README

ECSE 211 - TEAM 04

December 7, 2016

Contents

1 Client Docs

These are the most recent files provided by the client with regards to specifications and deliverables

2 Hardware

2.1 DEMO HARDWARE WRITE-UP

The final demo hardware was simply hardware version 3.03. This document expands on the version's documentation in the hardware document by including a complete set of pictures of the final version instead of the simple pictures of improvements in the hardware document, more fully explaining the functionality that the hardware provides, and expanding upon the possible improvements by utilizing observations made during the final demo, and days leading up to it.

Full file history available here: https://www.overleaf.com/7245357zhmsksbnyhcg

2.2 HARDWARE DOC VERSIONS

These documents detail the entire process taken in designing and building the robot's hardware. It begins with assessments of ideas, weighing pros and cons, and feasibility, to come to conclusions on which components to build and test. The process then moves to construction, testing assessments, and finally to full assemblies. Once the first full robot is assembled, the iterative process begins. The robot undergoes many minor to significant improvements, all the while maintaining a functional prototype for use in software design, and testing. All 12 versions are included in this directory

2.3 LDD MODELS

This directory contains LDD files and screen-shots for individual hardware components as well as for the full assembly.

3 Management

BUDGET.xlsx: Contains all the hours logged over the duration of the project.

Demo Day Checklist.pdf: Checklist that was filled out for each run on the final demo day.

Poster.pdf: The poster that was presented in front of judges on the final demo day.

Prof-TA Meeting Minutes: Contains feedback, notes as well as questions and answers during weekly meetings with Professor Lowther and Dirk. Full file history available here: https://www.overleaf.com/6838573kdgdszpnwnqw

3.1 Gantt Charts

This folder contains all the weekly versions of the Gantt chart since the start of the project. Note that a full change history is available here: https://github.com/kareemhalabi/DPM-TEAM04-Gantt

The Gantt tasks are colour coded by sub-team. Green represents Documentation heavy tasks, red is Hardware, cyan is software, yellow is testing and the default is for Miscellaneous. 10 % represents 1 hour. NOTE: when viewing the resources pane, the budget units are overstated when a member is working on more than task at once, so to view the true number of hours spent per resource, expand each resource and add the units individually

3.2 Initial Documents

Contains the four initial documents. Only final versions have been included, the version control was managed through Overleaf with links provided below:

Capabilities Document: https://www.overleaf.com/6810056sxtyswtpdcvf

Constraints Document: https://www.overleaf.com/6744303vprqqj

Requirements Document: https://www.overleaf.com/6751228yjgtjt

System Document: https://www.overleaf.com/6751450hqhwss

3.3 Weekly Presentations

Contains the PowerPoint files that were presented to the client on a weekly basis.

4 Software

Preliminary Software Flowchart.png: This was the original algorithm we came up with towards the beginning of the project.

Software Document.pdf: Contains the results of the API research conducted towards the beginning of the semester. Full file history available here: https://www.overleaf.com/6790421dwdvkj

Software Flowchart V2.pdf: This was the finalized algorithm that we planned to execute on the final demo day.

4.1 Class Diagram

Contains the raw ObjectAid file used to construct the class diagram. Two file formats of the export are included since the pdf version has some slight imperfections.

4.2 JavaDocs

An HTML export of the JavaDoc comments of the most recent source code.

4.3 Source Files

The final version of the main and test source files. Both the JavaDocs and the source were version controlled through GitHub:
https://github.com/kareemhalabi/DPM-TEAM04-Source

NOTE: This repository was originally private but has been made public only until January 3, 2017 after which it will be re-privatized.

5 Testing

Testing Document Template.pdf: Template used by the testing team.

5.1 Preliminary Tests

These research oriented tests were conducted towards the beginning of the project to investigate the potential and limitations of available hardware and software.

Colour Sensor Test.pdf: This test uses the RGB values on the tools section of the brick. We are trying to figure out what will condition will correctly read a blue Styrofoam block. We figured that out to be that the second value must be greater than the first value.
Hybrid Test.pdf: This test aimed to determine whether the swinging collector/grabber hybrid design could reliably collect and grab blocks at various positions and orientations in front of the robot. It was determined that the design is able to successfully collect and grab the blocks in all reasonable positions, and all orientations except when the block is at a 45 degree angle with the device.

Initial Wheels Test.pdf:The initial wheels test was designed to check which wheel design works best. The three designs in question are (i) the metal sphere (ii) the gear wheels (iii) the treads. The metal sphere is unreliable when crossing discontinuities because it can only overcome them at specific angles. Gear wheels are also unreliable but the range of angles at which it clips is quite smaller. The treads cause too much friction and inhibit the robot from turning properly and effectively, reaching the destination. Given these results, the best option so far is the gear wheels.

Multiple Bricks Test.pdf: This test will be used to check whether multiple bricks can communicate with each other. We realized that this is possible, but errors resulting from multiple bricks may be hard to debug.

Partial Platform Grabber.pdf: This test aimed to determine whether the thin lego wings on the grabber would be able to slide under the block and not simply push the block. It was determined that the wings were two thick, and not lying flush with the ground, which caused the design to push the block, and never slide the wings underneath.

Static Collector Test.pdf: This test aimed to simulate the robot with a static collector driving either straight into a block for collecting, or using a

shifting motion to collect the block. The design successfully collected the block in all cases when using the shifting motion, but failed a significant number of times when simply driving straight.

Wheels Test 2.pdf: This test further checked which wheel design works best. We are planning to test tireless rims and large gears. Rear wheel drive improved robot's movement/navigation and it helped crossing the discontinuities. The large gear with tape design performed best.

Wifi Code Test.pdf: This test verifies that the provided Wifi code works with our robot.

5.2 Robot Tests

These tests were conducted to verify compliance with the requirements.

Hardware V3.01 Navigation Constants Precision Test.pdf: This test allowed us to find the constants for the navigation and track for version 3.01.

Hardware Version 1.5 Localization Timing Test.pdf: This document was used to test whether our localization could work for hardware version 1.5.

Hardware Version 2.5 and 3 Discontinuities Test.pdf: These tests are used to determine which hardware version crosses the discontinuities best. Our tests involved driving the robot forward on discontinuities at various angles. We concluded that hardware version 3.00 was more effective than hardware version 2.5 as it was able to cross at all discontinuities.

Hardware Version 2.5 and 3 Navigation Odometer Test.pdf: For this test, we used square driver to find the track width and wheel radius.

Hardware Version 3.03 Navigation Odometer Test.pdf: This test is to further ensure the calibration of the track and wheel radius.

Hardware Version 3 and 3.01 Object Pickup Test: This test verified that our idea for object collection worked. We had to update the hardware

version to make sure that the tower arms do not pop off.

Integration Test.pdf: This test is designed to measure the capabilities of the robot as a whole. The tests showed us that all the methods worked to some degree. The most reliable methods were localization, object detection and object pick-up. The least reliable methods included avoidance and search. The accumulated errors in avoidance and search caused inaccuracies in the odometer which resulted in stacking failure or unstable stacked towers.

Localization Test.pdf: This test verifies which of the bumper designs to use in the final hardware design to work best for localization. relies on several bumper designs. The tests for the designs showed us that the technique to use a flat bumper, spinning 360 degrees, bumping into the wall after getting the shortest distance, turning 90 degrees and bumping into the wall again worked best.

Obstacle Avoidance Hardware 3.03.pdf: This test is used to determine the optimal right wheel rotation speed to avoid obstacles. The most optimal rotation speed for this version is 150.

Odometry Correction Constant.pdf:This test will help us find the CS Distance and CS Angle. We obtained 34 for the angle value and 15.8 for the distance value.

Stacking Test.pdf: This test is used to see how many blue styrofoam blocks can be stacked. We noticed after seven tests that it was able to pick up a maximum of 2 blocks.