsal use.	a. Pulls music documents from the database. b. Music menu appears first for user to select what document they want to work from first. c. Menu bar then retracts to the top. d. Needs to swipe between main screens(Left to Coordinates) e. Needs to swipe between multiple music pages(up and down) f. Needs to be able to edit digital music and save them to the database i. Edits: writing/drawing on the picture - like Snapchat ii. Notes: user can write specific notes into a built in notepad for each sheet of music.

4 – Coordinates	3,5,7	The product will need to pull and display coordinate data tables onto the screen and allow the user to take notes and make edits directly into each table for rehearsal use.	a. Pulls coordinate data tables from the database b. Coordinate menu appears first for user to select what coordinate sheet they want to work from first. c. Needs to swipe between main screens(Right to music) d. Needs to swipe between multiple coordinate pages(up and down) e. Can be a fixed table that can be writable and saved to the device.
5 – Notifications	8	The product will need to communicate between the student and the teacher via direct messaging.	a. Small popup originates from the menu bar and disappears into an icon on the menu bar. b. To access, user must open the menu bar, then select the notifications icon.
6 – Menu Bar	8,9	The product will need to have a menu bar that holds a set of tools for the user to easily navigate the application and have access to educational other tools.	a. Activates first, and takes the user to the directory menu. b. Holds the directory to select the music or coordinate sheets from. c. Contains metronome option, notifications, and music tuner option.
7 - Attendance	10,11	The product will need to display the login status of all members of the organization using the application during rehearsal. This allows the teacher to take attendance and send notifications to the specific students directly.	a. Pulls login statuses for all users from the database. b. Shows which students are currently logged into the system. c. Can send notifications from here. d. Can add or remove students from the roster.

Nonfunctional Requirements

Look and Feel Requirements

The client did not specify any visual requirements for the product. This allows the development team to have an organic feel while building the application. The application will not feature any specific school designs or art as it needs to be universal for all band programs to use. The visual design will be simple and basic for users to navigate the application easily without any distractions or usage boundaries. The main visual effects that need to appear within the application are the switch between screens and display of music and coordinate sheets. Music sheets will be displayed as full sheets of music with the menu bar at the top. Coordinate sheet set tables will appear similar to the following:

Example of Coordinate Sheet Table:

Set #	Front to Back	Side to Side(Left to Right)	# of Counts	Music measure #s	Notes:
1	4 stps front FH	On Side B 40	8 steps	mm. 1-2	Hold, horns up to the box
2	...				
3	...				

There are no specific requirements for colors, so the application will use black and white as universal colors until the development process calls for more dynamic colors to use. However, notification colors will be displayed in red to make them stand out within the product.

Usability and Humanity Requirements

Ease of Use

The product is going to replace the traditional use of sheet music during marching band rehearsal. Using this product, marching band students do not need to carry a several sheets of paper around a marching field. The user interface must be simple for the user to have an easy time using the product. If the interface is too complicated, the user may become confused about how to use the product. In addition, the user will need to spend a lot of time learning how to use the complicated product, which will cause problems. The menu bar and mean screen should also be easy to understand so that user can find the data and tools of product that they want to use. For example, music will always use a lot of pages; for users easy to find the page they want to view, the menu must be very clear to use.

Learning Requirements

This product is for marching band members, so they should have at least middle school level education. The product should be very easy to learn so that the users can get right to work in rehearsing their marching show. Every functionality for the application should be easy to identify and locate within the product without the need of a user manual so that users can find exactly what they need when they need it.

Understandability and Politeness Requirements

This product is for marching band members, so the product may use some upper level music terms. However, that will not be an issue because the product is supposed to provide for educated music members. Thus, all users who utilize this product will know any terms that show up for musically inclined students.

Performance Requirements

Speed and Latency Requirements

The product will be used during marching band rehearsals, so the response time needs to be very fast for efficient and progressive rehearsal schedules. If the product has too much latency, then it may cause users to fall behind in rehearsal and not be on the same page with the rest of the ensemble or the teachers. The product will save some data to the mobile device so that it can reduce some of the response time.

Availability Requirements

The application will be available for use at all hours of the day so that students can have access to all of the materials and tools that they may need to practice their work on their own time. As long as there is internet available to the device, the user can also send notifications or messages to the teachers and vice versa if the student ever had a question for the teacher or if the teacher needed input from a student.

Accuracy Requirements

The product will need to make sure that it sends the correct data or files to the user when requested so that rehearsal or practice time does not slow down or become lost. This should not be a major issue to overcome, but it can become one if functions overlap each other and the database becomes overwhelmed due to bad code.

Fault-Tolerance Requirements

The product only needs the internet to download new pieces of music from the school database, or logging into and out of the system for the teacher to take attendance. The application will also store login information to the device's database so that the user can access the product without the

need for the internet and still have access to all of the materials that they need. This is because all of the needed materials will be saved to the mobile device instead of an online database.

Capacity Requirements

The product will need to have access to the mobile device's data storage and an online database. The online database will only store login credentials and downloadable music for the user to have access. The devices storage will store any downloaded music, edited music via the application, and edited coordinate sheet tables. The capacity for each storage must be very high for the applications to be usable for any organization. The online database must be able to hold information for over 300+ users along with several pieces of music for each instrument of the ensemble, which can range up to 60 different instruments. The device storage needs only to store the instrument specific sheets of music and data tables for each coordinate sheet. This can range up to an average of 5 different sheets of music alongside an average of 4 coordinate sheet tables, each containing about 20 sets of coordinates.

Extensibility Requirements

The goal for the project is to build an application that is accessible to all marching bands across the United States in terms of functionality and ease of use towards the programs' rehearsal techniques. To build a universal app that allows all marching bands to be educated at the same rate with the same advantages so that competition is still educational and fair.

Operational and Environmental Requirements

Expected Physical Environment and Interfacing with Adjacent Systems

The product is designed to be used by any type of Android device. The product needs to be comfortable to use and easy to access, in comparison with using the traditional music binder approach. The product's only physical environment requirements are to not use the mobile device in water if they are not waterproof, and do not leave the devices soaking in the summer sun for too long. Also, the user must take care of the battery life of their devices so that they have enough power for the band's rehearsal that day.

Maintainability and Support Requirements

As technology advances, the need for an updated app will come when the hardware or software makes the current version unavailable. Advancements in technology will also call for the need to update application features to stay in competition with other products and keep the user interface simple and easy to use. Support for other devices will also need to be developed so that the range of users can be expanded upon.

Security Requirements

Access Requirements

The product has two parts, one is application for teacher version, and the other one is for student version. For the access requirements, the product will need to have a user name and a password to login to the application. These credentials will be stored into the online database and the mobile device's database for offline access.

Privacy and Audit Requirements

The product will only provide the student information to the teacher and not to any other student or outside application. The student's information can only be edited by the teacher and the specific student.

Issues

Compatibility:

Teachers and students, which are our intended audience, have different mobile devices with different operating systems. We are aware of the fact that capability is an issue and our ultimate goal is to reach as many audiences without any interruptions. But we will limit the prototype to the android development.

Starting from scratch:

Also another issue is the problem of starting from scratch. Starting from scratch can be very painful and time consuming. Time is valuable so our team wants to save as much time as possible. We decided to use simple templates already out there for us so we can concentrate on bigger issues such as the database code.

Bugs:

Every programmer knows that all software might contain bugs. Our team is aware of that and will do our best to rid of each and every bug issues that may arise in the android application. We will make a list of things that the android application should not do and test it accordingly. If it does so that the android application does fail our tests, then we will fix the bugs immediately.

Working Environment:

Another issue is the working environment. We decided to build the application using android studios IDE, since this IDE is specifically made to build android applications. However, this IDE is very vast and can get extremely complicated at times. Also there are complications with running the android virtual machine which we will need to test out application. So in order to fully optimize our application we must have a very good understanding of the IDE so we can fully utilize all of its functions.

Project Timeline:

For each product development such as the android application our team is building, there should be project timeline. One of the major issues with projects like this is deadlines and making an effort to complete the given task within the specified amount of time. In order to avoid miscommunications between team members and avoid falling behind schedule, our team has set up a detailed project timeline starting with the initialization of the project and ending with delivering the project to the client and putting it out on the market so people to use.

Knowledge:

Upon developing this project, we discovered that there are many factors preventing us from completing our tasks. Such risks include our ability to complete the project because of our knowledge, we are a team of four and are new to the work field, and none of us have actually developed an android application in java or have extensive experience with java. However, our group does have many years of experience in other languages so learning a new language shouldn't be too difficult.

Requirement Changes:

Another risk factor is requirement changes. It might happen that the client asks us to make changes in our project to fit his or her criteria. Changing the requirements especially at the last second could put us in a lot of pressure. This might mean working day and night and completing this project our number one priority. Also we might have to change our style of approach while coding in order to accomplish the task. However, if there so happens to be a requirement changes, we will work hard and make sure to fulfil the requirements within the giving time.

Code Sharing:

In projects like these, another issue that arises is sharing code and where to store all the code and database information. Upon developing this project we will use GitHub as our code sharing source. The monitoring structure is very simple. A team member will set up an account and add everyone so they have access to the project. In GitHub, everyone will get their own branch so they can work on their part of the project. The branches will have project requirements and deadlines so team members have to complete their part within the specified date. Once a team member have completed their part of the project, they are to upload their branch to the master branch so that every can see their completed work. Upon uploading their part of the project, they are to type a statement saying what they did, how they did it, and what they will do next.

We believe this is an effective way of monitoring since we can monitor every one of our team members and also help them if needed.

Database:

For storing the database we will need a server that will allow us to store all the user information such as username and password. Thus, whenever the teacher or student attempts to log in, their login information can be verified. For offline use, another database will be used and stored within the mobile device. This database will hold all of the rehearsal materials and login credentials for the user to have access to all of their work without the need for internet. However, it will take away from the attendance and teacher communication aspect of the application.