Interfacing the ordinary Joystick Module Using Basys3 XADC

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1 Introduction

This document provides a guide to interface the joystick module using Basys3 built-in XADC. Basys3 FPGA provides an internal Analog-to-Digital Converter which can be used to read analog input voltages. The XADC is capable of reading differential input voltages from 0-1 V. It can be used in various configurations according to the needs. For this application, we will be using the unipolar configuration which will require us to ground the negative pin of each of the analog input pair. The joystick module used contains two potentiometers which output two resistance values corresponding to the x and y axis of the joystick. Since we need to keep our input voltage within one volt, we have used a voltage divider which gives us a safe range of input voltages $(0 - 0.76$ V$)$ for the XADC.

2 Circuit Diagram

The 4-pin module represents the used input from the joystick module and the 6-pin head represents the XADC PMOD port used. For the input resistance, a serial combination of 15k-ohm and 680 ohm resistor can be used.

Note: Please be careful while making your circuit. Make sure you have connected the wires correctly and have only used the Analog PMOD since a wrong setup can cause the fpga to malfunction or in extreme cases result in hardware damage.
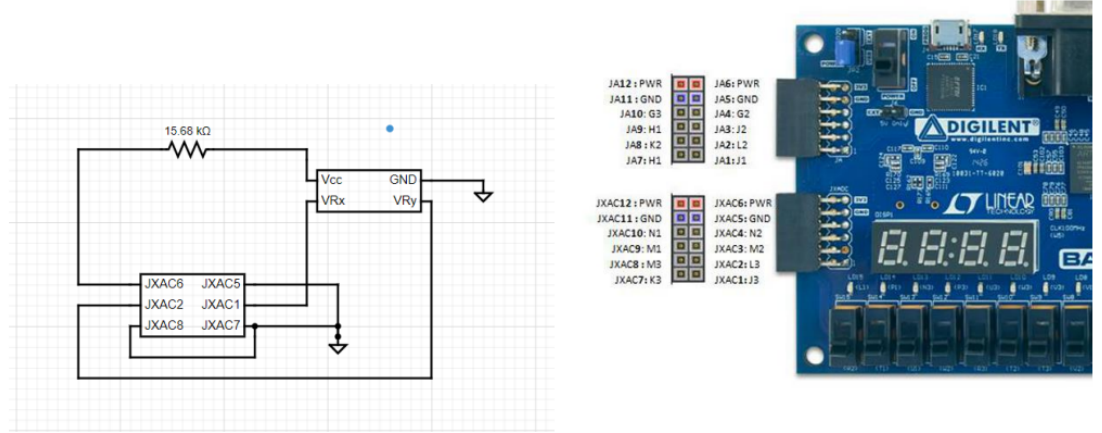
Figure 1: Circuit Diagram for connecting the Joystick (left), basys3 Analog Pmod port pinout (right).

3 Brief Code Explanation and Usage

https://github.com/muhammadali74/Basys3-Joystick-Interfacing.git
The repository contains the project to run/test the joystick. The XADC module can only read from one of the inputs at an instance of time, therefore, we need to switch between reading VRx and VRy many times a second inorder to (almost) accurately read the movement of the joystick on the xy-plane. We can do this using a multiplexer and use a clock signal to switch between the input values or use it as intended. The xADC has a pin for the address bus for each input and therefore, we can use a multiplexer to switch between different addresses so that we can read from multiple analog pins periodically. The output signal we need is the 16-bit 'data' signal in the code. This is the input that we can use in our game logic.

Collaborators

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References

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