**Final Report**

Group #4 (Parham Gholami, Bradley Khang Tran, Joshua Soteras, Kevin Andersen)

**Introduction**

All information compiled for this report was gathered by our four-member team (Parham Gholami, Bradley Khang Tran, Joshua Soteras, Kevin Andersen). Over the course of the project, our primary goal was to have the leader robot able to avoid obstacles and return to its original trajectory, as well as have the follower robot be able to autonomously track and follow the leader throughout its sequence of movements.

In order to effectively tackle each part of the assignment, the group was split into two: one subgroup addressed the leader logic and the other subgroup handled the follower logic. We collectively worked on designing the acceleration and deceleration system for the robots. Through the process of implementing the logic and testing the robots in the field, we experienced several challenges that we managed to overcome with extensive iteration, as outlined in later in this report.

**Findings and Challenges**

Upon our initial tests, we realized that the motors were not consistent across the board for advancing. No matter how much we would tweak the respective motor speeds via the pulse length variables, subsequent runs would never be consistent due to the unequal output capabilities of the motors. This resulted in the robot drastically veering to the left or right as it would advance.

Another major obstacle we ran into was that the follower robot would occasionally have trouble detecting the leader robot via the sensor. As we troubleshooted this issue, we found that the angles in which we had set the servo/sensor to measure the distances for were not enough. There were “blind spot” angles that we had to account for.

Some side issues we found through our in-person testing were that our leader robots sequence of movements were being carried out too quickly. This resulted in the follower robot losing track of the leader as it would not have an adequate amount of time to complete its tracking/detection. Besides that, the follower robot also had trouble tracking the leader due to a lack of size/proper surface area for a clean returned pulse signal reading when it would attempt to detect the leader robot.

**Conclusion**

Before testing our robots in person, we tested their functionality separately. The robots could complete their individual tasks of obstacle avoidance and following successfully. However, the bulk of the issues that we faced required actual live in-person tests so that we could better understand how they would behave in a live setting with one another. Upon completing our troubleshooting, these were our courses of action for resolving the primary issues that we faced:

1. We implemented a course\_correction function that would compare the current distance of the obstacle from the robot to the previous distance as the robot would advance along the side of the obstacle. If the current distance when compared to the previous distance was found to be getting closer to the obstacle, the robot would rotate slightly away (left) and if the robot was moving further away, it would rotate slightly towards the obstacle (right).
2. The way we initially had the follower robot set up to get readings was roughly at the 20°/90°/160° angles. To account for the “blind spot” angles where the follower would miss the leader robot, we added additional angles for tracking which would equate to roughly 55°/125°. By adding these two angles for tracking, the follower was able to track the leader more consistently within its field of view.
3. To resolve the speed issue, we dramatically increased the delay time between each action for the leader so that it would carry out its movements at a pace in which the follower could actually keep up. Regarding having a proper surface area for the follower to get a clean return signal off of the leader, we slightly modified the leader by taping pieces of cardboard around it that increased its size. This allowed the follower to have a more consistent surface from the leader to send/receive a signal off of.