Project Proposal

Distance Sensor MIDI Controller

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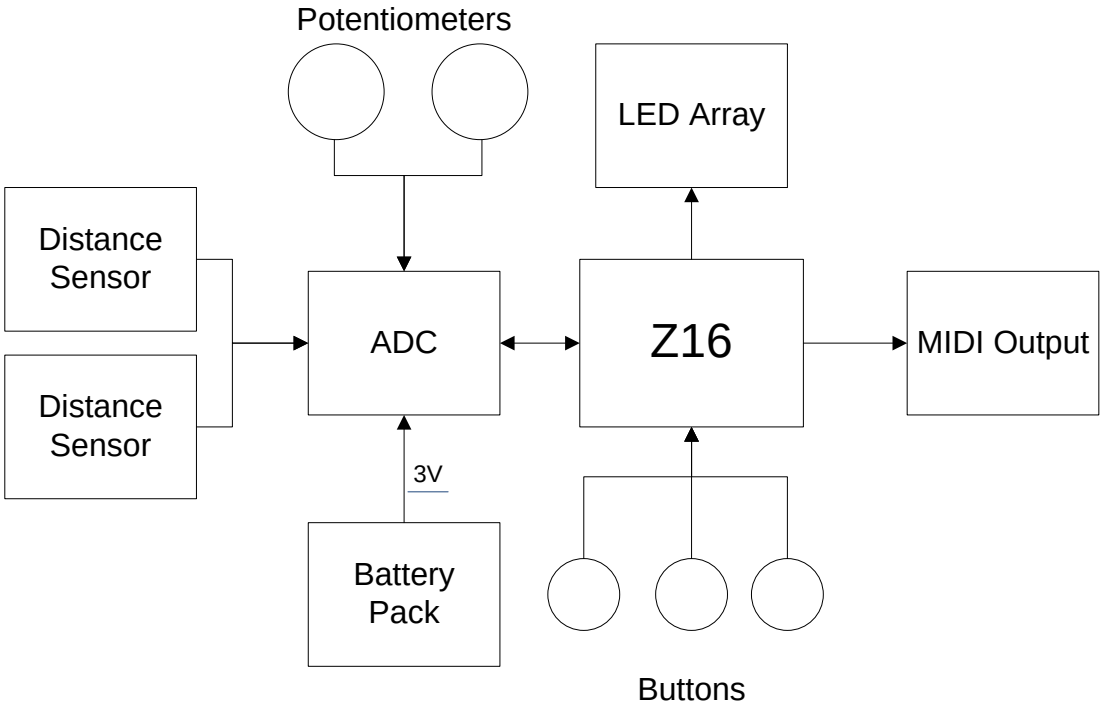
Project Abstract

This project is an interactive MIDI controller that allows a user to control virtual instruments and other MIDI triggered musical devices by raising and lowering their hands. This will be done using two motion sensors, one for each hand, with one controlling the pitch and another controlling pitch bend. MIDI settings, such as the selected instrument channel, will be adjustable using the buttons. The current settings will scroll across the LED array when being adjusted. Settings will be cycled using button presses. Potentiometers will be used as an alternate input source for generating MIDI messages.

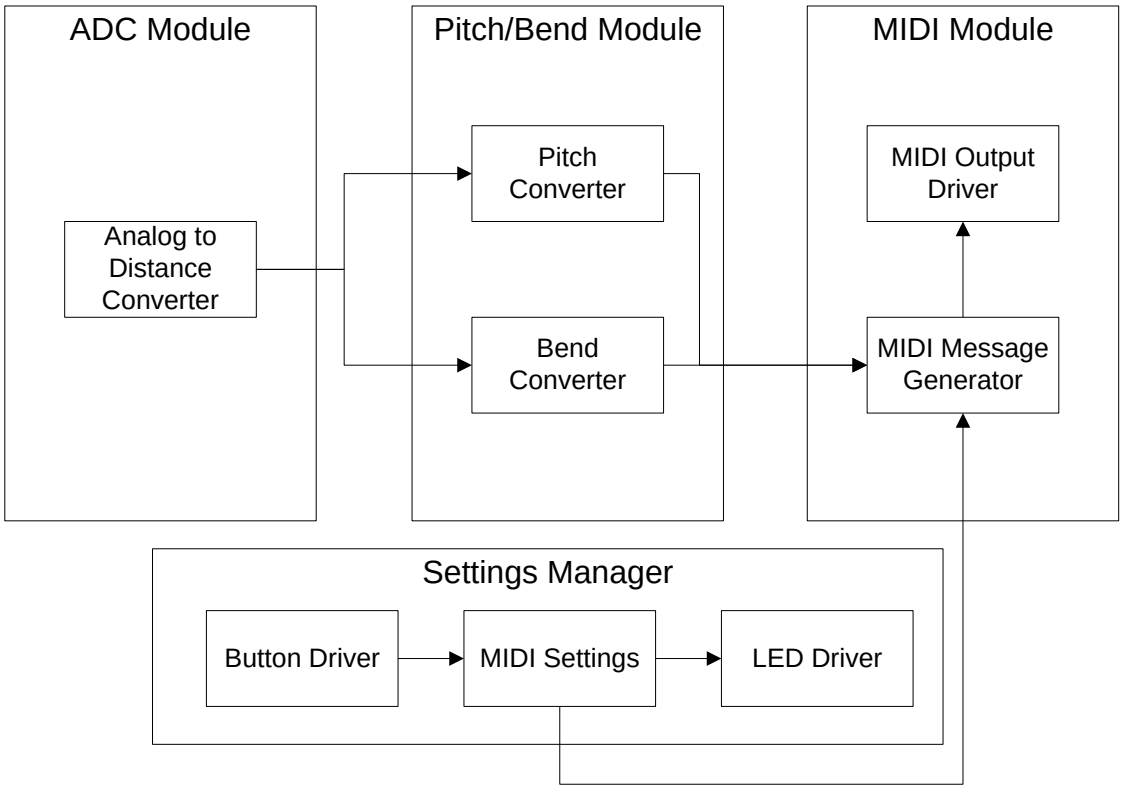
Strategy

Description of the overall design: See the project abstract.
What platform: Z16
What capabilities: GPIO, analog inputs, analog to digital conversion, timers, interrupts, MIDI Protocol, and serial output.
What external: 2 potentiometers, 2 distance sensors, a 5-pin MIDI connector, and a power supply.
What sort of evaluations: The reference voltage for the ADC will depend on what distance sensor is used.

What software modules: ADC to Distance Converter, Distance to Pitch Converter, Distance to Pitch Bend Converter, MIDI Message Generator, MIDI Output Driver, and Settings Manager. The MIDI driver will be reusable and will be capable of sending all MIDI messages.



Preliminary hardware block diagram



Preliminary software block diagram

Unknowns

The reference voltage needed for the analog to digital conversion of the distance sensors will depend on what sensors are ultimately used. However, most sensors seem to require a reference voltage of 3 volts.

The MIDI spec must be examined in more depth to figure out how it is clocked.

The distance sensors may be very inaccurate. It may be difficult to convert the 10-bit analog values to distance values.

Implementation Plan

Uses the Z16F2811FI contest board.
Acquire all components (Potentiometers, Distance Sensors, 5-pin MIDI Connector).
Test distance sensor outputs and derive an equation for matching these values to distances.
MIDI specification research.
Build reference voltage power supply.
Implement the ADC driver module.
Implement the analog to distance conversion module for potentiometers.
Test the ADC layer. Smaller units tests will be created continuously.
Implement the analog to distance conversion module for distance sensors.
Implement pitch and pitch bend conversion modules.
Build the MIDI message generator.
Build the MIDI driver.
Test the MIDI layer.
Implement the button handlers.
Build the settings manager.
Integrate the buttons, settings manager, LED, and MIDI Driver.
Integrate the analog devices with the MIDI driver.
Test the whole project.

Resources

Z16 Contest Board: University provided.
2 Distance Sensors: Will be purchased.
2 Potentiometers: Will be purchased.
Power Supply/Battery: Will be purchased.
5-pin MIDI Connector: Will be purchased.
A MIDI Interface: Currently possessed.
A MIDI Instrument: It will control Ableton Live virtual instruments on a laptop.