Architecture for An Indoor Distributed Cyber-Physical System Composed of Mobile Robots and Fog Computing Nodes

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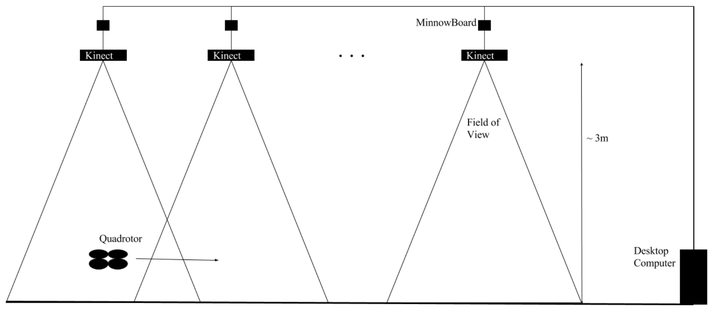
Objective

Develop an architecture for providing localization information to robots using StarL across the view of multiple Kinect cameras connected to x86 MinnowBoards in a Fog Computing fashion

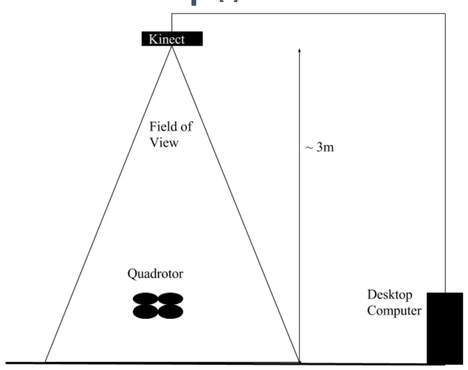
Desired Setup



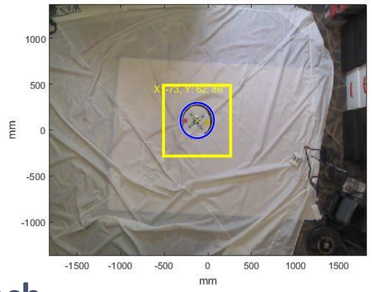
Motivation

The current system uses a single Kinect camera which limits the total field of view. By adding more Kinect cameras, the area covered by the localization method is expanded so tests can be run across a larger area. Additionally, the architecture could be used for other, similar distributed systems

Current Setup [1]



Localization Example



Approach

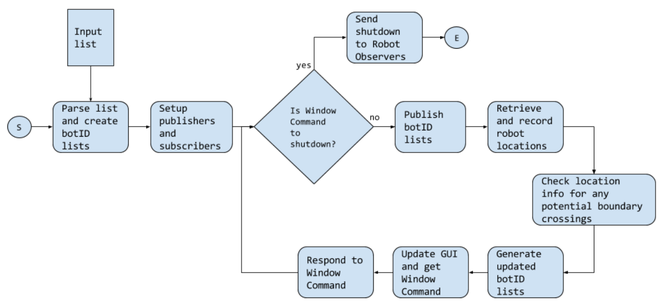
StarL and examples are available at:
https://github.com/verivital/starl

- 2 types of ROS nodes: Central Command, and Robot Observer
- Central Command records position information and informs each Robot Observer node which drones to look for
- Robot Observer nodes process the Kinect image and report location information to the Central Command node

Central Command Subscription List

- */kinect#/locations*
  - List of robot names and location information
- */kinect#/response*
  - Report from indicating whether or not a robot was found crossing its boundaries

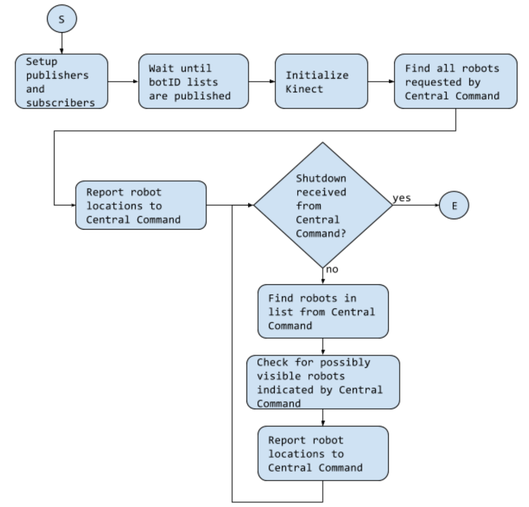
Central Command Code Schematic



Robot Observer Subscription List

- */botID_list*
  - Full list of robot names, types, and colors
- /shutdown
- */kinect#/bot_list*
  - A list of robots to track
- */kinect#/incoming*
  - A list of robots to watch the boundaries for

Robot Observer Code Schematic



Remaining and Future Work

- Finish writing code
- Fix issues between Kinect and MinnowBoard
- Validate system design
- Add more drone types to the system

References

[1] N. Hervey, “Localization and Control of Distributed Mobile Robots with the Microsoft Kinect and StarL”, April 2016
[2] J. M. O’Kane, A Gentle Introduction to ROS. Independently published, Oct. 2013, available at http://www.cse.sc.edu/~jokane/agitr/.

Acknowledgments

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