

Assignment#4: Global localization and Collision detection

Due: 11/12/2015

Goal: After this assignment, you will have a basic understanding of global localization using visual landmarks and collision detection using accelerometer with low-pass filter.

Content Detail:

1. Global localization using visual landmarks

Identify landmarks and print out the corresponding landmark_id's under the following conditions:

- a. "Drop-off" problem: Hamster is at an unknown position in a known map with landmarks
 - i. Global localization: we are trying to find hamster's current position in the map.
 - ii. In this exercise, we will only identify the given landmark at the current position since if we can identify the landmark available at the current position, we know the global location of hamster in the map.
- b. Hamster's current position
 - i. hamster(yellow box): anywhere inside of grey area #0 (2 x 10 cm) (ref. figure 1)
 - ii. fixed orientation: facing arrow direction always (ref. figure 1)
- c. Landmark at the current location
 - i. landmark: combination of boxes at known six box locations
 1. six box locations #1~6 → $2^6 = 64$ combinations (ref. figure 1)
 2. each box location: 2 x 10 cm
 3. at each box location: zero box, one box, two boxes stacked up
 4. each box: 2 x 2 x 10 cm
 - ii. landmark_id: 6 binary numbers = xxxxxx
 1. x=1: two boxes stacked up
 2. x=0 otherwise (one or zero boxes)
 3. example:
 - a. landmark_id : 101000 → 2 boxes stacked up at locations #1 and #3
 - b. landmark_id : 111111 → every location with 2 boxes stacked up
 - c. landmark_id : 000000 → no landmark
- d. Hint: use the scanning distance sensor unit (PSD IR sensor + servo motor)

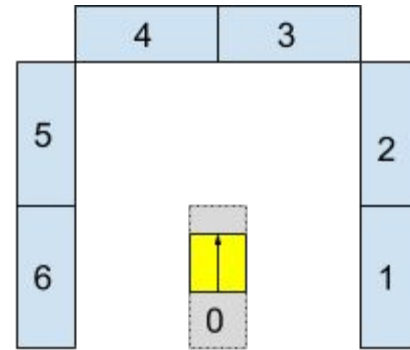


Figure 1. landmarks

2. Collision detection

Detect collision robustly (no false-negative, no false-positive) and print out the collision magnitude under the following conditions.

- a. Collision magnitude: magnitude of changes in the x and y accelerations
- b. Speed is -50 for both wheels.
- c. Hamster is colliding to a rigid static (immovable) object.
- d. Hint: use accelerometer with low-pass filter (from Lecture #14)

Reference:

Hamster Manual

http://web.stanford.edu/class/cs123/materials/Hamster_Manual.pdf