**INTRODUCTION**
- CADRE project is developing a network of shoe-box-sized mobile robots called PUFFER that could enable future autonomous robotic exploration of Moon, Mars, etc.
- Each robot contains an onboard computer, wireless radio and camera
- In this project, we divided to software team who in charge of the formation control and the hardware team.

**FORMATION CONTROL**
- The distributed measurement techniques require robots to autonomously explore unknown places while maintaining a specific formation.
- Develop parametric formation control algorithms using ROS.
- Each PUFFER will publish message to talk to other PUFFERs.

**WAYPOINTS MODE**
- Each puffer will calculate individual trajectory based on the given offsets between the puffers and the scan length.
- The puffers will reach each checkpoint in a synchronized manner.

**LEADER-FOLLOWER METHOD**
- Use the Lyapunov control
- The leader PUFFER will follow the given waypoints and followers will go to the calculated point based on the given offsets and bearing angles derived from the leader’s position.
- The leader puffer will wait for the follower to reach each checkpoint before setting off for the next goal.

**FORMATION SIMULATION**
- Obstacle detection in the simulation environment Gazebo by the camera.
- The simulated mission time of waypoint mode is less than leader-follower mode.

**LEADER**
- The wheel track of PUFFER is slightly smaller than the wireless charging antenna, so the platform for it to drive over it is needed.
- The PUFFER can climb up from 330-degrees.
- The maximum distance from the receiver and antenna is approximately 10cm.

**DUST ACCUMULATION DETECTION**
- Utilize the change of solar cell characteristics, which is the power peak and corresponding voltage, at different light intensity to detect the dust accumulation.
- Use rosserial to communicate with PUFFER about current environment condition.
- The experiment setup is with fixed light source and add flour gradually to see how the dust will affect solar cell output.

**WIRELESS CHARGING PLATFORM**
- The current design of PUFFER utilizes a rigid ball as tail.
- Caster wheel is chosen in hope of improving the traction and preventing the rover flipping over when going downhill by shifting center of gravity back.
- Allows the PUFFER can directly move backward and pivot better.

**FUTURE WORK**
- Integrate the simulated results into real PUFFER successfully.
- Use the PCB to integrate the result of solar cell into the rover.
- Test different caster wheels to see if and/or which perform better than previous design in terms of mobility.