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Deployment Strategy for Wireless Networked Multi-Agent Systems using ROS

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Introduction

A multi-agent system is a system composed of multiple interacting intelligent agents.

Figure 1: Multi Agent System

While single agent performing one missions will yield some benefits, greater benefits will come from the cooperation of teams of agents.

Key : Cooperative Control

Most of the work specific to multiple robots are architectures and communication.

ROS offering a wide range of controllers for various hardware platforms. Drivers for several robots and sensor devices and a well defined structure for communication.

MiniLab Enova Robot

Mini-Lab Enova Robot is a mobile platform with two differential driving wheel. Mini-Lab is medium sized mobile robot optimized for indoor applications. Each wheel has a drive motor mounted on his axis. The wheels have been chosen to provide more accurate odometer localization. The control architecture is open-source based on the Robot Operating System (ROS). ROS is a flexible framework for writing robot software.

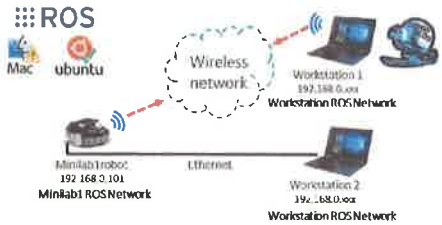


Figure 3: MiniLab Enova Robot

Experiment Setup

ROS network has been configured, it is time to launch the multimaster_fkie nodes

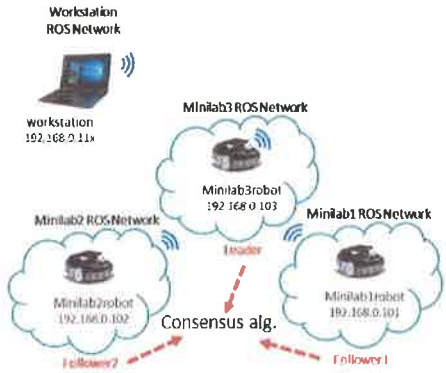


Figure 4: Leader Follower Multiagent System Network

Objective

To implement a decentralized control architecture using multi-master systems using multiple MiniLab Enova Robot

→ To manage wireless network communication of multiple robots.
→ To build ROS multi-master systems.
→ To implement ROS functionalities for coordinated multi-robot systems in the area of cooperative multi-agent systems.

Figure 2: Multimaster ROS for managing communication

ROS Communication

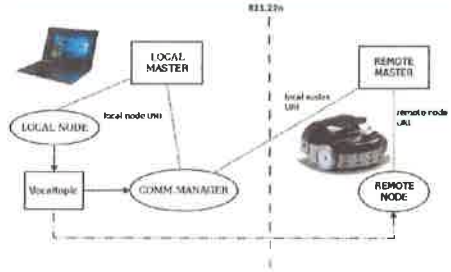


Figure 4: ROS communication with remote master

Communication Topology

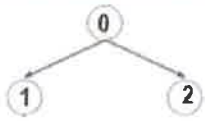


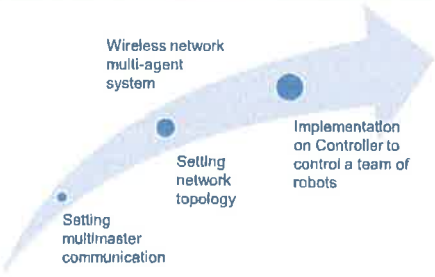
Figure 5: Communication Topology

Validation in Practical

```
lamih-minilab@lamihminilab:~$ rosservice call /master_discovery/list_masters
masters:
  -
    name: 192.168.0.101
    uri: http://192.168.0.101:11311/
    timestamp: 1527161324.16
    timestamp_local: 1527161324.16
    online: True
    discoverer_name: /master_discovery
    monitoruri: http://192.168.0.101:11611
  -
    name: 192.168.0.103
    uri: http://192.168.0.103:11311/
    timestamp: 1527161442.47
    timestamp_local: 1527161434.65
    online: True
    discoverer_name: /leader/master_discovery
    monitoruri: http://192.168.0.103:11611
  -
    name: lamihminilab
    uri: http://lamihminilab:11311/
    timestamp: 1527160708.62
    timestamp_local: 1527160708.62
    online: True
    discoverer_name: /master_discovery
    monitoruri: http://localhost:11611
  -
    name: 192.168.0.102
    uri: http://192.168.0.102:11311/
    timestamp: 1527190668.74
    timestamp_local: 1527190607.67
    online: True
    discoverer_name: /master_discovery
    monitoruri: http://192.168.0.102:11611
lamih-minilab@lamihminilab:~$
```

Figure 6: Information reported by the rosservice call command for topology presented

Methodes



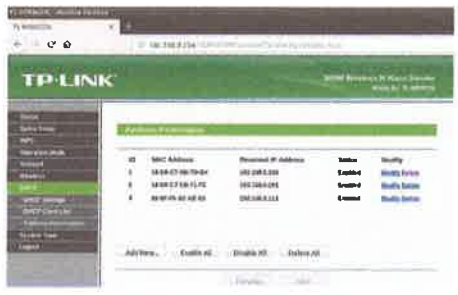


Figure 6: Address reservation for purpose topology

Conclusions

The leader-follower multi-agent system framework was presented. It is clear from the results that this the multimaster system works properly. Using this scheme it is possible to communicate multiple robots using wireless network. Also, it is possible to use this low cost configuration for using only one workstation as monitoring and control for multiple robots system.