電気情報工学基礎演習B

Simulation of Controlling Mobile Robot
Lecture 3

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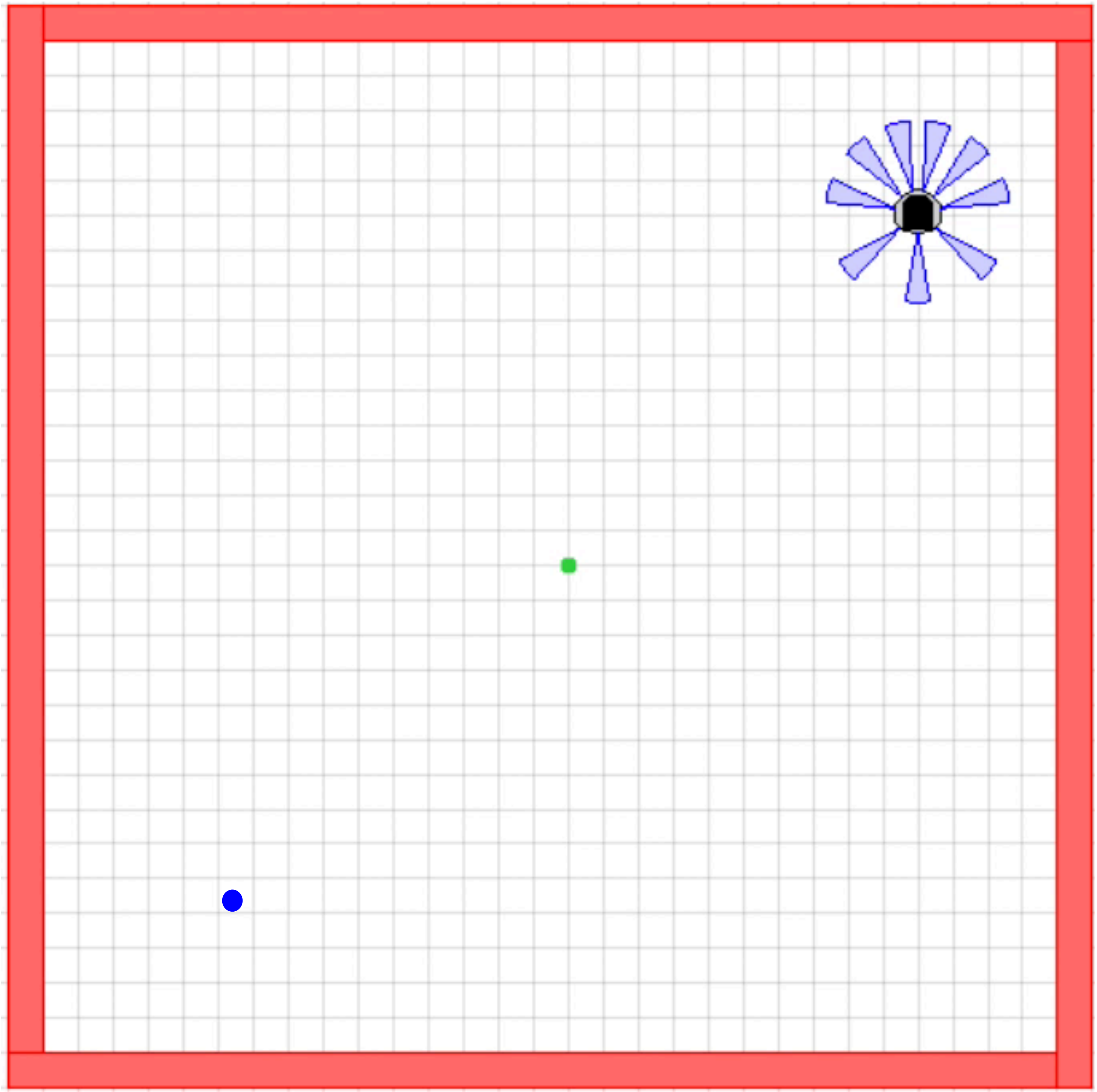
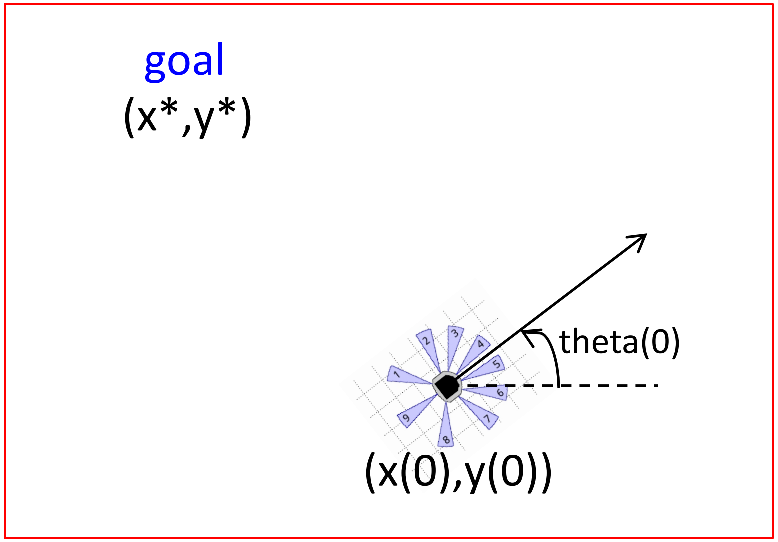


Lecture 3

- GoToGoal control

Go To Goal

- Objective: steer the robot to reach a goal



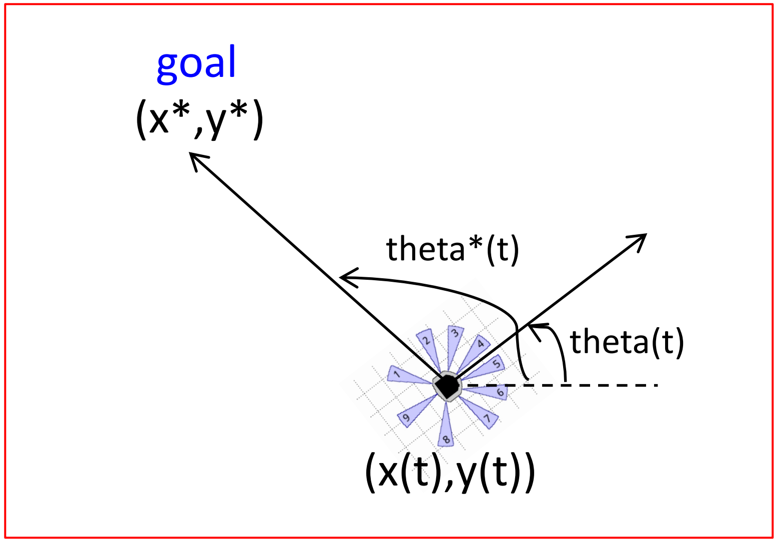
Assume robot is moving at linear velocity v=constant.

We only control robot's angular velocity w: $\frac{d\theta}{dt} = u(t)$, control input

$$\text{Objective: } x(t) \to x^* \text{ and } y(t) \to y^* \text{ as } t \to \infty$$

GoToGoal Controller

- Objective: steer the robot to reach a goal

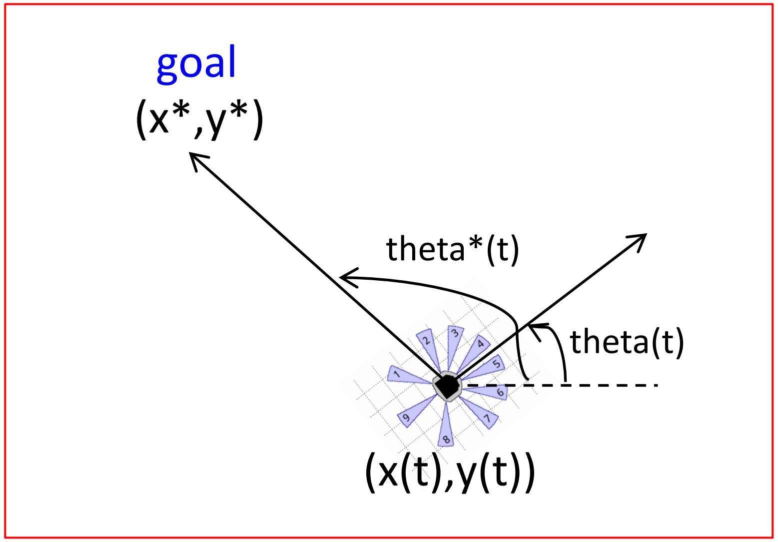


Objective: $\theta(t) \to \theta^*(t)$ as $t \to \infty$

$$\theta^*(t) = \tan^{-1}\left(\frac{y^* - y(t)}{x^* - x(t)}\right)$$

GoToGoal Controller

- Objective: steer the robot to reach a goal



1. Use P-controller $u(t) = K_p(\theta^*(t) - \theta(t))$ to achieve $\theta(t) \rightarrow \theta^*(t)$

2. Stop robot when it is 'close' to goal: $\sqrt{((x^* - x(t))^2 + (y^* - y(t))^2)} < \text{d\_stop}$

Code

- +simiam/+controller/+khepera3/K3Supervisor.m
  - function obj=K3Supervisor()

```
% Input your code below %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%Specified (constant) speed
obj.v = 0; (change this to see what happens)
%Goal location
obj.goal = [-1,-1]; (change this to see what happens)
%Stop condition
obj.d_stop = 0.1; (change this to see what happens)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

Code

- +simiam/+controller/GoToGoal.m
  - function obj=GoToGoal()

```
% Input your code below %
%%%%%%%%%%%%%%%%%%%%%%%%%%%
% Propositional control gain %
obj.Kp = 0; (change this to see what happens)
%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

Code

- +simiam/+controller/GoToGoal.m
  - function outputs = execute(...)

```
% Input your code below %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% distance between goal and robot in x-direction. Hint: use x_g, x
u_x = 0; (change this to see what happens)
% distance between goal and robot in y-direction. Hint: use y_g, y
u_y = 0; (change this to see what happens)
% angle from robot to goal. Hint: use atan2, u_x, u_y
theta_g = 0; (change this to see what happens)
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
```

$$\text{theta\_g} = \tan^{-1}\left(\frac{\text{y\_g}-y}{\text{x\_g}-x}\right) = \text{atan2}(\text{u\_y}, \text{u\_x});$$

Exercises

- Use package: simiam_lecture3.zip
- Change robot's initial pose in settings.xml
- Set robot's linear speed, goal location, and stop distance in K3Supervisor.m
- Adjust control gain parameter in GoToGoal.m
- Compute desired angle to goal in GoToGoal.m

Task

- Set robot's pose (1,1,3.14) in settings.xml
- Set robot's linear speed 0.3, goal location [1,-1], and stop distance 0.1 in K3Supervisor.m
- Find the minimal and maximal control gain parameters in GoToGoal.m that works "smoothly"