INTERACTIVE MUSIC TRAINING SYSTEM

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ABSTRACT

In this contribution, we present an interactive system for playing while learning music. The game is based on different computer games controlled by the user with a remote control. The remote control has been implemented using inertial measurement sensors (IMU) for 3D tracking. The computer games are programming in Python and allow to practice rhythm as well as the tune, ascending or descending, of musical notes.

1. INTRODUCTION

The serious game concept is used to describe games designed to serve an additional purpose to that of pure entertainment. The term serious game had been introduced in 1970 [1] but it was not until early 2000s when they surge in different types of educational games designed for the younger learner.

Serious games for music learning are very interesting [2], especially for children who start to learn music, given the difficulty involved in the individual study of music. Among the different elements to practice in the music studio, rhythm and tone perception are basic and general to any kind of music. In this contribution, we present an interactive music training system that allows to practice rhythm and tone perception in a fun and easy way, using a remote control and a computer game.

2. SYSTEM DESCRIPTION

The scheme of the interactive music training system is shown in Fig. 1. In this figure, it can be seen that the developed system consists of two different parts: a remote control and a computer game module. The remote control is designed using inertial measurement sensors (IMU) and the computer game system is programmed in Python.

2.1 Remote control subsystem

The functionality of the remote control includes to communicate with the computer and detect the position and movement of the user's hand. Fig. 2 shows the block diagram of the remote control hardware.

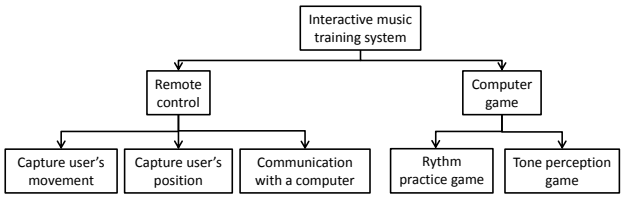

Figure 1. Diagram of the interactive music training system.

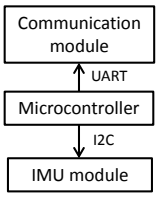

Figure 2. Block diagram of the remote control hardware.

In Fig. 2, the tree basic modules of the remote can be observed:

- Microcontroller: This module is the core of the remote control system; its function is to calculate and send the information of hand position and movement of the users to a computer. Texas Instrument TM4-C123GH6PM is the microcontroller selected because it has enough memory to include a real time operating system for concurrent processing.
- Communication module: Bluetooth HC-06 has been selected to send information to the computer by means of Bluetooth 2.0.
- IMU module. This module is used to get measures of acceleration in the three axes. These measures are processed in the microcontroller to obtain the position and movement of the user's hand. The intelligent sensor BNO055 has been selected because it is an inertial absolute orientation 9-axis sensor.

In Fig. 3 the remote control designed is presented. In this figure, it can been seen that it is a very compact system.

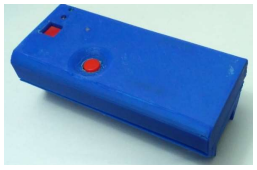

Figure 3. Remote control designed.

2.2 Computer game subsystem

The computer game system is programmed in Python. In order to achieve the requirement of serving to practice rhythm as well as the tune, ascending or descending, of musical notes, three different games have been developed: 'Note order', 'Rhythm fun' and 'Virtual Drums'. Also, an utility to compose your own scores for the rhythm game has been developed.

2.2.1 Note order game

In this game, the user listens two notes sequentially with a separation of one second. Once the notes have been played, the user must choose whether the sequence of notes have ascending, descending or equal tone. The selection is made by moving the remote control, up, down or horizontally. Fig. 4 shows several screenshots of the note order game.

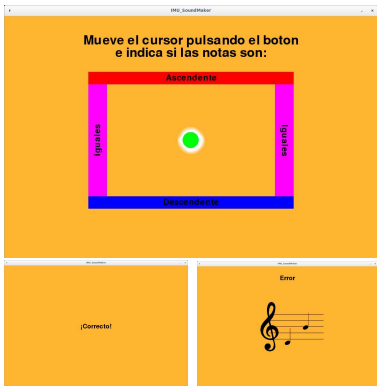

Figure 4. Note order game screenshots.

2.2.2 Rhythm fun game

In this game, the user has to set the rhythm of a score. The game includes several predefined scores but the user can create his own score. The user has two aids: an arrow that moves through the notes of the score and the sound of a metronome. Fig. 5 shows a screenshot of the rhythm fun game.

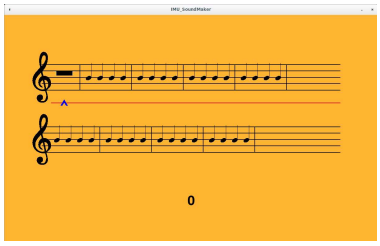

Figure 5. Rhythm fun game screenshot.

2.2.3 Virtual drum game

In this game, the user has the possibility of using the remote control as a drumstick of a drummer. Fig. 6 shows a screenshot of the virtual battery game.

2.2.4 Compose your own score

With this utility the user has the possibility of using the remote control and the keyboard to compose his own score to practice rhythm. In this case, the first screen allows to select the measure and the second one to compose the score. Fig. 7 show two screenshots of this tool.

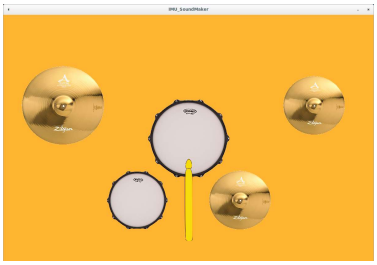

Figure 6. Virtual drum game screenshot.

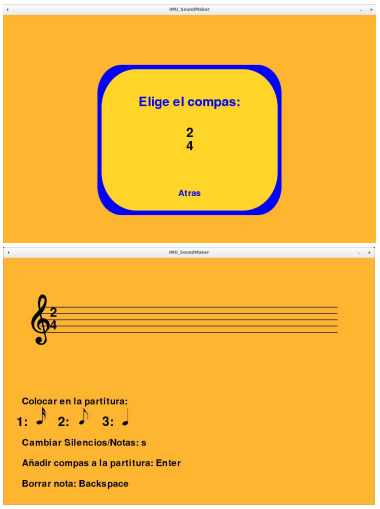

Figure 7. Compose your own score screenshots.

3. CONCLUSIONS

An interactive system for playing while learning music has been presented. The game is based on different simple computer games controlled by the user with a specifically designed remote control. The remote control has been implemented using IMU sensors for 3D tracking. The computer games are programmed in Python and allow to practice rhythm as well as the tune progression, ascending or descending, of musical notes. The system has been used with different music students that were pleased with its operation.

Acknowledgments

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4. REFERENCES

[1] C. C. Abt, *Serious Games*. The Viking Press, 1970.

[2] I. Barbancho, L. Tardón, and A. Barbancho, *Real-Time audio interaction in serious games for music learning*. 19th International Society for Music Information Retrieval Conference, 2018.