Pursuit-Evasion Games Using Sensor Networks

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Pursuit-Evasion Game and Sensor Networks

Game Formulation

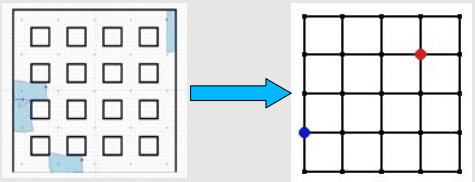
- **Multi-agent teams of pursuers collaborating and trying to catch the evaders, who try to escape from the pursuers**
- **Requirements for the formulation of the game and policies**
  - Time optimal pursuit and evasion policies
  - Use of sensor network for gathering the evader/other pursuer locations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

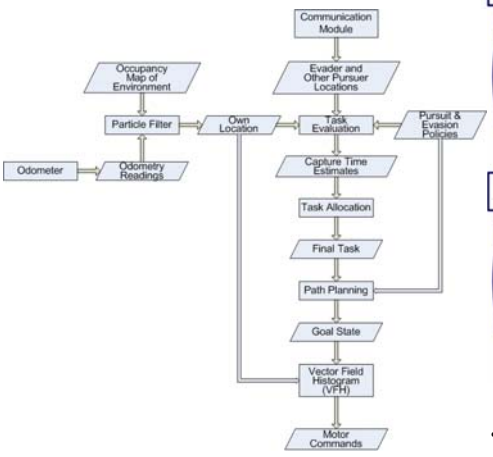


Implementation:

Pursuer/Evader Agents

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

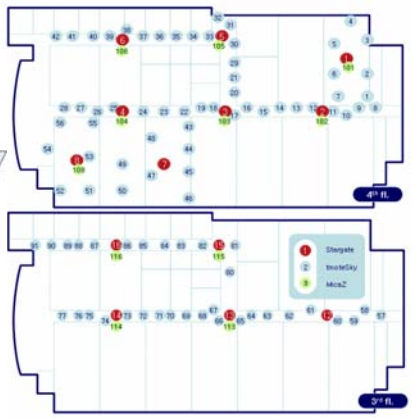
- **Control System Architecture**



Sensor Network Test bed: Tutornet

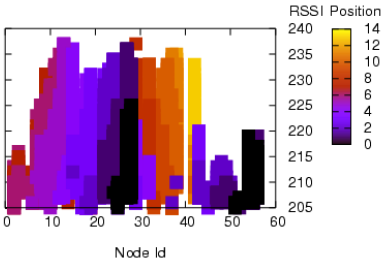
- **Implemented on the 3rd and 4th floor of Ronald Tutor Hall building on University Park Campus**
- **Hierarchical network architecture**
- **Sensor Network Components**

- **Sensor Network Layout**

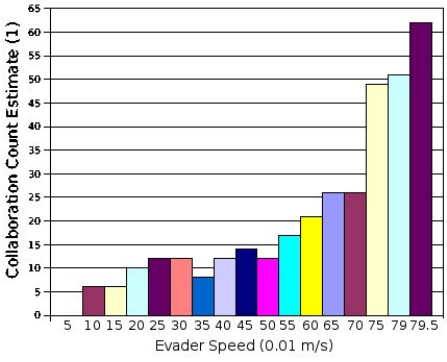


Some Results

- **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)**



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**