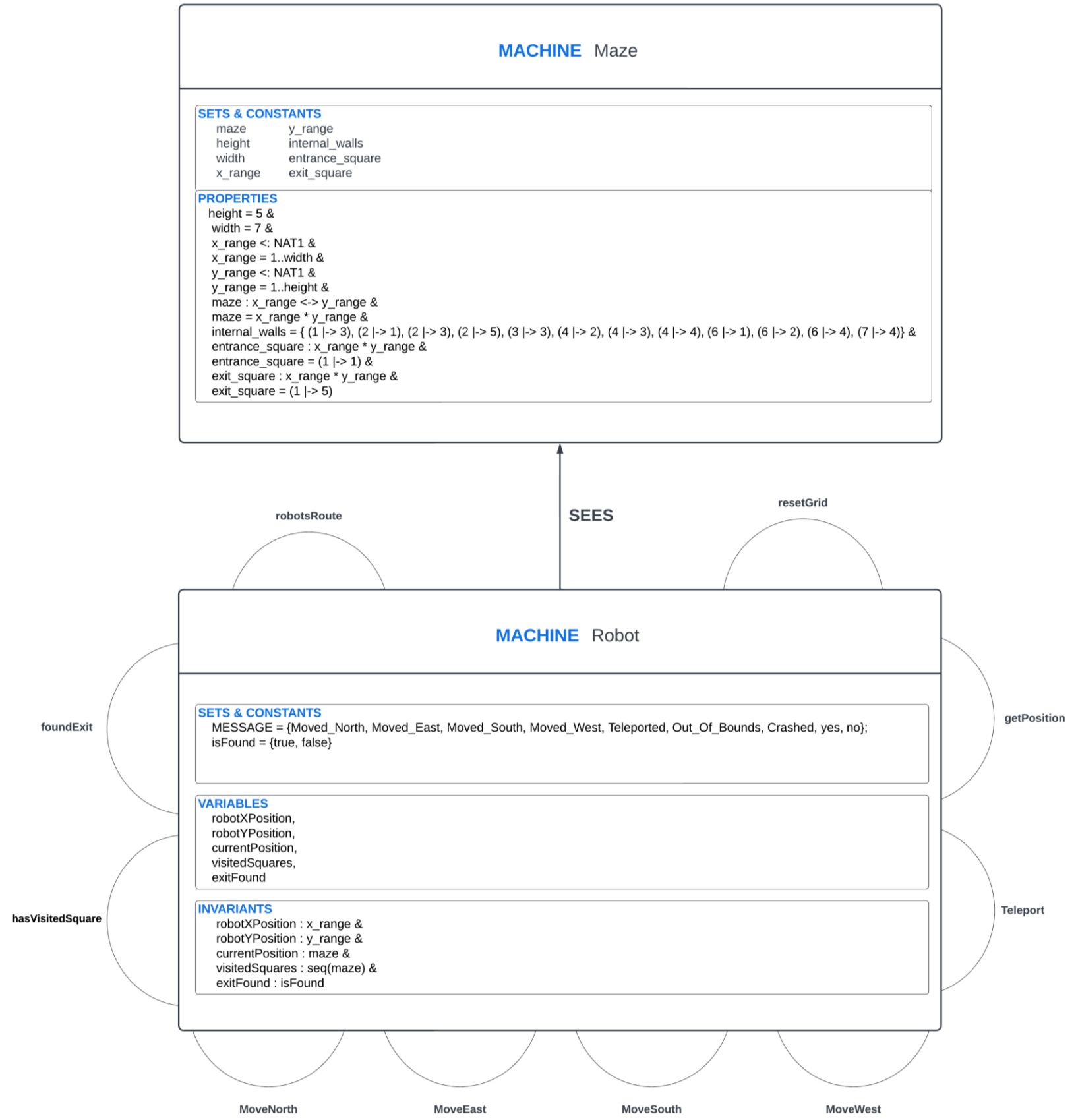
MACHINE Maze
SETS & CONSTANTS
maze
height
width
x_range
y_range
internal_walls
entrance_square
exit_square
PROPERTIES
height = 5 &
width = 7 &
x_range <: NAT1 &
x_range = 1..width &
y_range <: NAT1 &
y_range = 1..height &
maze : x_range <-> y_range &
maze = x_range * y_range &
internal_walls = { (1 |-> 3), (2 |-> 1), (2 |-> 3), (2 |-> 5), (3 |-> 3), (4 |-> 2), (4 |-> 3), (4 |-> 4), (6 |-> 1), (6 |-> 2), (6 |-> 4), (7 |-> 4)} &
entrance_square : x_range * y_range &
entrance_square = (1 |-> 1) &
exit_square : x_range * y_range &
exit_square = (1 |-> 5)
SEES
robotsRoute
resetGrid
MACHINE Robot
SETS & CONSTANTS
MESSAGE = {Moved_North, Moved_East, Moved_South, Moved_West, Teleported, Out_Of_Bounds, Crashed, yes, no};
isFound = {true, false}
VARIABLES
robotXPosition,
robotYPosition,
currentPosition,
visitedSquares,
exitFound
INVARIANTS
robotXPosition : x_range &
robotYPosition : y_range &
currentPosition : maze &
visitedSquares : seq(maze) &
exitFound : isFound
foundExit
getPosition
hasVisitedSquare
Teleport
MoveNorth
MoveEast
MoveSouth
MoveWest

Explanation of "state invariants" used in the system

The state invariants describe the properties the states must satisfy at all times.

The state variables in that should be managed in the system are,

1. robotXPosition
2. robotYPosition
3. currentPosition
4. visitedSquares
5. exitFound

Since the robot can only move within the bounds of the maze, the position of the robot is always within x_range(7) and the y_range(5). Therefore, the robotXPosition and robotYPosition will always be a value that is a subset of the x_range and y_range respectively. This can be represented as an invariant as,

robotXPosition : x_range &

robotYPosition : y_range

Furthermore, since the current position must always be a square on the maze, it is denoted as being an element of the maze relation (x_range <-> y_range).

Finally, we are required to keep track of whether the exit has been found or not to stop the application. This should be considered as a boolean and the values for this are stored in isFound which is the set (true, false). Since exitFound should always be of this type, we denote it as,

exitFound : isFound