Homework
Robot Programming Methods (ERPM)

Problem

Design a controller for a system defined as follows:
- The hardware of the system consists of a 6dof manipulator and a suction gripper. The manipulator is actuated by 6 electric motors with encoders attached to their rotors. The manipulator is located between a conveyor having black tape and a feeder providing molds. Moreover, the system is equipped with a Kinect sensor looking at the conveyor. The location of all of those devices is known in relation to a fixed base coordinate system.
- The task of the system is to detect flat objects (e.g. cakes) having one of the three shapes: regular triangle, square or circle. The objects arrive on the conveyor. The objects lie flat on the conveyor, they are located randomly, yet far apart (they do not overlap). The objects are white and of constant size. They have to be inserted into plastic molds provided by the feeder. The feeder makes available three types of molds: triangular, square and circular, into which the delivered objects fit loosely. All three types of molds are available simultaneously. Whenever an object is inserted into a mold, the mold is instantaneously removed from the feeder and the next one of the same shape is supplied. Neither the conveyor nor the feeder are controlled by the designed system – thus their controllers need not be designed. The velocity of the black conveyor tape is not greater than 0.1 m/s and moves continuously.
- The system starts its work after receiving the START command, signaling that the conveyor is moving and the feeder is ready, and terminates when the STOP command appears. The commands are issued by a separate agent that need not be specified here.

Define the structure of the system in terms of agents. Define the necessary:
- internal structure of the agents,
- sampling rates of the agents' subsystems (i.e. iteration period of a behavior of each subsystem),
- general behavior of the virtual effectors 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 automatons governing the actions of those subsystems)
- data structures (buffers) within the control subsystem of the agent,
- transition functions and terminal conditions governing the behaviours of the agent (just the control subsystem) – state those in mathematical terms; assume that no error conditions are necessary,
- structure of the FSM of the control subsystem invoking the above defined behaviours (e.g., a graph, where the nodes represent behaviours and arcs are labeled by predicates representing initial conditions of behaviour execution).

The design of the controller should be specified using the formalism presented in the lecture notes.

Deadline for submission of the homework is the 8th of January, 2024 at noon (12:00). Deliver the result of your work to Prof. Wojciech Szynkiewicz.