IDP Final Report

Name: Cody Lau

CRSid: chyl2

College: Girton

Lab Group: 48

IDP Team: M102

Summary of Design+Strategy

An ultrasonic sensor was used to detect the mines and the walls. The robot would start by moving sideways along the white line. As the side ultrasonic sensor detects a mine, the robot turns 90 degrees and moves towards the mine. 2 pairs of infrared transmitters/receivers are used to detect when the mine passes the front of the robot and stops. Hall effect sensors at the front detects if the mine is live or not and this is displayed with LEDs independent of the microcontroller. Then an arm controlled by a servo pushes the mine onto a curved ramp to lift it up. The robot then moves back towards the white line, turns, and stops in front of the disposal area. The arm continues rotating and pushing the mine around until it falls onto a ramp and into the box.

Major design decisions include: 1) Using a single rotating arm to pick up mines, instead of other pick-up ideas. 2) having front walls to house the infrared emitters/receivers, which meant we had to use a ramp for the mines to be able to go over these walls.

Summary of My Role

I was in the mechanical team and together with another person we were in charge of designing the main mine-pickup mechanism and all dimensions, creating CADs in Solidworks of all the parts, crafting the whole robot physically in the workshop, and integrating electronic components into the robot with mounts.

We were always on schedule (Gantt chart). We created the minimum chassis with wheels and motors as soon as possible so the software team can start testing their codes. Then we created the rotary arm, front ramp and walls, and miscellaneous mounts afterwards. Everything was finished with a few days before the competition for the other subteams to fully test the robot.

Review of Major Decisions

The decision to use a single rotating arm to pick up mines was correct. It was a straightforward mechanism and was easy to craft. It also works 100% of the time regarding the ability to picking a mine up and disposing it. Another decision was to abandon the mechanism at the rear which shifts the ultrasonic sensor sideways in order to check if the robot is parallel to the walls. This was again correct, because we ended up driving the robot into a wall which realigns the robot, and this method makes the code simpler and one fewer motor to worry about.

Team Management

We had a team leader in the software team and he oversaw the group deadlines. He organised the initiation of the presentations and group report, and everyone contributed to finish them on time. This worked very efficiently. Everyone stuck to the Gantt chart as much as possible, most notably the priority of a minimal chassis for movements, and priority of the IR sensors before hall effect sensors for the electronics team.

Performance

We scored 0 points in the first competition, as the robot failed to detect any mines and pick them up. This was due to us not having enough time to properly calibrate the IR sensors and motors (which are fairly inconsistent). We then scored 10 points in the final competition for correctly detecting the type of mine once. We successfully picked the mine up a few times, but had to reset because the robot went off at a wrong angle. In previous trial runs, we were able to successfully detect the mine, pick them up and put them in the correct box multiple times. However, in the final competition, the IR sensors didn't work properly when mines were passed through, and also the line follower detected the wrong line (due to slight sensitivity adjustment and random white marks on the surface). Some points were also lost due to the mine touching the arm before the type of mine was determined.

We had it working after the competition again, therefore if we just had a little more time then we would have been able to deliver more mines and meet more of the task specification.

Mass Production

The front components are fairly complicated and time consuming to create (the side walls, mounts for that and ramp, and funnel + mount, hall effect sensor mount). Therefore, for mass production some of these parts would see greater production speed if it were cut with a water jet so multiple parts are combined into one metal sheet then folded as required. Some other parts such as motor mount and arm mount were bolted on for better modularity, but when everything is correct, there is no need and could simply be welded/be part of the chassis for faster production.