PORTLAND STATE UNIVERSITY

2020 CAPSTONE PROJECT

FUNCTIONAL TEST PLAN FOR RASPBERRY PI MOTOR AND TURNTABLE

Content

Introduction

To measure the reflectivity of radar absorbing material at various angles, by constructing a low-noise turntable. This document serves as a detailed testing document for the turntable and the Raspberry Pi and motor

Objective

The purpose of this test plan is to have a systematic and strategized plan for executing test which will lead to a desirable result for the Raspberry Pi and the turntable.

Reference

NRL Arch: Naval Research Laboratory Arch design for hanging antennas for reflection measurements

Description/Operation

This test is designed to communicate through the computer t the optic cable then, to the Raspberry pi which ill intend control the motor to turn the acrylic plate mounted on the turntable to a desirable expectation as shown in figure 1.

Turntable would consist of a metal box containing the servo, power supply, microprocessor, and fiber optic converter. It will report an angle of accuracy to 1 degree through a command line interface over a fiber-optic communication as shown in figure 2.

Pretest preparation

A prior test is conducted on the software, the equipment's, and its function ability to make sure that the system is ready for the test.

Software

The software is the beginning stage of the test where the code is run to function appropriately. There is a flow chart that gives a brief description of each component and their relationship as depicted in figure below. During this stage is where debugging takes place due to some errors that may arise from running the code as well net work issues. Debugging is done thoroughly to ensure that the code can run the test accurately.

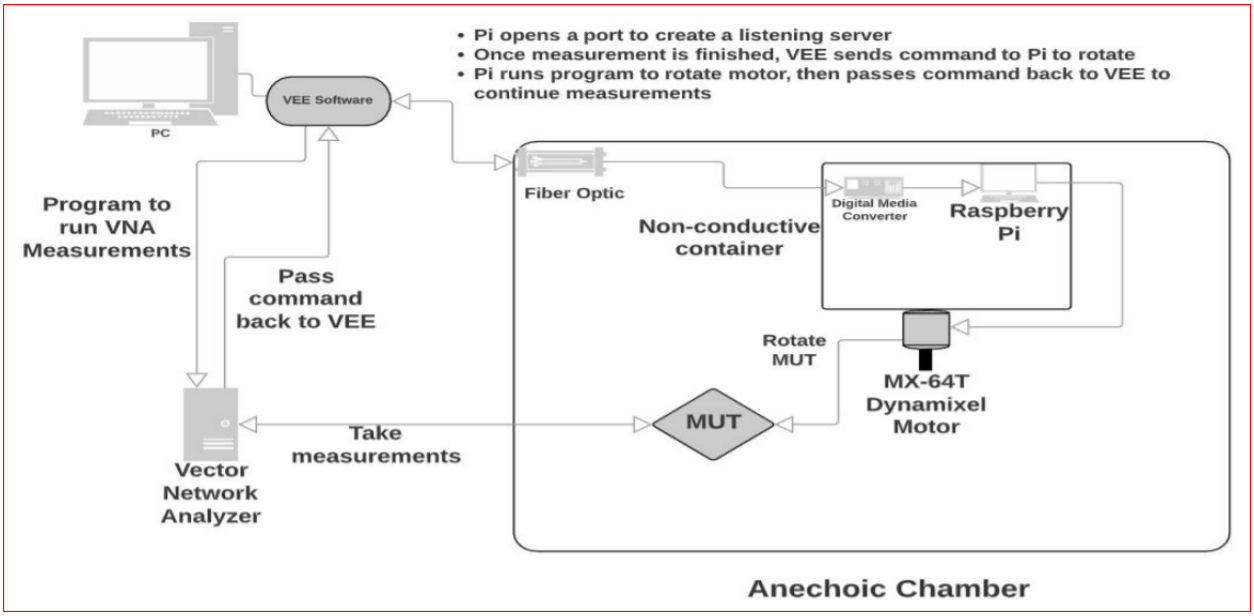

Figure 1: Dynamixel motor automation flow

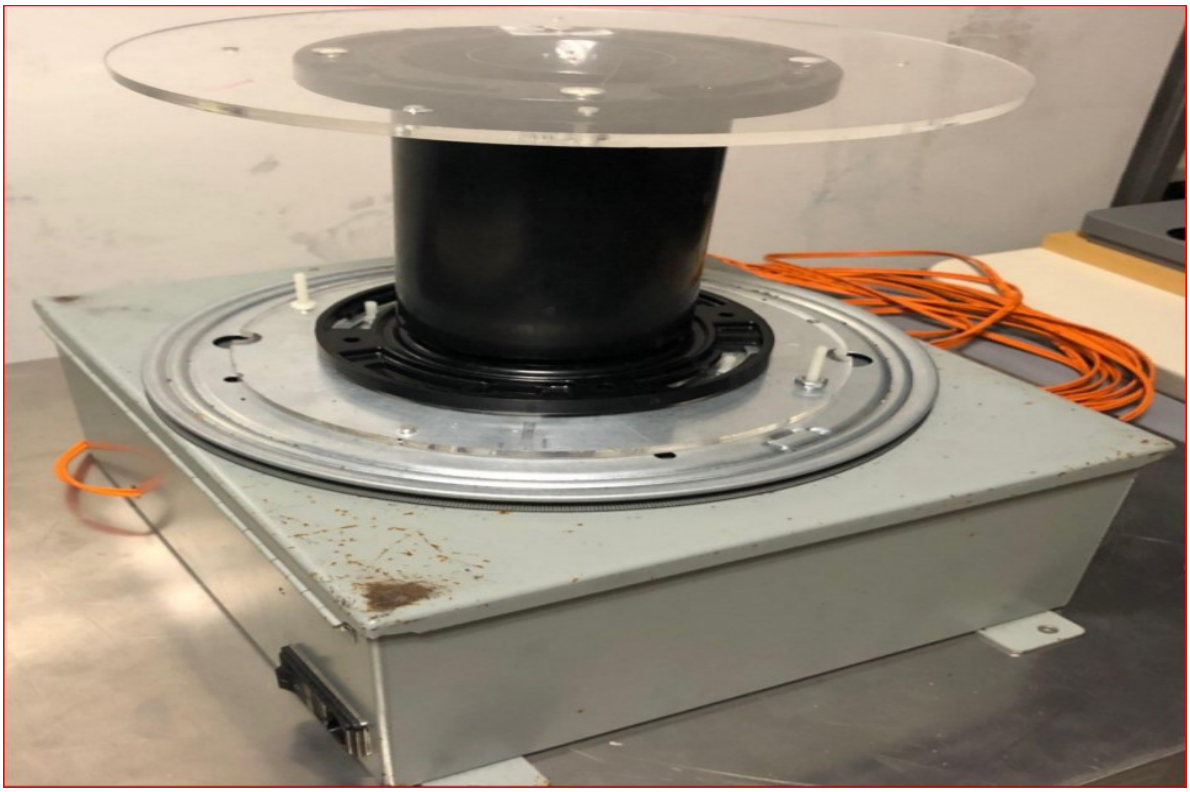

Figure 1: Acrylic plate sitting on the turntable

Equipment

The USB power supply must be checked to ensure no breaks to give a good charging rate. The Raspberry Pi must have an SD card preinstalled in it to store the code. The monitor must be in good connection with the network to be able to ensure a correct output. A straight edge is needed to take measurements in positioning the acrylic plate. Finally, the motor is tested separately ensure it is running, and its speed is efficient. There will be a protractor for taking measurements in different angles for the acrylic plate to be situated on the turntable.

Functional test

There will be a trace on the power supply flow to ensure power flow in the set up. In addition, the servo movement is checked to know if the servo is moving accordingly as expected. When the servo movement is okay it sends signal to the LED indicator to blink its light for readiness.

System test

There are seven different systematic test cases on a range of accuracy in angles with an increment of steps to obtain a desirable output. There will be a range of accuracy test in angles. This will be conducted in different angles for different test results. The test acceleration will be determined if fast or slow pace from each test range. The test will be in an incremental step of 1 degree for different test cases as shown in the testing procedure in tables 1 and 2 below for the motor and turntable, respectively.

Functional test

There will be a breadth of movement from 180-degree turn to both left and right and then a test of 140 to 160-degree increment will be tested for a step of 1 degree for the turntable as shown in table 2.

TESTING PROCEDURE FOR THE MOTOR

TEST CASES	DESCRIPTION	SUCCESS
1. Ping	Ping	We should have a terminal feedback that says correct
2. Position to Rotate	Rotate from 0 to 360 degrees	Should be able to rotate through an angle of 360-degrees
3. 1 Degree program	Rotate with 1-degree error bounce of +- 0.1% by marking a line on a piece of paper	Should have an error bounce of plus or minus 0.1%
4. Vee communication	To see if it can be moved by a Vee	Should have an error bounce of plus or minus 0.1%
5. Vee communication with 1 degree	Call it to move with 1-degree program	Should have an error bounce of plus or minus 0.1%
6. 1 Degree program with Load	Make it move in a 1-Degree program with Load attached	Should have an error bounce of plus or minus 0.1%
7. Run 1 Degree with Load attached	Make it run 1-degree with a load attached	Should have an error bounce of plus or minus 0.1%

Table 1: Testing procedure for motor

Turntable		
Test	**Results**	**Expected**
Angular Accuracy		
Mark a series of angles on the box. Rotate the turntable to these angles and report the difference between the reported and measured angles		Measured and reported angles agree within 0.5 degrees
Weight Limits		
Rotate the turntable with no load	Rotates easily	Rotates easily
Rotate the turntable with the aluminum sheet	Rotates easily	Rotates easily
Noise		
Place an x-band horn antenna directly above the turntable and measure the power of the received signal		The received signal should be relatively small
Place an x-band horn antenna directly above the turntable and measure the power of the received signal with the motor running		The received signal should be relatively small
Complete the NRL arch measurements with and without the running motor	Noise was found to be around 3 dB	Noise is expected to be less than 10 dB

Complete the radiation pattern measurement with and without the turntable	Noise was found to be less than 3 dB	Noise is expected to be less than 5 dB

Table 2: Turntable Test Plan

Conclusion

A conclusion will be drawn based on the results from the test plan to know the expected results match up with the desired results and include errors that may have led to the errors if there were errors.