KEYBOARD LEARNER

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CSC 470: Applied Software Project

PROJECT PURPOSE

Keyboard learner is a piece of software with a goal of increasing typing proficiency for the user. Typing is an important skill for everyone to have, no matter what field. Other typing education software lacks the drive for desire to learn. It can be boring and uninteresting. Something that many people find enjoyable is music. According to a study found on statista, the average person in the United States listens to more than 26 hours of music per week (1). The piano is a fun and easy way to learn how to create your own music. By combining these both typing and music, learning to type can be fun and interesting. Through the use of this software, one can learn how to type proficiently while also acquiring knowledge of how to play monophonic musical charts on a piano. Those that will benefit from this software are those that desire to learn how to type, as well as have an interest in learning the piano. It may also benefit those who often use music software, especially composition software, that uses many keyboard shortcuts.

SYNOPSIS

The keyboard learner will have multiple levels, ranging from easy to difficult. By utilizing components of music, such as rhythm, tempo, and pitch, different computer keys will be mapped to keys on a virtual keyboard. The user will hear the piano as they type the computer key associated with the piano keys. By doing this, the user will learn to associate different pitches with different keys, thereby teaching the user about typing as well as piano playing. This creates an enjoyable environment for one to learn to type. When someone enjoys the manner in which they're learning, they will learn it faster and can apply these skills to other areas of life.

BACKGROUND

THE PROBLEM

The average typing speed is about 40 words per minute (wpm), productive speed is about 50 wpm, and advanced speed is about 80 wpm (2). There is a desire in any technical industry for fast typers. The keyboard learner is designed to encourage anyone to learn typing faster. Anyone with a desire to play music as well will benefit from this software. If I have a friend that enjoys playing the piano but struggles to write their paper because their typing speed cannot keep up with their thoughts, the keyboard learner would be a great way to apply their interests to something that could benefit them in their career or typing skills. The situation can also be flipped: perhaps I have a friend that loves to type or play online typing games and also has a desire to learn the basics of piano. They can also apply their skills and interests to learn basic songs on the piano using the keyboard learner. Piano is an important skill to have if you desire to play music, as it is one of the most versatile. It can be played with almost any genre of music.

The keyboard learner takes into account these two areas of interest: typing and piano. The software will contain different levels or "lessons" that will progressively get harder the more the user interacts with the program. The computer keyboard will be mapped to different ranges of piano keys on-screen. The goal is to map the computer keys to piano keys in a way that make sense. For example, if a song requires four consecutive notes (e.g., C D E F on a piano), then the mapped keys on the keyboard should also be consecutive (e.g., A S D F on the keyboard). This will be helpful for those who hope to apply their typing skills over to the piano as well.

The use of this software should solve the user's problem of having a low WPM typing speed, or the problem that the user finds other typing learner unappealing and uninteresting. Anyone can benefit from this software—especially those with a passion for music!

PROJECT STAKEHOLDERS

STAKEHOLDERS

- Me (the project manager and developer)
- Technology educator end users
- Music educators end users
- Typing novice end users
- Piano novice end users

REQUIREMENTS

SYSTEM REQUIREMENTS

- Windows Operating System
- .NET Framework System Components
- QWERTY keyboard
- Speakers for audio
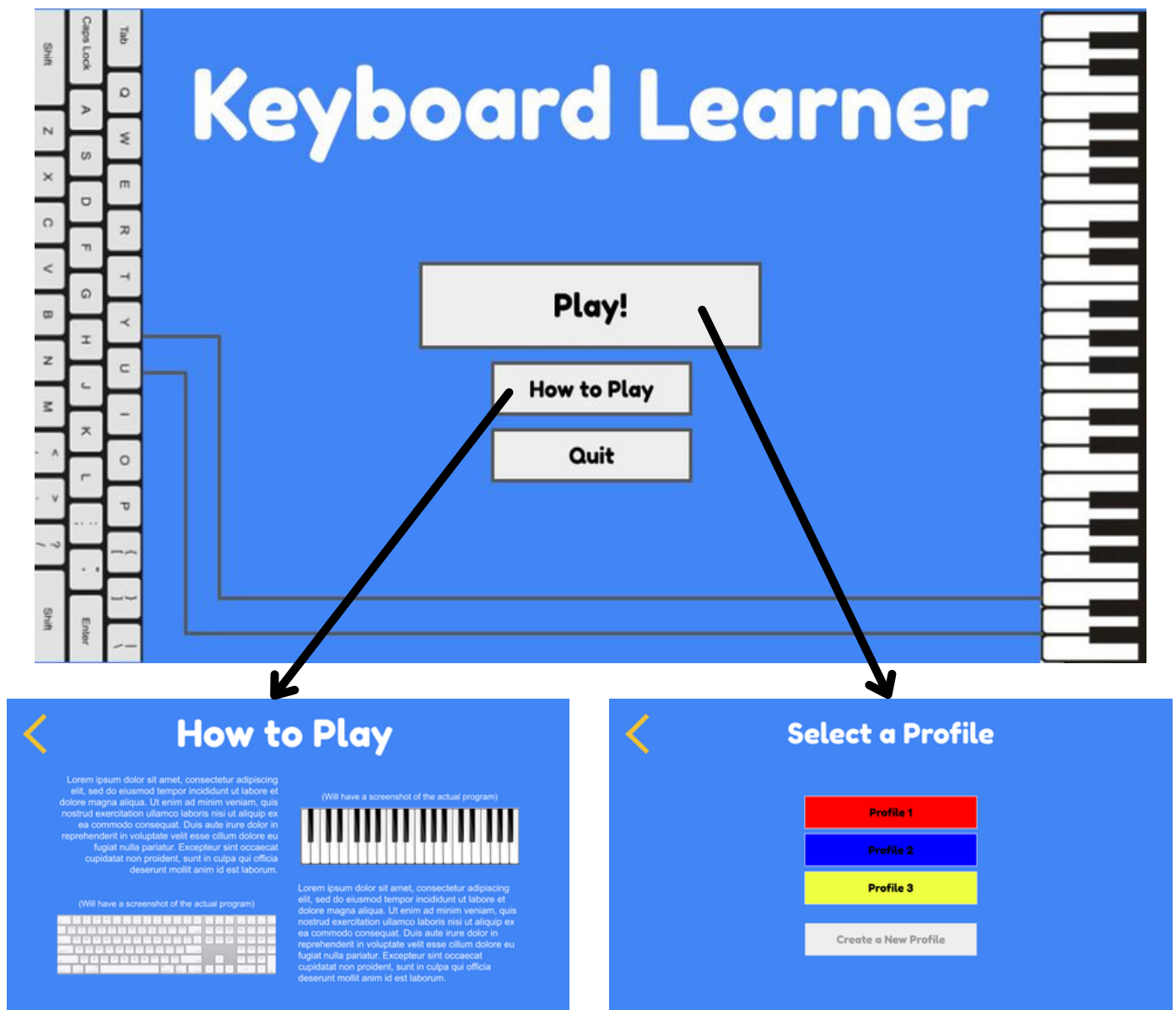- Disk space for data (At least 1GB)

FUNCTIONAL REQUIREMENTS

- The user must have the ability to choose which game level they can play
- The system should appropriately map keys from the computer's keyboard to virtual piano keys that closely simulates positions on a real piano
- The system must automatically save and display the user's progress, including an indication of estimated WPM typing speed
- The system must allow for multiple profiles to be created and saved
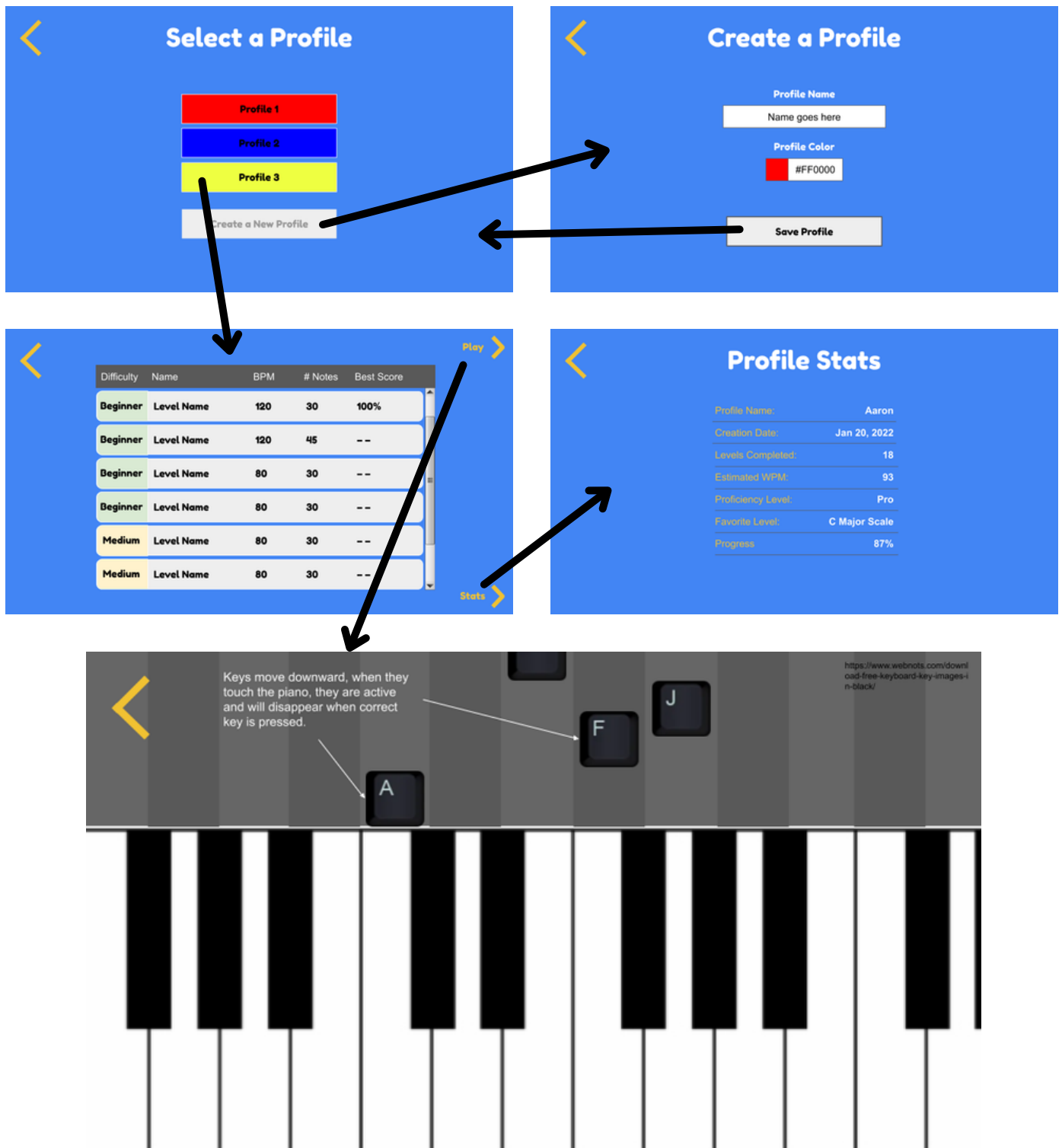
NON-FUNCTIONAL REQUIREMENTS

- The user shall be able to exit the program safely at any point of execution
- The system shall have no delay between the pressing of the keyboard and audible note associated with it
- The system shall automatically save the user's progress without delaying the system functions
- The system shall graphically and audibly indicate to the user when a key is pressed
- The system shall be easy to navigate, including selecting levels, viewing progress and settings, and safely exiting the software

ARCHITECTURE

ARCHITECTURE(CONT.)

Select a Profile

Profile 1
Profile 2
Profile 3
Create a New Profile

Create a Profile

Profile Name
Name goes here

Profile Color
#FF0000

Save Profile

Difficulty	Name	BPM	# Notes	Best Score
Beginner	Level Name	120	30	100%
Beginner	Level Name	120	45	--
Beginner	Level Name	80	30	--
Beginner	Level Name	80	30	--
Medium	Level Name	80	30	--
Medium	Level Name	80	30	--

Play

Stats

Profile Stats

Profile Name:	Aaron
Creation Date:	Jan 20, 2022
Levels Completed:	18
Estimated WPM:	93
Proficiency Level:	Pro
Favorite Level:	C Major Scale
Progress:	87%

Keys move downward, when they touch the piano, they are active and will disappear when correct key is pressed.

https://www.webnots.com/download-free-keyboard-key-images-in-black/

J

F

A

USER STORIES

TYPING NOVICE

John is a computer novice and wants to learn how to type quickly. To motivate himself to learn typing, he wants to enjoy the process, as if he is playing a video game, so that he is not bored and gives up on learning to type. John enjoys interactive games that keep him interested in the process where he doesn't need to focus on learning; it comes automatically the more he uses it. John knows that learning to type will help him navigate through his computer faster and more efficiently.
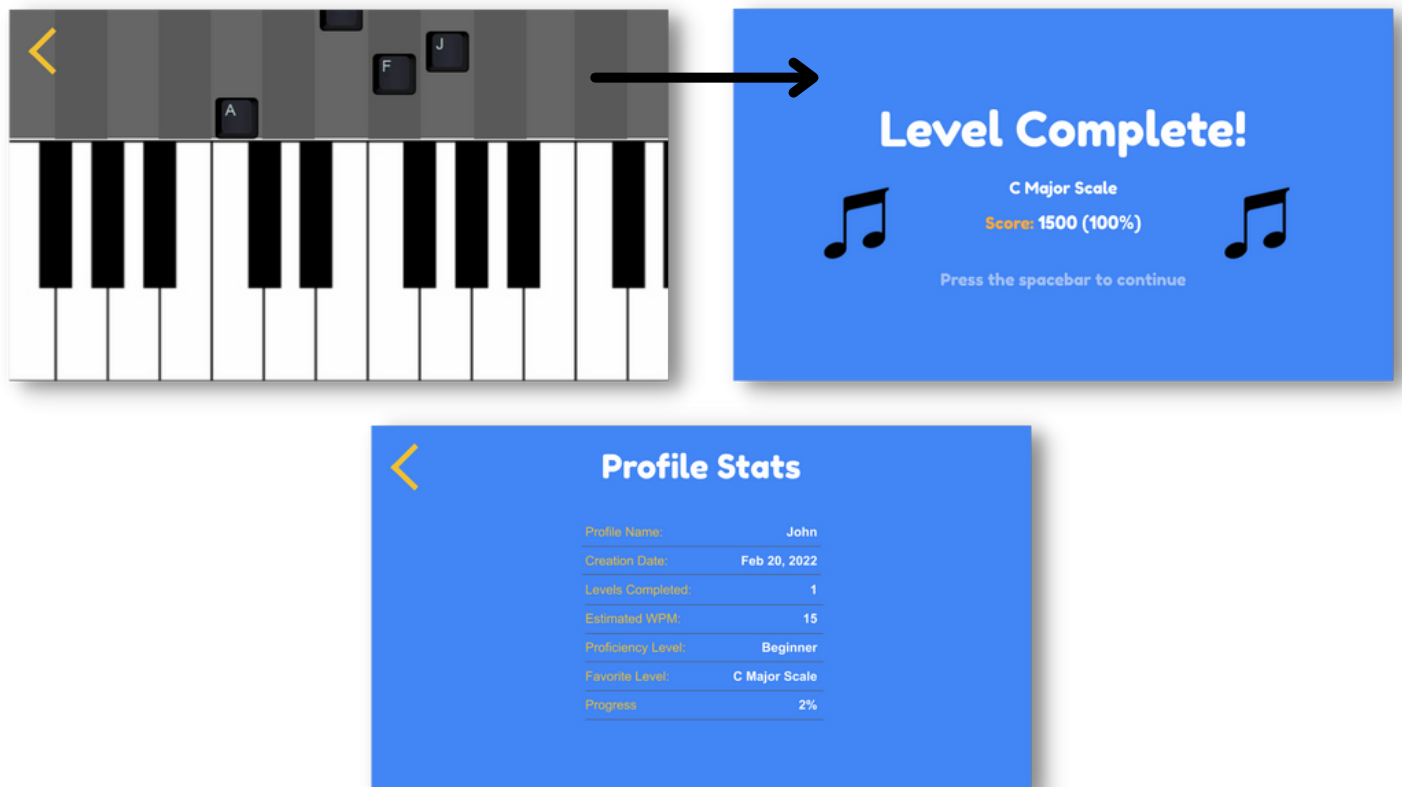
PIANO NOVICE W/ TYPING EXPERIENCE

Jane is a piano novice who wants to learn to play the piano. She has experience with typing on the computer and wants to be able to utilize these skills to learning so that the process happens faster. Because she is already comfortable using a computer keyboard fluently, she believes she can find an association between typing and playing the piano. She wants to be able to analogize her technology skills as much as she can to piano playing since they appear to use similar parts of the body and muscle memory.
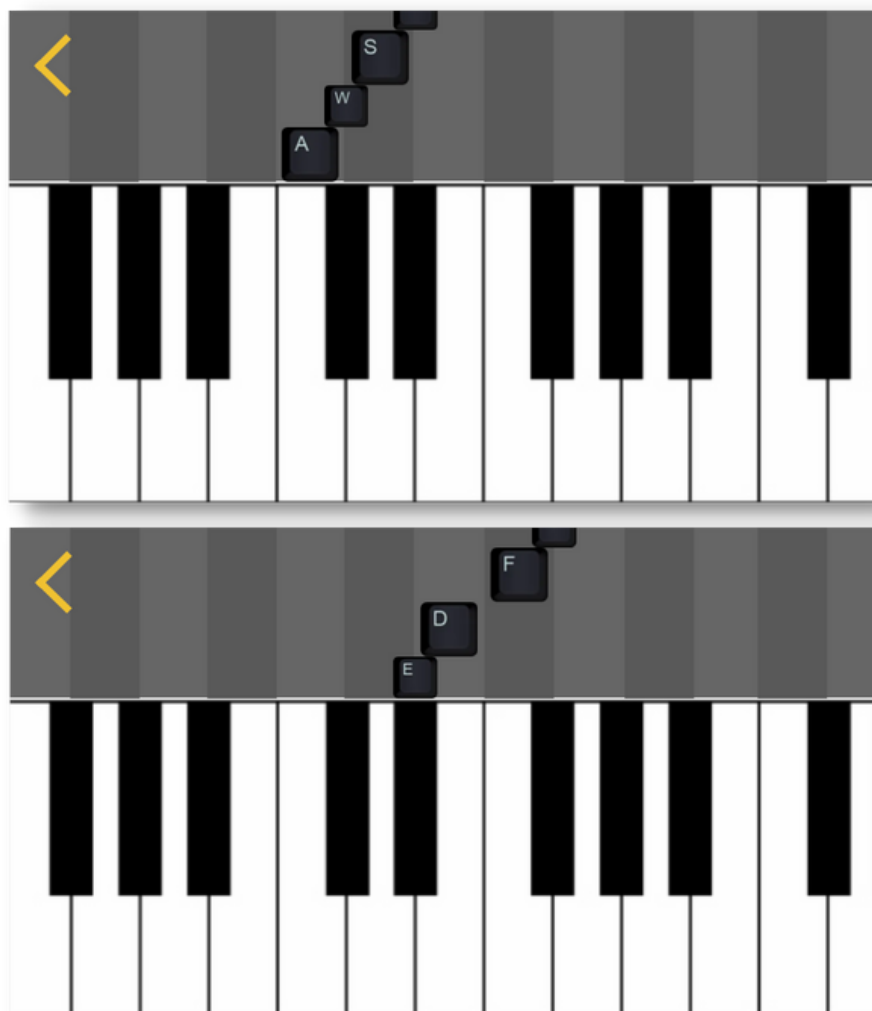
USER STORIES (CONT.)

ADMINISTRATIVE USER

As an administrator of the program, I should be able to easily create new levels inside a special privileged location within the software, as well as adjust existing levels, mappings, files, or any other data within the database. I should be the only one allowed to modify the database, so I should be able to use credentials to access the admin area. When creating new data for the database (such as creating a new level), I want to be able to use an interface that does not confuse me or make it more difficult than it needs to be.

USER STORY
UML DIAGRAMS

USE CASE DIAGRAMS
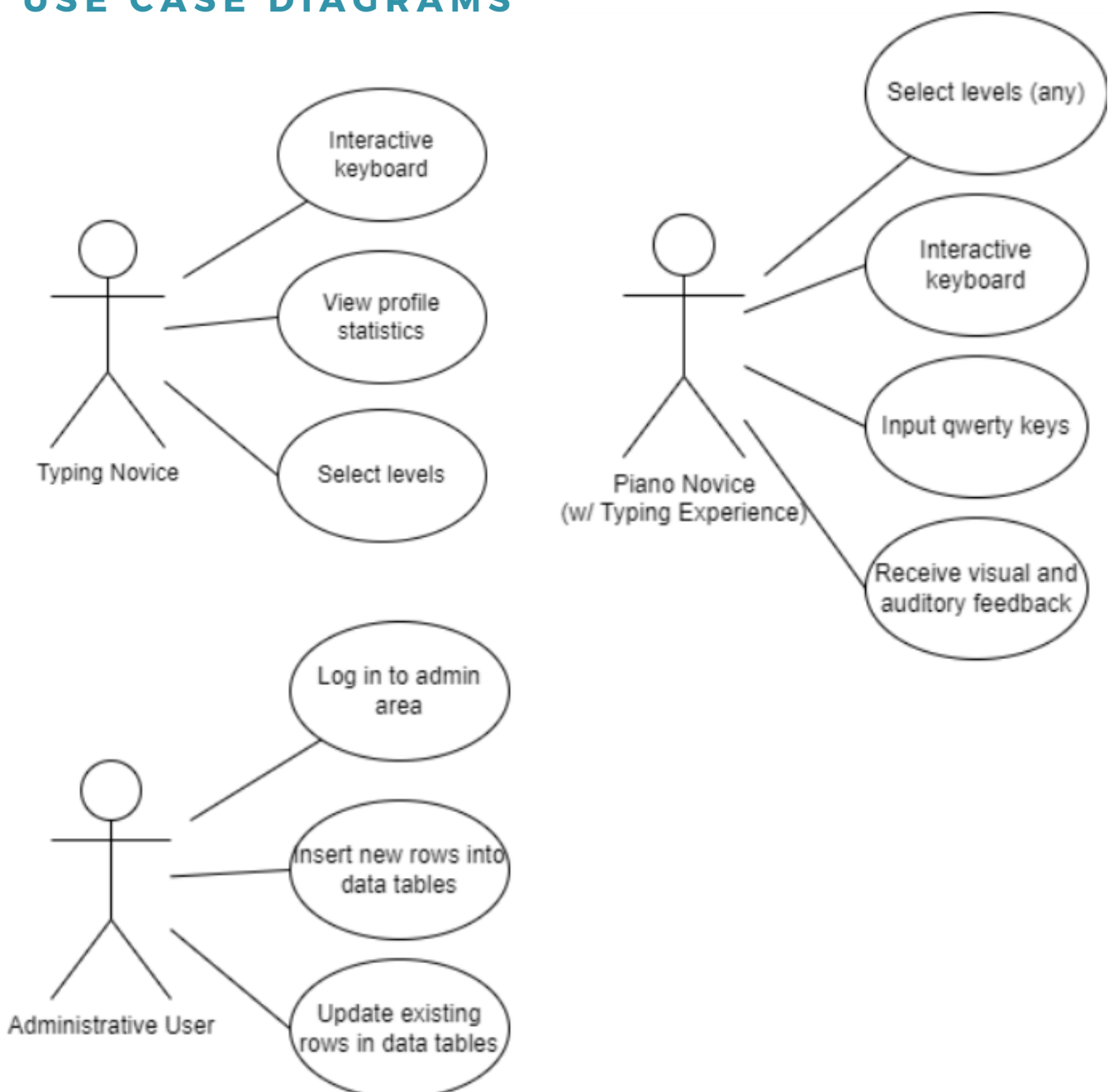
USE-CASE SCENARIOS

SELECT AND PLAY A LEVEL

1. User launches software, UI fits to window
2. User clicks the "Play" button and selects a profile
3. Progress is loaded from the database, lists available levels
4. User selects a level by song name
5. Level information is loaded from database, UI updates to show the piano layout and indicates the keyboard mappings to the user
6. Key letters come at appropriate speed from above, depending on the level's WPM/BPM speed
7. User presses appropriate key letter and the on-screen key disappears as the note sounds
8. Level is completed and user is brought back to the level selection screen with updated progress

Extensions

- 7a. User presses incorrect key, the on-screen keyboard letters remain until the correct key is pressed by the user

CREATE A PROFILE

1. User launches software, UI fits to window
2. User clicks the "Play" button and is brought to the profile selection screen
3. User selects to create a new profile and is brought to profile creation form
4. User fills out name, selects a color and selects "Save Profile"
5. New profile instance is added to the database
6. User is brought back to the profile selection screen and can now choose their new profile

Extensions

- 4a. The profile name is already in use, so error message is prompted and user can re-enter a profile name

UNIT TESTS LIST

LEVEL

- ValidateStrings_MatchingLengths_ReturnsTrue
- ValidateStrings_MismatchedLengths_ReturnsFalse
- ForceStringMatch_RhythmLonger_ShortensRhythm
- ForceStringMatch_PitchesLonger_ShortensPitches
- GetDifficultyName_Value1_ReturnsEasy
- GetDifficultyName_Value2_ReturnsMedium
- GetDifficultyName_Value3_ReturnsHard
- GetDifficultyName_OtherValue_ReturnsUnknown
- CountNotes_ValidRhythmString_ReturnsStringLength
- BeatsPerSecond_100bpm_DividesBpmBy60
- ParseRhythm_ParseOneOfEachRhythm_AllSuccessfullyParsed
- SortPitches_MixedNotes_SortAndEliminateDuplicates

PROFILE

- ValidateColor_ValidHexColors_ReturnsTrue
- ValidateColor_InvalidHexColors_ReturnsFalse

SCORE

- GivePoints_NoDelay_GiveMaxPointValue
- GivePoints_FiveHundredSecondDelay_GiveMinPointValue
- GivePoints_EqualAboveAndBelowZeroSecondDelay_GiveSamePointValue
- TakePoints_MoreThanCurrentTotal_SetToZero
- TakePoints_StandardMethodCall_TakesDefault10
- GetAccuracy_90PercentOfMax_Returns90Percent

PIANOKEY

- GetRangeValue_NotesOneApart_SortedCorrectly
- GetRangeValue_MultipleNotes_SortedCorrectly
- IsWhiteKey_KeyIsWhite_ReturnsTrue
- IsWhiteKey_KeyIsBlack_ReturnsFalse
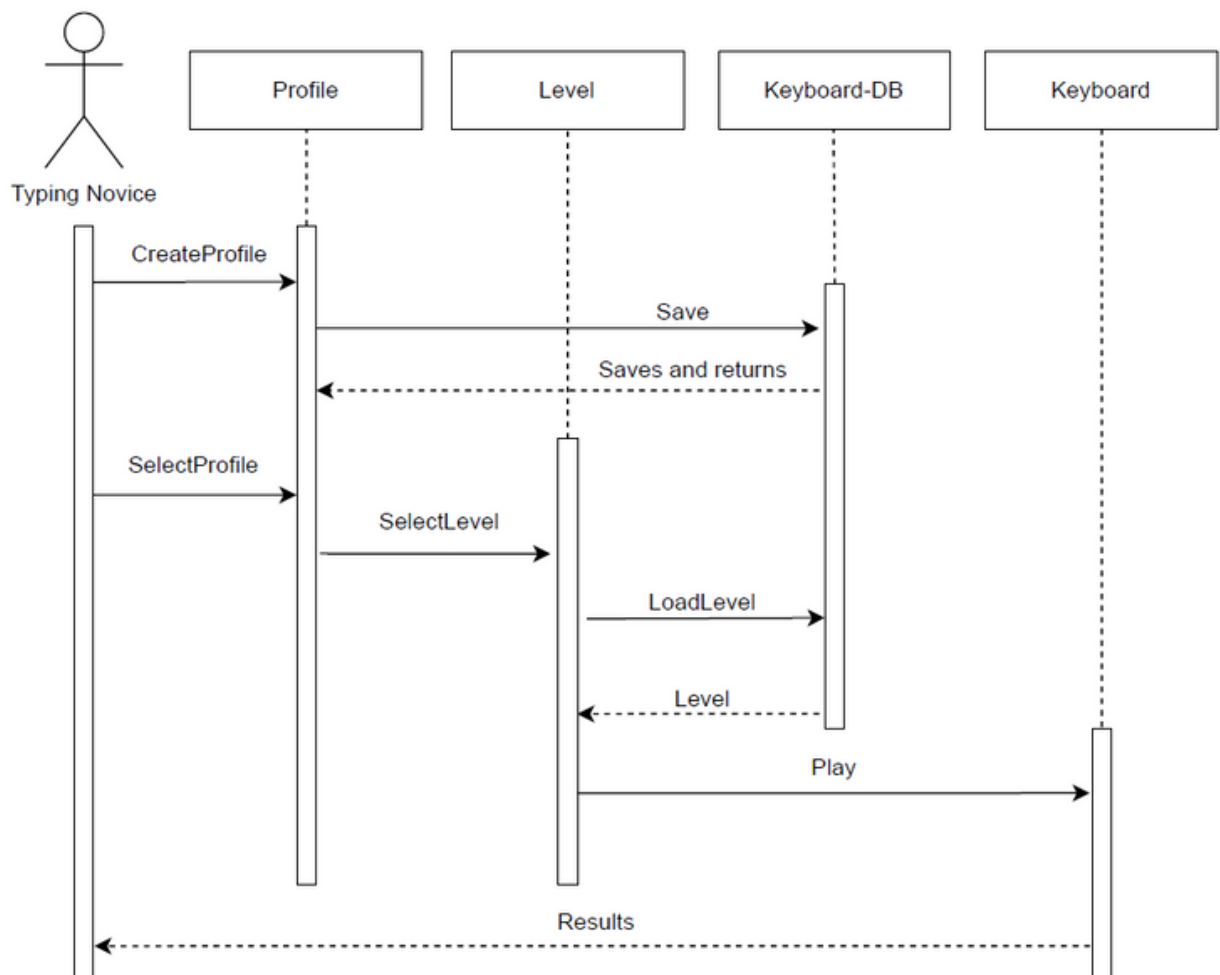
USER SCENARIOS

TYPING NOVICE

John is starting to learn how to type with the Keyboard Learner and is using it for the first time. He wants to be able to begin quickly with minimal setup. He chooses "Play" on the main menu and creates an account for himself. After he creates his profile, he selects it and chooses the very first level: the C major scale. He is able to understand how to play by following along with the keys coming down on the screen. Afterwards, he is shown his score, which he can choose to improve or move on to more levels to better his typing performance.
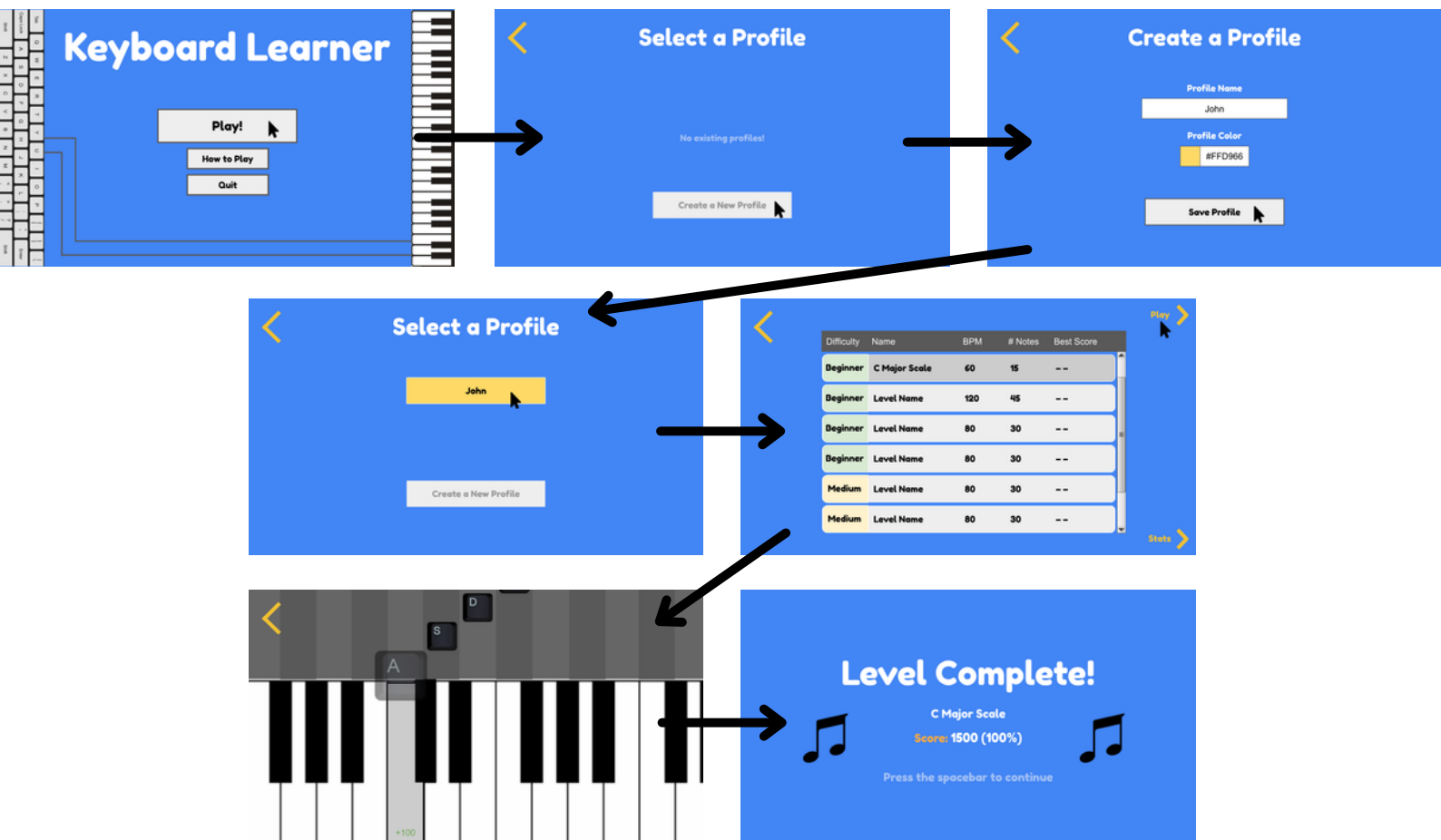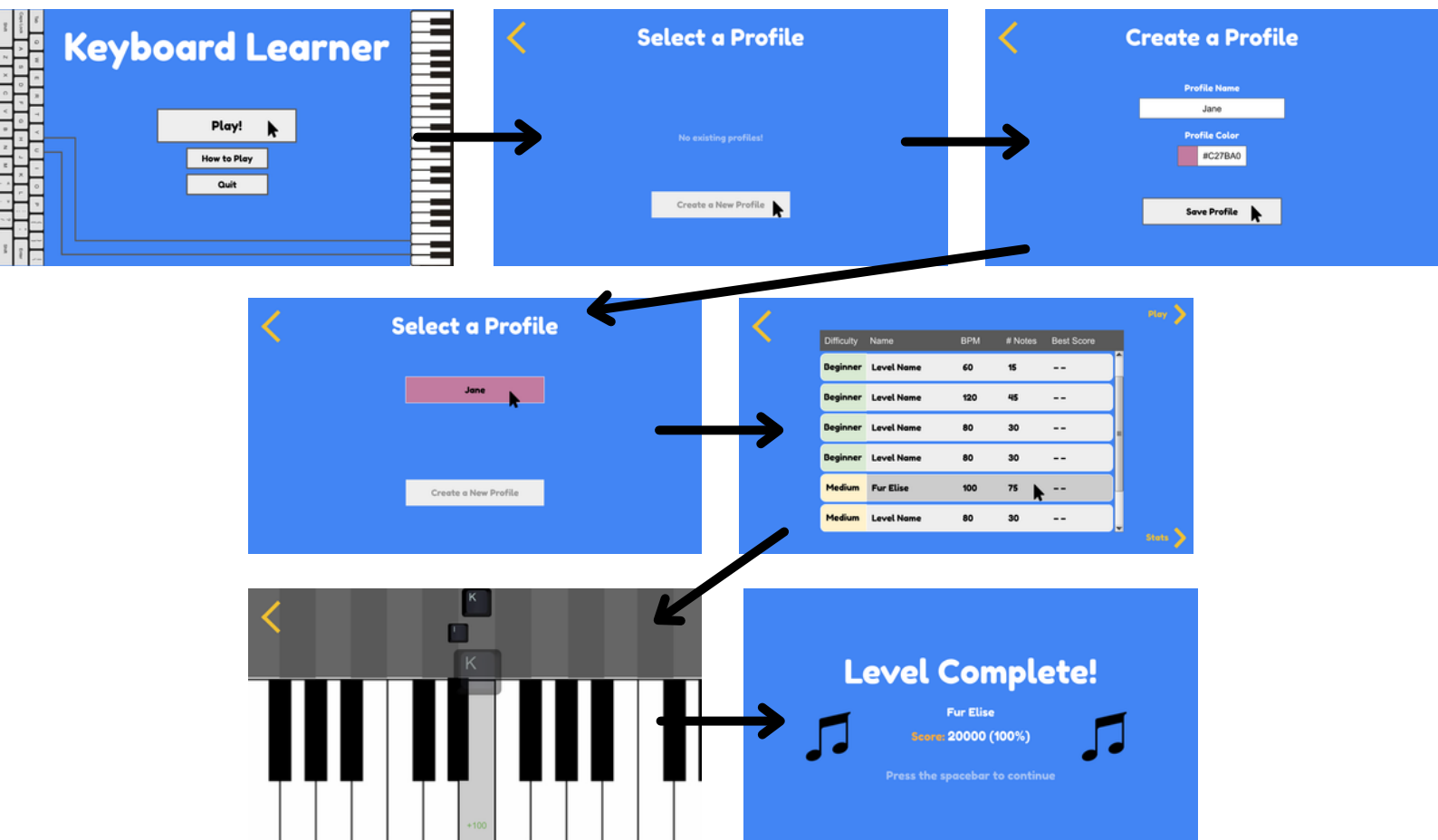
TYPING NOVICE
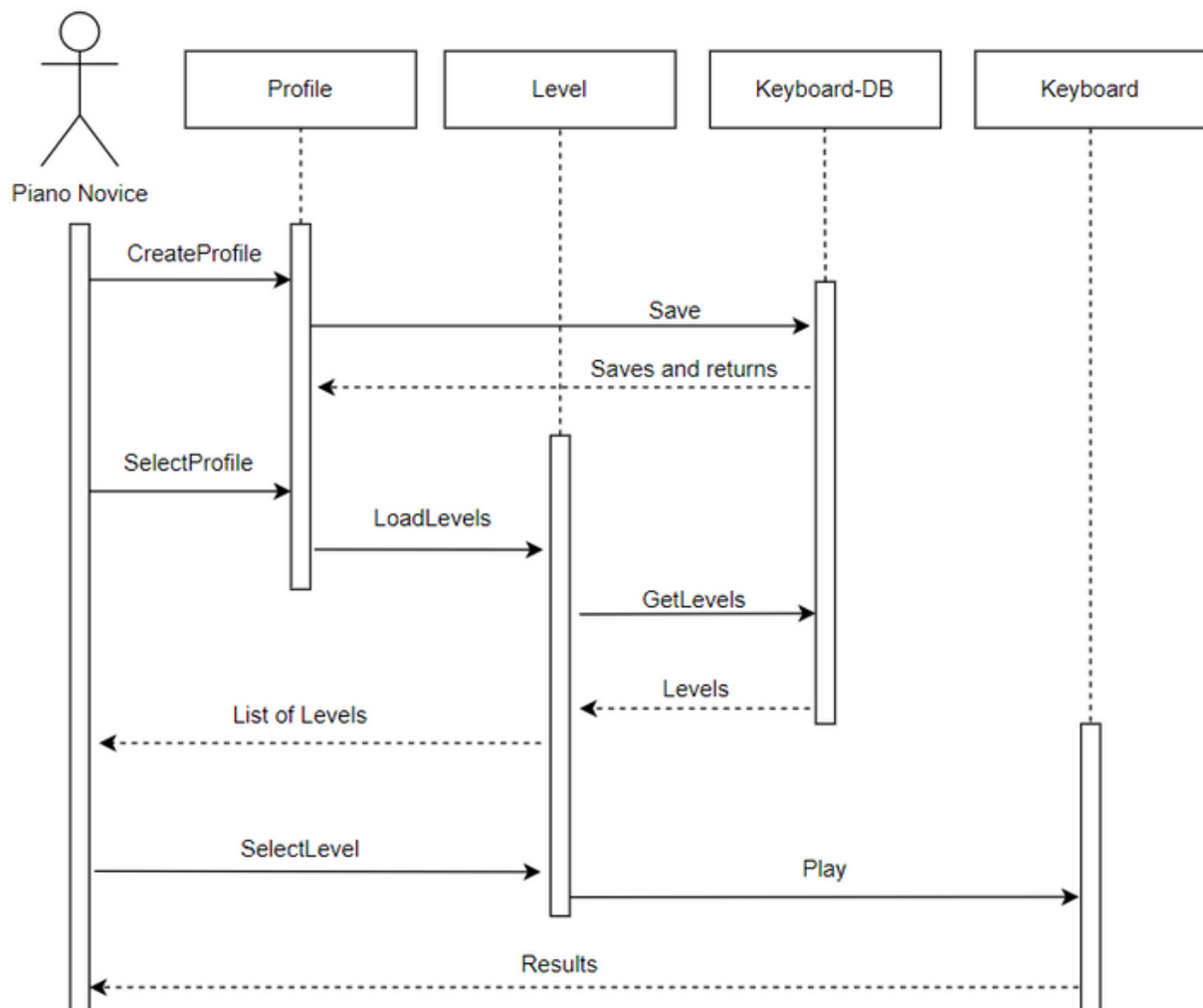
USER SCENARIOS (CONT.)

PIANO NOVICE

Jane already has a decent typing speed but wants to learn some of the basic melodies on piano. Since she already has experience with typing, she does not want to start from the first level of the keyboard learner. She presses "Play" on the home screen and creates a new profile for herself. When she selects her new profile, she wants to be able to select a more difficult level right away instead of slowly progressing through the levels and losing interest. She hopes to see how Fur Elise is played. She can then see her score from the level and play it again if she desires.

PIANO NOVICE

CASUAL END USER

Jim is using the Keyboard Learner casually to learn typing. As he learns, he makes plenty of mistakes, so his score is not very great when sight-reading the music. He does not want his mistakes to impact the level progress though, as he wants to learn how to do it correctly. His score is impacted, but he still wants to be able to know how the music SHOULD sound. The level should wait for him to press the correct key and then progress. He presses three wrong notes before pressing the correct one. This way, he can notice his progress as he plays the level more times to try to beat his high score.
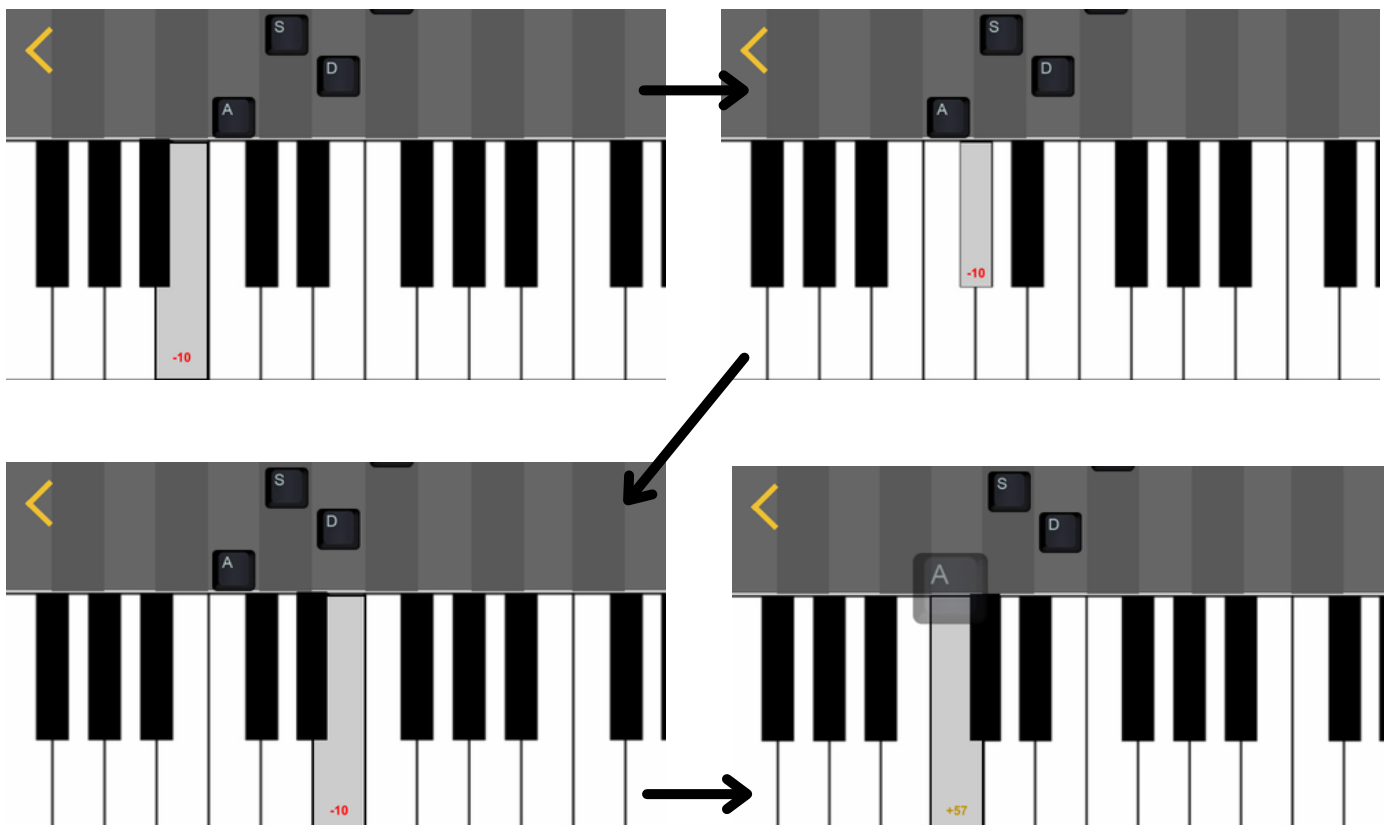
USER SCENARIOS (CONT.)

CASUAL END USER
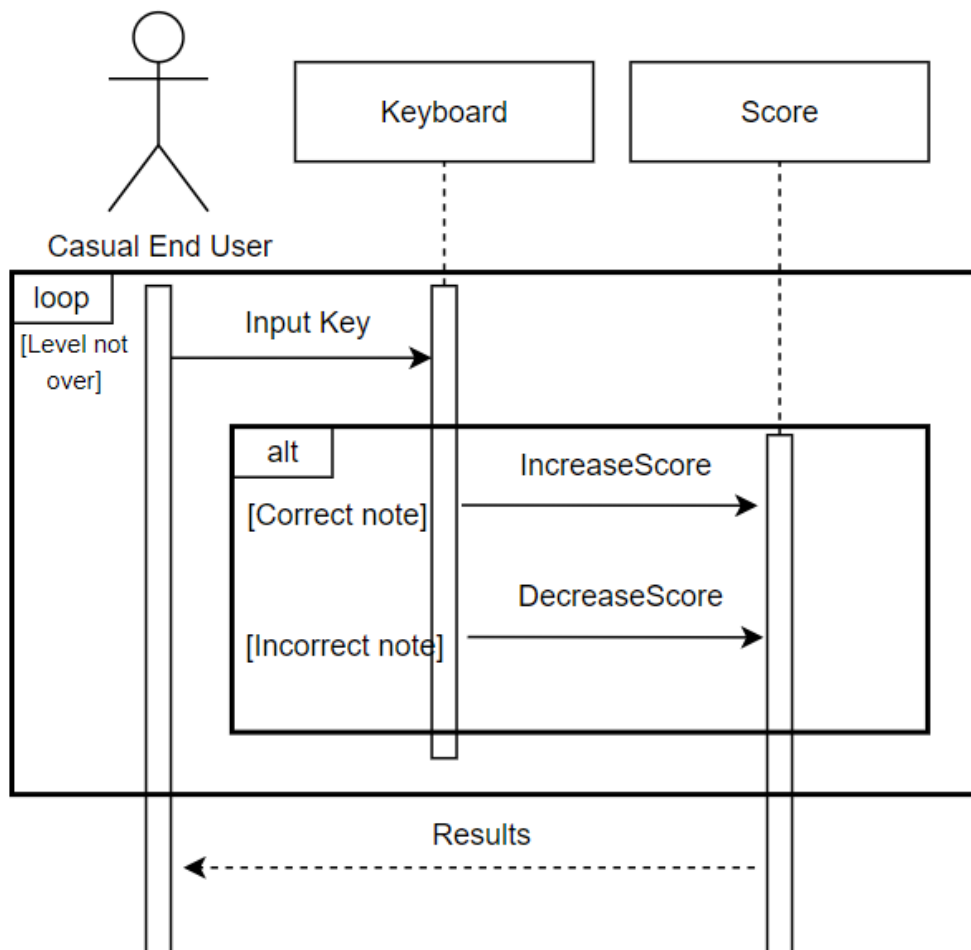
DATABASE

TABLES

Underline = primary key

profile
- p_name: VARCHAR(255)
- color: CHAR(6)
- create_date: DATE
- lvls_complete: INT
- wpm: INT
- fav_lvl: INT

mapping
- lvl_id: INT
- key: CHAR(2)
- qwerty: CHAR

level
- id: INT
- title: VARCHAR(255)
- difficulty: INT
- bpm: INT
- note_cnt: INT
- rhythm_str: VARCHAR(255)
- pitch_str: VARCHAR(255)

key
- note: CHAR(2)
- filename: VARCHAR(255)

scores
- profile_name: VARCHAR(255)
- lvl_id: INT
- score: INT

RELATIONSHIP DIAGRAM
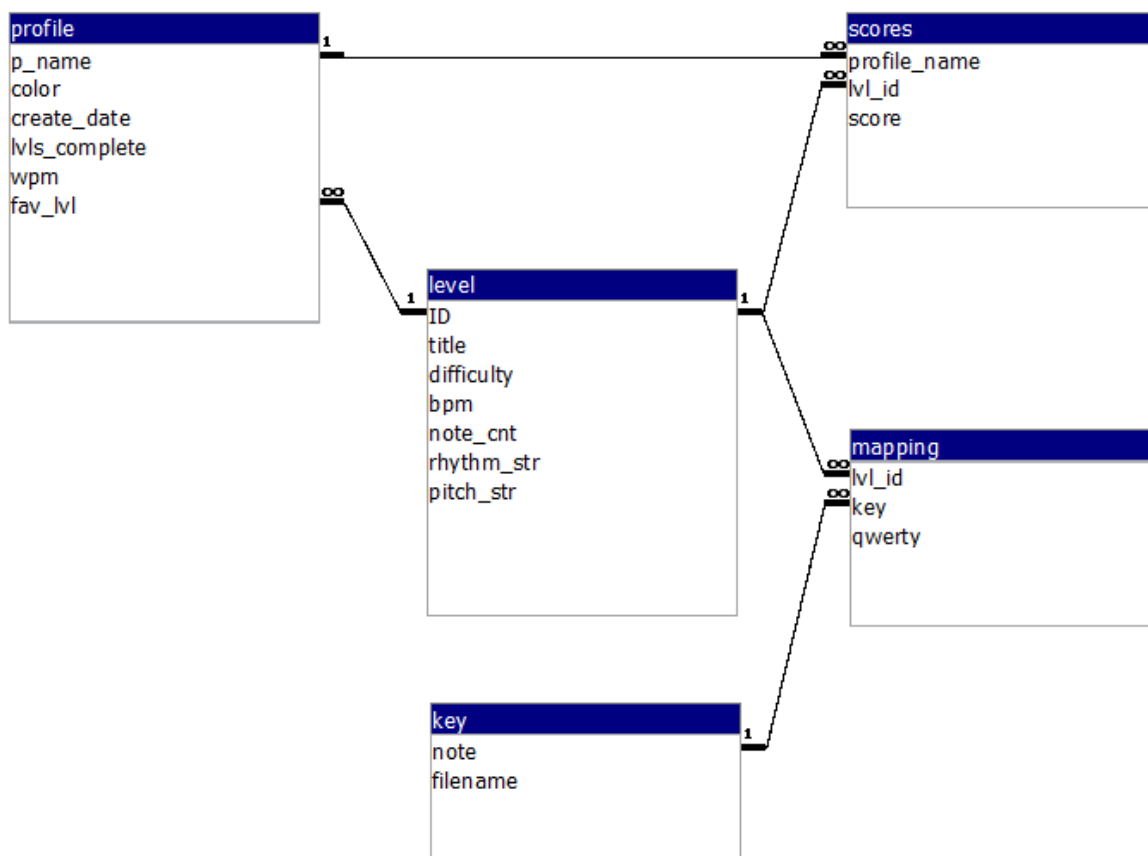
PROJECT TIMELINE

GANTT CHART

Task	January	February	March	April
Milestone 1: Planning	**1/27**			
Project Brainstorming	1/11			
Project Planning Document	1/27			
Milestone 2: Design & Proposal		**2/24**		
Mockups & Wireframes		2/8		
User Stories Sketches & Diagrams		2/17		
Create Demo		2/24		
Milestone 3: Major Implementation			**4/5**	
Database Creation			3/1	
Virtual Keyboard & Mapping			3/15	
Profiles and Saving			3/24	
GUI Screens and Functionality				4/5
Milestone 4: Testing & Finalizing				**4/28**
Unit Tests (and debugging)				4/14
Update Project Planning Document				4/19
Security Review				4/21
Final Presentation				4/28

PROJECT RESOURCES

1. https://www.typing.com/blog/typing-speed/
2. https://www.statista.com/statistics/828195/time-spent-music/
3. https://www.webnots.com/download-free-keyboard-key-images-in-black/