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Simple User-Friendly MIDI Controller using Arduino.

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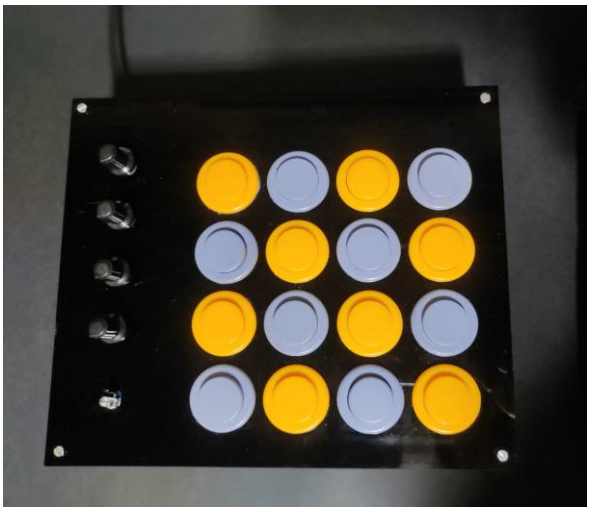
Abstract - *Daily new and innovative MIDI controllers are being launched but there is cost-push inflation for the same, discouraging a fledgling artist. In light of this problem, our paper intents to showcase not only a cost-effective but also easy to build MIDI Controller. This instrument can be used in various fields such as Engineering, Mathematics, etc. The project's orientation on other hand provides a practical understanding and making of a MIDI Controller Using Arduino.*

***Key Words*: Arduino, MIDI controller, FL studio, DAW, DIY, MIDI, Launch-pad, Music Synthesis.**

1. INTRODUCTION

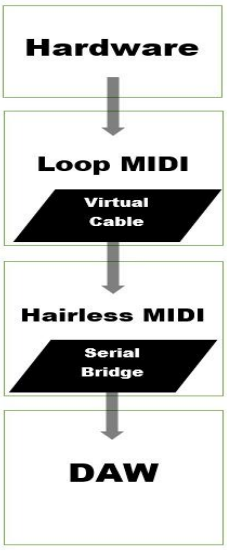
By the mid-1980s electronic instruments gained momentum in India. These were not only used in pop culture music but also in various ways to produce music. India is currently beholding its greatest and foremost electronic and digital revolution. Thus, this gives rise to surplus use of electronic devices. Even with a thriving business in digital instruments, a survey in 2018 shows that 60 % of artists prefer to perform using a live instrument rather than software simulations. In this project, we practice a cost-effective way for the beginner artist to learn and perform using the Midi controller. A MIDI is an open protocol and flexible for anyone using it. It is a bridge between software and hardware. This project works on DAW that accepts a MIDI controller and you can play your preferred instrument on your MAC or PC. Taking into consideration the socio-economic situation in India and difficulties in obtaining electronic instruments this paper aims at reducing and minimizing the cost and by this, we are bringing a worldwide revolution to electronic instruments and making them accessible to the growing middle-class generation



1.1 MIDI

Musical Instrument Digital Interface

Possibilities of building a MIDI are multitudinous. Hence in this paper our primary inducement is to create an affordable MIDI. As the MIDI protocol is present in all Digital Audio Workstation (DAW), the model shown here is capable of operating on software such as Ableton Live, Logic Pro and FL Studio, as well as open-source software such as LMMS and Ardour etc.



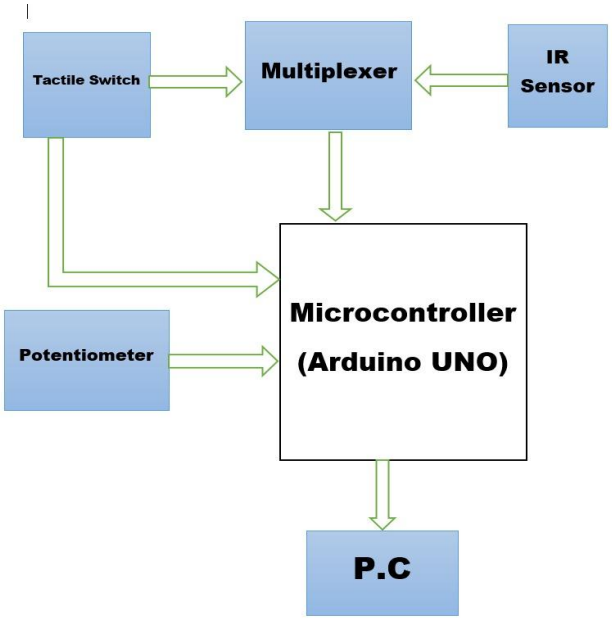
ARCHITECTURE DESIGN

2. METHODOLOGY

2.1 WORKING PRINCIPAL

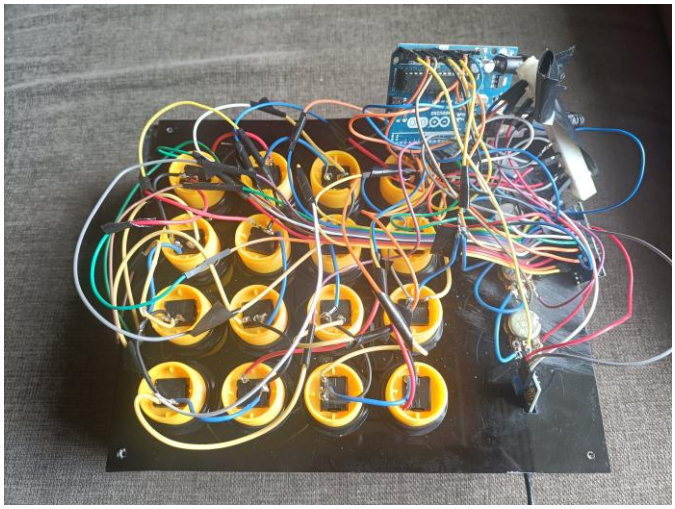
To experience all kinds of musical instruments at our fingertip we use a communication protocol 'MIDI' or musical instrument digital interface. MIDI enables us to connect various devices and communicate with each other. The midi controller is populated with 16 tactile switches or arcade buttons an IR sensor or touchless switch and 4 potentiometers. These comes under the controlling layer of the project where each component can be operated individually. Each component triggers a sound or help change the parameters of the occurrence of sound

2.2 HARDWARE REQUIRED



Block Diagram

Arduino Uno is used as the heart of the controller which will send instructions to the software as per the inputs pressed by the user. As the input/output pins on Arduino are not sufficient we have used a multiplexer module compatible with Arduino. We used CD74HC4067 16 channel Analog digital multiplexer which uses logic circuits to concentrate many inputs such as the buttons to the same output. Each button has two states NO or normally open and NC that is normally closed. Button when pressed goes from its default state NO to NC and sends binary signal to the Arduino and then to the software. IR sensor in a similar way is used as a touchless button when sends signal to the microcontroller when the hand is placed above within the range. The potentiometers by sending Analog data enables us to perform various operations such as volume control other applications include- treble, bass, pan, stereo, stretch, velocity, volume, fade etc.



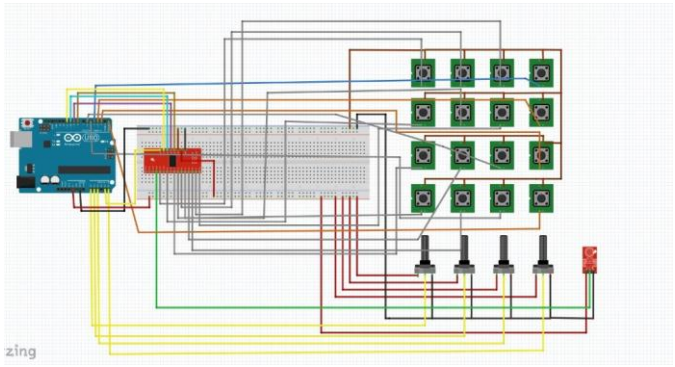
Hardware Implementation

2.3 SOFTWARE REQUIRED

To transfer MIDI data to the computer we need to create a virtual midi port on our pc as we are using USB cable hence-forth we use the software loopMIDI which creates a virtual MIDI port and acts as an invisible cable between them.

Then we use a software 'Hairless MIDI' which acts as a serial bridge connecting the serial devices where we set the input and output targets. Input target being the port we created through loopMIDI. Hairless midi makes it really easy to send and receive midi signals through serial devices

All this data is then sent to DAW (digital audio workstation). DAW as the name suggests is the workstation where all the signals are processed. Using DAW we can virtually control all the instruments and replicate their sounds not just the instruments but also the synths which does not represent any instrument. We are using FL studio for our project because it is easy to work on and is compatible for our hardware without any issues and complications. Using FL studio this midi controller can also be used to record and edit audio, Mix and Master tracks etc.



Digital circuit diagram using Fritzing

3. ANALYSIS

After connecting the controller to the DAW the performance was tested by using the FPC plugin from FL studio where the drum sounds were tested, all the buttons performed well. Then each button was tested individually along with the potentiometers were tested with the piano sounds with FL keys plugin and the data was recorded. Next is output for the same.

4. OUTPUT

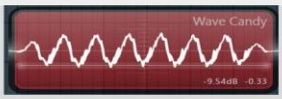
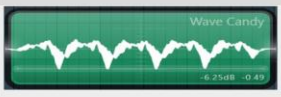
SR. NO.	BUTTON NUMBER	OSCILOSCOPE DATA
1.	BUTTON 1X1	
2.	BUTTON 2X1	
3.	BUTTON 3X1	
4.	BUTTON 4X1	

Chart-1: Oscilloscope Data

The following data is recorded from the IR sensor, the two different output waveforms represent data recorded for different time duration and hand placed on the sensor with different intensity. A potentiometer controlling the treble was recorded with different treble settings (minimum and Maximum)

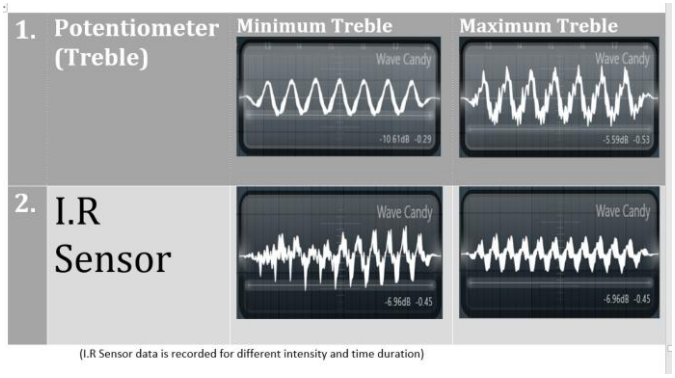


Chart -2: Potentiometer and IR sensor Data

5. CONCLUSIONS

Advancement of this paper has stimulated an avant-garde way to create affordable MIDI controller. As for our future establishment, this MIDI controller can be used for controlling stage lights, more buttons and switches can be added and with the help of that we can play more instruments at the same time and use it as a launchpad. Similarly, we can add more IR Sensors and potentiometers to control additional parameters, however we can also add keyboard piano type keys in our MIDI controller. Thus, this paper is developed to be plug-and-play and facilely connect to computers. Users with little mastery of music are also targeted, so switching from different keys and buttons makes it fun and easier to mandate simple command.

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