Test Plan

LED Snake Cube
Revision 1

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Document History and Distribution

Revision History

Revision	Changes	Date
1.0	Initial draft	11/30/2017

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1 Introduction

The LED Snake Cube is a device that is used to play a 3-D modified version of the classic arcade game Snake. The game will be processed with a PIC32 microcontroller, controlled using a modified Nintendo Entertainment System (NES) controller, and displayed using a 4x4x4 LED Cube.

1.1 Objective

This test plan outlines the testing process and defines each of the test cases to be performed. The tests conducted are to be consistent with the requirements set in the 411 Requirements Doc, version 1, dated 10/19/2017.

1.2 Scope

The purpose of this test plan is to quickly and safely power up the LED Snake Cube board so that the discrete systems can be verified as working correctly.

1.3 Testing Strategy

Testing will begin with verifying the operation of the boards power supplies, both the 5v and 3.3v supplies will be tested. The power is provided to the board by an external circuit, and as such can be safely tested without risk to other components. After the power is confirmed to be working, we will then test the digital logic (latches, multiplexers, and darlington transistor pairs) and the LED cube using logic values provided by a DC power supply. Then the NES controller will be tested for the correct output given particular button presses. The microprocessor will then be added with the prototype program already loaded, modifications will be made as needed.

1.4 Reference Material

- LED CUBE schematic V4
- LED CUBE layout V4
- LM317 Datasheet
- LED CUBE level 1 block diagrams
- ECE411 Requirements doc.docx

2 Test Items

2.1 Equipment

- Tektronix: Laboratory DC power supply
- Tektronix: Digital Multimeter

3 Features to be tested

- Digital Logic
- NES Controller
- LED Cube
- Code for Snake game

4 Approach

4.1 Test Setup

All equipment needed for test is available in the PSU capstone Lab.

4.2 Component Testing

- Power supply test (ID# PST-LSC1)
- Flip-Flop test (ID# FFT-LSC1)
- Multiplexer test (ID# MXT-LSC1)
- Microcontroller test (ID# MCT-LSC1)
- NES controller test (ID# NCT-LSC1)
- Snake game program test (ID# SPT-LSC1)
- LED cube circuit test (ID# LCT-LSC1)

4.3 Integration Testing

- NES-PIC interface test (ID# NPI-LSC1)
- PIC-Logic interface test (ID# PLI-LSC1)
- Logic-LED cube interface test (ID# LLI-LSC1)

Appendix A

Test Writer:		Yufei Chen, Meiqi Zhao				
Test Case Name:		Power Supply Testing		Test ID:	PST-LSC1	
Description:		Test verified the output voltages are 3.3V for PIC, 5V for NES controller		Type:	Black Box	
					White Box	X
Tester Information						
Name of Tester:		Yufei Chen, Meiqi Zhao		Date:	2017-11-26	
Hardware Version:				Time:		
Set up:		LM317 and L7805 should be set up, and powered on. Laboratory DC power supply and Digital Multimeter				
step	Action	Expected Result	Pass	Fail	N/A	Comments
1	Using L7805 voltage regulator to transfer 9V input to 5V output.	When we measure the output, should how 5V DC output voltages on Digital Multimeter.	Yes			We got approximately 5.02 V for the output, error in control range.
2	Using LM-317 voltage regulator to transfer 5V input to 3.3V output	When use the LM317, we measure the output of LM317, should show 3.3V DC voltage on Digital Multimeter	Yes			We got approximately 3.26 V for the output, it should be good, because the allowed input voltage of microcontroller is from 2.6V to 3.6V
Overall test result:			Yes			

Test Writer:		Kestutis Saltonas				
Test Case Name:		Flip-Flop test			Test ID:	FFT-LSC1
Description:		Ensure output stays latched with changing input values.Check to make sure the output values correspond to the input values (clock & input).			Type:	Black Box
						White Box X
Tester Information						
Name of Tester:		Kestutis Saltonas, Brian Milanek			Date:	11/30/2017
Hardware Version:					Time:	1:40
Set up:		SN74ABT374A D-Type Flip-Flops tested using vcc of 5v, input of 3v (PIC32 GPIO output voltage), and manually clocked. A multimeter was used at first, followed by the LED cube once the values were confirmed "safe" enough for LED's.				
step	Action	Expected Result	Pass	Fail	N/A	Comments
1	Input value of 1, Input clock, current output 0. Check with multimeter.	The flip-flops are edge-triggered,on clock input,output value will take on the value of the current input in this case would be high.	X			output voltage from flip-flops is about 4v, this is drawn from vcc not input.
2	input value of 0, input clock, current output 1. Check with multimeter.	The output should change to 0 on the clock input.	X			output voltage from flip-flops is about 20mv, this is within an acceptable 0.
3	input value alternating, NO clock, current output 1. Check with multimeter.	There is no clock input, so the changing values on the input should NOT change the output.	X			output voltage from flip-flop stayed at about 4v as expected.
4	repeat steps 1-3 using LED's instead of multi-meter. Confirm LED is bright enough, and does not burn out.	on high output values, the LED should light up. on low output values the LED should stay off. results should be as previous steps.	X			The LED did not burn out, however using resistors as a precaution is advised.
Overall test result:			X			Flip-Flops operating voltage is 4.5-5v.