1. PROBLEM DEFINITION

Design a controller for a system defined as follows:

- A 6 dof manipulator is the effector of the robot. The current position of the manipulator is obtained from its motor encoders, i.e., this is the proprioceptive input.
- The end-effector of the manipulator forms a cylinder with 5 binary touch sensors attached, 4 of which are evenly located on the circumference, while the fifth protrudes from its axis and is parallel to it. Those exteroceptors are used to detect the walls and the floor of the maze.
- The environment in which the robot operates, i.e., the maze, is flat, however it contains walls that are at right angles to each other. Those walls run either from east to west or from south to north and do not form cull-de-sacs.
- The operator (treated as an agent that needs no definition) separately sets the initial location of the end effector, from which the maze running starts. This is done by a SET command. The execution of the maze running task is initiated by a START command. The START command causes the robot to go to the initial position, moving above the walls of the maze, and then it tries to find the exit of the maze, which is defined as a location outside the perimeter of the maze. The execution of the task can be terminated prematurely by the operator issuing a STOP command. Please note that the operator issues 3 different types of commands. The operator contacts the robot via wireless communication.
- The location of coordinate system attached to one of the corners of the maze with respect to the robot's base coordinate system is known and constant. The height of the walls is also known and constant. The perimeter of the maze is defined in relation to the mentioned coordinate frame and is a rectangle with known dimensions. The sides of the rectangle run along the x and y axis of the frame attached to the corner of the maze. The height of the wall is in the z direction.

Define the structure of the system in terms of agents. Define the necessary:

- internal structure of the agent,
- sampling rates of the agent's subsystems (i.e., the iteration period of a behaviour of each subsystem),
- general behavior of the virtual effector and receptors (just a general statement what those subsystems do will suffice – there is no need to define the transition functions or the finite state automaton governing the actions of these subsystems),
- data structures (buffers) within the control subsystems of the agent,
- transition functions and terminal conditions governing the behaviours of the agent (just the control subsystem) – state those in mathematical terms,
- structure of the control program of the control subsystem invoking the above defined behaviours (e.g., a graph, where the nodes represent behaviours and arcs are labelled by predicates representing initial conditions for behaviour execution).