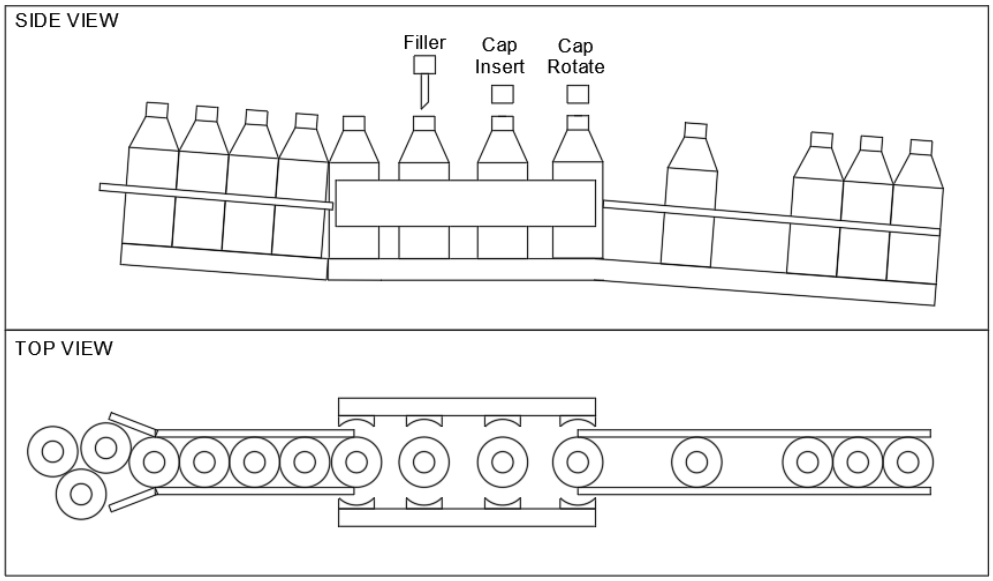
CONESTOGA COLLEGE
SCHOOL OF APPLIED SCIENCE AND TECHNOLOGY

Introduction to PLCs

Project 1

The Machine

Consider the following automation. It moves bottles into fill automation which fills the bottle, inserts a cap and then rotates the cap onto the bottle.



The parts are transferred station to station via a walking beam. The walking beam, when clamped, will secure the bottles at each station and then extend. When extended, all bottles have advanced one station. When the walking beam unclamps, the bottle on the right is free to transfer down the chute. The walking beam will then retract to position itself to secure the four parts in the new locations and clamp to secure the parts for automation.

The first station locates the bottle into a position where the walking beam can secure it. No operations are completed at this station.

The second station fills the bottle. The Filler spout needs to be lowered into the bottle before it can release product to avoid spillage. There is a proximity sensor to detect when the bottle is filled. Once the Filler spout is raised, the operation is complete.

The third station applies a cap onto the bottle. The caps are automatically fed into the fixture and a small cylinder pushes the cap down to sit loosely on top of the bottle.

The fourth station secures the cap onto the bottle. It has a motor that rotates the cap onto the bottle. The automation is lowered onto the cap and applies pressure. When the automation reaches the lowered position, we are assured the cap is fully secure.

There are two gravity conveyors that allow bottles to feed into and out of the machine. There is a sensor on the outfeed conveyor to ensure the walking beam doesn't advance unless there is room on the conveyor.

In addition to the project demonstration video, watch the following videos to get an idea of how this system would work in real life:

- Bottle Filling Machine - https://www.youtube.com/watch?v=tYWTLWnWZGQ
- Walking Beam - https://www.youtube.com/watch?v=DTRaTSV_T3E

The Details

1. ***Review the Project Videos:*** Note in the video it shows a few different options for programming, feel free to choose an option or program the whole system for extra complexity marks.
2. ***Review the I/O Drawings:*** Review the electrical input and output drawings to understand which sensors and outputs are available and how they are addressed.
3. ***Plan the Program:*** Choose all or a just a section of the automation to program with the following in mind, it is up to you to decide how it works!
    - Your system must be fully automated, (pressing simulation buttons to trigger the process is okay)
    - Input / Output Minimum Requirements
        - Program at least two **single solenoid valves or motor**
        - Program at least one **double solenoid valve**
        - Use at least 3 **sensors** to run your system
        - Program **Start/Stop control** so the system only runs when intended
        - Use at least two **lights**, that gives the user information regarding your system.
    - Programming Requirements
        - Use **SEALING** logic in at least three separate locations.
        - Do not use LATCHING instructions in your program.
        - Use **AND** logic at least twice (not including the AND required for sealing logic).
        - Use **OR** logic at least twice (not including the OR required for sealing logic).
        - Do not use an output energize more than once in the program for the same output address.
        - Use at least 2 **hardware** and 2 **simplified addresses** within your PLC rungs.
        - The program should run automatically without operator intervention when the cycle is active (Start/Stop control). *Clicking the reset buttons in the top right corner to reset a part is not considered operator intervention. Clicking a pushbutton (ie. PBA) while the cycle is active to extend a cylinder would be considered operator intervention.*
    - Program Organization
        - Organize your logic rungs into a meaningful order
        - Organize your logic rungs into appropriate subroutines (at least 2 not including the main routine)
4. ***Write and Test your Program:*** Use the project simulator to help test your program.
    a) Start with the Project #1 Template
    b) Write your program, note it can be as simple or as complex as you want!
    c) Comment your rungs and add descriptions to your addresses
    d) Test your program using the Project #1 Visual Interface.

5. ***Demonstration:*** Demonstrate your functioning program by creating a demonstration video of you describing and demonstrating your program. *Refer to the Recording and Submitting Videos document for helpful instructions and guidelines for creating and submitting your video.*

   Your video should not be longer than 3 minutes. Include the following in your demonstration:
   1. The stations you programmed and how the program should operate.
   2. How to start and stop the machine.
   3. What any lights represent.
   4. What any pushbuttons represent.
   5. You operating your program through at least 4 cycles.
6. ***Evaluation:*** Refer to the Rubric for a detailed marking breakdown.
7. **Submit -** Submit the following to the Project 1 Submission folder on eConestoga
   - Project 1 Logic.pdf - All PLC subroutines printed to one PDF file *Do not include the R99_Simulate routine*
   - Project 1.acd – The PLC program in RSLogix5000 format
   - Project 1 Demonstration Video Link - Link to the Demonstration Video, this can be in a word or pdf document, or in the comments of your submission.
   - **No Zip files please!**
8. **Things to Note**:
   - To be completed **individually**, no collaboration is permitted. If two projects are similar, it will be considered an academic offense.
   - **Due Week 5** **Refer to the Instructional Plan for specific deadline*
   - **10% of Final Mark**