Intelligent Robotics - Assignment 2

Group Members - Anudeep, Sumeet, Dishant, Sushil.

November 12, 2022

Abstract

Project report for Assignment 2 where problem statements demands us to navigate a robot in a webots environment with 4 static obstacle and 2 mobile obstacle . In this assignment we work to formulate a controller for the robot(e-puck) to navigate through the mentioned environment.

1 Introduction

The primary purpose of the assignment was to implement and develop a robot controller to navigate through the environment presented in Figure 1. The setting for the project has three e-puck robots; one has to go towards the goal while avoiding obstacles, remaining two are moving obstacles translating at a velocity of 0.50 m/s. These two e-pucks move along a line using carrot chasing algorithm. Further, there are four yellow circular obstacles. The Webot environment is as follows:

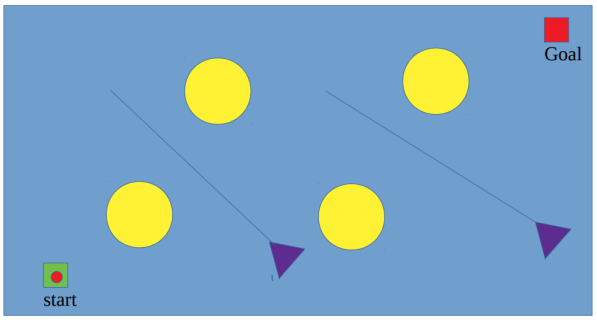


Figure 1: Problem Statement Enivironment.

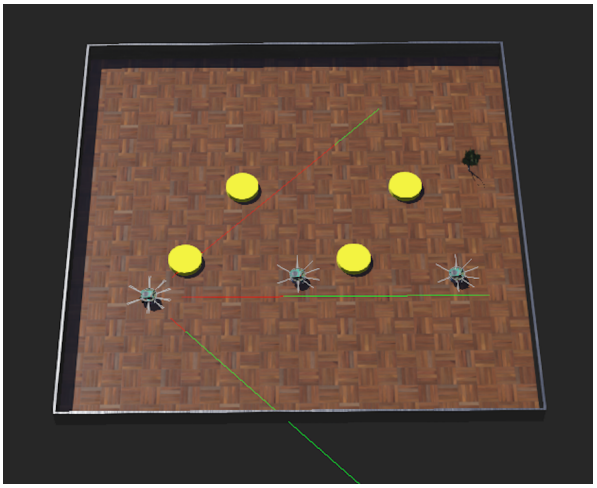


Figure 2: Initial Webots Enivironment.

2 Methodology

2.1 Sensors used for the navigating e-puck

To help navigate the e-puck through the environment we take the help of the Sharp GP2Y0A02YK0F sensor which is a distance measuring sensor unit, composed of an integrated combination of PSD (position sensitive detector), IR-LED (infrared emitting diode) and signal processing circuit. 3 sharp sensors are used to help orient the robot. One sensor oriented towards the front of the e-puck, other two at an angle of 45° along the each side of the axis of the robot. Further a GPS, Compass and Inertial Units were used for the location and orientation of the e-puck.

Specification	Value
effective range	42
output type	analog
response time	33[ms]

Table 1: Specifications of Sharp GP2Y0A02YK0F.

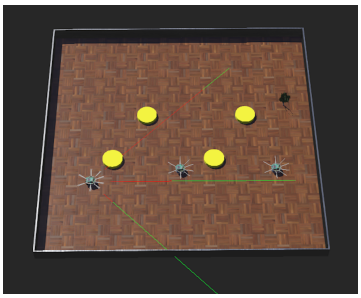
2.2 How we go about the problem

- We are using three distance sensors that sense distances at three different orientations (straight ahead, left at 45 degrees, and to the right at 45 degrees). We have a threshold of 30 centimeters for each sensor, and if all the sensors have a reading above the threshold, the e-puck will align and move toward the goal.
- If the above condition is not met, then we will check the following three conditions. If the right sensor is below the threshold, then the e-puck moves to the left and tries to avoid the obstacles, similarly, for the left sensor, it moves to the right to avoid the obstacle, and if the front sensor is below the threshold, it moves to the right.
- Turning the robot is done using a proportional controller, which decreases the velocity of the motor towards the obstacle direction more as the obstacle is closer.

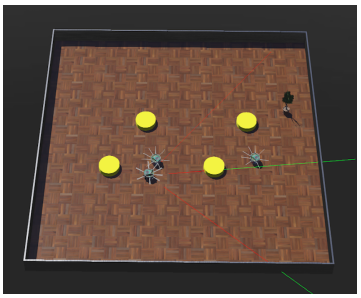
2.3 Results

In this section, we will see the various stages of the simulation of e-puck with our controller in the given environment. Explanation of the stages are given below.

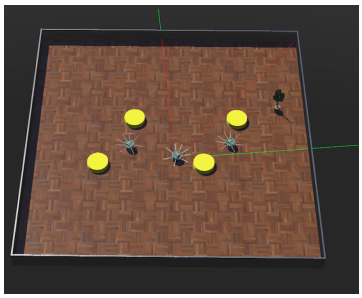
- **STAGE 1:** Initial configuration of the environment before simulation.
- **STAGE 2:** E-puck avoiding collision with the moving obstacle1.
- **STAGE 3:** E-puck moving towards the goal while avoiding stationary obstacle.
- **STAGE 4:** E-puck avoiding collision with the moving obstacle2.
- **STAGE 5:** E-puck at the goal.



(a) $STAGE1$

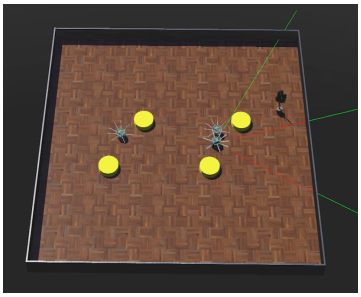


(b) $STAGE2$

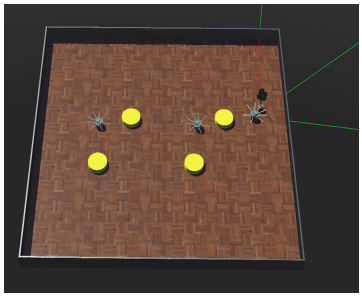


(c) $STAGE3$

Figure 3: Stages of the Simulation



(a) $STAGE4$



(b) $STAGE5$

Figure 4: Stages of the Simulation