Gocen: a Handwritten Notational Interface for Musical Performance and Learning Music

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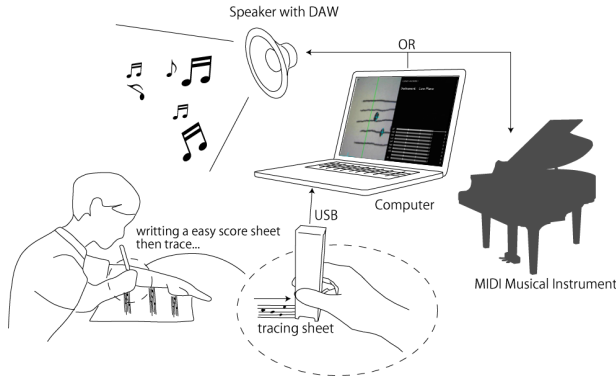**Figure 1:** *A sketch of the system*

1 Introduction

Not only in childhood but also adulthood, we need some trainings to read music scores, which sometimes make music hard to learn and enjoy. In this article, we shall propose the system that enables users to play their handwritten musical notations by our musical interface.

Since 1960s, Optical Music Recognition (OMR) has become matured in the field of printed score. In recent, Yamamoto[Yamamoto et al. 2011] proposed musical interactive system that directly utilizes printed music score as a instrument with keypoints matching. However, few researches on handwritten notations have been done, as well as on interactive system for OMR. We combined notating with performing in order to make the music more intuitive for users and give aids to learn music to users.

2 System

Our system mainly consists of a scan device, computer and sound module. A user can play simple music by tracing notes with the scan device as shown in figure 1. The computer processes captured images by using openCV and our algorithm at 30fps, then outputs sounds according to the data from the notations. We do not need any special materials other than this system. A user can use normal white paper and his/her own pen. Our device is built with a USB camera, microcontroller, and vibration motor(see figure 2). The vibration motor is used for tactile feedback while the user is playing.

3 Interactions

Our system is not only an OMR system but also performance system. We developed several musical interactions for this interface.

Note on/off   A user can make a sound by getting the green bar on the computer display (see figure 3) to pass through a simplified
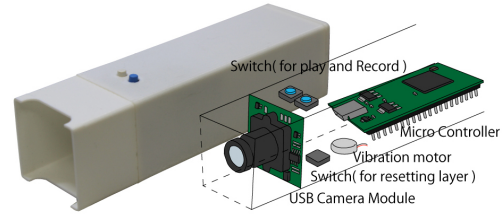
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Figure 2: *Gocen device consisting of USB camera, microcontroller, switches and vibration motor*
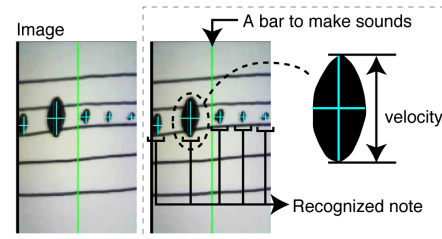

Figure 3: *A captured and processed image.*

note, while pressing "manual play button".

Control velocity(volume)   Our system can detect the size of a musical notation. It is interpreted as control note velocity. Figure 3 shows the relation between a recognized musical notation of processed image and its velocity.

Pitch bend   While a user is playing a note, he/she can change the pitch of the note by moving the device vertically like a vibrato.

Change instrument   A user can change the instrument of sound by covering a text he/she prints to indicate the name of instrument, such as pf(piano), bs(bass), gt(guitar), dr(drums), etc., with the device, by means of Optical Character Recognition[1] .

Record and play like an music sequencer   A user can record sound events into timeline, while pressing "recording button" and make a loop like a sequencer. Each recorded note will be set in the quantized timeline.

We are now developing other devices for more sophisticated ensemble performance with this system. Furthermore, we are trying to make a more consumer oriented device from our system for learning music.

References

YAMAMOTO, Y., UCHIYAMA, H., AND KAKEHI, Y. 2011. onnote: playing printed music scores as a musical instrument. In *Proceedings of the 24th annual ACM symposium on User interface software and technology*, ACM, New York, NY, USA, UIST '11, 413–422.

[1]We adapted a Ocrad Library - The GNU OCR