COMPSYS 704 Group Project

Riley Fromont and Tomas Antunes

Operation Instructions

Note: This project was built and run using Eclipse on Windows.

1. Run BuidAll.launch

2. Wait for console to read <terminated>

3. Refresh Project to find files

4. Run RunController.launch

5. Run RunPlant.launch (this will open our GUI)

6. Run OrderingSystem.java (this opens our simple POS)

To make an order select the liquid that are desired on the POS then press the order button and the ok button on the pop-up window. If no order is made the bottle will remain in position 2 until an order arrives and the bottle can be filled.

To begin the bottling process the add bottle button must be pressed. To progress the bottling process, press the enable button.

To refill the caps press the refill button.

To remove the bottle cap and allow the bottling process to continue, press the remove cap button. A bottle cap is added randomly to the bottle.

System Overview

Our system uses SystemJ to separate each device of the overall system into their own separate Clock Domains, consisting of multiple parallel reactions implementing the functionality of those devices. A

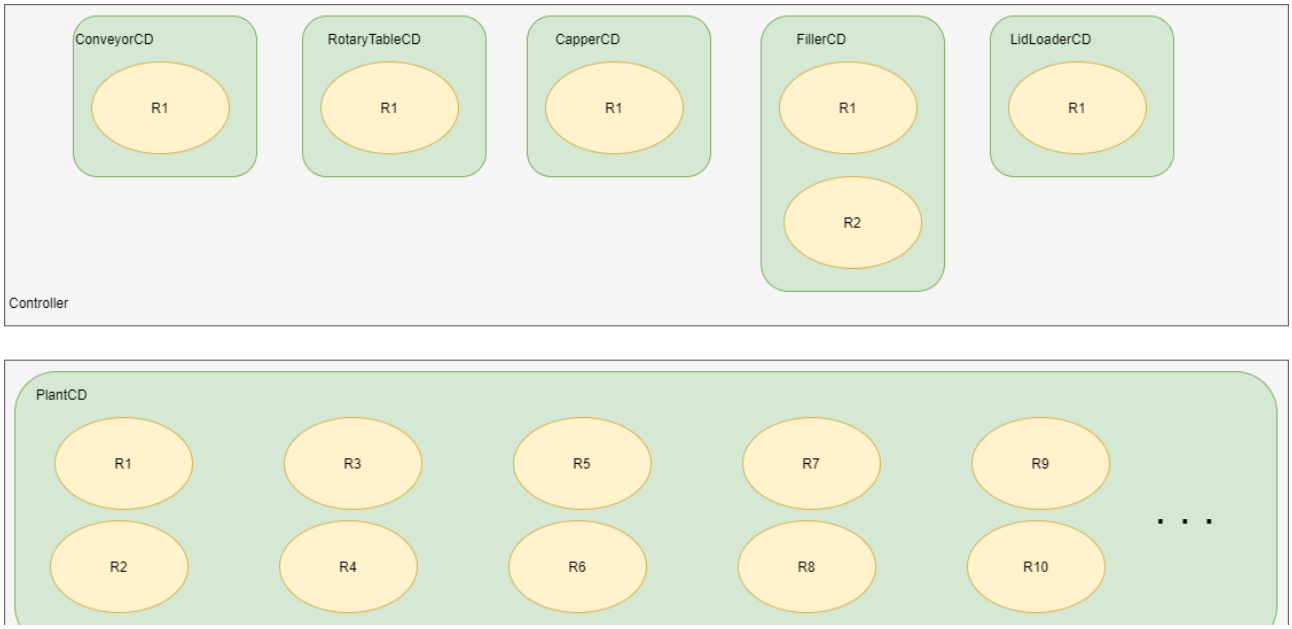


Figure 1: SystemJ representation of System

brief diagram illustrating this is shown below (Figure 1). In our design each device controller is contained within its own Clock Domain. The Controller Clock Domains communicate with their respective reactions within the PlantCD. The Plant.sysj file contains a single clock domain which consists of many reactions that model the actuation of hardware in the system. The Plant also communicates with the GUI to illustrate the state of the system to the user and allows the user to step through and control the simulation using buttons.

Component Operation Descriptions

Each component/device has its own Tab in our GUI illustrating the signal states for the device with a bit of context. The components primarily work independently with one another, and only communicate with other devices on the completion of their process. Below are brief descriptions of each device and the logic that drives their operation.

Conveyor

The Conveyor device is designed to bring bottles to and from the Bottling Station's Rotary Table and executes with the help of a few sensors which determine the location of the ordered bottle and a conveyor motor which drives the belt to move the bottles.

The Conveyor device operates with the following steps:-

1. Wait until no bottle on conveyor
2. Enable conveyor motor
3. Check if bottle at position 1
4. Turn off conveyor motor if bottle at position 1
5. Wait for bottle to be at position 5
6. Turn conveyor motor on
7. Wait until bottle registered as having left conveyor
8. Turn off conveyor motor

Rotary Table

The Rotary Table is designed to move the bottles between the different stations and stages of the Bottling Process. The device consists of sensors which check the table alignment and location of the bottle, and an actuating motor which rotates the table.

The Rotary Table operational logic is as follows: -

1. Wait for a bottle to be sensed at Position 1 and check the bottle does not have a cap on it
2. If bottle has a cap, wait for the bottle to be removed.
3. Rotate the Table until the bottle is sensed at Position 5 or the Table is Aligned with a station.
4. Wait for Station 2 to signal that the operation is completed
5. Rotate the Table until the bottle is sensed at Position 5 or the Table is Aligned with a station.
6. Wait for Station 3 to signal that the operation is completed
7. Rotate the Table until the bottle is sensed at Position 5 or the Table is Aligned with a station.
8. Wait for Station 4 to signal that the operation is completed
9. Rotate the Table until the bottle is sensed at Position 5 or the Table is Aligned with a station.

Filler (Station 2)

The Filler Station fills the bottle up with a specified liquid or mixture of liquids and is built with sensors indicating the state of the cylinder holding the liquid to be expelled into the bottle. The filler station can fill the bottle with 4 different types of liquids and can mix them accordingly. Our design and implementation can fill a bottle with multiple liquids but operates with a few assumptions and limitations.

1. Each liquid can only be used once in an order.
2. The quantity of the required liquid is assumed to be one "full cylinder's" worth of the Filler's inlet.
3. The liquids labelled 1,2,3,4 can only be added in 'numerical' order e.g. 1 then 2 or 2 then 4 etc.

The Filler Station operational logic comes in two parallel reactions which are summarised below: -

Reaction 1 (Liquid Selection):

1. Request Liquid order values from FIFO.
2. For each liquid in order (determined via bitwise operation on Integer value)
    i. Switch liquid/nozzle until the requested liquid is found
    ii. Signal other reaction that correct liquid/nozzle is present
    iii. Wait until Filling process has completed then move to next iteration
3. Once all liquids have been added, signal end of order.

Reaction 2 (Filling Operation):

1. Wait for the end of order signal to be present or that the correct liquid/nozzle is present
2. If end of order signal is present signal rotary table that the station is finished
3. If the bottle is at Position 2, Inject the liquid into the cylinder and retract the pressure cannister.
4. Once the cylinder is full, stop injecting liquid and open the inlet allowing the liquid to be expelled into the bottle. Force the pressure cannister down
5. Once the cylinder is empty and the pressure cannister is at the bottom, close the inlet
6. Repeat.

Lid Loader (Station 3)

The Lid Loader feeds a lid to the Capper Station. In our design we hold the bottle at position 3 in the rotary table until the Lid Loader has completed its operation. The lid loader consists of a magazine containing lids, a pusher and arm with a vacuum gripper.

The Lid Loader logic is summarised below: -

1. Wait for the bottle to be sensed at Position 3
2. Move arm to destination position
3. Extend the pusher to move the lid
4. Retract the pusher
5. Move the arm to the lid (Source)
6. Turn on vacuum and wait for grip sensor to be active

7. Move arm to destination position while sustaining the vacuum on
8. Turn off vacuum and wait for lid to be released
9. Move arm back to source position
10. Signal rotary table that station 3 is finished operation.

Capper (Station 4)

The Cap Loader attaches a lid onto the bottle and utilises actuators to grip and twist the bottle and cap, as well as controlling a mechanical arm. These actuators are controlled via signals which indicate the location of the bottle and capping unit.

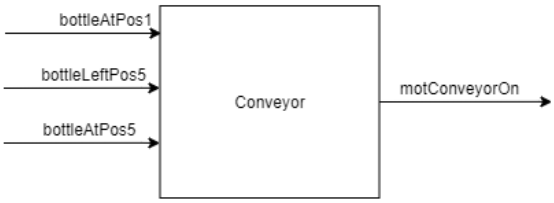
The Cap Loader operates as follows: -

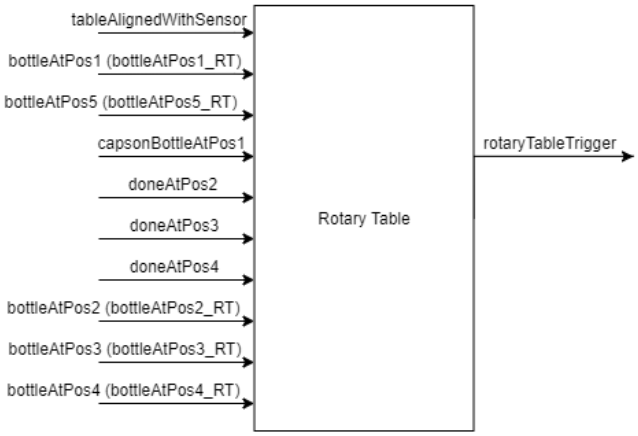
1. Wait for bottle to be sent at Position 4
2. Clamp the bottle and lower the gripper
3. Grip the cap and twist the cap onto the bottle
4. Release Cap and untwist the gripper
5. Raise the gripper
6. Unclamp Bottle

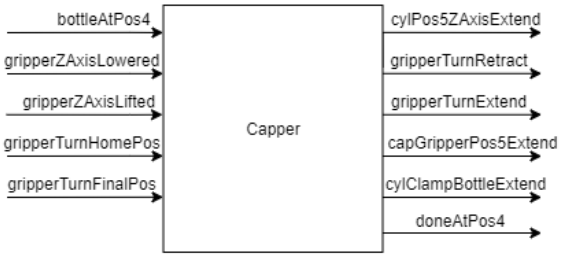
ABS

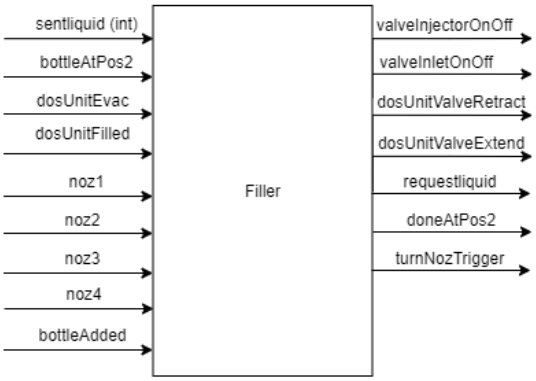
Sensor Signal input

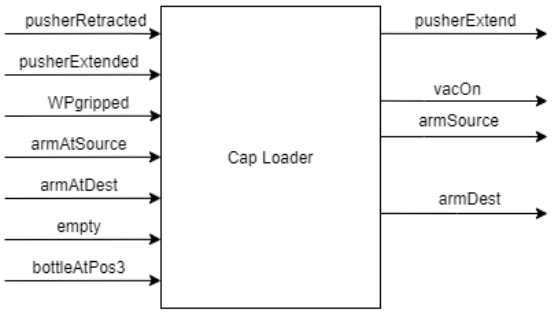
Signal Out











The plant also includes output signals to the GUI. There is a GUI bound signal for each of the inputs and outputs of the plant. These have the same name with an 'E' appended on the end.