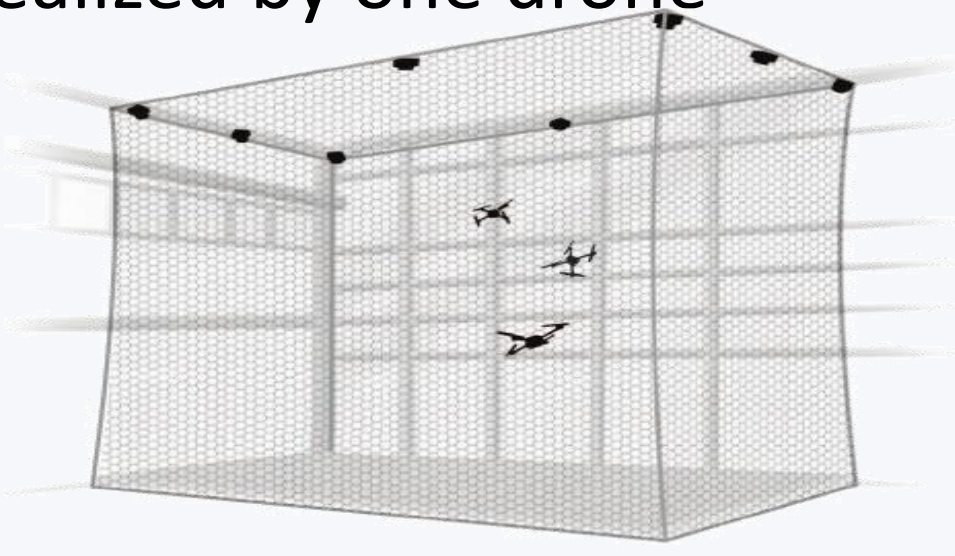


Quadcopter swarm using Wi-Fi

Omar Shrit

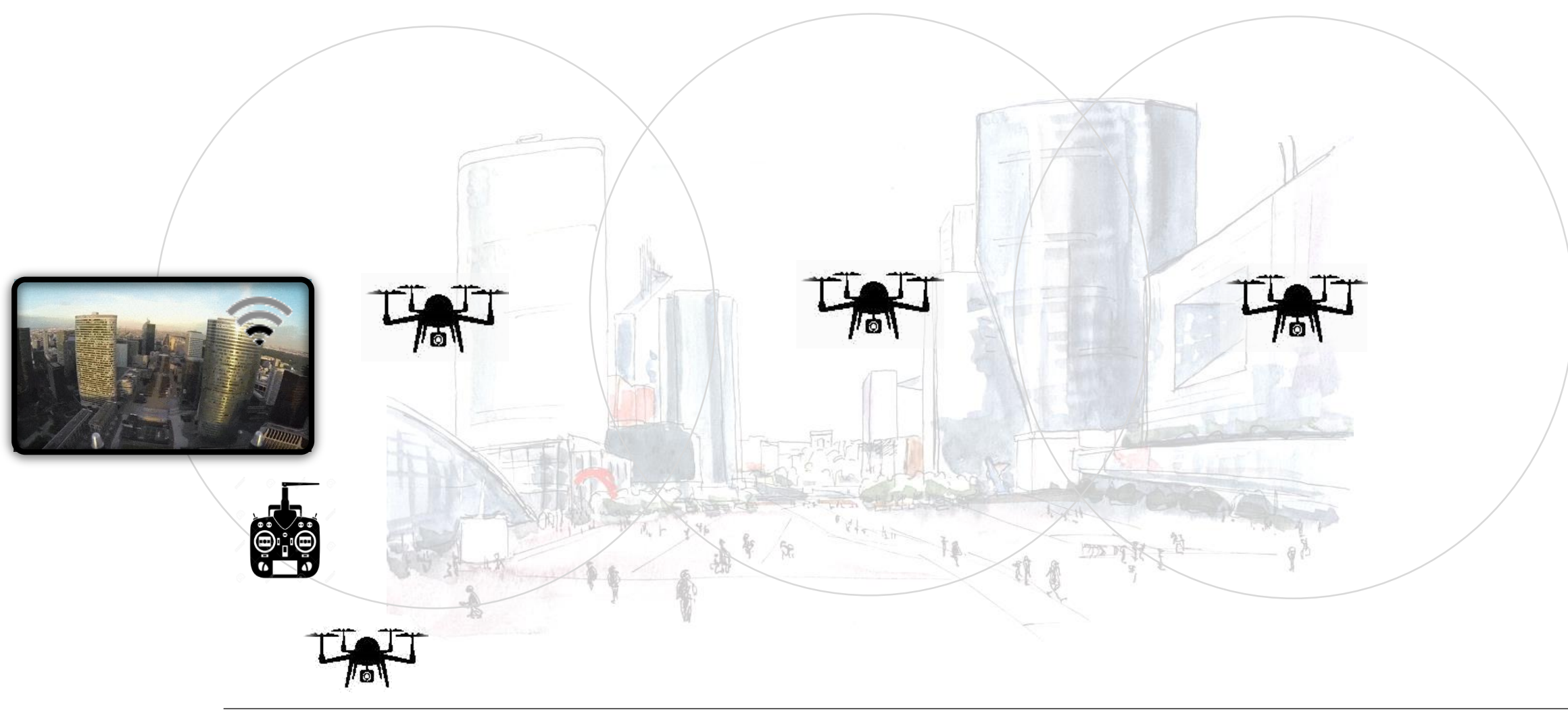
Introduction

- Drones and quadcopters are present in different fields (photography, agriculture, etc.)
- We notice that specific missions cannot be realized by one drone (Construction, etc.)
- Existing solutions position their quadcopters using vision based system positioning



Problem: **How to manage a swarm of quadcopters without having any synchronization, communication issues?**

Proposal



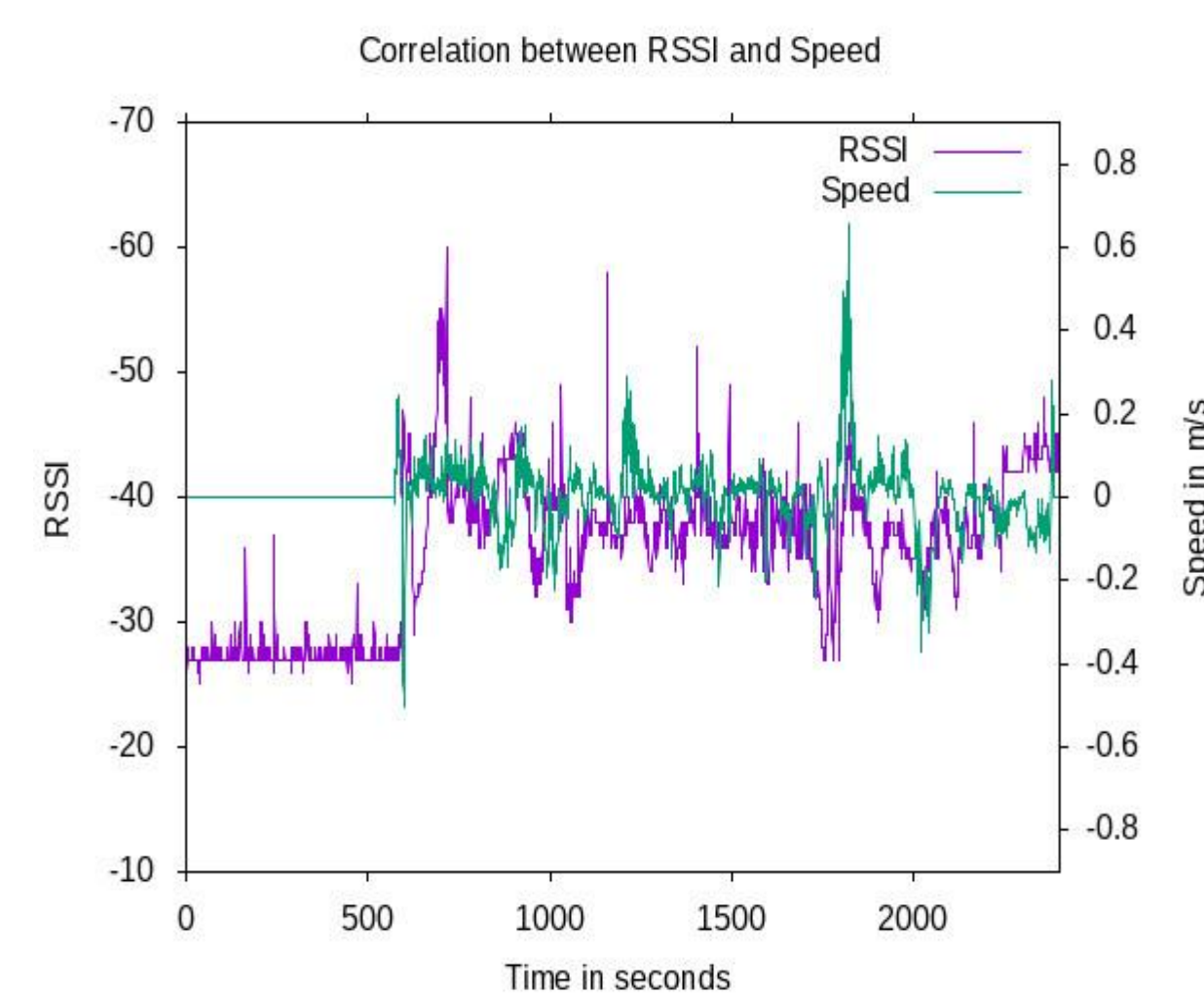
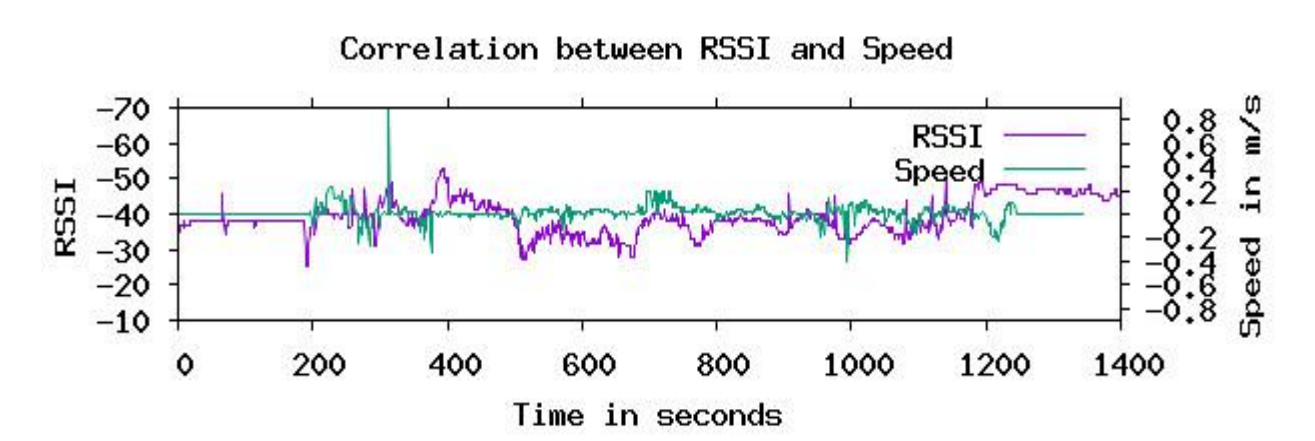
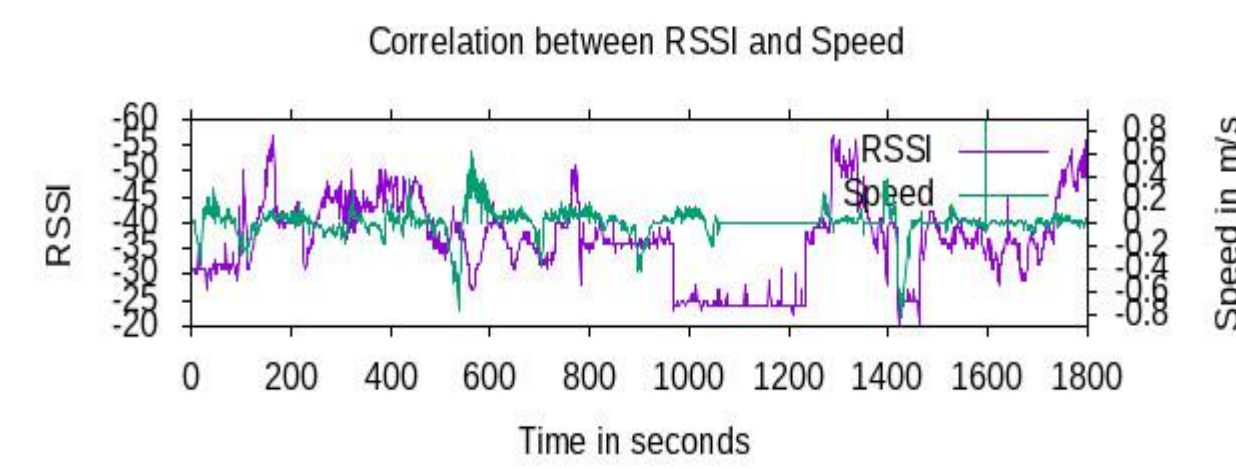
- Our solution uses leader follower concept, where leader is controlled by the pilot
- Followers measure periodically signal strength received from the leader, and position themselves according to the defined Quality of service.
- Followers takeoff, land and position themselves automatically.
- Leader captures HD video and forwards it to the pilot through several hops of followers.
- Each quadcopter sends status messages to their follower, containing orientation, velocity, and the name of the leader quadcopter.
- This solution allows different type of applications where only one pilot can manage entire swarm.

Control center software: To establish the ad-hoc network, discover the topology and manage followers' take-offs and landings



Drone software: After taking off, quadcopter position itself correctly behind the followed quad according to the Quality of service.

Results



- we realized real flight with 4 bebop quadcopters in outdoor environment
- The aim of experiments was to validate the autonomy of the followers in terms of speed and signal strength
- The following results shows correlation of the speed and signal strength measured by the followers.

Perspective

- Simulation are being realized using Gazebo simulator with Ns3 binding.
- Three quadcopters in triangle formation are being tested using the same algorithm.
- We are testing flying algorithms such as using particle swarm optimization to generate the trajectory of the followers.
- We need to use machine learning to predict better the future movement of the leader.

Publications

Omar Shrit, Steven Martin, Khaldoun Al Agha, Guy Pujolle. A new approach to realize drone swarm using ad-hoc network. *2017 16th Annual Mediterranean Ad Hoc Networking Workshop (Med-Hoc-Net)*, Jun 2017, Budva, Montenegro. IEEE, 2017,