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MicroMiDi

Rahul Sharma

rahulkv505@gmail.com

Presidency University, Bengaluru, Karnataka

Rahul Madhariya

rmadhariya@gmail.com

Presidency University, Bengaluru, Karnataka

Yudhisthir Chavan

yudhi.4u11@gmail.com

Presidency University, Bengaluru, Karnataka

Geeta Patil

geetapatil@presidencyuniversity.in

Presidency University, Bengaluru, Karnataka

ABSTRACT

Modern MIDI (Musical Instrument Digital Interface) controllers require significant physical space due to their preset button layout and space consuming setups. Despite their high price, modern MIDI controllers have only one setup. With one setup, music producers or artists have a hard time carrying their MIDI controllers around for concerts or other performances. The controller addresses the high cost that physical MIDI controllers currently hold on the market by allowing users to make/create their own specific MIDI control board using any combination of knobs, dials, buttons, and sliders. This customization of the controller allows the user to save space and money, while also accommodating for their style or a specific performance.

Keywords— Embedded Hardware, MIDI, Microcontroller, Arduino, music

1. INTRODUCTION

At the beginning of the recording industry, everything was custom built and everything was analog. This made professional recording equipment incredibly expensive and required a high level of technical expertise to develop. This applied a segment of Electrical Engineering known as signals processing to create amplifiers, speaker drivers, and recording equipment.

Programming with different micro controllers has recently become more and more common for various types of tasks. Micro controllers and different modules for these chips become cheaper and more accessible. With a cheap micro controller and some sensors there is much that can be done.

2. THEORETICAL ASPECTS

Multimedia computers are in the information age that people must rely on equipment. Composer must change the traditional concept of the creation, expansion mode of thinking, the use of high-tech means to plunge into the creation of the new century music in the past. In recent years, electronic equipment and information technology innovation and development become more and more "computerized", "information" and "networking", the future will be based on computer music system based on computer network to build up. As 21 century composers, online music must have mastered the skills of resource development and utilization of quality.

Resources in the network is extremely fast and convenient way to get what you need music, text, images, audio and other music information, be able to look around the world of folk music, data files of famous musicians, classical music and foreign various periods, calendar of music publications and periodicals, live concerts, the latest scientific research and musical works, works of recent music competition or solicitation messages, etc., if not timely understanding and knowledge of these new technologies, it is undoubtedly the lack of competitiveness. Computer music technology to bring this revolutionary new way to contemporary music composers put forward higher requirements, musical works from the initial idea to the finished, all the various operations by the composer himself and the entire computer electronic equipment systems. In addition to the composer's music has extensive accumulation, superb music theory, composition techniques skilled, but also has a diverse musical creative thinking, mastery of advanced technology and strong multimedia computer hardware system's actual operating capacity.[1]

There are some solutions available serve similar purpose.

Few of the existing systems are listed below:

2.1 Drum Machine



Fig. 1: Drum Machine

A drum machine (**Fig. 1**) is an electronic musical instrument that creates percussion sounds, drum beats, and patterns. Drum machines may imitate drum kits or other percussion instruments, or produce unique sounds.

2.2 Synthesizers



Fig. 2: Synthesizers

A synthesizer (**Fig. 2**) is an electronic musical instrument that generates audio signals. Synthesizers generate audio through methods including subtractive synthesis, additive synthesis, and frequency modulation synthesis.

2.3 Samplers



Fig. 3: Samplers

A sampler (**Fig. 3**) is an electronic or digital musical instrument which uses sound recordings of real instrument sounds, excerpts from recorded songs or found sounds. The samples are loaded or recorded by the user or by a manufacturer.

2.4 MIDI Interface



Fig. 4: MIDI Interface

A MIDI interface (**Fig. 4**) is a device that provides MIDI In/Out to and from a computer or MIDI-equipped hardware via standard 5-pin MIDI jacks. There are standalone MIDI interfaces, virtually all of which connect to a computer via USB. MIDI interfaces can also be integrated into keyboards, pad controllers, control surfaces, and audio interfaces. This provides a wide range of options for configuring your studio or live rig.[2]

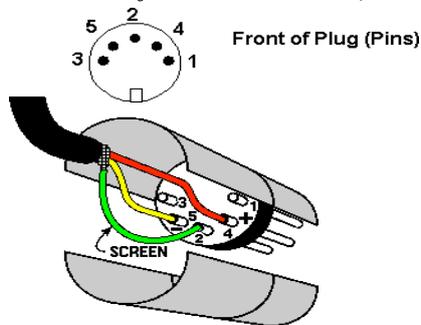


Fig. 5: Universal Asynchronous Receiver /Transmitter [2]

3. EXPERIMENTAL ASPECTS

3.1 Hardware description

The below **Table 1** consists of all the components required to make MicroMiDi

Table 1: Hardware description

Product number	Product name	Specifications
1	Arduino pro micro [7]	Atmega 328u4
2	Touch switch digital Touch Sensor Keypad [6]	TTP229
3	Potentiometer [8]	Rotary
4	Dual axis XY joystick module [9]	KY-023
5	Buttons [10]	Tactile

3.2 Software description

Arduino Ide: The Arduino IDE is an open source software where we can write, execute and upload to the board it can install for windows, Linux, etc., here programming language C is used. I have written the program in embedded C and uploaded to hardware board by connecting USB. We have used the software to code for our device.[4]

Fritzing: Fritzing is an open-source hardware initiative that makes electronics accessible as a creative material for anyone. We offer a software tool, a community website and services in the spirit of Processing and Arduino, fostering a creative ecosystem that allows users to document their prototypes, share them with others, teach electronics in a classroom, and layout and manufacture professional PCBs. We have used the software for circuit design.[3]

Ableton Live: Ableton Live is a digital audio workstation for macOS and Windows. In contrast to many other software sequencers, Ableton Live is designed to be an instrument for live performances as well as a tool for composing, recording, arranging, mixing, and mastering. Our device is used to control this type of DAW's (Digital Audio Workstation). We have mentioned this DAW as it is used in testing and demonstration.[5]

3.3 Programming Language

C: Arduino compiler/IDE accepts C. In fact, many of the libraries are written in C. Much of the underlying system is not object oriented, but it could be. Thus, "The Arduino language" is C.

3.4 System Architecture

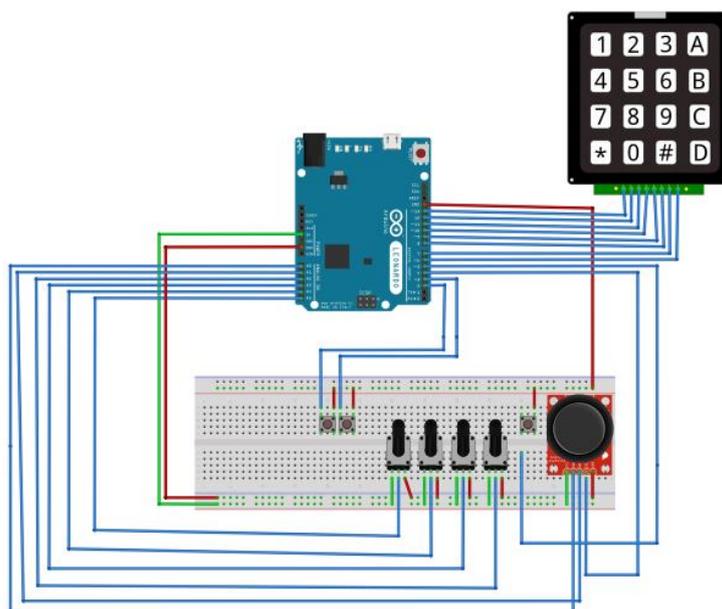


Fig. 5: Schematic Diagram

In Fig 2.6 Arduino pro micro is the microprocessor used as it is USB compliant, which makes it universal plug and play device. And of course, Arduino gives us the ability to customise it any possible way that we want. TP229 as drum machine. Potentiometer are used to map different knobs present in the DAW.

Push Buttons for different functions.

- Record
- Bank select

Dual axis XY joystick module to map different effects like

- Pitch
- Low pass filter
- High pass filter

4. RESULTS

Through MicroMiDi we propose a system which solves most of the below limitations. A system which is cheap, portable, easy to use and pocket friendly so that the beginners who are producing music can also use it very easily. So we used the above mentioned components such that the device can help use the basic MIDI functions provided by the existing system in a cheaper price.

5. DISCUSSION

This project aims to build a hardware device which is capable of sending real-time sensor data from our device to the computer and the digital audio workstation.

To start using our device you must have a digital audio workstation installed in your computer. DAW is the most important software. Apart from this our device is based on micro USB cable/bus.

MicroMiDi is a basic device which can be used to find rhythm of any samples instrument, record the groove of drum sequence you figured out, add variations to the drum sequence you recorded and much more.

5.1 Limitations of existing systems

- The above systems are expensive.
- They are not portable.
- It requires high skill and knowledge to operate each of the above devices.
- In case of any damage it will affect the whole system and replacing parts turns out to be very costly.
- These devices use 5 pin configuration Universal Asynchronous Receiver /Transmitter (**Fig. 5**) which is not directly compatible with PC'S and require an audio interface to connect.[2]

6. CONCLUSION

MIDI is essentially both a communication protocol, a type of digital interface and type of connector all rolled into one. It is a way to connect electronic instruments together, sending information in between them and interpreting them to eventually make sounds, to make music. It is only used as an Arduino to “speak” MIDI via USB to DAW. It is important to note that MIDI does not transfer any actual audio but only transfers data from hardware to the computer. The reason we have made this simple device as mouse and keyboard are not so efficient enough to control /adjust various aspects in DAW.

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