Fall Validation Experiment – Test Plan

Overview

The purpose of this experiment is to demonstrate the proof of concept and technological capabilities of the Fieldroid robotic platform by painting a scaled down rectangular field with the "midfield" line. Figure 1 below shows the rectangular figure that Fieldroid is supposed to paint. This Fall Validation Experiment is to be performed on Nov. 24th, 2014 inside the FRC. The Fieldroid robot will paint the graphic on a canvas sheet. Chuck Whittaker will participate in this experiment as the only approved personnel capable of operating the Leica Robot Total Station. The length of a single test run is 14 minutes.
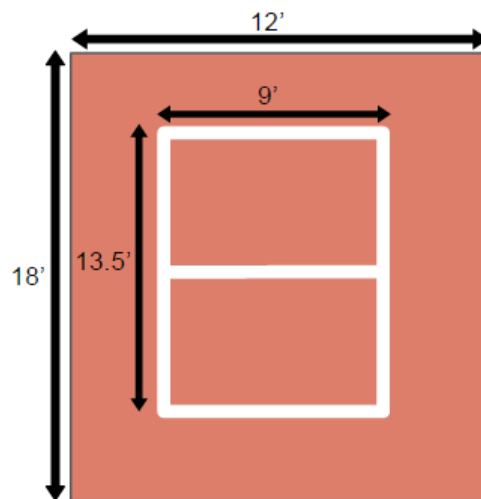

Figure 1. Depiction of scaled down rectangular field with midfield line painted on a canvas sheet.

Project Requirements to Validate

This experiment aims to test the following requirements for our project:

- MFR1: Perform 100% of autonomous tasks by itself
- MFR2: Paint 100% of the line markings according to league standard regulations
- MFR3: Plan a path within 1 minute given user inputs
- MNFR1: Have a 10cm error deviation between paint jobs
- MNFR2: Have an accuracy of 30cm while performing paint jobs

Location and Equipment

Location	Field Robotics Center (FRC)
Test Area	24 ft x 18 ft area
Equipment	• Leica Robot Total Station (Chuck W.) • Proprietary USB to Leica cable (Chuck W.) • Leica 360 deg. Mini Prism • 24ft by 18ft canvas sheet • Fieldroid robot platform • Water-based white paint • Laptop running Ubuntu 14.04

Test Procedures

[5 min] Pre-Deployment Procedures of the Leica Robot Total Station (Chuck Whittaker)

1. Set the Leica Robot Total Station 10ft away from the starting corner of the field.
2. Set-the Leica Robot Total Station to measure data continuously.
3. Connect the laptop to the Leica Robot Total Station with the proprietary USB cable.
4. Plug in the command station radio to the laptop connected to the Leica Robot Total Station. This radio displays a flashing green LED indicating that it has power.
5. Manually aim the Leica Robot Total Station and target the prism mounted on the robot.
6. Initialize tracking functionality of the Leica Robot Total Station with the prism.

[3 min] Pre-Deployment Procedures of the Fieldroid Robot Platform

1. Place the 24ft by 18ft canvas sheet on the ground. Ensure that no obstacles along its area are obstructing a clear line of sight to the Leica Robot Total Station.
2. With its power off, move and place the robot on the starting corner. Face the robot in the direction of the length of the field to be painted.
3. Power the drive-system and on-board electronics of Fieldroid via the red 2-position switches.
4. Ensure that board electronics is receiving power and distributing it to the other components. This is verifiable by looking at the LEDs on the DC power distribution board.
5. Ensure that the on-board radio is powered on and searching for a radio pair. This happens when the on-board radio flashes a green LED.
6. Check to see that both radios are paired. This occurs if the radios both display a solid green LED instead of flashing green LED.

[6 min] Deployment Procedures

1. Launch the autonomous field painting program.
2. Set the initial values of the robot (position and direction) as the origin of the field and as the zero degree heading (relative North).
3. Input the dimensions of the field to be painted.
4. **[5 min]** Start the autonomous painting operation and wait for the robot to complete the field.
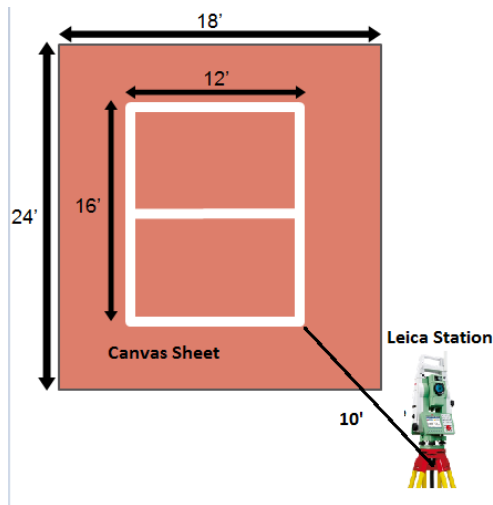5. Repeat all the steps one more time.

Figure 2. Leica station initial position w.r.t. to starting corner. Use Figure 1 dimensions for field.
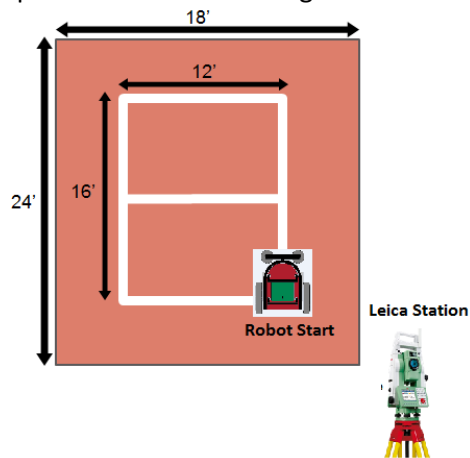

Figure 3. Fieldroid starting corner w.r.t. to Leica station. Use Figure 1 dimensions for field.
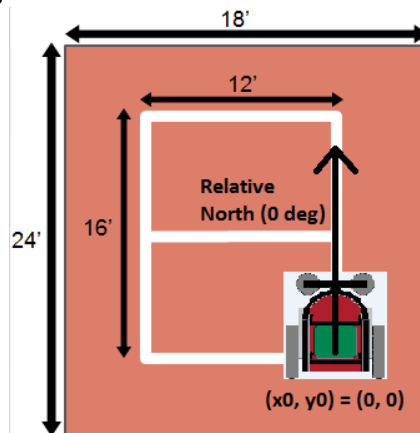

Figure 4. Fieldroid initial position and heading configurations. Use Figure 1 dimensions for field.

Validation of Functionalities and Requirements

Validation Check	Functionality/Operation	Relevant Requirement
	Plans path within 1 minute after choosing initial settings and field dimensions.	MFR3
	Paints line markings with consistent width of 12.7cm.	MFR2
	Performs autonomous task without user interaction.	MFR1
	Paints lines within 30 cm of its intended spot.	MNFR2
	Repeats its paint job with 30 cm of error deviation between runs	MNFR1

Notes and Observations