Roomba Swarm Project Plan

Team: sdmay22-02

Project Management Style

We will manage our project with KanBan which is an agile methodology management system that focuses on continuous small changes. KanBan works by visually organizing tasks in columns according to their stage in the development process. KanBan allows for the backlog of tasks to be constantly changing as well as provides openness about the progress of the project.

A combination of a KanBan board (probably on Trello) and various GitLab features will help track progress and manage tasks.

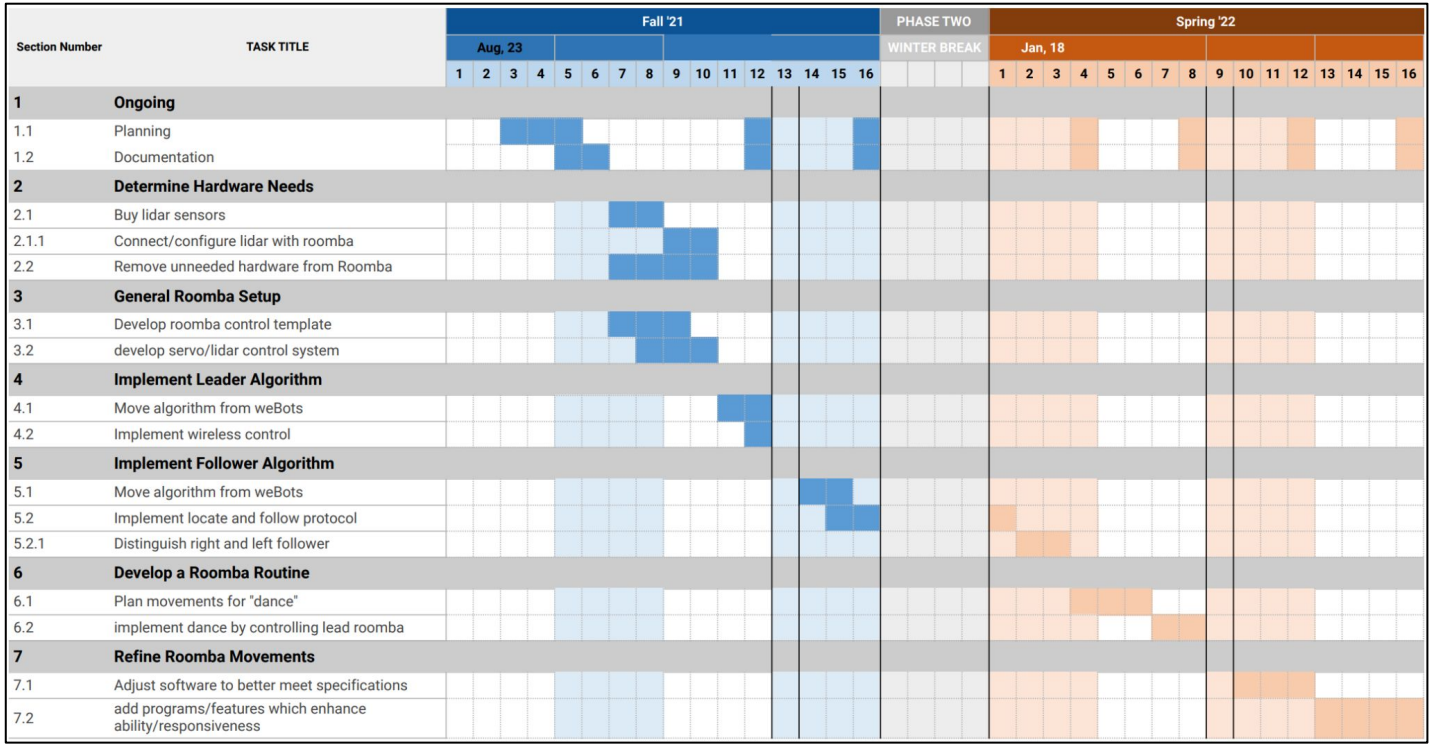
Task Decomposition

1. Ongoing - Documentation
    a. Weekly team meetings
    b. Project Documentation
2. Determine Hardware Needs
    a. Buy lidar sensors
    b. Connect lidar to Roomba
    c. Remove unneeded hardware from Roomba (IR and Sonic Sensors)
3. General Roomba Setup
    a. Develop template for general roomba control
    b. Develop control systems for lidar and servo
4. Implement leader robot algorithm
    a. Move algorithm from simulated weBots to classroom Roomba
    b. Implement wireless control of leader
5. Implement follower robot algorithm
    a. Move algorithm from simulated weBots to classroom Roomba
    b. Implement locate and follow protocol for roomba
    c. Setup system to distinguish between right and left follower
6. Develop a Routine for Roombas
    a. Plan movements for a “dance” that the Roombas follow
    b. Implement dance by only controlling the lead roomba
7. Refine Roomba Software and Movements
    a. Adjust software to better comply with specifications by client
    b. Add programs which enhance ability and responsiveness of Roombas

Personnel Effort Requirements

Hours	Task
60	Ongoing - Documentation
15	Determine Hardware Needs
30	General Roomba Setup
30	Implement Leader robot algorithm
40	Implement follower robot algorithm
60	Develop Roomba Routines
Remaining Time	Refine Roomba Software and Movements
235 +	Total:

Schedule


Section Number
TASK TITLE
Fall '21
PHASE TWO
Spring '22
Aug, 23
WINTER BREAK
Jan, 18
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
1 Ongoing
1.1 Planning
1.2 Documentation
2 Determine Hardware Needs
2.1 Buy lidar sensors
2.1.1 Connect/configure lidar with roomba
2.2 Remove unneeded hardware from Roomba
3 General Roomba Setup
3.1 Develop roomba control template
3.2 develop servo/lidar control system
4 Implement Leader Algorithm
4.1 Move algorithm from weBots
4.2 Implement wireless control
5 Implement Follower Algorithm
5.1 Move algorithm from weBots
5.2 Implement locate and follow protocol
5.2.1 Distinguish right and left follower
6 Develop a Roomba Routine
6.1 Plan movements for "dance"
6.2 implement dance by controlling lead roomba
7 Refine Roomba Movements
7.1 Adjust software to better meet specifications
7.2 add programs/features which enhance ability/responsiveness

Milestones

- Roomba control template is coded and configured with the servo and lidar sensor
  - Roomba can set servo position within 2 degrees of error
  - Lidar sensor can be read by Roomba and is accurate within 1 inch
  - Combo servo and lidar sensor can identify a post representing a roomba
- Lead roomba can be operated wirelessly
  - Lead Roomba will follow the preset dance routine
  - The lead roomba can be controlled by a user
- Followers will follow a leader with less than 15% deviation from the prescribed following distance.
  - Members of the swarm can observe the distance between them and their leader
  - Members of the swarm can observe the angle between them and their leader
  - Members of the swarm can adjust accordingly to follow a leader at an acceptable distance
  - Members of the swarm can adjust accordingly to follow a leader at an acceptable angle

Milestones Cont.

- The swarm can reliably move in formation without falling more than 7 inches out of place.
  - A swarm member can distinguish other members between environment objects
  - A swarm member can observe distances between one another
  - A swarm member can adjust to fit formation based on angle and distance from one another
- Develop Roomba routine that uses sound/song as input to control the swarm
  - The swarm leader will listen/play/know the song and move accordingly
  - The swarm followers will follow the lead roomba without knowledge of the sound