TENORI-ON

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ABSTRACT

Development of a musical interface which allows people to play music intuitively and create music visibly.

Keywords

Human Interface, Software

1. INTRODUCTION

Media artist Toshio Iwai and YAMAHA have collaborated to develop a new digital musical instrument for the 21st century, TENORI-ON (See Figure 1). A 16x16 matrix of LED switches allows everyone to play music intuitively, creating a "visible music" interface [1].

Figure 1. TENORI-ON

In the past, there were some musical interfaces with a new point of view to music, which allow everyone to play music intuitively and visibly like Audio Pad [2] and Block Jam [3], but the new point of TENORI-ON is the interface with the inevitable design that makes you understand the musical structure visibly and the high quality feeling made by YAMAHA that has been manufacturing various kinds of traditional musical instruments for 120 years [4].

The interface of TENORI-N is completely unique and consists of a 16x16 matrix of light emitting switches. These switches, however, are not mere input switches, like the keys on a keyboard, but function as individual displays that emit light that emulates

intuitively the related sound. When you push a switch for a short time, a ripple of light spreads out from switch that corresponds with sound you have chosen. If a switch is held down slightly longer, a dot of light remains on the panel indicating that the light and the sound will be played repeatedly. One remarkable effect of this sound and light synergy is that people seem to quickly understand the relationship between the sounds and switches such that even non-musicians can enjoy improvising and even composing almost immediately.

2. EXPOSITION

2.1 System

This interface is an embedded system operated by the real-time OS called ITRON that mainly controls the sound output, LEDs and the 256 switches. The core technology making this interface unique is the algorithm we developed to make music visibly with the 256 switches including LEDs inside.

Below are the main technical functions of TENORI-ON.

1. Analyze how long a switch among 256 switches has been touched

2. Analyze the direction of the finger touching the switches continuously

3. Analyze the angle of the interface with the acceleration sensor embedded in the interface

Those elaborate and highly developed technologies make it possible to give us a lot of information simultaneously, which we can't get with our eyes, and we can expand the possibility of our expression by controlling the sound and the light with those information.

2.2 Interface

2.2.1 Features Of TENORI-ON

Below are the main features of TENORI-ON.

1. Interface that anybody can play easily

    When you push the switch, the light is emitted and you'll have the points to generate the sound.

2. Create Music with the various kinds of loops

    ① : When the scan bar moves one by one from left to right, it generates the sound at the point where the switches were pushed and loops.

② : Making some figures like triangle and rectangular by pushing switches, the light runs on the line of the figure and when it gets to the vertex, it generates the sound.

And TENORI-ON has more loop modes besides 2 examples mentioned above.

3. Session with another machine

When you connect your machine to another machine, it synchronizes with another one and it enables you to play the session with another person. It will be another interest that you can never experience when you play by yourself.

2.2.2 Construction Of The Interface

2.2.2.1 Surface
The upper frame has 2 speakers and 1 switch as the clear function between the speakers.

The left frame and the right frame have 5 function switches on each side.

The lower frame has a dial, a LCD and 2 function switches. And the base side has 2 terminals for a headphone and a volume.

The inside of the square frame has a 16x16 matrix of light emitting switches. (See Figure 2)

2.2.2.2 Backside
The backside of TENORI-ON controller has also a 16x16 matrix of light emitting button that is a dummy button not to be pushed.
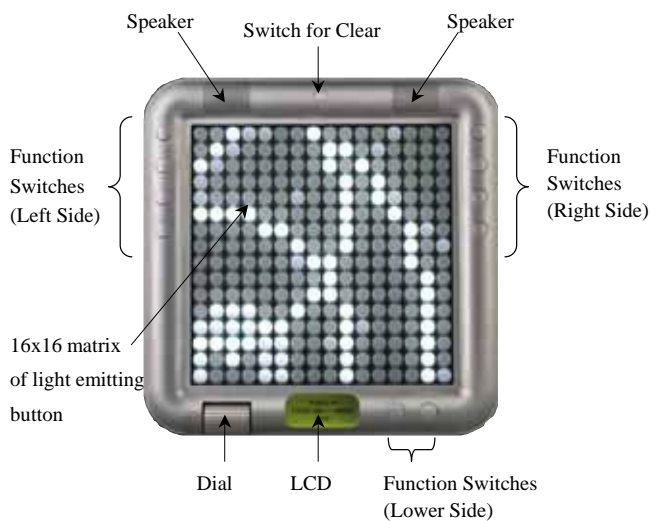

Figure 2. Interface of TENORI-ON (Surface)

2.3 How To Play

2.3.1 Several Modes To Play
TENORI-ON has several modes to play like the following 3 modes. Each mode should be selected from the menu written on the LCD.

- Play Mode : A mode to play TENORI-ON
- Remote Mode : A mode to control TENORI-ON by another MIDI instrument or PC

- Save / Load Mode : A mode to save and load files (examples : a data file of the performance, a file of the state (pattern) of the layer, the function parameter set file, the firmware file (load only) and so on)

2.3.2 Panel Operation
The performance of TENORI-ON should be done by pushing a 16x16 matrix of light emitting switch on the TENORI-ON controller. Depending on how long you push the switch, the reaction of the panel button should be different. The following description is about the basic actions after pushing the button.

- Pushing a switch for a short time : Single tone is generated （LED also emits light at a time）
- Pushing a switch for a long time: You can set the points to generate the sound in each loop mode（LED also continues to emit light with some varieties of animation）
- While you're pushing a switch is pushed : Just the same as Pushing a switch for a long time （ If the sound is the single tone (not the continuous tone), the tone should be just generated repeatedly. ）

2.3.3 Master Function Set
The following descriptions are about the data that effect to all layers.

- Master tempo
- Master volume
- Layer selection
- Page selection
- Effect selection

2.3.4 Layer Function Set
The following descriptions are about the data that you can control on each layer.

- Positions of the points where the switches are pushed on each layer
- Loop Mode *
- Tone *
- Layer tempo *
- Volume *
- Sound length *
- Octave *
- Pan *

The data with * cannot be set plurally in the same layer.

2.3.5 Using As A MIDI Controller
You can use TENORI-ON is to control other MIDI instruments or PC by sending MIDI data as the operation data generated from the TENORI-ON controller through the MIDI OUT interface of TENORI-ON.

2.4 Software

2.4.1 Several Loop Modes
TENORI-ON has several loop modes. The following descriptions are about the main outlines of the loop modes in TENORI-ON.

By multiplying these different loop modes, TENORI-ON generates more complex and interesting music.

2.4.1.1 Score Mode

The horizontal axis means the time and there're 16 steps. And the vertical axis means the pitch and the 16 different pitches are assigned.

When the scan bar moves one by one from the left side to the right side and hits the point where the switches were pushed, it generates the sound at the point. Simultaneously the point where the switch was pushed emits the light strongly and the animation should be played from the point. When the scan bar reaches the right side on the panel (16th bar), it gets back to the left side and moves toward the right side again. In Score Mode, this action should be continued. (See Figure 3)
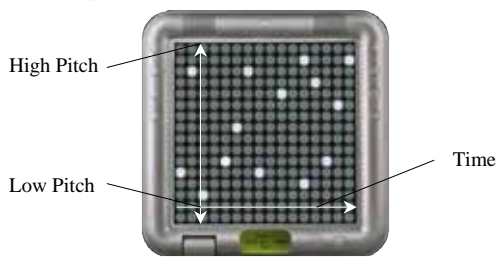

Figure 3. Basic Mode

2.4.1.2 Random Loop Mode

When you push the panel switch one by one, the point where the switch was pushed should be memorized as the order it was pushed.

The light moves between the points where the switches were pushed and the sound should be generated when the light hits the point. Then it moves back to the first point that you pushed at first after the light hits the last point that you pushed. Therefore you can make a loop by making various kinds of figures in this loop mode. (See Figure 4)
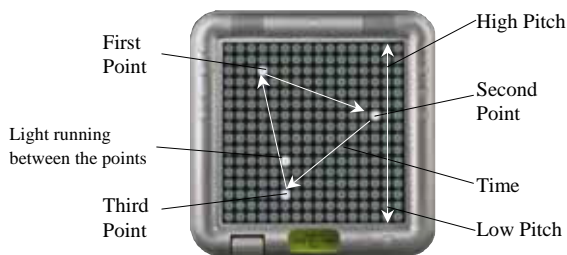

Figure 4. Random Loop Mode

2.4.1.3 Real Time Rec Mode

The data of both the time and the position of the switch that you pushed are memorized during a loop time of the Score Mode, and your last performance should be reappeared and looped as it's memorized. The memorized data of your performance should be repeated as the order that you operated 1 loop time before. (See Figure 5)
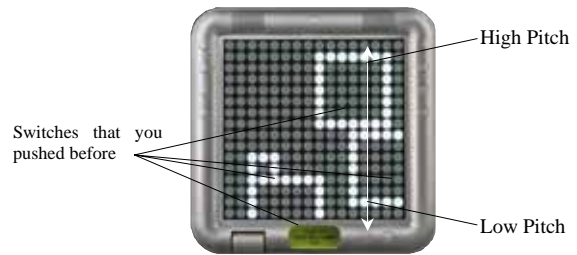

Figure 5. Real Time Rec Mode

2.4.1.4 Bounce Mode

When you push the panel switch, a dot of the light moves down to the bottom line of the panel switch. It generates the sound when the dot hits the bottom line, after that, the dot moves up to the point which you pushed at the first time. And when the dot gets to the point which you pushed at the first time, it moves down again. In this loop mode, it repeats this up and down movement.

In this mode, the horizontal axis means the pitch (the left side : low pitch, the right side : high pitch) and the vertical axis means the time. (See Figure 6)
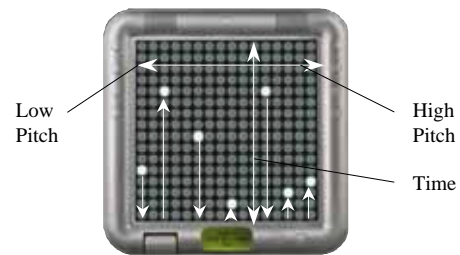

Figure 6. Bounce Mode

2.4.1.5 Push Mode

While the panel switch is pushed, the sound and the light are changed gradually.

After pushing the panel switch for a short time, it stops to generating the sound and emitting the light. And after pushing the panel switch for a long time, it continues to generate the sound and emit the light until the switch for the clear function is pushed. (See Figure 7)
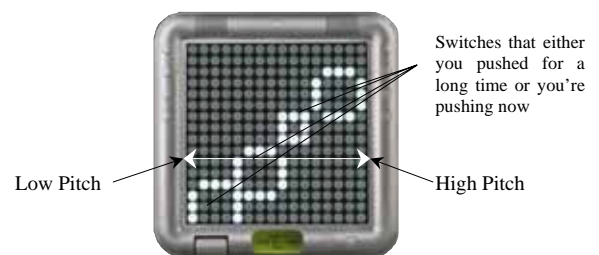

Figure 7. Push Mode

2.4.1.6 Solo Mode

The sound is generated continuously while the panel switch is pushed, and after holding the switch that you pushed, it stops generating the sound and to emitting the light. (See Figure 8)
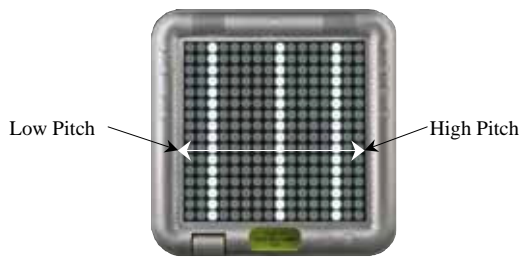
Figure 8. Solo Mode

2.4.2 Other Functions

2.4.2.1 Session With Another Machine
TENORI-ON can be connected to other TENORI-ONs with MIDI and play the session with other users.

In the session, a TENORI-ON as a master role sends the system real-time message among the other TENORI-ONs. The Other TENORI-ONs should get the message from the master TENORI-ON and synchronize the master's timing.

2.4.2.2 Save And Load The Data

2.4.2.2.1 Save and Load the data of the performance
TENORI-ON memorizes when and which panel switches were pushed from the start of the recording to the stop of the recording. The decision of the start and the stop of the recording should be done by the user's operation. The recorded file will be saved in the memory card like SD memory card.

Below are the main data to be saved.

- Positions of the points where the switches were pushed on each layer
- Time stamps of the points where the switches were pushed on each layer (The very first time stamps should be the beginning of the recording)
- Loop modes on each layer
- Master function set
- Layer function set
- Other sets on the menu

2.4.2.2.2 Save the state of a layer
You can save the data of the layer selected as a top layer.

Below are the main data to be saved.

- Positions of the points where the switches were pushed on the layer that's selected as a top layer
- Layer function set

CONCLUSION

2.5 Message From Toshio Iwai -- Musical Instrument For A New Age
I want to handle both light and sound simultaneously and pleasantly, as we play music or draw pictures. This is the theme I have been working on for a long time. Pursuing this idea further I have, in collaboration with YAMAHA, been developing TENORI-ON with particular attention being given to, the beauty of the light and sounds, the ease of performance, and as a musical instrument for the future, the design and the quality of the product as a whole. In days gone by, a musical instrument had to have a beauty, of shape as well as, of sound, and had to fit the player almost organically.(Instrument like the violin spring to mind.) All of these elements were once considered indispensable. Modern electronic instruments don't have this inevitable relationship between the shape, the sound, and the player. What I have done is to try to bring back these, once indispensable, elements and build them in to a true musical instrument for the digital age. TENORI-ON.

2.6 Our Goal
We developed this work with a new point of view to music. And we'd like to keep on thinking the musical structure and music with a new point of view. When we develop some work with the idea and the image gotten from this method and make the idea move, then you can catch a new image of music, which you've never seen before. And if you control the motion of the new image, the interface will be a brand new thing inevitably. Sometimes, you might have to develop some new basic technology at first to make it. In that case, you could develop a work that is exactly mixed art with science, and the possibility being a brand new work could be enhanced. We hope that people could get a new point of view to music and it could connect to the development and the expansion of the possibility of music by people using the interfaces like our work.

Finally we hope this work would make it possible for many people (including people who don't usually play any musical instruments) to experience the pleasure of music more than before. And when our work that has a new point of view to musical structure helps to expand the possibility of music and to develop music, we would like to think that it would be our goal.

3. ACKNOWLEDGMENTS

4. REFERENCES
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