PROGRESS REPORT (WEEK 3)

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.

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GANTT CHART

The Gantt chart has been updated from v1 to v2. In this version update, the distribution of tasks have been revised, since the tasks that were initially assigned for multiple people did not require as much resources, so the extra resources have been relocated. The time required for each part has also been revised in order to fit our time line more accurately. Furthermore, milestones have been modified and added, in order to clear misunderstandings, and to make the Gantt chart easier to read.

MECHANICAL DESIGN

The mechanical design from the previous week has been tested using the launching test (refer to the launching test folder in the week3 folder). The results were very positive. The accuracy of the launcher was within 3cm in the longer axis, and 5cm in the shorter axis, which we have defined as y and x respectively in the testing document. Furthermore, we have added two Lego pieces to stabilize the ball resting area (more detail is shown in Mech\_Design\_Update.docs). The light sensor was also moved 1cm higher in order to avoid scratching the floor. Therefore, the mechanical design has been finalized, as we have decided to keep this design due to its accuracy and success. However, the disadvantage of our design is that the ping pong ball does not shoot very high, since it only goes up to 10cm in height. Thus, if the target is too high, this design will need to be modified, by adjusting the angle of impact between the batting piece and the ping pong ball.

SOFTWARE DESIGN

The navigation, localization, obstacle avoidance, and odometer codes have been implemented one by one so far. The preliminary code has been finished. However, the navigation and obstacle avoidance still need to be refined in order to be on par for the competition. Furthermore, the light sensor filtering needs to be done, since we are using a differential filter rather than absolute values. The localization also needs to be refined in order for it to be accurate enough, and potentially faster. In general, all parts of the code has been merged and all the errors have been fixed. However, the odometer is not as accurate as it should be, so the odometer part needs to be reworked also.

TESTING

The following list is a revised list of our testing plan and our proposed tests (more detail in Week2\_ProgressReport.docx).

1. Loading and Launching Test
2. Obstacle Avoidance Test
3. Odometer Test
4. Localization Test
5. Integration Test
6. Ultrasonic Sensor Performance Test
7. Light Sensor Performance Test
8. Speed Test

This week, the loading and launching test, localization test, obstacle avoidance test, odometer test, and ultrasonic sensor test, have been done. The loading and launching test had positive results, where the loader functioned throughout the test, and the launcher was always within a 5 cm error range. The localization test results have also been positive, the standard deviation for the rising and falling edge are 2.885 and 2.201. Ideally, the localization should be more accurate in order to reduce the error on the odometer. Thus, the localization should be refined or reworked. The obstacle avoidance test has mostly positive, since the obstacle has been avoided in most occasions. However, the two extreme cases described in the testing document for the obstacle avoidance almost never yielded a positive results, thus the obstacle avoidance still needs to be reworked in order to avoid unknown obstacles. This result allows us to consider using the “safe zones” in the competition, rather than going through the shortest distance to the target area. The odometer test has also been done. The results yielded slightly problematic results. The errors of the x and y axis are 5.437 cm and 4.616 cm, while only running in a square path of 60x60 cm (240 cm traveled), which is problematic, since the final competition is 270x270 cm (approximately 1080 cm traveled), and since the error increases linearly, there will be an error of 4.5x (5.437 and 4.616 cm) by the end of the course. Errors of 24 and 20 cm is significant, since it is almost a complete small square. Finally, a preliminary test of the ultrasonic sensor’s capabilities is performed. This test yielded a strong correlation between the actual distance and the measured distance, however an exact equation could not be determined in order to predict the error as the distance increased.

PLANS FOR THE FOLLOWING WEEK

We plan to finish testing the code and the testing documents for the following week, in order to allow time to make necessary modifications and refining. For the parts of the code where we have already tested and that needs refining, we plan to make another version and test it along with the rest of the testing components. We also plan to check all the documents up to date and the Gantt chart, and make revised versions, since most of the coding has been done. We also plan on procuring cardboard pieces in order to cover the light sensors and ultrasonic sensors, and test them (before and after the cardboard) in order to test the improved accuracy.