Final Report

COMPSYS 704: Advanced Embedded Systems

Project 1

Group 7

Beck Busch (bbus692)

Frank Shen (fshe388)

Rufaro Manjala (rman429)

# 1. Introduction

Advantech Ltd., a company for manufacturing and delivery of sensitive and high value bottled liquids, have decided to build a new manufacturing facility that will automate the manufacturing process within the existing facility, provide advanced system for monitoring and controlling environmental conditions and access and security control.

This project is to develop this solution leveraging IoT concepts, synchronous programming and system-level designing. This is a milestone report documenting the progress and decisions made for this project.

# 2. Brief

The solution is facility wide. Incorporated in multiple parts of the physical facility as well as in the purpose of the facility, it has the following requirements:

* A developed Automated Bottling System, as this is facility’s purpose, to output orders of bottled goods
* Be able to monitor who is within the facility as well as specifically where they are
* Be able to provide security in the form of only allowing selected personnel in general and specific areas of the facility (e.g. restricted access to the main office)
* Continuously monitor and adjust the facility's climate factors such as humidity and heat to desired conditions. Even able to adjust the climate of specific areas differently within the facility
* Receive and process orders from registered customers for bottling

These are the high-level requirements from which more detailed and specific requirements stem from.

# 3.Design

The following section explores the design of the solution developed. Beginning by showing the overall design, each sub-system is further explained in subsections to provide a full explanation of the different components and subsystems

## Overall Design

As shows by the below <<Figure 1>>, the overall design is a collection of sub-systems running independently yet working with each other to fulfill the entire brief. A decentralized approach was chosen to allow for sake of modularity, ease of task allocation, and to reduce the chances of harmful coupling.

<<Figure 1 – Diagram of overall design>>

In the end the design had some differences to the initial specifications that were provided.....

## ABS

The Automatic Bottling System (ABS) is the sub-system tasked with the main objective of the facilities. This is to intake orders and act upon them by loading bottles, filling them with the ordered mix, capping securely closing the bottle, and passing it on. It goes about doing this by having multiple stations that the bottle passes through to complete each task.

### Capping Station

### Conveyor Belt

### Filler

**Input signal(s)**

* 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 signal(s)**

* 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) o dosUnitValveRetract – brings the pressure canister to top
* dosUnitValveExtend – brings the pressure canister to bottom

Basic operation of the filler clock-domain is:

1. Check if a bottle is at position 2, if not, wait until it arrives
2. Turn on the valve injector & pull pressure canister to top (will start filling with liquid). Stop filling once timer for filler ends or canister is fully retracted (whichever happens first).
3. Open inlet and force down the pressure canister until canister at bottom (fully extended)
4. Signal that its own process is finished
5. Wait for final filler to complete and for bottle to be moved along

The filler will keep looping through this while operating. There are four fillers. Each filler mixes in one liquid into the bottle. Each filler has an independent that it utilises

### Rotary Table

## ACS

## ECS

## POS

# 5.Conclusion