TESTING - Battery vs Performance Test

Project: Design an Autonomous Robot

Task: To design an autonomous robot that is capable of navigating to a predetermined position while avoiding obstacles and firing objects at two targets. This is to be done in the shortest time possible.

Document Version Number: 1.0

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Tester: Eric

Software Version: 4.0

Hardware Version: 3.1

Goal: Determine the robot’s battery threshold that will be tolerated for the final competition.

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# Purpose

Determine the robot’s performance at difference battery percentage using robot’s software version 4.0 and hardware version 3.1.

# Objectives

For every drop of ~20%, verify the robot’s ability to navigate and launch projectiles and ultrasonic/light sensor readings. All the tests will be done inside the Trottier DPM lab room performed on 4x4 platforms.  
This test is made to ensure that the optimal or the threshold of the battery the robot will be allowed to run for the final competition. Therefore, any battery level lower than the threshold should be replaced with new ones in order to ensure that the robot will perform as desired.

# Procedure

State the steps of the test (STEP BY STEP). EXPECTED RESULTS

1. Record the robot’s ability to launch projectiles
2. Record the robot’s ability to navigate in a straight line (x=0, y=90cm)
3. Record the robot’s ability to localize
4. When robot’s battery has dropped by ~20%, perform step 1-3 again.
5. In the case if the robot completely fails one of the steps 1-3, record the % at which it occurs and end the test.

# Expected Results

The robot is expected to performance at its best when fully charged, because the motors and the sensors can use the maximum energy provided by the batteries. Also, the robot should be just as well as when it is fully charged. When reaching about 50% or below, the robot should show some weaknesses and the motors should start to lose power and the launcher may not be able to launch projectiles as it needs to flick the Lego piece.

# Format of Output Required

|  |  |  |  |
| --- | --- | --- | --- |
|  | Localization | Navigation | Launching |
| 100% |  |  |  |
| 80% |  |  |  |
| 60% |  |  |  |
| 40% |  |  |  |

# Sample Calculations

No calculations will be performed during this test.

# Test Report

The test was performed once for each run at different battery percentage (100%, 80%, 60%, 40%)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Localization | Navigation distance | Launching / distance |
| 100% | Pass | Pass | Pass /160cm |
| 80% | Pass | Pass | Pass /155cm |
| 60% | Pass | Pass | Pass /121cm |
| 40% | Fail | Pass | Fail / N/A |

# Conclusion

The results and the predictions were fairly accurate. In fact, it has already been noticed during pre-beta demo testing and calibration.

For the localization at **40%,** the robot failed to localize properly as the ultrasonic sensor failed to detect the minimum on the first try, thus giving a wrong position at the end.

For the Navigation at **40%**, the robot succeeded at travelling in a straight line within an error of 1.5cm.

For the launching at **40%**, the robot failed to launch a single Ping-Pong ball as the motor failed to flick the Lego piece as it required too much power for the motors to handle.

For the remaining percentages, the robot performed navigation and localization perfectly. However, it is important to note that the battery percentage has a significant on the launching distance. For instance, at fully charged (100%), the robot would launch approximately 160cm and at 60%, the robot would launch only at a distance of 121 cm. Thus, it is important to take it into consideration when calibrating the robot for the final competition.

# Action

Thus, the threshold of the robot’s battery for the final competition should be set at 80% as the launching distance was only reduced by 5 cm and the localization and navigation worked perfectly. The launching distance calculation should be adjusted depending on battery %.

# Distribution

This test belongs to the hardware department.

No further follow-up will be needed.