EE / CprE / SE 492 - sdmay21-40
Dancing Swarm of Robots
Bi-Weekly Report 4

Mar. 1 - 14
Client: Dr. Akhilesh Tyagi
Faculty Advisor: Dr. Akhilesh Tyagi, Dr. Diane Rover

Team Members

Abdalla Abdelrahman ─ Meeting Facilitator, Software Engineer
Daniel Nikolic ─ Test Engineer
Benjamin Schneider ─ Report Manager, Hardware Engineer
Noah Thompson ─ Chief Hardware Engineer
Mason Walls ─ Chief Software Engineer
Cole Weitzel ─ Meeting Scribe, Software Engineer

Weekly Summary

During this cycle, we focused on the follower algorithm developed during the previous cycle. The follower algorithm is now able to detect when the lead robot turns left or right and can steer each follower accordingly. Currently, followers can only steer at a fixed rate left and right, so followers tend to drift out of position after the first few turns. Additionally, the time required for the sensor head to perform a complete sweep can delay the follower's movement, causing the followers to drift further off target. We also edited the controller for the leader robot so that will take keyboard input from the user to control the leader instead of randomly turning or moving forward.

At our advisor meetings, we discussed different stages in the processing pipeline that would introduce a propagation delay, extending the time required to process a full sensor sweep. However, these hardware stages would only be present on the physical CyBot platform and may not necessarily be rendered in WeBots. With this list, we have begun investigating if and how these time delays are modelled on our simulation software and how we can compensate for them. If we can do so, this would reduce our processing time for a full sensor sweep and, in turn, our error margin for the followers' positions.

Past Week Accomplishments

- Modified first version of the follower algorithm to incorporate turns for the followers
- Incorporated keyboard inputs to the leader's movements to allow the user to control the leader's path
- Identified potential hardware computation time limitations that may need to be accounted for in our follower algorithm

Pending Issues

- Currently, our algorithm can cause followers to lag behind the leader when beginning or ending a turn. A more sophisticated turn control for the followers and/or a reduction in sensor sweep time will be needed to reduce this position error margin.
- A potential issue within WeBots when switching between repo branches was identified. In some cases, device node IDs between a robot's child nodes and the robot's controller become unlinked. The issue seems to occur every time different branches are checked out locally.
- Our follower algorithm is still relatively generalized. It will require adjustments in order to fully incorporate it into our WeBots simulation, since we are most likely not going to do a hardware implementation for this project due to lab shutdowns.

Individual Contributions

Team Member	Contribution	Weekly Hours	Total Hours
Abdalla	- Continued Research on Sound Detection sensor on physical hardware - Researched ways to implement sensor onto iCreate Robots on WeBots - Started working on implementing sound onto robots	3	14
Daniel	Worked on sound implementation for the robots	2	11
Benjamin	– Started investigating time delay propagation in WeBots – Worked on servo lookup table to bring our model up to spec with those used on the CyBot platform – Found datasheets for servo and distance sensor used on the CyBot platform	5	28.5
Noah	Worked on user controls for leader	3	13
Mason	-Implemented turning capabilities for leader and follower -Experimented with follower and leader movement speeds Started quantile data calculation	4	18
Cole	Worked on leader controller for keyboard input	6	18

Plans for Coming Week

- Abdalla
  - Will continue implementing sound detection on iCreate Robots
  - Work on PIRM presentation
  - Identify how to implement external sensors onto WeBots
- Daniel
  - Continue working on sound implementation
  - Work on PIRM presentation
- Benjamin
  - Investigate device node ID issue
  - Work on reducing hardware sensor sweep time via the distance sensor's processing time and the servo's slew rate
- Noah
  -
- Mason
  - Continue calculating theoretical and actual max values of dispersion
  - Improve follower algorithm (less jittering, more accuracy)
- Cole
  - Continue working on keyboard input
  - Work on the follower movement algorithm to smooth out the followers so that they can turn better and do not stop and start moving as much

Summary of Advisor Meeting
--Meeting with Professor Tyagi on 3/4/2021:

Attendees: Cole, Ben, Mason, Noah, Tyagi
Missing: Abdalla, Daniel

General Notes:
- Continue working on the follower movement
- Figure out why one follower falls behind

Status Updates:
- Abdalla
  -
- Ben
  -
- Cole
  - Going to add keyboard control
- Daniel
  -
- Mason
  - They can turn now, but still working on edits, if turning left, the right follower gets behind. The leader has to go a little bit slower
- Noah
  -

--Meeting with Professor Tyagi on 3/11/2021:

Attendees: Cole, Ben, Mason, Tyagi
Missing: Abdalla, Daniel, Noah

General Notes:
- Looking into an audio file for the dancing part
- Need to quantify the movement algorithm, in terms of the distance and angle
  - Theoretically, and experimentally
  - Servo timing and sensor read delay
- Figure out sweep time of the servo
- Lookup lidar scan time in datasheet

Status Updates:
- Abdalla
  -
- Ben
  - Hardware tasks to run with detecting sensor value
  - To do
    - Mapping time delay with sensor
    - Sensor delay on hardware end or synthetic
    - Slew rates of servo
- Cole
  - Worked on leader controller with keyboard input
- Daniel
  -
- Mason
  - Fixing the follower from falling behind
- Noah
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