



University of Idaho

College of Engineering



BUTTON CYCLER ENHANCEMENTS FOR ADVANCED INPUT SYSTEMS

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VALUE PROPOSITION

Exhaustive testing of human machine interfaces (HMI) associated with high technology equipment is needed to assure that the HMI remain fully functional throughout the anticipated usage life.

The goal of our project is to design a next-generation keyboard testing equipment/software package that can be easily configured to a broad range of keyboard geometries.

The test will reduce human labor required for data acquisition/visualization and provide information about changes in switch health throughout the entire testing procedure.

PROBLEM STATEMENT

Develop enhancements to a button cycler for use in qualification testing of electro-mechanical switches designed into Advanced Input Systems' products.

CURRENT SYSTEM CAPABILITES

- I Incremental counters detect and display # of switch closures after reset
- I System force can be somewhat controlled through input pressure.
- I Multiple air cylinders (Bimbas) can test multiple keys on a device.

CURRENT SYSTEM DRAWBACKS

- I No way to monitor or adjust force applied by pneumatic Bimbas.
- I No way to measure or quantify **switch health**.
- I Switch closure count doesn't indicate *when* an error has occurred.

SYSTEM REQUIREMENTS

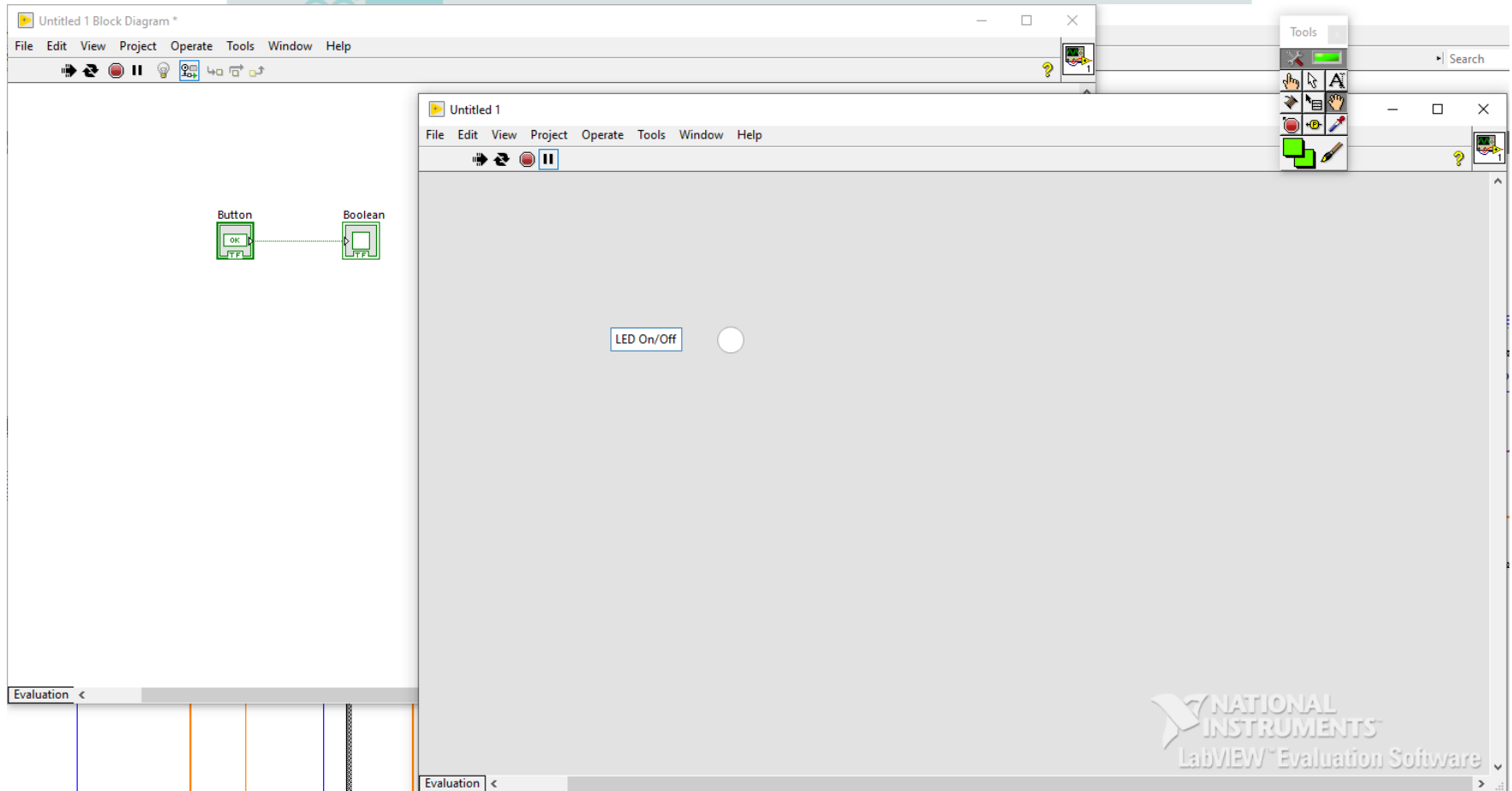
I Priority scale, structured as tiers (1-4)

- 1 – LabVIEW program, debounce detection, and datalogging
 - Test 1 to 30 switches simultaneously at a rate from 1Hz to 5Hz,
 - Allow operator to assign cycle rate, and cycle count prior to test start.
 - Monitor switch health during cycling:
 - Open/Closed resistance waveform
 - Show present values of data logging during test.
 - Switch bounce that lasts >10ms
 - Allow operator to pause/resume/restart tests and save test setups.
 - Format Excel report at test end.

SYSTEM REQUIREMENTS

- I Priority scale (1-4), structured as tiers (lowest number is highest priority)
 - 2 – Force input and detection
 - Allow operator to assign cycle force prior to test start.
 - Monitor maximum applied button force during cycling
 - 3 – Switch characterization
 - Characterize switch's F/D/R behavior at pre-programmed test intervals
 - Output hysteresis curve of results
 - 4 – Additional hardware redesign
 - Modernize hardware setup for button cycler system with new test apparatus

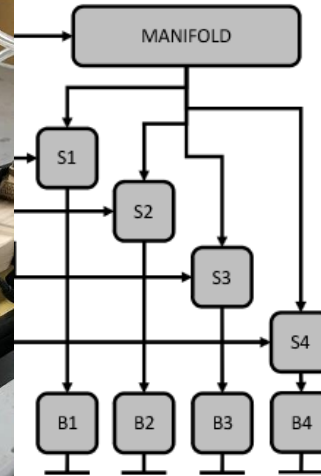
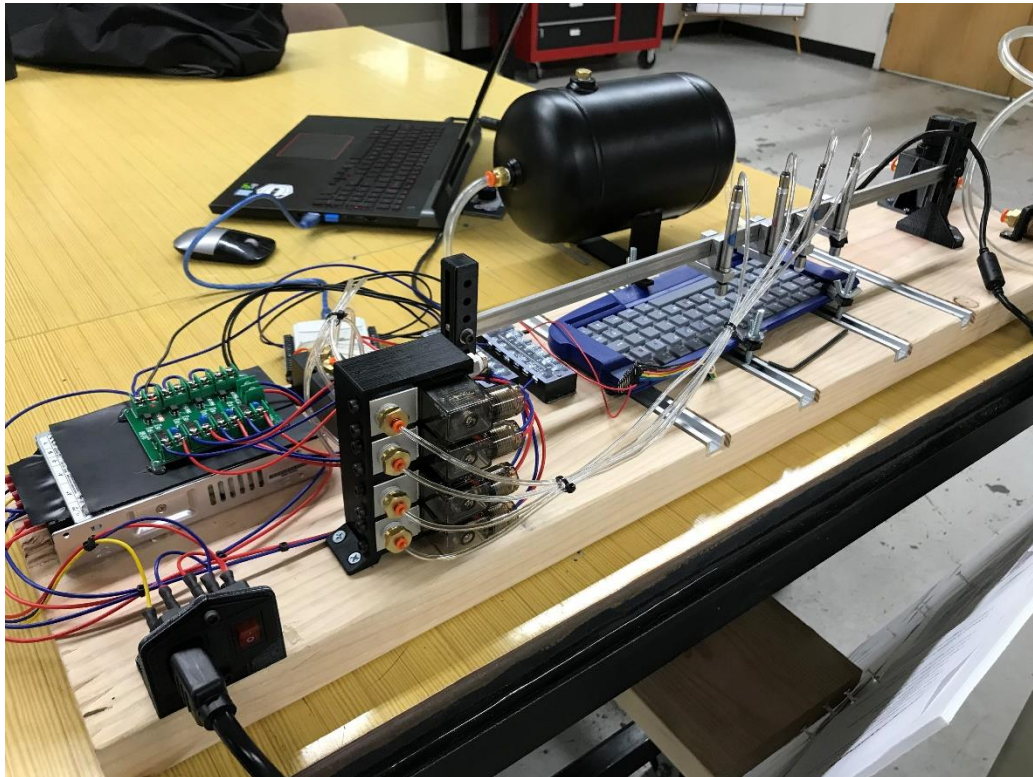
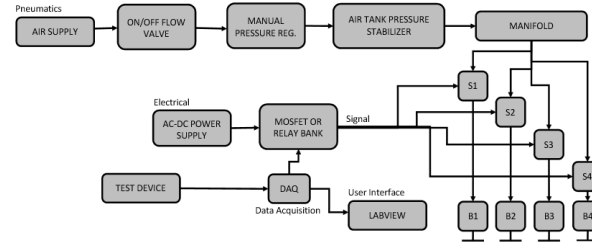
WHAT IS LABVIEW?



SYSTEM HARDWARE

AIS Button Cycler Enhancements Priority 1 System Diagram

AIS Button Cycler Enhancements
Priority 1 System Diagram



Key:
Solenoid – S
Bimba – B

Key:
Solenoid – S
Bimba – B

SYSTEM SOFTWARE - FUNCTIONALITY

I Program structure (overview) – series of states

- Idle
 - User can graphically assign test parameters
 - Natural state of the program when nothing is happening
- Calibrating
 - Data on the system is obtained that is needed prior to the test
- Testing
 - Information on switch health is recorded and displayed to the user
- Logging
 - A brief system pause is allowed to log data to the device
- Paused
 - So the operator can make adjustments to hardware if needed during the test
- Complete
 - The test reached its specified number of cycles and is now finished

SYSTEM SOFTWARE – GUI

AIS Button Cycler V0-06 CLOSE VI

Program State
Idle ○ ○ ○

Setup Run

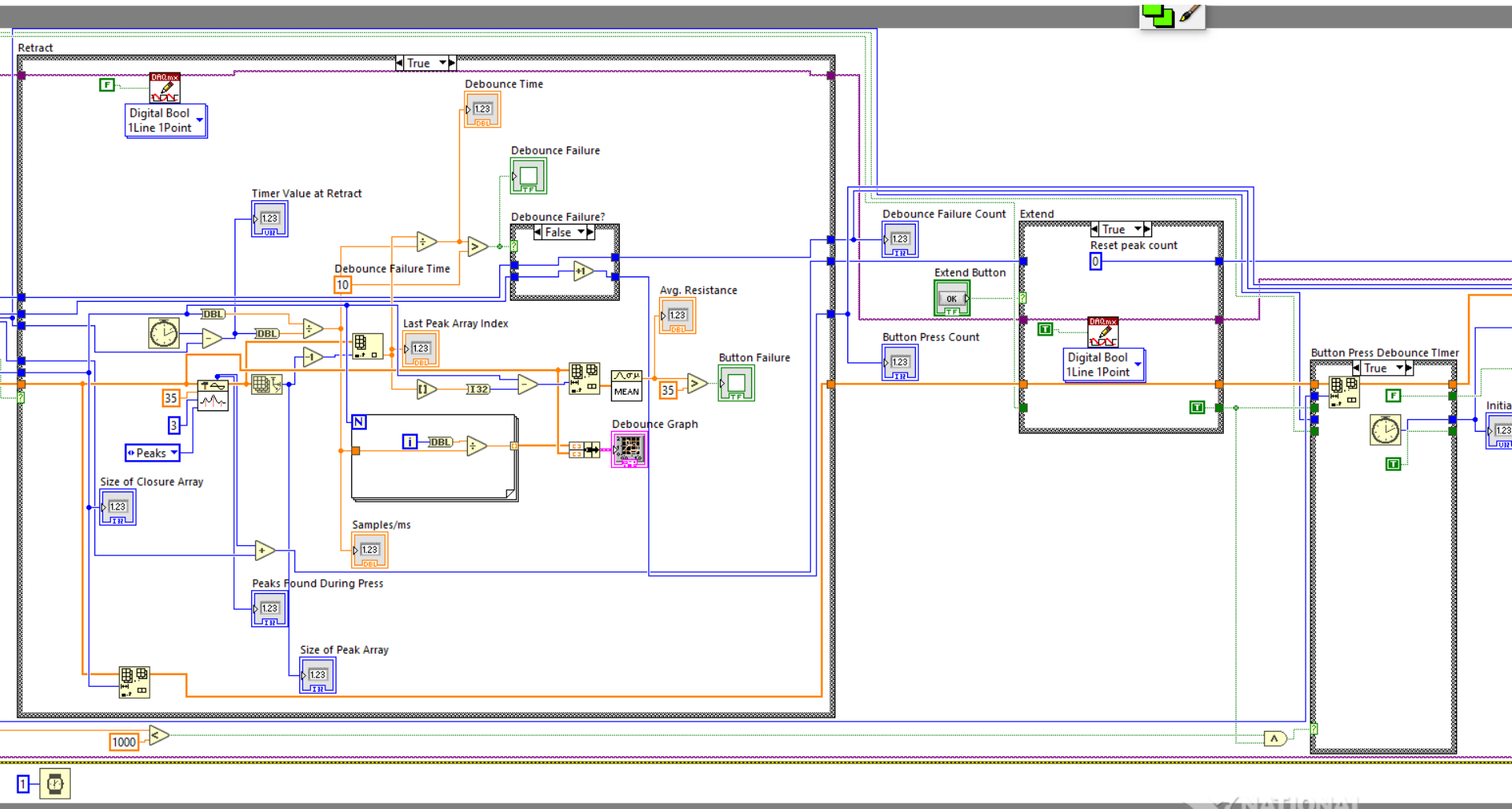
Test Statistics

Current Test Cycle
0

Failure	Cylinder ID	Switch ID	Successful Closures	Closed Res.	Debounce Time (ms)	Debounce Failures
<input checked="" type="checkbox"/>	1	A	0	0.00	0	0

START PAUSE STOP EXPORT TEST DATA

SYSTEM SOFTWARE – DEBOUNCE DETECTION



BUDGET OVERVIEW

Capstone Project Budget Template - Fall/Spring

Project: AIS

Last Updated 12/2/2019

Expense Items	Year							
	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Equipment/Tools:								
Travel:								
Travel to Cour d'a Alene	\$ 100		\$ 100			\$ 100		\$ 100
Supplies / Parts / Services:								
McMaster-Carr		\$ 205						
Moscow Building supply		\$ 17						
Amazon		\$ 70						
McMaster-Carr			\$ 170					
Amazon			\$ 104					
Shop Usage (est. Hrs):								
		15						

Item Total	
\$ -	
\$ 400	
\$ -	
\$ 205	
\$ 17	
\$ 70	
\$ 170	
\$ 104	
\$ -	
\$ -	
\$ -	
\$ -	
\$ -	
\$ -	
\$ 965	Expenses Subtotal
Hours	
15	
0	
0	
0	
0	
0	
0	

Graduate Student Support	\$ 1,000	including fringe
Shop Overhead	\$ 400	
University Overhead	\$ 118	5% of all expenses
Totals	\$ 2,483	\$ 4,000 \$ 1,517 Budget Excess

DESIGN VALIDATION PLAN

Senior Capstone Design

Project: AIS Button Cyclor Enhancements

Primary Author: Chris Crozier

Team: P.R.E.S.S.

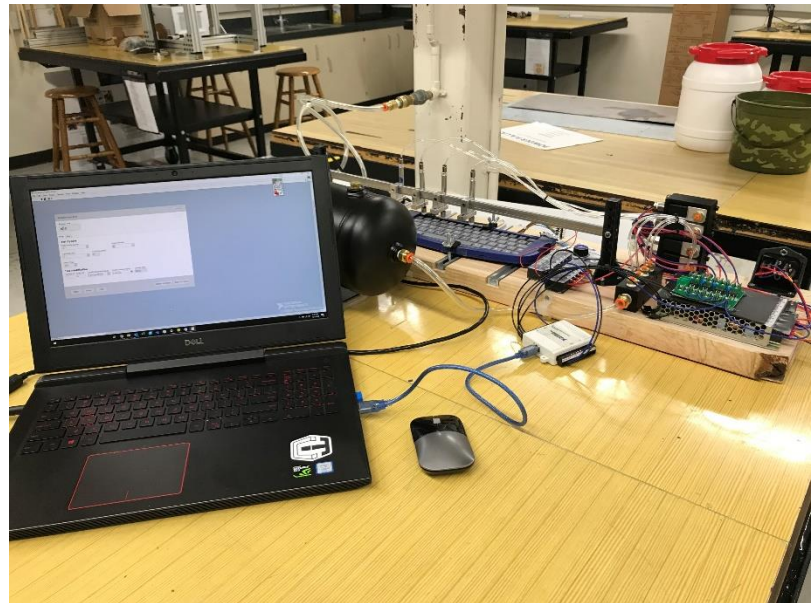
Date: 12/2/2019

Design Validation Plan & Results (DVP&R)

Requirement	Test	Test Subject	Target Date	Result	Recommendation
Force set and calibrated prior to test start	Use load cell to measure accuracy of Bimba force at variable input settings as well as degree of error over many cycles	Individual Bimbos and full system			
System must function off existing pneumatic supply (100 psi)	Full battery short test	Full system, regulator tanks	10/22/19	Confirmed	
Characterize switch F/D/R at preset intervals	TBD				
Monitor switch resistance	Produce waveform of switch resistance over time	LabView VI	10/23/2019	Confirmed	
Flag switch bounces > 10 ms	Manual test	LabView VI	12/4/2019	Partially complete	

NEXT STEPS

1. Purchase DAQ
2. Multiple Bimba system
3. Complete Priority 1 project requirements
4. Begin Priority 2 project requirements
5. Above and beyond...





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QUESTIONS?