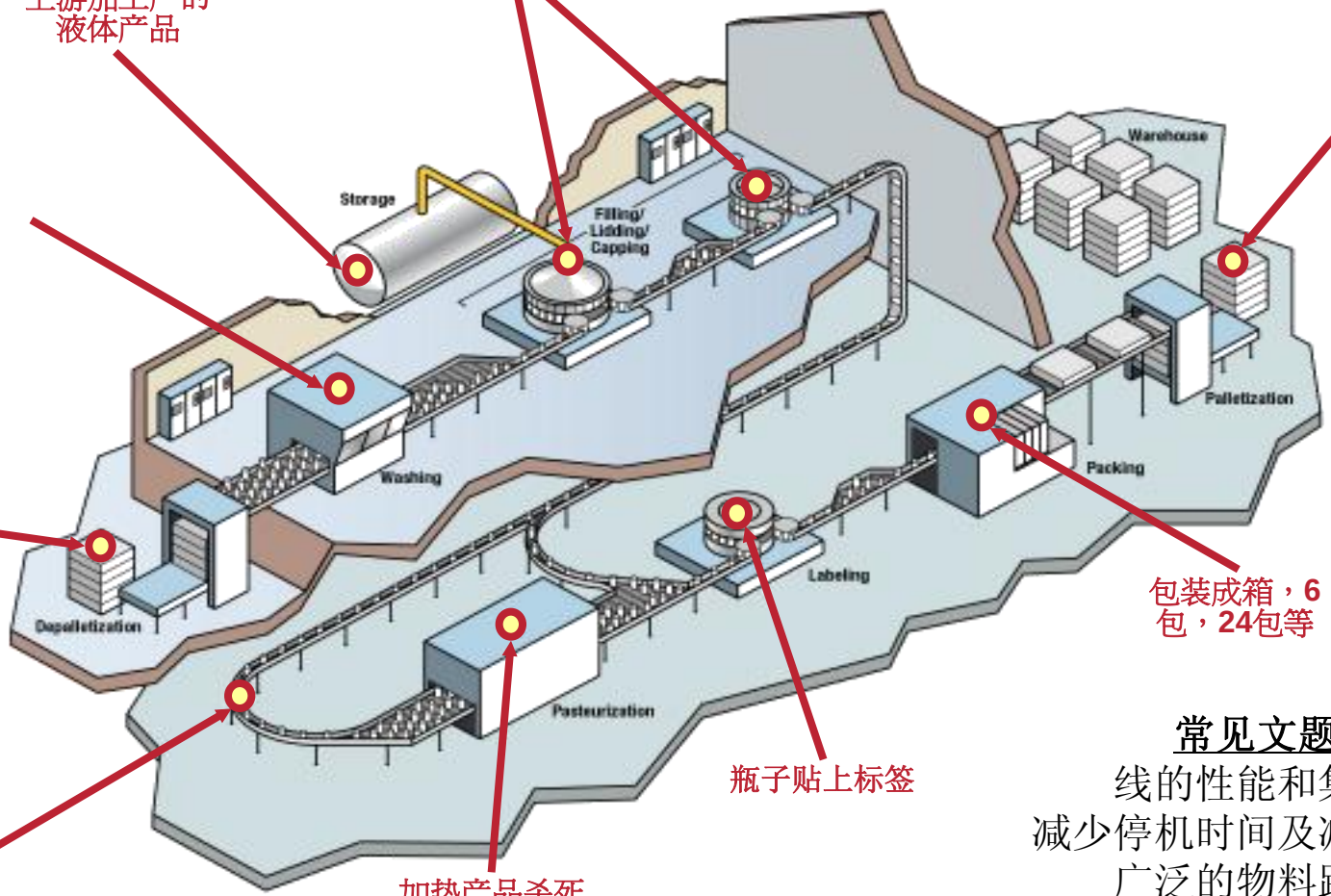
啤酒与饮料生产线整合-Brew and Beverage Line Integration

Customer Presentation

典型的包装生产线 - Typical Operations in Brew & Beverage Packaging

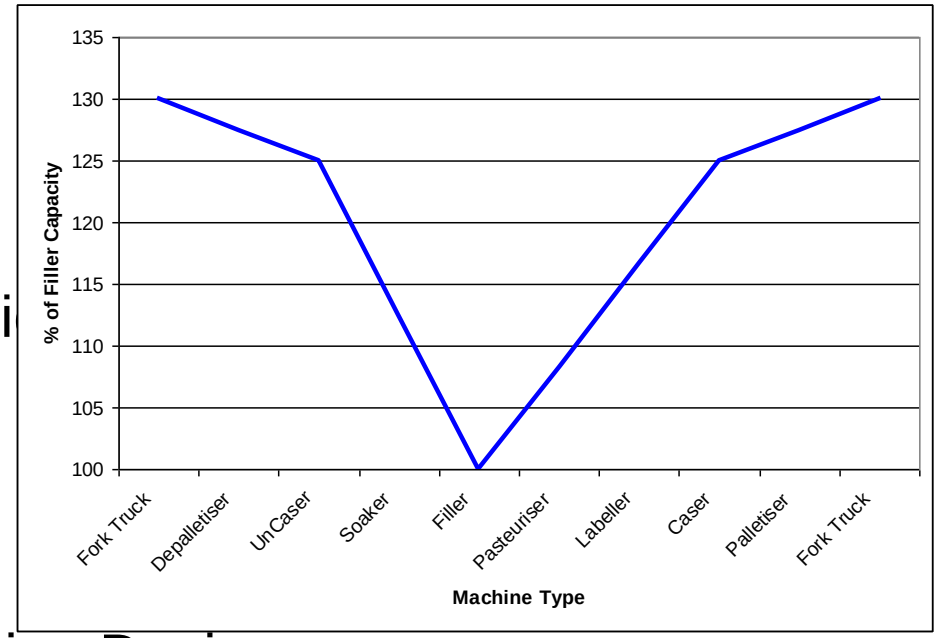


常见文题

线的性能和集成
减少停机时间及减少废物
广泛的物料跟踪
减少操作员工

Principles of Beverage Line Operation

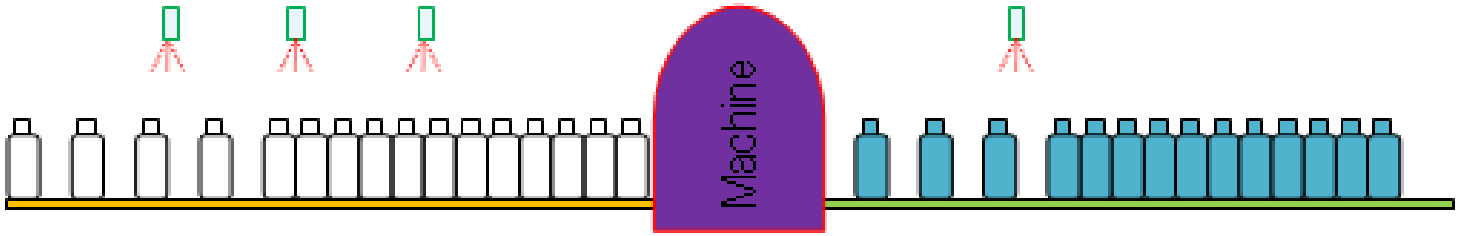
- Line should be “Balanced” around the Filler
  - Push empty containers “in”
  - Pull full containers “out”
  - Filler should run constant at 100% of its rated capacity
- Conveying System Design Criti
  - To prevent container damage
  - Bi-Directional accumulation tables up and downstream of Filler to keep line running
- Prerequisite factors for Good Line Design
  - Conveyor Section Length
  - Variable speed control for conveyors
  - Adequate buffer space for accumulation



Proper calculation of buffer zones and control programming is critical for optimal line layout and operation

Traditional Principle of Conveyor Control

- High End Lines:
  - Normally increase 1 or 2 sensors on the infeed conveyor to adjust machine running speed to Low/Mid/High speed.



  - Conveyor will be controlled.
    - Break down the line to several conveyor sections and handled by monitoring the status of each section.
    - The concept for this solution is actually filling up every section, make each section as full as possible. If gap been detected, the upstream section will try to moving faster to fill up the gap, ensure each machine can running continuously.

Concepts - Targets of Line Balance Control

- 基于生产线速度和线上设备的使用情况，来自动优化线上其他机器的运行速度，达到使整个生产线平稳运行的目的。
- 根据不同类型的输送带，基于生产线速度来自动优化设计它们的利用率，达到节能、有效储瓶并减少Downtime时间的目的；如果进一步优化输送带的机械设计---如带宽、带长等，将最终达到替代生产线集瓶台的作用，从而节省空间。
- 通过对全线设备和输送带的运行情况进行优化，达到提高全线生产效率的目的。
- 通过引入生产线控制的概念，建立起生产线控制的基础配方，这将极大节省更换生产品种所需的时间。
- 为将来和LMS系统连接，创造接口。

Line Buffering Concept

Modeling Line Components

Critical aspect of any form of LineFlow Control is estimating its fill volume as the fill volume in combination with the own, preceding and subsequent unit's material speeds is the base of a decision to increase, decrease speed or even generate a stop.

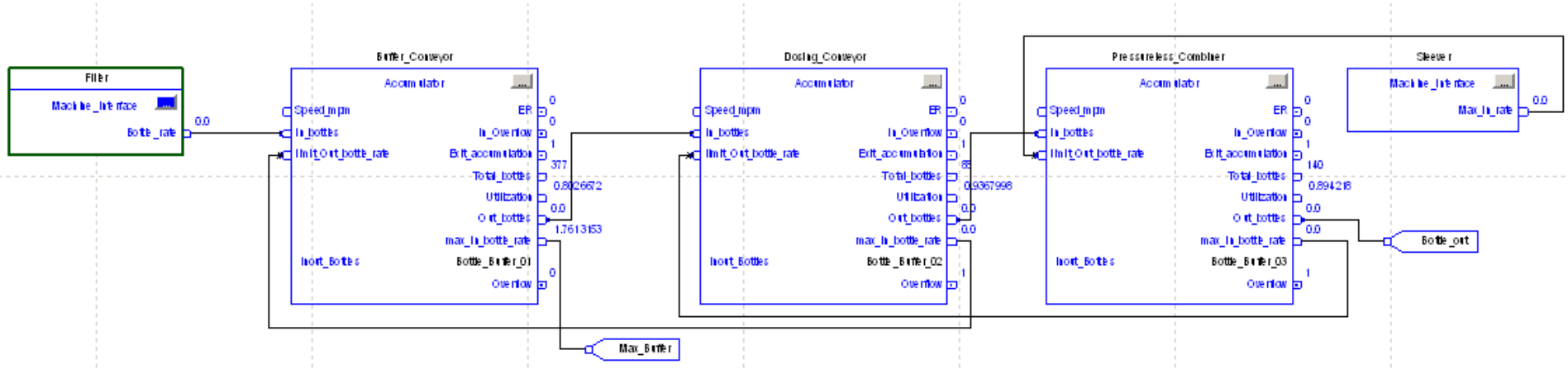
Our approach will be to program a geometrical buffer model for each Line Element that effectively passes counts of product (bottles) through the entire Line. For machines (Fillers, Labelers, Sleevers, wrappers) the physical production rate is easy to establish, while for bulk product conveyors this mechanism requires rate-relative estimates using

- Length
- Width
- Physical Speed
- Calculating Fill Volumes of the system
- Understanding speeds and volumes of systems before and after

Line Buffering Control Technology

An AOI is use to handle the flow control for each conveyor section, input the parameters of conveyor such like length/width/maximum volume/line speed etc. The instruction will calculate the actual volume of within each section, also realizing how many bottles are being deliver to next section.

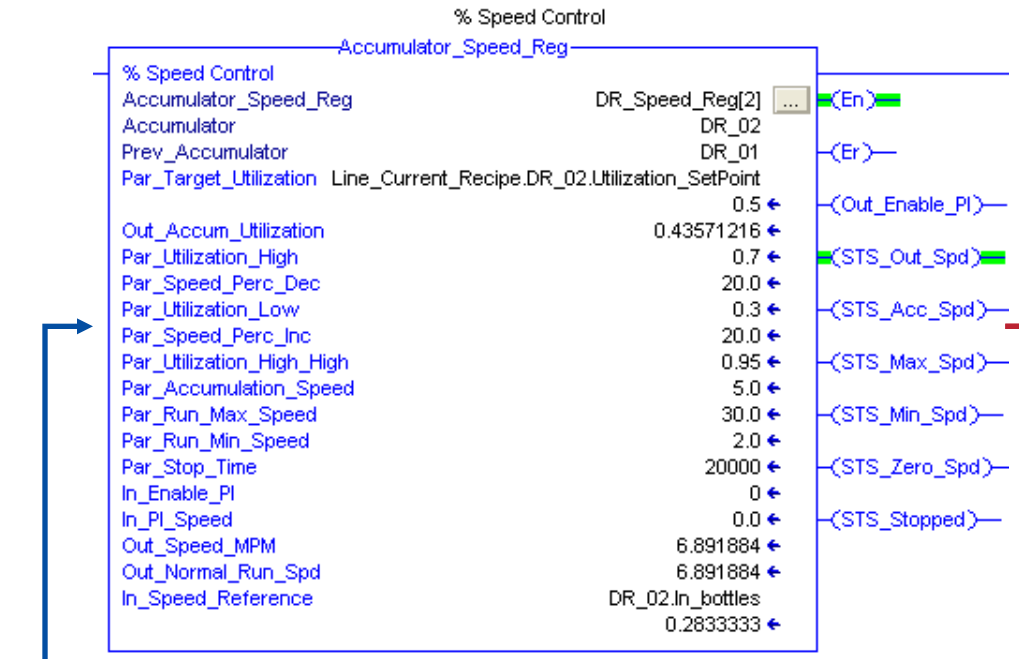
We can link up each instruction, just like a soft line layout, programmer can easily realized the status of each section and help to trouble shooting.



Line Integration and Balance Control Introduction

- A Concept where the line condition is simulated inside the controller and external components (Conveyors) are controlled
- Each conveyor speed will be regulated based on their set target utilization.
- An Add-on instruction called Accumulator with math algorithm will calculate the current utilization % of the conveyor.
- A Conveyor control add-on instruction with its user defined rules and regulations will control the speed of the conveyor based on the utilization data received from Accumulator Aoi.
- The Utilisation Vs Speed rules changes based on the conveyor function in the line (exit, accumulator, infeed).
- The speed command from the conveyor control AOI is

Technology Toolsets (AOIs) for Conveyor Control



Utilization as Calculated

Speed Command

Control Interface

-Module Control Program : according to the module functionality (eg : buffer , dosing, pressureless combiner, etc)

-Up-down stream Machine status to determine its module start/stop status

- Using accumulator utilization value to carry out the pre-determine control algorithm for mechanics interface

Drive Interface

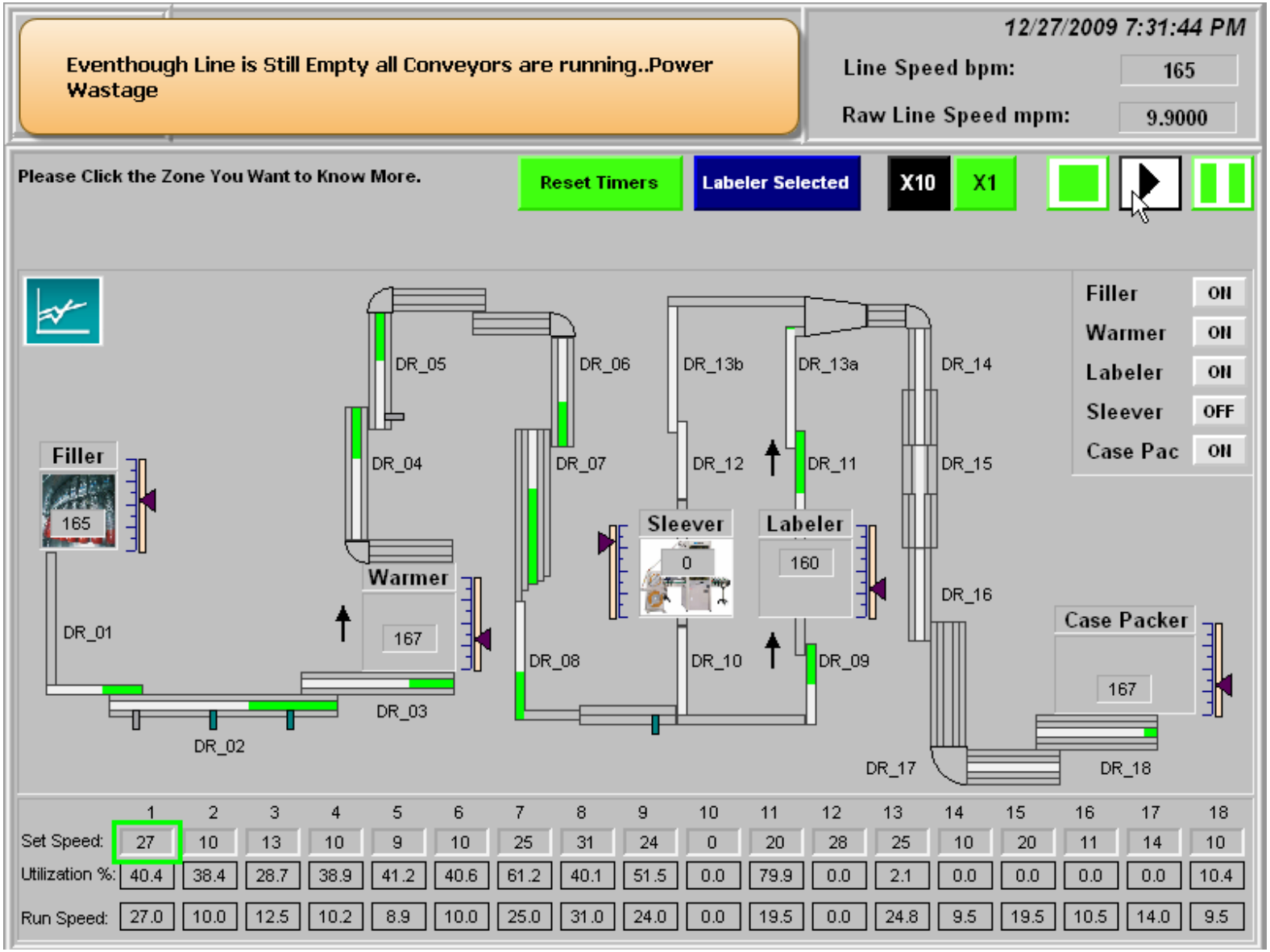
-Control the VFD

-Scalar from motor RPM to MPM

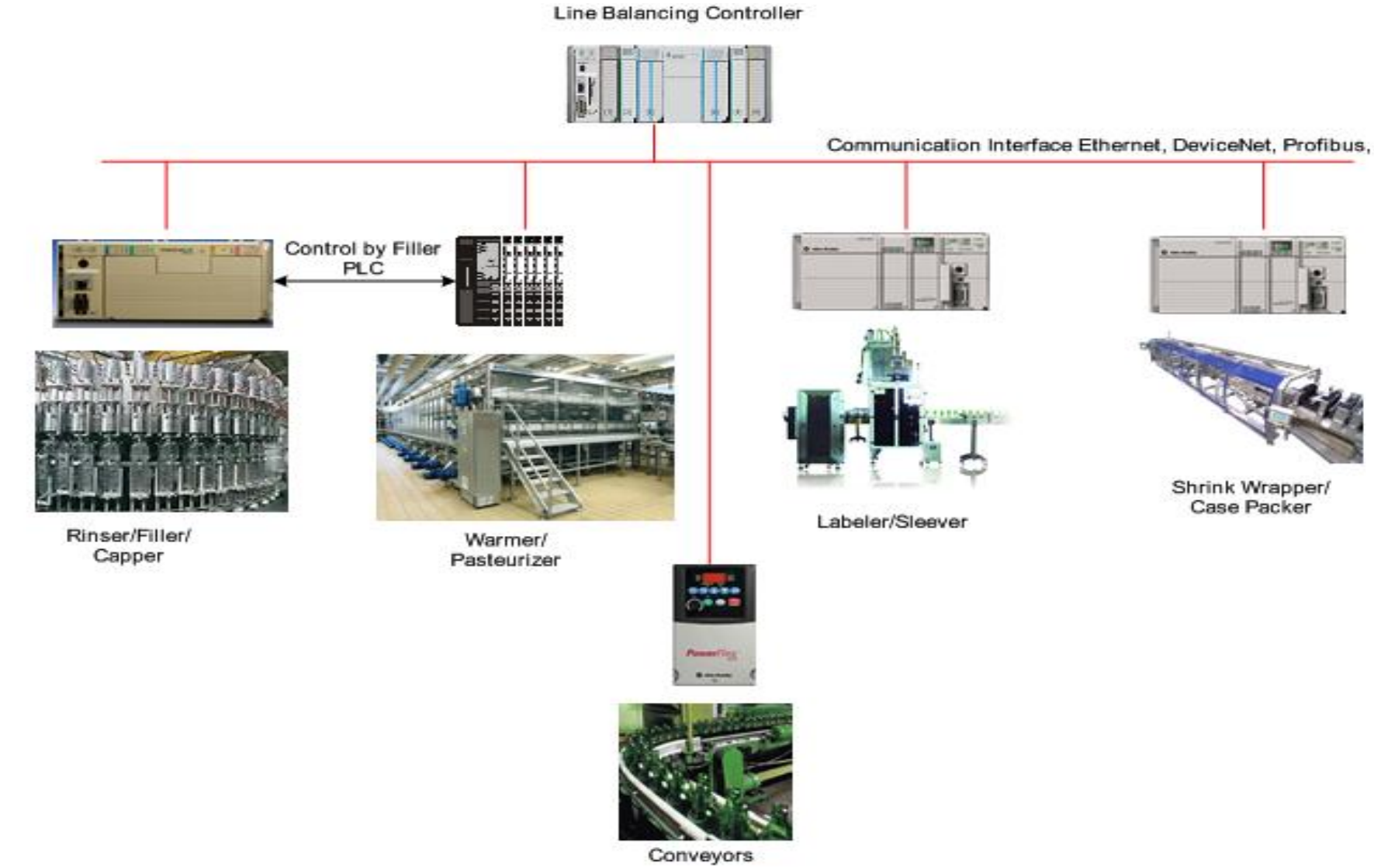
- PI to control the conveyor speed

-Line Speed value to accumulator AOI

Simulation Model for Packaging Line



Line Balancing Control for Beverage Line



Benefit from Integrated Architecture Line Interface

- All Machines software developed using PackML standard
  - State based programming with readily available template of PackML
  - Standard control and user interface for each machine. Ease of operation and less training

- Ease of Information exchange thru Ethernet
  - No need for physical digital/analog wiring
  - Pre-defined interface tags for machine to Line controller interface can be used as Produce Consume tags
  - Less time to interface
  - Centralised availability of data and diagnostic information. Machine, Conveyor Drive and Line Controller related data is available in one centralized user interface.