MOGFUN: Musical mObile Group for FUN

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ABSTRACT

The computational power and sensory capabilities of mobile devices are increasing dramatically these days, rendering them suitable for real-time sound synthesis and various musical expressions. In this paper, we demonstrate a novel mobile music making system which leverages the ubiquity, ultra-mobility, and multi-modality of mobile devices (iPod touch) for people to create and compose music collaboratively. Unlike the conventional music making applications which generate the music on a single mobile device with a preset sound and interface, our system allows several players in a group to be connected together through wireless LAN network, creating music with different sounds and interfaces. While playing, the music of all the players can be sent to and mixed on each individual device so that each player can hear all the players' music through his own device. Moreover, players may configure their musical interfaces with different difficulty levels, starting notes, scales and display notations, producing flexible music making opportunities. Finally, the performance can be recorded as a single music file and played back in the future. The paper also shows some application scenarios for this collaborative music making system in future research.

Categories and Subject Descriptors

H.5.5 [**Information Interfaces and Presentation**]: Sound and Music Computing; J.5 [**Computer Applications**]: Arts and Humanities—*Music*

General Terms

Design, Human Factors

Keywords

Mobile Devices, New Music Instruments, Community Music Making

1. INTRODUCTION

Mobile devices are growing in sheer number and computational power nowadays, and are becoming deeply entrenched in the lifestyles of people around the world. Computationally, today's mobile devices have reached a point where the processing power and the diversity of the interesting sensors are able to transform mobile devices from a passive music player into an active music making tool. Although they lack the physicality of real instruments, they have the advantage of ubiquity, ultra-mobility, and multi-modality, making it possible to have jam sessions, music rehearsals, and performances almost anywhere, anytime.

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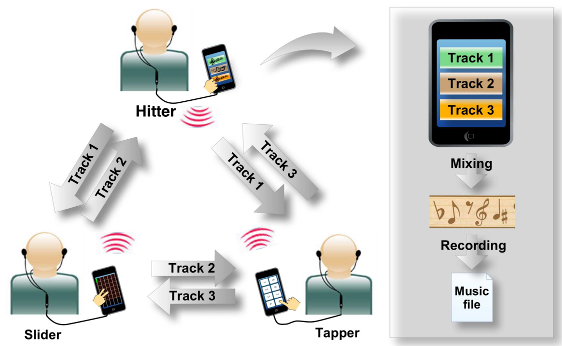


Figure 1: MOGFUN system diagram

Turning mobile devices into musical instruments has been explored in the past few years. A survey about the current development, possibilities, and challenges in this area is provided in [3]. Currently many commercial mobile music making applications are available on the market. For example, the famous iPhone's Ocarina[1] mimics the ancient flute. ZooZ Mobile[2] provides a gesture-based music game for hip-hop on iPhone. Almost all these applications focus on making music on a single device and only provide a single virtual instrument with preset configurations.

As shown in Figure 1, we present a mobile music making system MOGFUN (Musical mObile Group for FUN), which allows people to play music with the flexibility to change the different starting notes, difficulty levels, music scales, and display notations to personalize the virtual instruments. When people are playing music as a group, the music of each player can be sent to other players in the group so that all their music can be mixed on each device. Simultaneouslsy the performance can be recorded and played back on each device. With the fast popularization of WLAN service, this system can be widely popularized as a collaborative music application at home and some public places such as cafeterias, airports and even certain busses. They can still use our system wirelessly with headphones even if the environment is not suitable for playing loudly.

2. SYSTEM DESCRIPTION

We chose to implement MOGFUN on iPod touch which is a popular mobile music player with 3.5-inch multi-touch screen, tri-axis accelerometer, and WIFI network interface.

2.1 Network

Each device sets up a UDP server socket which conforms to the OSC (Open Sound Control) [5] specification. Each server socket is then advertised using Bonjour, Apple's implementation of Zeroconf, which is a service discovery protocol. Subsequently each device uses Bonjour to browse for other devices that are using the same service in the network. Upon finding such devices, the browsing device dynamically resolves their IP addresses and connects to them after creating UDP client sockets (also conforming to the OSC protocol). In this way servers do not need to hardcode their IP addresses. Messages to clients are transferred using OSC. It was also observed that network latency increases drastically when communication between iPods is idle. To prevent the communication from becoming idle, a message is sent every 200 milliseconds.

2.2 Sound Synthesis

The sound synthesis library STK (Synthesis ToolKit in C++)[4] is adopted in our system to generate sound on the iPod itself. To support remote players' sounds played on a local device simultaneously, the iPod should be able to generate multiple instrument sounds. Experiments show that among the sounds in STK we tested, the CPU usage can be up to 46% with four sounds playing on a single device without affecting the sound quality. Therefore, we allow 4 players to play together at maximum.

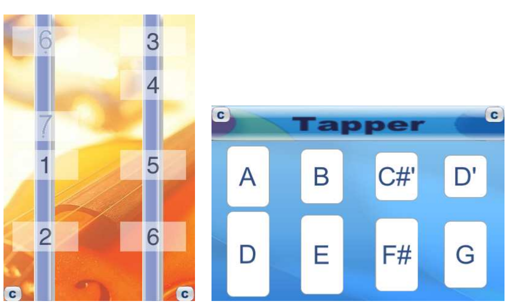
2.3 Musical Interfaces

We have developed three kinds of musical interfaces for group music making: tapper, hitter, and slider. Slider and tapper are showed in Figure 2.

Tapper: The tapper simulates the xylophone with three difficulty levels. The low, middle, and high level tappers have 4, 8, and 14 keys, respectively.

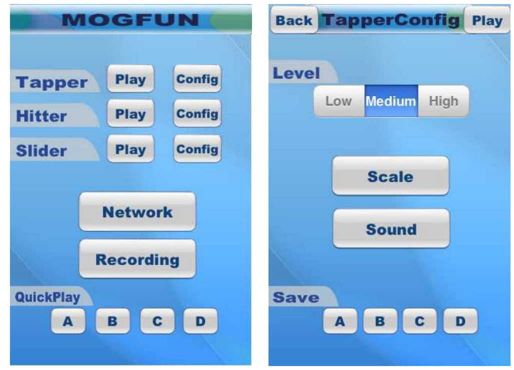
Slider: As shown in Figure 2a, note regions with same preset frequency are added to help beginners to play in tune. The higher the difficulty level the smaller the note regions. The highest level does not have any note regions, which corresponds to a real string instrument. Furthermore, the player can play smooth glissandi and vibrato.

Hitter: The hitter interface can be performed as a drum stick. The iPod touch responds to user's motion by analyzing the accelerometer data in three axes and detects the shake by the large zero-crossing within several contiguous accelerometer samples.



(a) Low level slider (b) Mid level tapper (starting note D in the 4th octave)

Figure 2: MOGFUN musical interfaces



(a) Main View (b) Tapper Config View

Figure 3: MOGFUN configuration interfaces

2.4 Configuration Interfaces

The main view and tapper configuration view are shown in Figure 3. For tapper, slider and hitter with pitched sounds, the player can customize his device by choosing starting notes, octaves and sounds. We also provide different display choices: major/minor, music notations. Once they have set the configuration, they can save it as a "shortcut" in the system. Next time if they want to play with the same configuration they can quickly load it without resetting.

3. SYSTEM DEMONSTRATION

We will demonstrate our system in 2 music performances: One is *Twinkle Twinkle* with 4 performers; the other is *Edelweiss* with 3 performers. In the demo, the performers will play their own customized interfaces with the mixing, recording, and network functions enabled.

4. APPLICATION SCENARIOS

Taking advantage of MOGFUN, people can play music together in a group on their own mobile devices, which opens a new realm of possibilities for education, music performance and social activities. Based on our previous research, the system can be easily integrated into classroom settings. Moreover, the difficulty levels of interfaces allow people with different music backgrounds to play the simulated instruments easily. Finally, the network functionality allows people to perform music together without spatial constraint, which enables collaborative music making.

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