

Progress Presentation-I

e-Yantra Summer Internship-2016

Formation Control of Multiple Swarm Robots

Om Singh
Chirag Shah

Mentor 1: Abhinav Sarkar

Mentor 2: Avinash Dubey

IIT Bombay

June 6, 2017

Overview of Project

Project Name: Formation Control of Multiple Swarm Robots **Objectives:**

1. Implement formation control over a group of Spark V robot using overhead camera and aruco markers for localization of the robot
2. Implement swarm behaviors like disperse, follow the leader etc

Deliverables:

- ▶ Robots capable of making any desired formation
- ▶ Robots capable of implementing Swarm behaviors

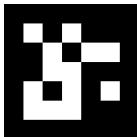
Overview of Task

No.	Task	Deadline
1.	Python,Spark V ,OpenCV introduction interface Xbee	2days
2.	Position and orientation calculation of multiple Spark V robots	3 Days
3.	Go-to-goal for a single Spark V	4 Days
4.	Formation testing for 2-3 robots	2 Days
5.	Algorithm for formation control of multiple robots	3 Days
6.	Avoid obstacle controller	3 Days
7.	Algorithm testing and fine tuning Scaling up the number of robots	3 Days
8.	Local Swarm behaviors	8 Days

Task Accomplished

Task Completed

- ▶ Cropping and transforming the arena area inside the black border
- ▶ The position and orientation (x, y, Φ) of multiple robots can be found using aruco markers placed on the robot

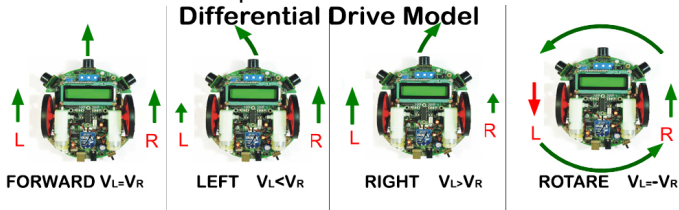


Opencv-Contrib-python (aruco library)

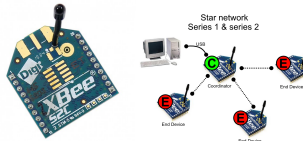
https://github.com/opencv/opencv_contrib

Task Accomplished

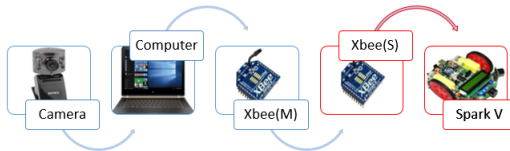
- Selected suitable equations for the differential drive robot



- (x, y, θ) of each robot is transmitted via XBee to the robot. The desired location (x_g, y_g, ϕ) is also transmitted. The XBees are configured in a star configuration



Task Accomplished



- The robot can turn and move towards the required location using a P controller for differential drive



Next Tasks

- ▶ Implementing a PID controller on the robot to increase the precision of Go-To-Goal
- ▶ Go-to-Goal for multiple robots

Challenges Faced

- ▶ Communication between computer(Master) and robot(Slave) to transmit the robots initial state and desired state (x , y , Φ)(Serial Communication Protocol)
- ▶ Developing an effective differential drive robot model for the Spark V
- ▶ Conversion from unicycle model to differential drive model
- ▶ Implementing Go-to-goal controller using P controller algorithm on the Spark V

Future Plans

- ▶ Communication of Master(PC) to Multiple slaves(Spark V)
- ▶ Multiple robots capable of moving to a point selected manually
- ▶ Multiple robots making pre-defined formation
- ▶ Swarm behaviors like "follow the leader"

Thank You

THANK YOU !!!