COS 495 - Lecture 12
Autonomous Robot Navigation

Instructor: Chris Clark

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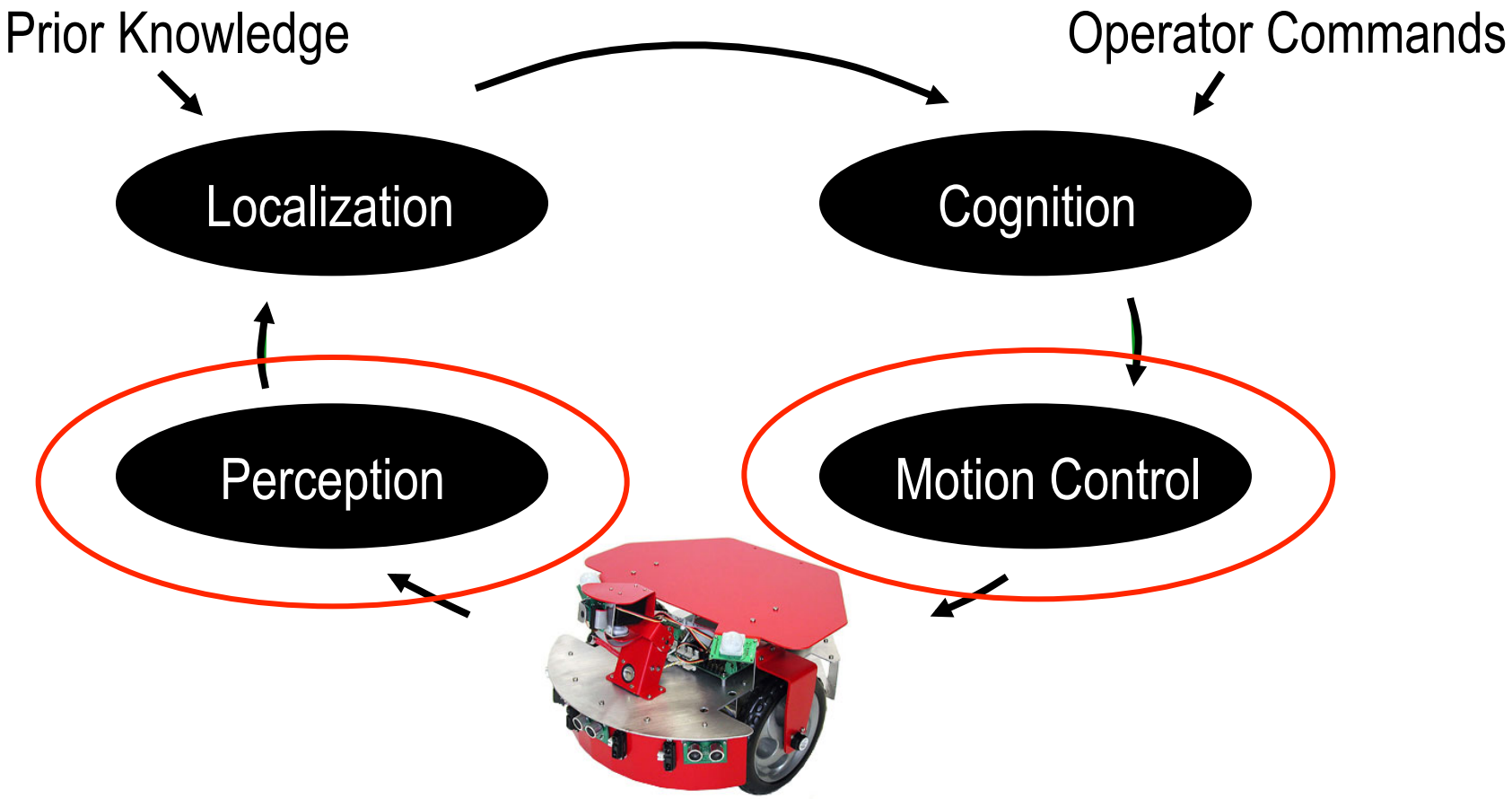
Figures courtesy of Siegwart & Nourbakhsh

Control Structure



Coordinate Frames

- An X80 robot has been equipped with two cameras c_1 and c_2, each placed respectively at angles α, $-\alpha$ relative the X axis of the robot's local coordinate frame. If the robot is located at state (x,y,θ) in the global coordinate frame, and c_2 detects landmark at range ρ and angle of β with respect to the direction of the camera, what is the position of the landmark with respect to the robot's local coordinate frame? Global coordinate frame? Use a figure with all variables labeled.

P-Control

- A robot's error states follow the following equations.

$$de_1/dt = -2e_1 + 6e_2$$
$$de_2/dt = \quad e_1 - \quad e_2$$

- Show all errors will not be driven to zero if they follow these equations.
- If the first error equation can be modified by adding a P-Control term (Ke_2), show how the error states can be driven to zero.

Wall Mapping

- The X80's range sensors are all broken except a left facing IR range sensor. It drives beside a wall and measures the range ρ_i to the wall from 3 positions (hence $i=1..3$). If the robots odometry is perfect (and hence we know the robot's location at each measurement), calculate the locations (x_i, y_i) where the range sensor hit the wall. Use these locations to describe the wall as a line of the form $y = mx + b$.