CompSys 704

Project 1

By Jouveer, Jason, and Phoenix

ABS Overview:

Lid Loader:

Function:

Picks up caps from magazine, places caps onto the filled bottle. Does not screw the cap on to the bottle

Signals:

Input
pusherRetracted: Indicates the pusher has been retracted.
pusherExtended: Indicates the pusher has been extended.
WPgripped: Indicates the workpiece has been picked up by the suction cup.
armAtSource: Indicates the rotary drive is reached to the source to pick up a workpiece
armAtDest: Indicates the rotary drive is reached to the destination
empty : Indicates the magazine barrel is empty

Output
pusherExtend: Continuous emission of this signal causes the pusher to extend (Absence of this signal will cause the pusher to retract)
vacOn: Continuous emission of this signal will turn the vacuum on.
armSource: Continuous emission of this signal causes the arm swivels to the source position to pick up a workpiece
armDest: Continuous emission of this signal causes the arm swivels to the destination position to drop off a workpiece

Conveyor

Function:

Moves bottles along, inserts bottles into position 1, and removes bottles from position 5

Signals:

Input
bottleAtPos1: Present when a bottle is arrived at position 1 of the index table.
bottleLeftPos5: Present when there is a bottle, which left from position 5 of the index table, still on the conveyor

Output
motConveyorOnOff: Enabling/disabling the conveyor motor.

Filler

Function:

Fills the bottles with the required liquid and the correct amount of liquid. With capability to fill multiple different liquids

Signals:

Input
bottleAtPos2: Present when the bottle is at position 2
dosUnitEvac: Present when a pressure canister is at bottom
dosUnitFilled: Present when a pressure canister is at top

Output
valveInjectorOnOff: Turns on or off the valve injector (Absence of this signal will turn off the injector)
valveInletOnOff: Opens the inlet valve (Absence of this signal will close the inlet)
dosUnitValveRetract: Brings the pressure canister to top
dosUnitValveExtend: Brings the pressure canister to bottom

Turntable

Function:

Checks Turns the rotary turntable 60° when required to position the bottles at the right place

Signals:

Input
tableAlignedWithSensor – Present when the positions of the index table are aligned with the sensors (photo-eyes).
bottleAtPos5 – Present when the bottle is at position 5
capOnBottleAtPos1 – Present when there is a cap on bottle at position 1

Output signal
rotaryTableTrigger – Turns the rotary table while a status of this signal is true

Capper

Function:

Twists the cap on top of the bottle to tighten it

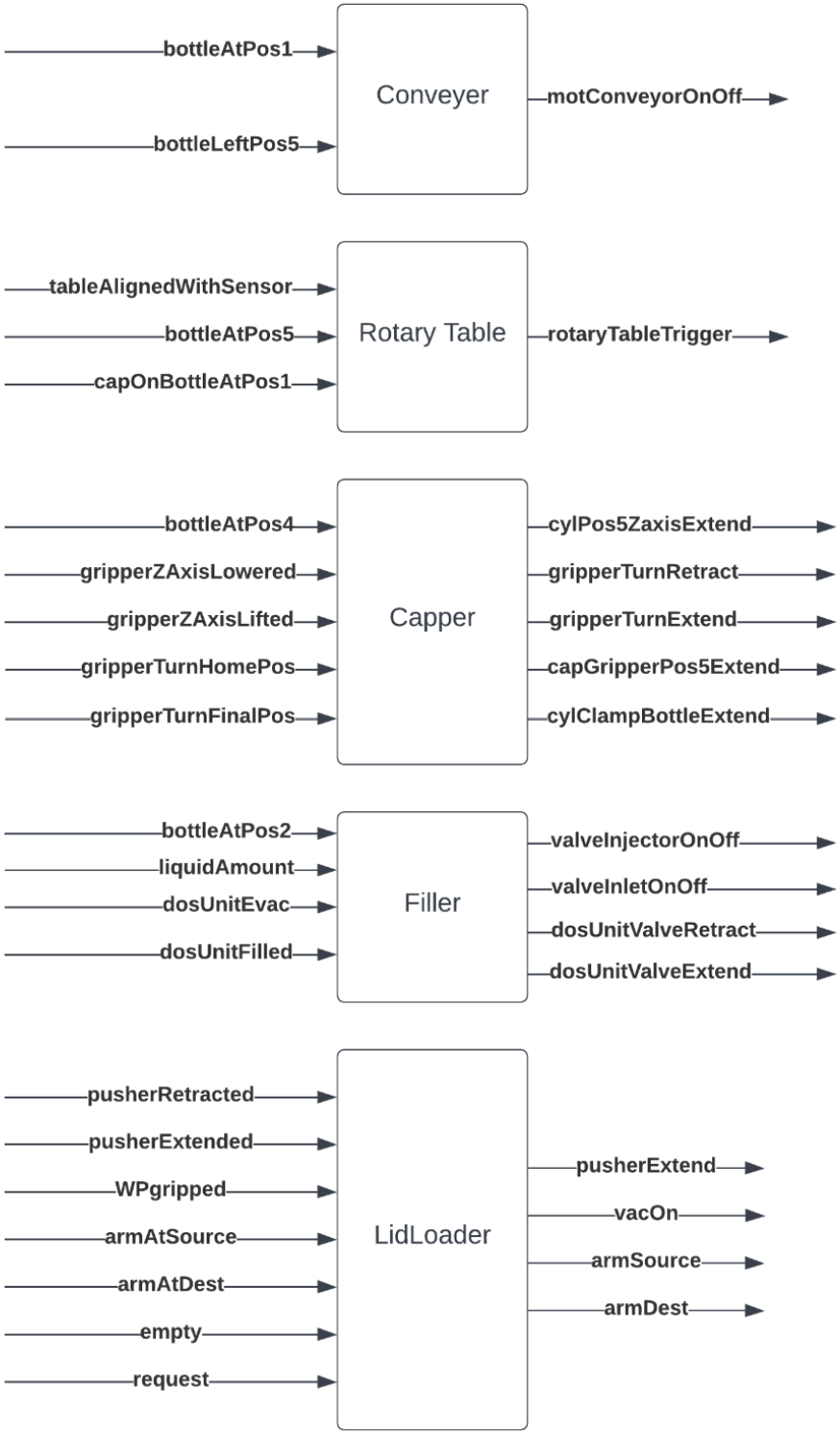
Signals:

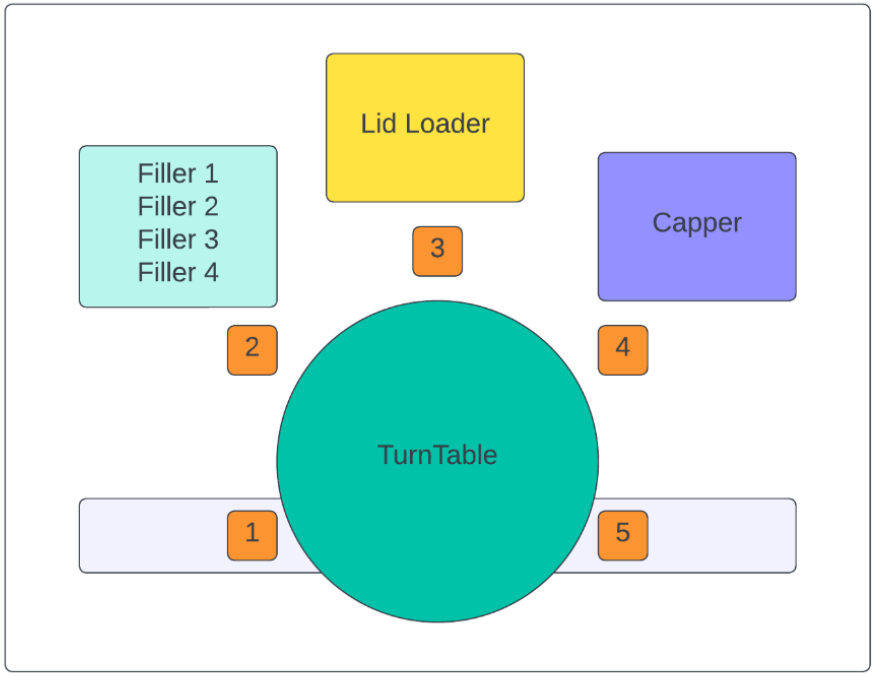
Input
bottleAtPos4: Present when a bottle is at position 4
gripperZAxisLowered: Present when the gripper/capper unit is fully lowered
gripperZAxisLifted: Present when the gripper/capper unit is fully lifted
gripperTurnHomePos: Present when the gripper is at the initial position
gripperTurnFinalPos: Present when the gripper is fully turned

Output
cylPos5ZaxisExtend: Brings the gripper down (Absence of this signal will bring the gripper up)
gripperTurnRetract: Untwists the gripper
gripperTurnExtend: Twists the gripper
capGripperPos5Extend: Grips the cap (Absence of this signal will release the cap)
cylClampBottleExtend: Clamps the bottle (Absence of this signal will unclamp the bottle)

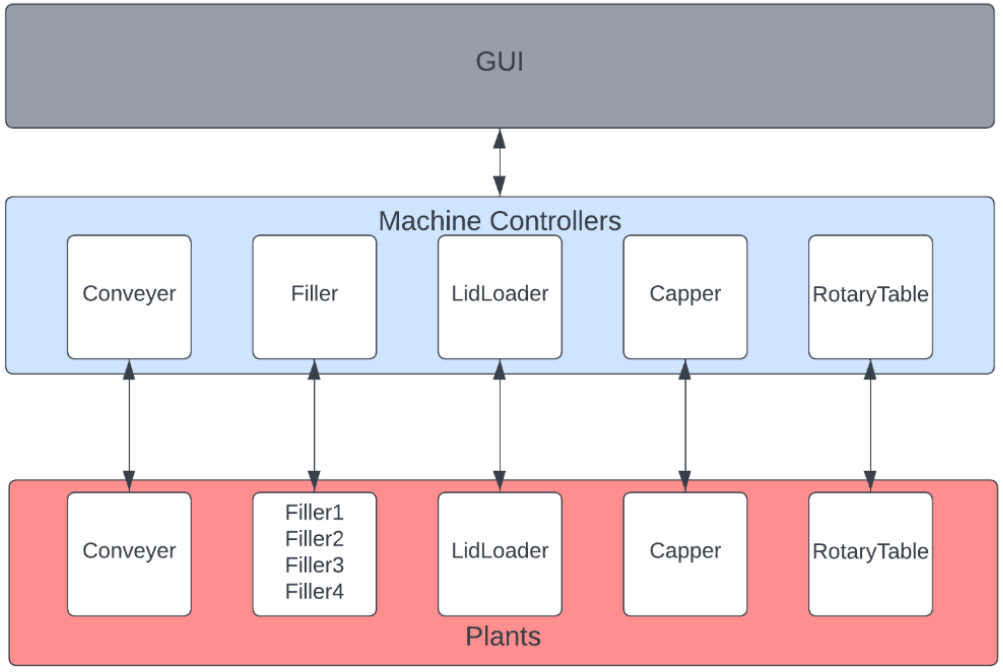
Process

1. The bottle loader picks up an empty bottle and places it on the conveyor at the bottle load point (left end of conveyor)
2. The bottle travels on the conveyor until it reaches the turntable and the presence of the bottle at that point is recognised by a sensor.
3. The turntable rotates and moves the bottle in steps of 60 degrees;
    a. First step moves the bottle until it is below the liquid filler.
    b. The bottle is filled, and the turntable rotates once more, until it is at the lid placement point
    c. The lid loader picks a lid supplied from a magazine to the pick-up point and places it on the bottle.
    d. The turntable rotates one more step, where the capper then pushes and screws the lid onto the bottle
    e. Finally, the turntable rotates one more step, where the finished bottle is taken over by the conveyor and moved to the collection point at the right end of the conveyor


bottleAtPos1
bottleLeftPos5
Conveyer
motConveyorOnOff
tableAlignedWithSensor
bottleAtPos5
capOnBottleAtPos1
Rotary Table
rotaryTableTrigger
bottleAtPos4
gripperZAxisLowered
gripperZAxisLifted
gripperTurnHomePos
gripperTurnFinalPos
Capper
cylPos5ZaxisExtend
gripperTurnRetract
gripperTurnExtend
capGripperPos5Extend
cylClampBottleExtend
bottleAtPos2
liquidAmount
dosUnitEvac
dosUnitFilled
Filler
valveInjectorOnOff
valveInletOnOff
dosUnitValveRetract
dosUnitValveExtend
pusherRetracted
pusherExtended
WPgripped
armAtSource
armAtDest
empty
request
LidLoader
pusherExtend
vacOn
armSource
armDest


Lid Loader
Filler 1
Filler 2
Filler 3
Filler 4
Capper
3
2
4
TurnTable
1
5

GUI Mockup

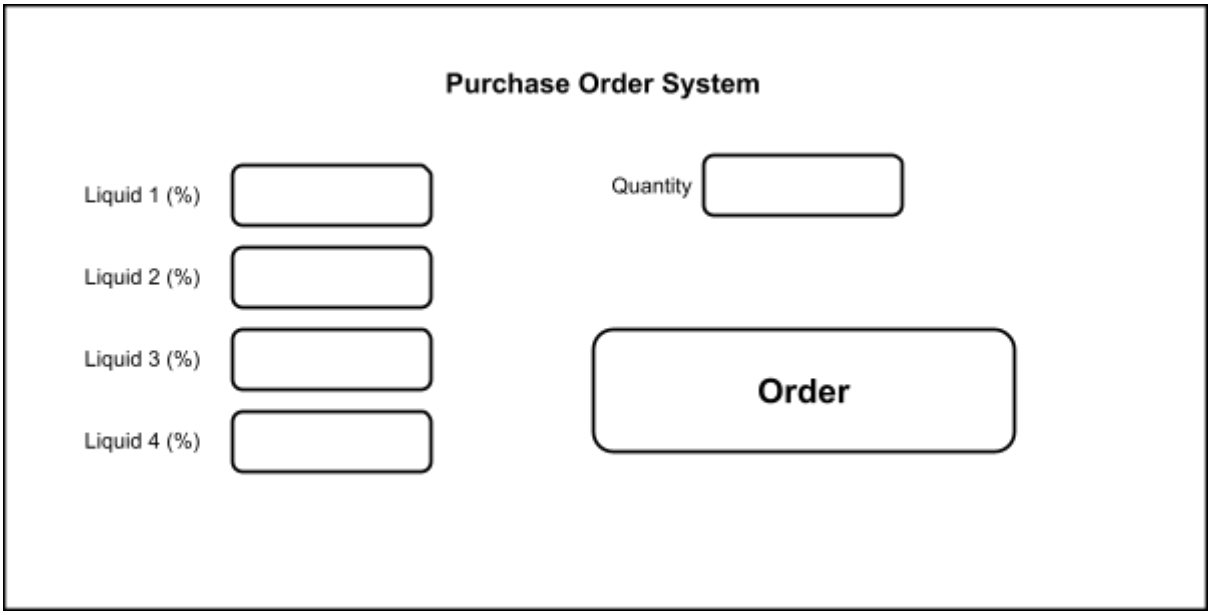

GUI
Machine Controllers
Conveyer
Filler
LidLoader
Capper
RotaryTable
Conveyer
Filler1
Filler2
Filler3
Filler4
LidLoader
Capper
RotaryTable
Plants

Task Allocation

Jouveer	Jason	Phoenix
CapController	ConveyorController	LidLoaderController
CapPlant	ConveyorPlant	ACS System
LidLoaderController	LidLoaderController	
RotaryTablePlant	RotaryTable	
POS System	ECS System	

Product/Purchase Order System (POS) - Jouveer

The POS is used so that order can be placed, then given to the ABS. The ABS will take the information given by the user in the POS and schedule the manufacture of the required amount, and mix the liquids in the required proportions.
The user interface will be created in Java, like the user interface given in the last lab.



Environment Control System (ECS) - Jason

The ECS has been split into 3 different sections grouped 3 different sections shown in the table below, it will be responsible for controlling the . The ECS is used to monitor and control the temperature and lighting of the facility while taking into account, current temperature, occupancy, working hours. An additional feature the ECS has to have is a fire detection system where once detected, it will activate the fire alarm and possibly a fire suppressant system.
The ECS will only be active during working hours of the facility (Assumed to be 9am-5pm) and then will utilise 3 concurrent reactions to monitor the temperature of each section and will control heaters and cooling within said sections

Lights
Section 1 will use an occupancy detector to determine whether a space is being used and will turn off after a certain amount of time has passed with no one using it.
Section 2 and 3 will always be on during operation hours due to storage of goods and the manufacturing section requiring a consistent temperature.

Grouping	Zones
Section 1 (Office)	1, 7
Section 2 (Storage)	2, 3, 4
Section 3 (Manufacturing)	5, 6

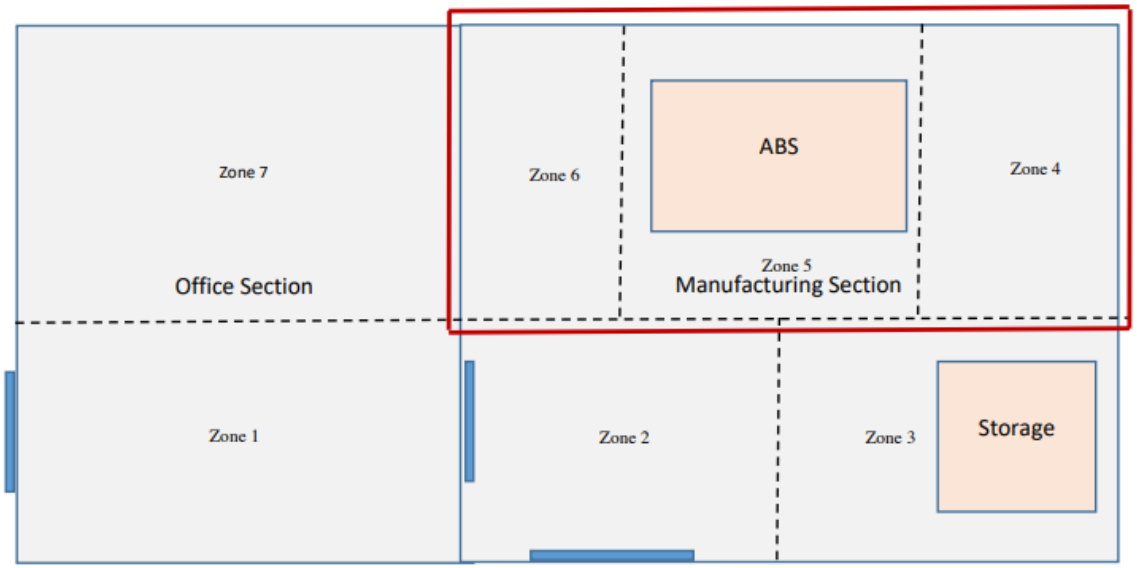


Figure 1 Manufacturing facility conceptual layout

Safety and Access Control System - ACS - Phoenix

Access Control System (ACS) controls movement of the personnel in the space. First, it authorises entry/exit from the Facility by the use of access cards and biometric information, the latter being only an option. Also, all personnel and visitors are issued a carry-on badge that enables identification and location of the personnel by using RF-based localisation system. Different access rights are assigned for Office section and Manufacturing section. Presence of personnel in the Manufacturing section is strictly controlled. Also, presence of personnel in the zones that directly associated with the manufacturing (ABS and around ABS) is detected and bottling process suspended as there must be no humans in the vicinity of the machines and the bottling process. Virtual boundaries, implemented using laser beams, are enforced around the ABS.

The ACS's main goals are to allow certain cards to access certain areas and to suspend the bottling process when the card is present in zone 4, 5 or 6.
Entry and exit from the facility is authorised through access cards and biometric information, the latter being optional. These cards can be programmed to allow access to different areas by zones.
Carry-on badges must be implemented to enable identification and location of the personal. This is achieved through an RF-based localisation system. These badges can be programmed to transmit location within the building and can store a specific hash or other identification method.
Through the use of virtual boundaries alongside the location transmission of the badges we can communicate to the machines doing the bottling process to suspend themselves immediately.