DSE418: Intelligent Robotics
Assignment 02 : Report

Team Members

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Introduction

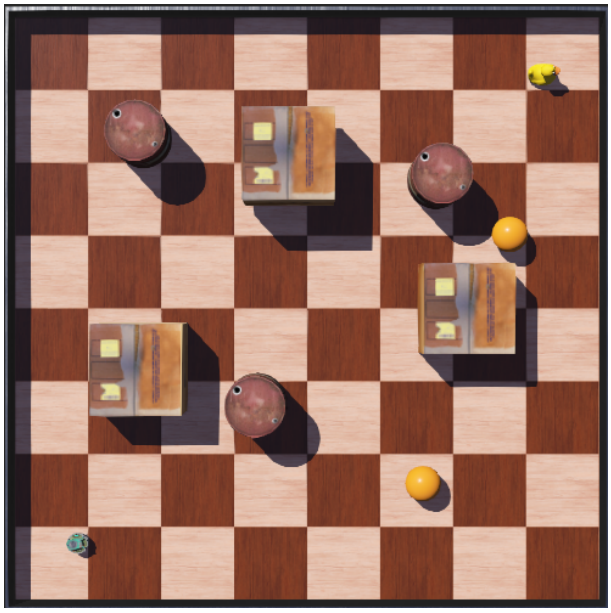
This work presents a combined illustration of carrot chasing algorithm and obstacle avoidance for some robots simulated in Webots.

Problem Statement

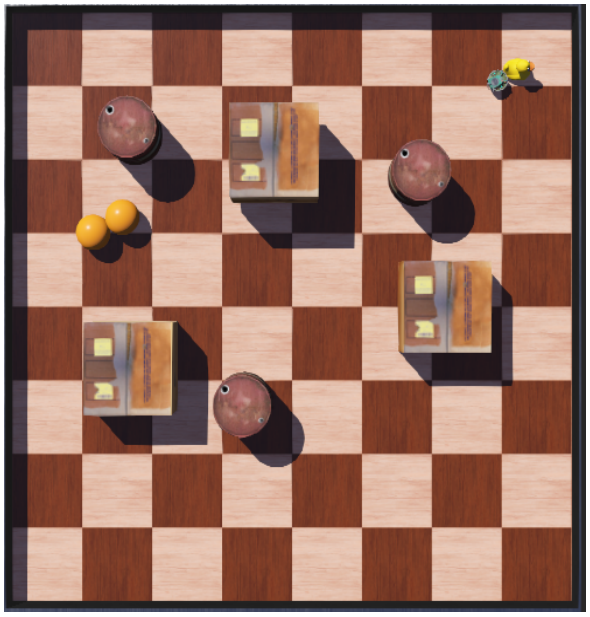
Consider an environment with three point mass robots. The objective is to move one robot from start to destination while the other two are the obstacle robots that block its path. The speed of the obstacle robots is 0.5m/s. They go along the assigned line using the carrot chasing algorithm. Apart from the path blocking robots there are other static obstacles. Moreover, the robot should be more than 2 meters distant from the path blocking robots so that it can avoid a collision.

Environment Setup

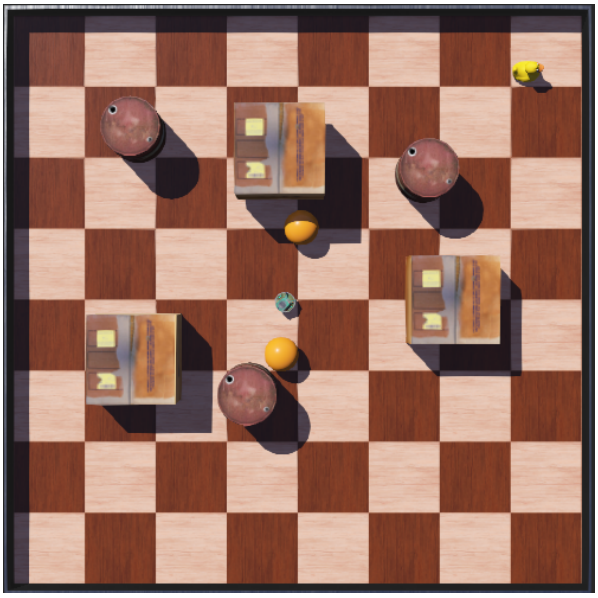
The environment contains an e-puck robot that moves towards the goal. There are three boxes and three barrels as static obstacles that block the way from start to goal. The two orange balls behave as dynamic obstacle robots that move in a straight line using the carrot chasing algorithm. Inorder to sense the distance from the obstacles, e-puck uses three distance sensors - one in the front, other on the left and right. Also, the current location and turning angle is measured by gps and compass respectively. Fig(a) and fig(b) show the initial and final setup of the environment respectively.



fig(a) : initial positions



fig(b) : final positions



fig(c) : e-puck crossing the trajectory of dynamic obstacle robots

It can be observed from the fig(c) that the e-puck robot maintains a considerable distance from the obstacle robots.

Methodology

Some modification has been done to the problem statement :

- The speed of the dynamic obstacle robots cannot be made 0.5m/s as they move relatively very fast. So the speed was set as

$$\frac{distance\ between\ the\ position\ of\ the\ mobile\ robot\ and\ its\ target}{10000\ or\ 8000}$$

- The arena is 2m*2m.
- The distance epsilon between the robot and obstacles is 0.3m.

The e-puck robot uses the Bug 0 algorithm to follow its trajectory while the robots that cross the path of the e-puck follow the carrot chasing algorithm.

Steps to implement Bug 0:

- Initialize the target point
- Calculate the desired heading angle by differencing the current heading angle of the robot and the alignment of the goal.
- Once the goal is located in the desired direction, the distance between the goal and e-puck robot position is computed.
- Robot follows the line in the direction of the goal until the distance between the goal and itself is less than 0.05cm.
- Whenever it confronts an obstacle it follows the boundary and till it can directly head towards the goal.

Steps to implement the carrot chasing algorithm:

- Initialize the robot position, the line and the goal at the distant end of the line.
- Calculate the desired heading angle by differencing the current heading angle of the robot and the alignment of the goal.
- Initialize a small distance (δ) on the line from the point that perpendicularly joins the robot to the line.
- The point at the δ distance is the temporary goal of the robot and it tries to reach there.
- If the robot heading angle and the final goal angle are not same, then the robot can deviate from the line due to its velocity which causes few oscillations during the initial phase of the travel.
- But in this case much oscillations cannot be observed due to less momentum.
- When the robot heading angle aligns with the final goal angle it follows the straight line until the goal is reached.

Challenges

- We could not set up a relation function that gives the distance between the e-puck and the dynamic obstacle robots, and design a proportional controller for vehicle tracking.
- There was only one collision that we could stimulate between the e-puck and the dynamic obstacle robots.