INFORMATICS INSTITUTE OF TECHNOLOGY

In Collaboration with

UNIVERSITY OF WESTMINSTER

6SENG005C Formal Methods

Module Leader: Dr. Thilini Piyathilaka

Student Name: Pasan Kottearachchi

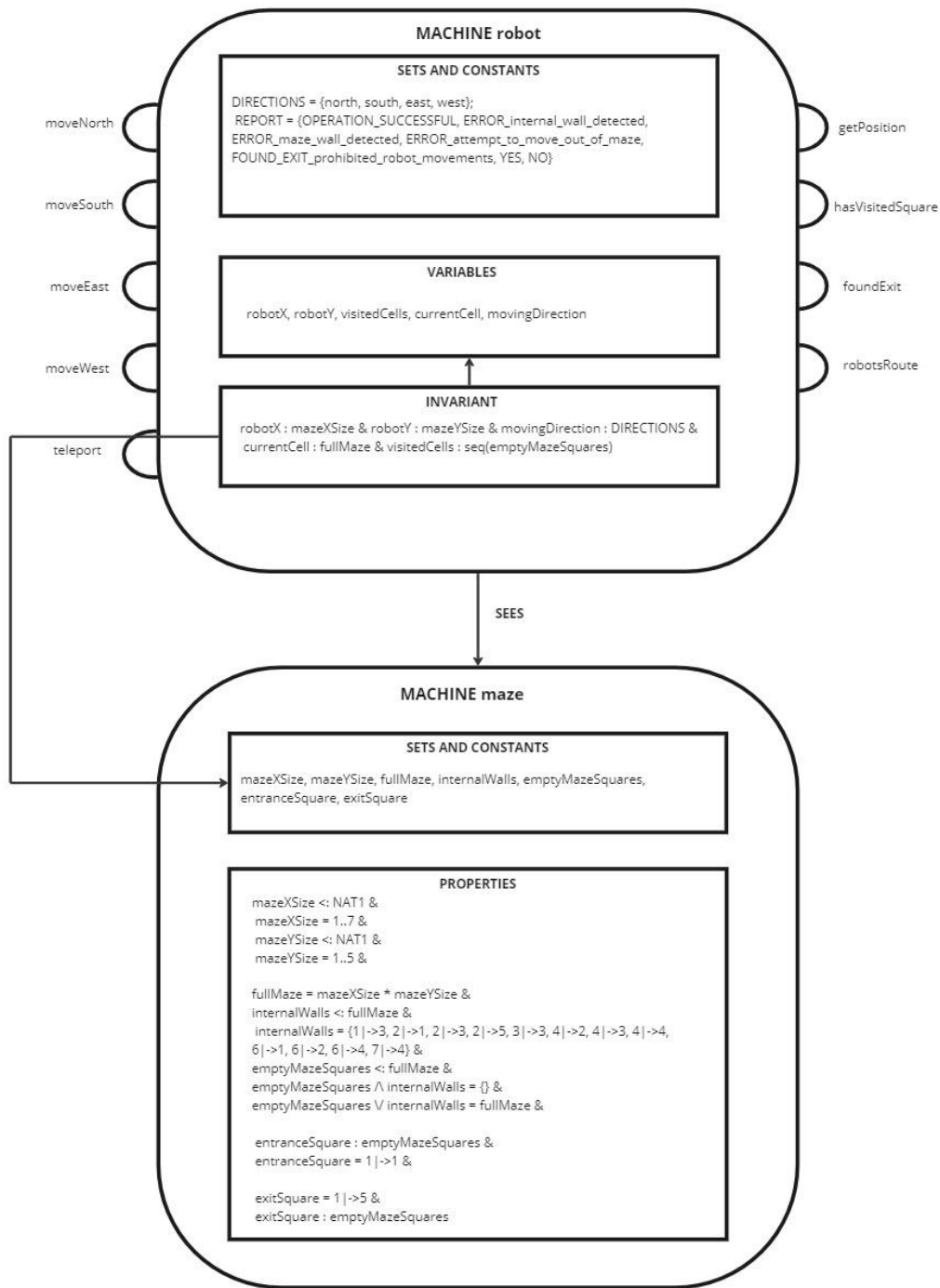**IIT Student Number: 2018315**

UOW Student Number: W1761885

Contents

Table of Figures

Structure Diagram

MACHINE robot

SETS AND CONSTANTS

DIRECTIONS = {north, south, east, west};
REPORT = {OPERATION_SUCCESSFUL, ERROR_internal_wall_detected, ERROR_maze_wall_detected, ERROR_attempt_to_move_out_of_maze, FOUND_EXIT_prohibited_robot_movements, YES, NO}

VARIABLES

robotX, robotY, visitedCells, currentCell, movingDirection

INVARIANT

robotX : mazeXSize & robotY : mazeYSize & movingDirection : DIRECTIONS & currentCell : fullMaze & visitedCells : seq(emptyMazeSquares)

moveNorth
moveSouth
moveEast
moveWest
teleport

getPosition
hasVisitedSquare
foundExit
robotsRoute

SEES

MACHINE maze

SETS AND CONSTANTS

mazeXSize, mazeYSize, fullMaze, internalWalls, emptyMazeSquares, entranceSquare, exitSquare

PROPERTIES

mazeXSize <: NAT1 &
mazeXSize = 1..7 &
mazeYSize <: NAT1 &
mazeYSize = 1..5 &

fullMaze = mazeXSize * mazeYSize &
internalWalls <: fullMaze &
internalWalls = {1|->3, 2|->1, 2|->3, 2|->5, 3|->3, 4|->2, 4|->3, 4|->4, 6|->1, 6|->2, 6|->4, 7|->4} &
emptyMazeSquares <: fullMaze &
emptyMazeSquares /\ internalWalls = {} &
emptyMazeSquares \/ internalWalls = fullMaze &

entranceSquare : emptyMazeSquares &
entranceSquare = 1|->1 &

exitSquare = 1|->5 &
exitSquare : emptyMazeSquares

Figure 1: Structure Diagram

miro

Plain English Explanation of State Invariants

robotX : The current x position of the robot. The x position of the robot should stay within the range of the maze x axis and cannot go outside the given range

robotY : The current y position of the robot. The y position of the robot should stay within the range of the maze y axis and cannot go outside the given range

movingDirection : The moving direction of the robot should belong to the set DIRECTIONS which includes north, south, east and west

currentCell : The current x and the current y position of the robot. The coordinates should stay with in the maze range.

visitedCells : The whole movement history of the robot. The robot should only move within the maze range and also within the empty squares of the maze that are not occupied by a wall