LANDING GEAR:
SYSTEM TEST PLAN

Team 8 | ECE 411
Chris Toner
Abram Fouts
Arturo Espino
Dennis Sorokin
Version 1.0
2-Dec-2019

Landing Gear Test Plan

Contents

Tables

1.0 Introduction

1.1 This Document

This document serves as the detailed testing documentation for the ECE 411 Project "Landing Gear."

1.2 Conduct of the Systems Tests

Testing of the Landing Gear system shall be undertaken by the project members of Team 8 as listed as the authors of this document.

2.0 Reference Documents

2.1 Design Documentation

All documents pertaining to design specification can be found at the group project Git wiki:

https://github.com/abfouts/ECE_411/wiki

3.0 Landing Gear Overview

3.1 Operational Description

The Landing Gear is a preliminary attempt at designing a retractable, working landing gear for model planes. The system uses a basic range finder to determine height from ground, which is input to an ATMEGA processor that controls several small servo motors. The motors instruct the gear when to fold and unfold depending on distance to ground.

4.0 Pretest Preparation

4.1 Test Equipment

- USB power supply
- Tape measurer
- LEGO Plastic Toy Wheels
- Ultrasonic Range Finder
- Protractor

5.0 System Tests

5.1 Functional Checks

5.1.2 Power Supply Checks

5.1.2 LED Indicator Check

5.1.3 Servo Movement Check

5.2 Ultrasonic Range Finder Accuracy

Table 1: Ultrasonic Range Finder Test Plan

Test Writer: C. Toner					
Test Case Name	Ultrasonic Range Finder Accuracy	**Test ID #:**		T8675-309	
Description	Check that range finder distances are within acceptable error range	**Type:**			
Hardware Version:	1.0	☒ Black Box		☐ White Box	
Name of Tester	Dennis Sorokin	**Date**:	6-Dec-2019	**Time**:	4:15 PM
Setup:	After program properly loaded, run several tests ensuring distance accuracy. Check large distance, and check that servo reacts to the programmed cutoff distance of 20cm				

Test	**Action**	**Expected Result**	**Pass**	**Fail**	**Comments**
1	Test range finder	Range to wall distance is 80cm, which we expect our sensor to register properly	☒	☐	Range finder returned a distance varying between 77-79cm, which at 3.75% error is within acceptable ranges
2	Test range finder at 22cm	Servo should rotate 90 degrees when landing gear is down	☒	☐	
3	Test range finder at 22cm	Servo should not rotate 90 degrees when landing gear is up	☒		
4	Test range finder at 18 cm	Servo should rotate 90 degrees when landing gear is up	☒		
5	Test range finder at 18 cm	Servo should not rotate 90 degrees when landing gear is down	☒	☐	

6	Test that servos fold back into plane	When range finder held outside of a foot for 3.5 sec, wheels fold back into plane body	☒	☐	
Overall Test Result:		**Pass**			

5.3 Servo Motor Functionality

Table 2: Servo Motor Range Plan

Test Writer: C. Toner						
Test Case Name	Servo Motor Functionality	**Test ID #:**		T69-420		
Description	Check to ensure the servos function with enough power, torque, rotation range.	**Type:**				
Hardware Version:	1.0	☒ Black Box		☐ White Box		
Name of Tester	Dennis Sorokin	**Date**:	6-Dec-2019	**Time**:	4:41 PM	
Setup:	Ensure that the servos function as designed. Motors work individually, wired together in parallel, and properly rotating. Servos are connected to functioning range finder and wheels are attached to check for proper torque power					

Test	Action	Expected Result	Pass	Fail	Comments
1	Test one individual servo	When range finder held at 6 cm for 2 sec, servo should reach full rotation of 80°	☒	☐	Predicted that 90° not attainable due to wheel size. Predicted 80 rotation. 78 is actual, but close enough that within acceptable error
2	Test three servos in parallel	When range finder held at 6 cm for 2 sec, full rotation	☒	☐	

3	Test that servos unfurl from plane	When range finder held at 6 cm for 2 sec, full rotation from plane	☒	☐	There is some vibration in the front servo from the wheel. Debugging to find out if mechanical vibrations from motor itself oscillating or reverberation within plane body
4	Test that servos fold back into plane	When range finder held outside of a foot for 3.5 sec, wheels fold back into plane body	☒	☐	
Overall Test Result:		**Pass**			