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## Posters

### Title

Pursuit-Evasion Games Using Sensor Networks (MAS 11)

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# Pursuit-Evasion Games Using Sensor Networks

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Robotic Embedded Systems Laboratory/Embedded Networks Laboratory – [enl.usc.edu/projects/peg/index.html](http://enl.usc.edu/projects/peg/index.html)

## Pursuit-Evasion Game and Sensor Networks

### Game Formulation

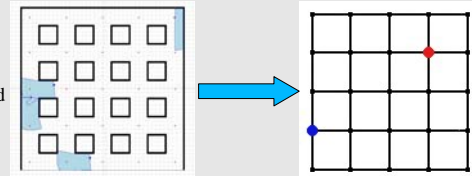
- Multi-agent teams of pursuers collaborating and trying to catch the evaders, who try to escape from the pursuers
- Requirements for the formulation of the game and policies
  - Time optimal pursuit and evasion policies
  - Use of sensor network for gathering the evader/other pursuer locations
  - Suitable to be applied to a sensor network setup and different evasion policies

### Sensor Network

- A Distributed Sensor for Localization of Evaders
  - Sense the location of the evader
- Long range communication among the pursuers
- Problems to be addressed in evader localization using sensor networks
  - Communication delay
  - Packet loss
  - Sensing errors in the sensing nodes

## Our Approach

- Pursuit/Evasion Policies**
  - Optimal, near or non-optimal policies
  - Generally for one pursuer-one evader games
- Main modules**
  - Task Evaluation
  - Task Allocation
- Discrete World Model**
  - Limits number of possible states agents can arrive at
  - Simplifies path planning, task evaluation and task allocation



## Implementation:

### Pursuer/Evader Agents

- Pioneer 2 wheeled robots**
  - Odometer
  - SICK LMS 200 laser scanner
  - On-board 802.11b wireless communication
  - Linux based OS

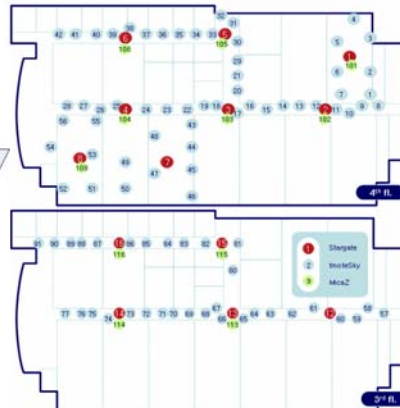


### Sensor Network Test bed: Tutornet

- Implemented on the 3rd and 4th floor of Ronald Tutor Hall building on University Park Campus
- Hierarchical network architecture
- Sensor Network Components

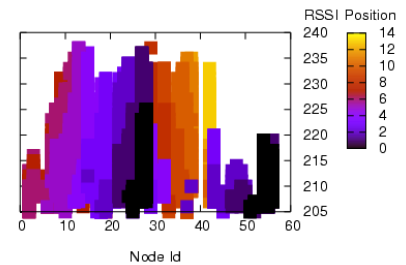
HW	SW
<ul style="list-style-type: none"> <li>Wired Ethernet adaptor</li> <li>Wireless USB network adaptor (Linksys WUSB1)</li> </ul>	<ul style="list-style-type: none"> <li>Fedora Core 1 (Linux kernel 2.4.22)</li> <li>tinyOS ver. 1.1.14 with nESC 1.1.3</li> <li>Kernel AODV ver. 2.2.2</li> </ul>
<ul style="list-style-type: none"> <li>7-port USB hub</li> <li>Wireless network adaptor (Orinoco Classic Gold PC card)</li> </ul>	<ul style="list-style-type: none"> <li>Stargate Release 7.3 (Linux kernel 2.4.19)</li> <li>Kernel AODV ver. 2.2.2</li> <li>bootstrap loader software for Tmote</li> <li>Python ver. 2.2</li> <li>watchdog</li> <li>serial forwarder</li> <li>Emulcr</li> </ul>

### Sensor Network Layout

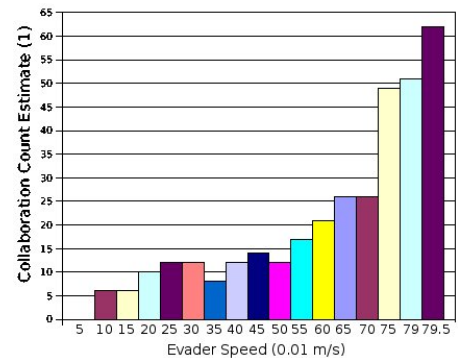


### Some Results

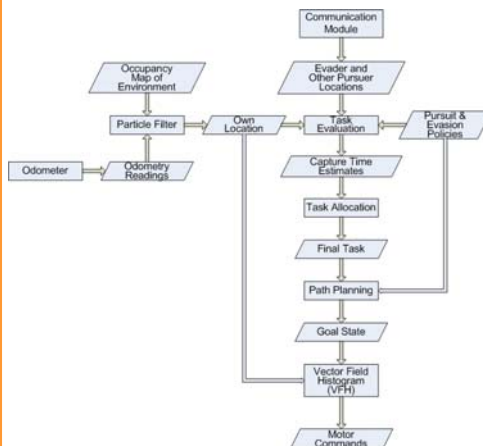
- Received Signal Strength Indication based evader localization



- More collaborations among the pursuers are needed for capturing faster evaders in the shortest amount of time (pursuer speed = 0.8 m/s)



### Control System Architecture



### Future Work

- Better estimation of evader location
- Increasing robustness of the pursuit policies against network delay and sensing errors
- Finding and testing suboptimal policies with high performance and lower computational requirements for real time implementations