ESE 356 Digital System Specification and Modeling
Project 2: Robot Navigation in Confined Areas
Phase 1 (Initial Version) Requirement

Due on 10/20/2020

Total Points (15): No late submission (submit the file by midnight of the due date)

1. Initial Phase Specification

Robot

Proximity sensor detects an obstacle within 3m
GPS determines its own location
Communicate with the server (real signals)
Communicate with the environment (virtual signals)
A path (a sequence of grids) is given before the simulation (i.e., provided through parameters)

Operation 1:
-   Send signal "CROSSING" to the server 0.5m before the boundary. Keeps moving.
-   If no signal is received, or "STOP" signal is received from the server, it stops at the boundary. The robot moves and crosses the boundary if the server sends "OK" signal

Operation 2:
-   When it detects obstacles within 3m, the robot stops. Sends status "STOPPED" to the server.
-   If obstacles are cleared, it moves again. Send status "MOVING" to the server.

Server

Monitors the data structure
Communicate with the robots
Update the data structure

Processing

Four loops of operations (executes every clock cycle)

Loop 1: each cycle, each robot updates the position
Loop 2: each cycle, each obstacle updates the position
Loop 3: for each robot, compare the distance from the boundary.
        If close to the boundary, sends the signal to the robot, then the robot sends the signal to the server

Loop 4: for each robot, compare the distance from the obstacles
> If the robot is close to the obstacle, stops the robot, sends robot the status and the robot sends the status to the server.
> If the stopped robot is clear from the obstacles, resumes the robot, sends robot the status and the robot send the status to the server.

Map
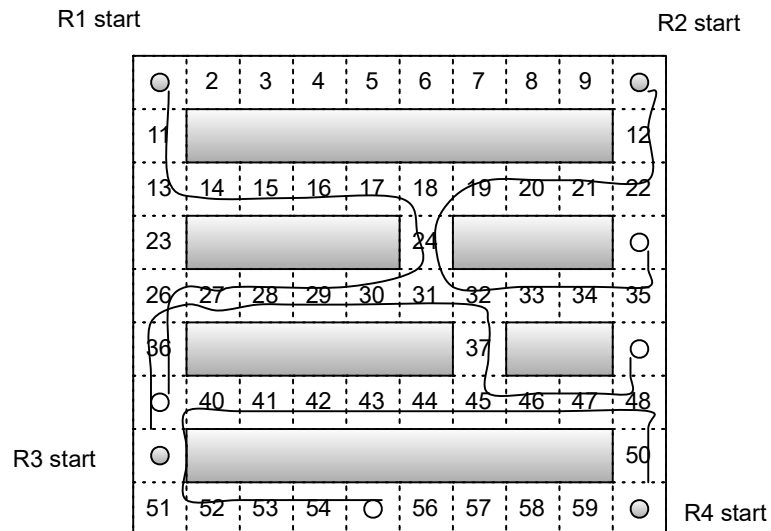
2. Verification and Simulation

- Simulation with 2 robots (R1 starts horizontally from Grid 1 and navigate to Grid 10, R2 starts vertically from Grid 10 to Grid 60) and 2 obstacles (Obstacle 1 starts horizontally from Grid 10 to Grid 1, Obstacle 2 starts vertically from Grid 60 to Grid 10) in 2-dimensional maps described in the Project Description.
- Grid size is 2m by 2m.
- Obstacles move (back-and-forth) with 4 m/s speed.
- Robots move with 2m/s speed.
- The path for the robots are parameterized.

3. Submission Requirements

- Source codes for robot, processing, server, top main and necessary test-bench codes
- Data base structures for robot, processing, server
- Description (pseudo codes) for handshaking mechanism
- Verification/Simulation results: Handshake event activities (with time and event)
- Summary report (1-2 pages)

Submission through electronic files (zip version)
The report grading will be based on 1. Clarity of the report, 2. Completeness of the results.

4. Grading

1. Source Codes (4)
2. Map Implementation (2)
3. Pseudo Codes/Usages of Data Structure for Handshake Mechanism (4)
4. Testbenches and Simulation (5)