

ENGR 4590 Testing and Statistical Analysis Worksheet

Team Name: MechBox

This worksheet describes the quantitative and qualitative testing and analysis for a voice controlled tool chest.

Table listing design constraints and test for each: add more rows as needed.

Constraint/Feature	Test/Performance Metric	Result
Drawer Lead Screw fully opens drawer	Drawer Completion Time	Pass
Lid opens more than 50°	Actuator Completion Time	Pass
Slider allows drawer to open/close fully	Lead Screw Alignment Success Accuracy	Pass
Voice Recognition	Accent Interpretation Accuracy	Pass

The project meets all the goals. The system's lead screws fully open the drawers, the lid opens more than 50 degrees, and the slider functions as presumed. The slider exceeded our expectations for it stays mounted in one place and prevents binding in the drawers as opposed to before. Furthermore, each drawer and lid open well after voice command, and they can fully close/open because of the slider.

The third constraint was the most difficult to meet. This was due to the slider not staying in place and moving sideways causing the drawer to bind and preventing the drawer from proper execution. This was the hardest constraint for we had to accurately readjust the slider on each drawer which took lots of time. Regardless, we were able to fix this difficulty and as a result all drawers open and close beyond our standards.

Quantitative testing:

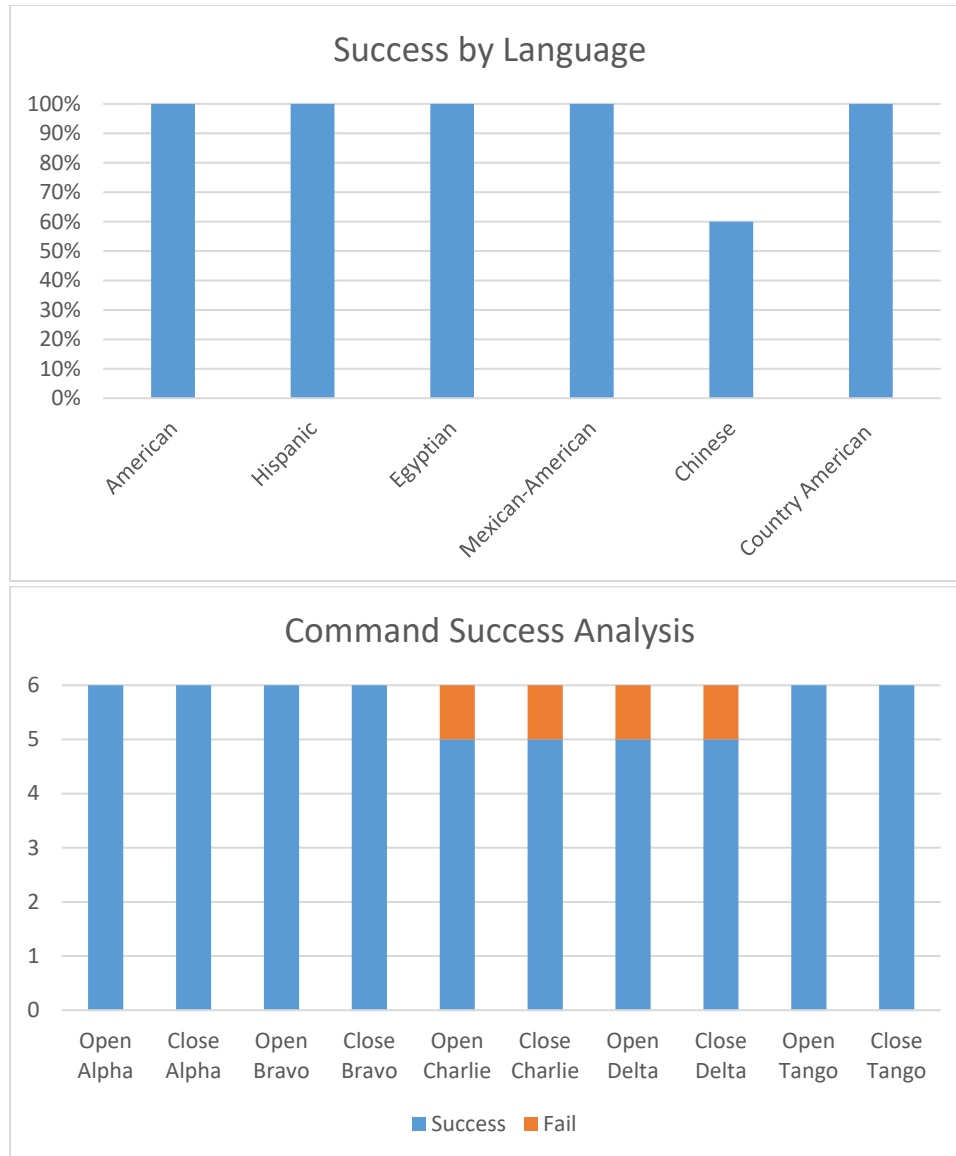
1. Accent Interpretation Testing:

- a. **Testing Metrics:** The goal of this test is to determine how reliable the voice assistants are at interpreting the commands of people with a variety of accents. If the assistants can successfully interpret commands from different people across a range of accents, the voice control is feasible and useful for most any user.

b. Testing Procedures: 6 people were sampled giving commands to one of the voice assistants by recording their voices and playing them back to the voice assistant when the assistant is listening for a command. If the assistant was able to successfully interpret and respond to each command given, the accent test for that command was deemed a success.

c. Data & Results:

American Accent			Egyptian Accent			Chinese Accent		
Command	Success	Fail	Command	Success	Fail	Command	Success	Fail
Open Tango	Success		Open Tango	Success		Open Tango	Success	
Close Tango	Success		Close Tango	Success		Close Tango	Success	
Open Alpha	Success		Open Alpha	Success		Open Alpha	Success	
Close Alpha	Success		Close Alpha	Success		Close Alpha	Success	
Open Bravo	Success		Open Bravo	Success		Open Bravo	Success	
Close Bravo	Success		Close Bravo	Success		Close Bravo	Success	
Open Charlie	Success		Open Charlie	Success		Open Charlie		Fail
Close Charlie	Success		Close Charlie	Success		Close Charlie		Fail
Open Delta	Success		Open Delta	Success		Open Delta		Fail
Close Delta	Success		Close Delta	Success		Close Delta		Fail
Country American Accent			Mexican American Accent			Hispanic Accent		
Command	Success	Fail	Command	Success	Fail	Command	Success	Fail
Open Tango	Success		Open Tango	Success		Open Tango	Success	
Close Tango	Success		Close Tango	Success		Close Tango	Success	
Open Alpha	Success		Open Alpha	Success		Open Alpha	Success	
Close Alpha	Success		Close Alpha	Success		Close Alpha	Success	
Open Bravo	Success		Open Bravo	Success		Open Bravo	Success	
Close Bravo	Success		Close Bravo	Success		Close Bravo	Success	
Open Charlie	Success		Open Charlie	Success		Open Charlie	Success	
Close Charlie	Success		Close Charlie	Success		Close Charlie	Success	
Open Delta	Success		Open Delta	Success		Open Delta	Success	
Close Delta	Success		Close Delta	Success		Close Delta	Success	



d. Conclusion: The data results shown above indicate how versatile the voice recognition is. By using existing voice assistants such as Google, Siri and Alexa, the toolbox takes advantage of existing voice and accent recognition algorithms to provide approximately 93.3% accuracy with toolbox control commands. Generally, it was observed that a heavier foreign accent proved less consistently interpreted but was still acceptable in most cases.

2. Top & Drawer Completion Time Study:

- a. Testing Metrics: The goal of this test is to ensure that the drawer opens fully in a timely manner. The test is deemed successful if each drawer opens and closes fully without overshoot.
- b. Testing Procedures: Each drawer is given the open and close commands and are timed from when they start moving to when they stop using a stopwatch. The data is then recorded below.
- c. Data & Results:

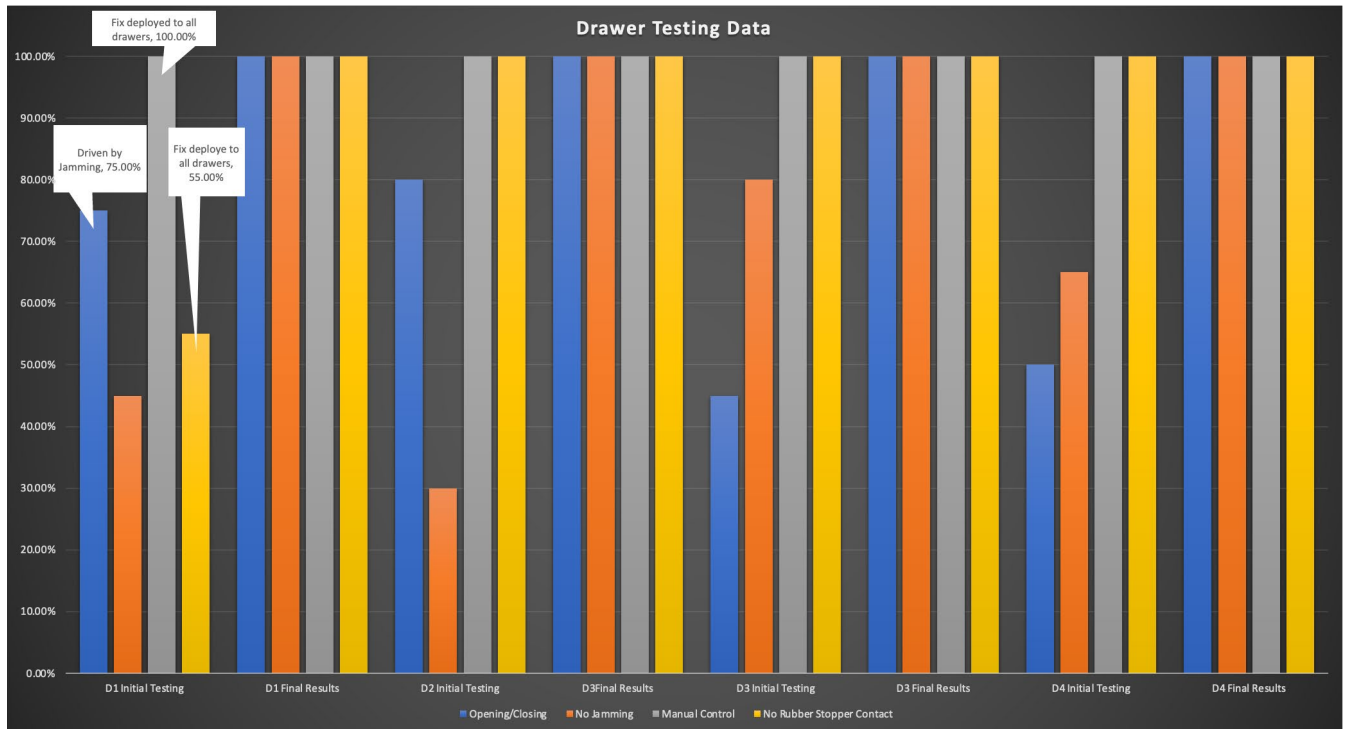
Drawer 1 Test		Drawer 2 Test		Drawer 3		Top Compartment Test	
Open Time	Close Time	Open Time	Close Time	Open Time	Close Time	Open Time	Close Time
501.15ms	501.68ms	502.08ms	503.02ms	501.39ms	503.08ms	7s	8s
501.36ms	501.71ms	500.98ms	502.15ms	501.87ms	502.56ms	8s	8s
500.89ms	502.05ms	501.28ms	502.36ms	500.99ms	502.41ms	8s	7s
502.03ms	501.58ms	502.54ms	502.41ms	502.01ms	502.98ms	9s	8s
501.64ms	501.27ms	501.26ms	501.98ms	550.24ms	541.26ms	8s	9s
Average: 501.41ms	Average: 501.66ms	Average: 501.63ms	Average: 502.38ms	Average: 511.3ms	Average: 510.46ms	Average:8s	Average:8s

- d. Conclusion: All the tested drawers and top compartment opened and closed fully without any significant overshoot. The time to open and close were reasonable, without taking too much time dragging out the process or too quick to make it unsafe.

3. Lead Screw Alignment Accuracy:

- a. Testing metrics: The goal of the lead screw alignment testing is to prove that the modified sliders used can self-adjust to the point where the drawers consistently opens and close without getting in a bind. The testing will be considered successful if at least 90% of drawer tests fully open and close without any significant delays or incompletions.
- b. Testing Procedures: Each drawer will be given an open and close command 5 times and recorded as either successful or failure in terms of completion of the requested command.

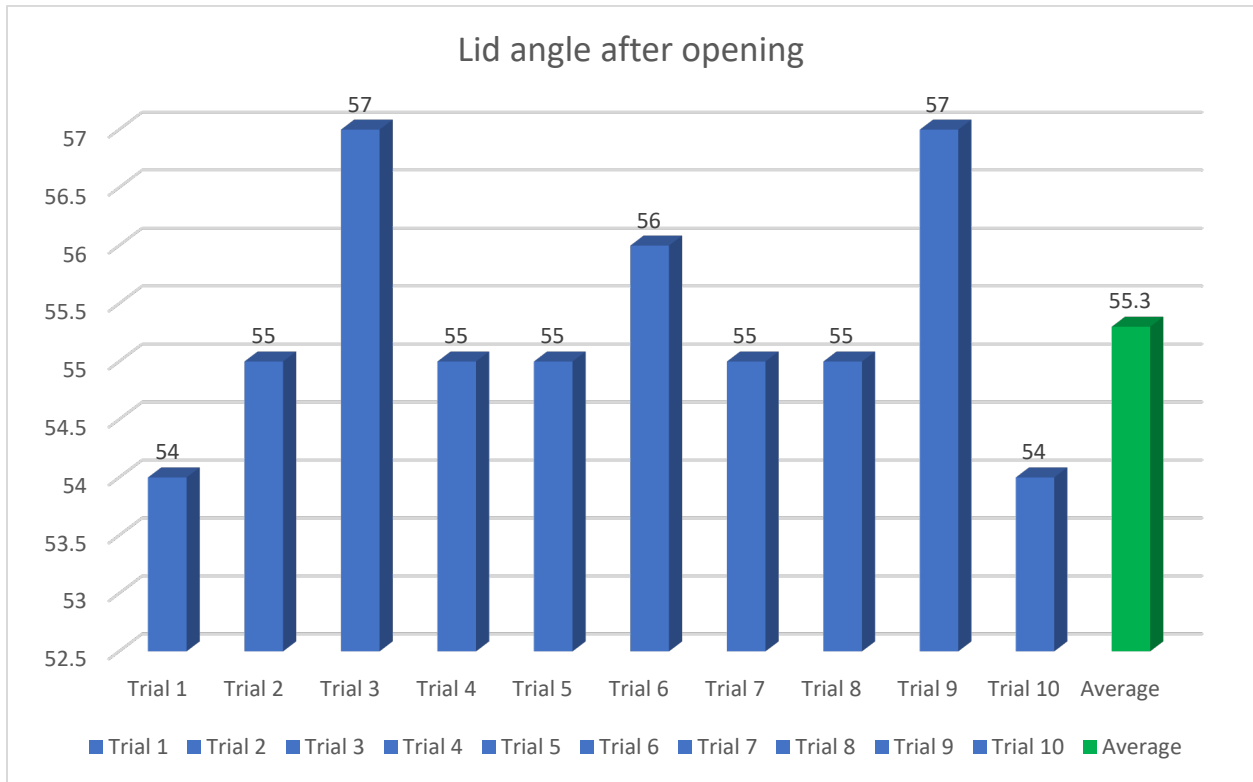
c. Data and Results:



d. Conclusion: Each drawer successfully completed the requested command nearly 100% of the tests on drawers A-C and the top compartment. Therefore, this test proved the success and consistency of the toolbox due to the self-adjusting slider that is installed.

4. Top Compartment Accuracy

- a. Testing metrics: The goal was to assure that the toolbox lid actuated more than 50 degrees
- b. Testing Procedures: The top compartment was opened and closed a set number of trials. A protractor was used to measure the angle the lid opened at.
- c. Data and Results:



- d. Conclusion: The test was proven successful for the lid exceeded 50 degrees on every trial.