EE267 Project Proposal

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1 Introduction

In this course project, we plan to build an interactive Mixed Reality application that guides and teaches users to play famous piano music.

2 Motivation

Piano is probably the most basic, but also popular musical instrument human beings have ever invented. However, most people like me could not become a piano musician for many reasons. First, learning piano can be very costly. Let alone the daunting tuition for a formal piano education, the musical instrument itself is already expensive. Second, it takes considerable gift to climb up piano's steep learning curve. For example, understanding and memorizing the score scripts is pretty difficult. Finally, piano is bulky and immobile so practicing is limited to designated locations. Moreover, ordinary people not planning to learn piano might also want to be able to play their favorite songs just for fun. Therefore, there is a strong incentive for such an educational and recreational application that addresses these problems for piano learners as well as enthusiasts like myself.

3 Related Work

There is already an app from Leap Motion building a virtual piano. However, we would like to bring it to the real world. We plan to build a virtual piano with the Hololens to render and with Leap Motion to detect finger motion. Many mobile piano-playing apps have features of intuitive cues of hint to remind users next key to play. We plan to implement this feature with hololens and unity.

4 Objectives

Broadly, we would like to build a VR/AR scene that:

1. has a piano that users can "play" and listen by recognizing hand and finger motion;
2. displays the score of a music piece selected by the user that rolls as the user plays;
3. prompts the user for the next key to play following the selected music piece.

5 Tasks and Milestones

5.1 Virtual Scene

We will build the virtual scene, our piano "practice room", with Unity. This task is fairly easy and we expect to finish it by the end of this week (May 28).

5.2 Sound Integration

We will map tones to corresponding piano keys. As a preliminary implementation, mouse clicks will be our means of interaction. Finger motion will be incorporated next. We expect to finish this task in 3 days by June 1.

5.3 Hand and Finger Motion Detection

We will implement hand and finger motion detection using Leap Motion and connect it to our virtual scene through Unity so that we can play the virtual piano now. We plan to finish this task by the end of week 9 (June 4)

5.4 Rolling scores and motion prompts

We will add in this feature by the end of week 9 (June 4).

5.5 Testing

We will use rest of the time for testing and improvement (until June 9).

6 References

[1]F. Huang, "Piano AR: A Markerless Augmented Reality Based Piano Teaching System", 2011 Third International Conference on Intelligent Human-Machine Systems and Cybernetics
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[3]D. Brown, N. Renney, A. Stark, C. Nash, and T. Mitchell, "Leimu: gloveless music interaction using a wrist mounted leap motion", in Proceedings of the international conference on new interfaces for musical expression, Brisbane, Australia, 2016, pp. 300-304.
[4]A. Almagor, "Mixed Reality for The AEC Industry Extending Trimble's Product Capabilities with Microsoft HoloLens"
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