CPE 470/670 Autonomous Mobile Robots

Harvester Robot Contest
Team 6

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Hardware and Software

The robot hardware design was similar to the last lab. We replaced the touch sensors with 2 ultrasonic sensors. We also added RFID and touch sensor in the back which was connected to another motor via a beam. We made the beam as long as possible because we wanted to cover a large area. This however did not work in our favor because rotating sensors were more error prone than those which are actually static. We learned that for sensors to work well , they need to as stable as possible.

For the software design , we started by writing tiny programs that just checked only for a particular sensor. Once we found that they are in proper working order , we put them together in their respective threads so that and verified that it works okay if the robot executes a random obstacle avoidance algorithm, ie it takes a random turn when it is about to hit a wall. After this was done we decided to come with our own wandering algorithm . We thought of 3 algorithms

(a) Zig Zag Path
(b) Fail safe algorithm
(c) combination of both using feedback.

In zig zag algorithm robot tries to take 45 degree turn at each decision point. The failsafe algorithm tries to cover most of the table by taking 180 degree turns but is rather slow. The feedback algorithm takes the current time and then the total points collected to determine the effectiveness of the robot , if the robot did not do good using zig zag algorithm it switches to failsafe mode. By experiment we got good results with zig zag algorithm and we used that for the lab contest. Also four wheel design of our hardware made is quite difficult to take 180 degree turns which made fail safe algorithm quite error prone.

Once the time elapses 60 seconds , robots enters home mode where it stops when it senses the home color. However moving sensors were error prone and was picking up dark spots and shadows as the home color.

Problems and Solutions

During the course of this project the team ran into some problems. The main problems that the team ran into were being able to capture all of the colors that were provided, picking up the RFID sensor and being able to do multiple tasks at the same time.

The issue of the colors was that the robot was able to pick up colors but it was only able to pick up the colors about every 1 of 3 times. In order to fix the team had to position the color sensor and the speed of the rotor, the rotator was a motor that had the colors and RFID sensors attached and swept back and forth. After the contest the team came to learn that a stationary sensor would have been more efficient, and there was a RGB color mode that would have make the color sensor better at distinguishing between black and white.

The RFID sensor was a huge issue for the project because of the speed that the RFID reads it would not always read the RFID, in order to fix this issue the speed of the robot and the sensor motor had to be adjusted.

The last problem that the team had was being able to do multiple tasks at one and putting those tasks in the correct priority order. The solution for this came through logic and trial and

error. Because of the weight unbalance of the robot it would jerk when it had to stop and turn, so we put the sensor priority first, then the color sensor, the RFID sensor, motor for the wheels and last was the motor for the sensors, having this order fixed the issues of false reads, and running into objects while harvesting.

Unsolved Problems

Some of the unsolved problems were being able to find home, and blind spots of the robot.
The issue of finding home was caused by the color sensor not being able to differentiate between black and white, after the contest it was found that if RGB mode was used it would have solved this issue. The issue of the blind spot was when the robot was at a particular angle with the wall it would not sense the wall even it it was running into it and would get stuck.