DISTRIBUTED INTELLIGENT SYSTEMS

PRESENTATION

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Introduction

• The aim of this project is to use e-pucks in order to develop a flocking behavior while avoiding obstacles.

• The various developed strategies should be performed in simulation on webots and adapted on the real e-pucks.

• Two scenarios should be implemented:
  • *One flock avoiding obstacles*
  • *Two flocks avoiding each other*
Subdivision

- Project segmented in four parts:
  - Flocking behavior:
  - Communication: transmission of information.
  - Localization: not be lost.
  - Analysis: evaluate the solution.
Flocking strategy

*Reynolds’ rules*

Three rules:

- **Separation**: robots should not be too close
- **Alignment**: robots should go to the same direction
- **Cohesion**: robots should not be too far

Specificities:

- Same coordinate system for all robots
- Relative distances and speeds
Communication strategy on simulation

- Each robot has an ID number given by the selector.
- This identifier defines the order of communication.
- It's a sequential communication each robot will emit and receive one after the other.
Communication strategy on the real e-pucks

- Informations:
  - The ID.
  - The distance of the emitter.
  - The angle of the emitter from the receiver.
Communication strategy on the real e-pucks

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Obstacle avoidance

Virtual force$^{[1]}$

Concept

- Virtual force
- Sum of these forces is applied

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Obstacle avoidance

Implementation

• Threshold
• Angles taken from e-puck datasheet
• Noise
• Inertia

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<th>$y$ (m)</th>
<th>$z$ (m)</th>
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Obstacle avoidance

Results
Odometry on real e-pucks

Frame sharing

• At init. e-puck 0 is taken as the (0,0) of the X-Y frame and communicate with others members of the flock
• Other e-pucks therefore adjust their odometry given the direction and the distance of the signal
Odometry on real e-pucks

*Position estimation*

- E-puck has motor encoders that give us how many steps were done in one cycle.
- The motor command is given by the flocking behavior.
- Allows us to know the displacement X-Y frame.
Odometry on real e-pucks

*Position estimation*

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- The motor command is given by the flocking behavior.
- Allows us to know the displacement X-Y frame.
Odometry

Real observations
Results
Simulations
Results

Real case
Questions ?
Sources

- Course Distributed Intelligent System, Alcherio Martinoli – EPFL, 2018