Robot Head Home Position

Start End

Head Movement

Capper Filled and Capped Bottle

Bottle Filling Conveyer Belt

DB

Empty Bottle

Product Level

Tank Fill ValveVT

cmdVT

Head Home Position

Head Movement CmdHeadSpd

ValveVB

cmdVB

DT = 20 cm

Product Level

Filled and Capped Bottle

Movement at a fixed but adjustable speed: cBeltSpeed
convSpeed: 10 cm / sec
flow: 100 ml/sec
headSpeedMax: 1 m/sec
Bottle Filling System

User

Master Control Computer System

Filling Control System

Robot

Plant

Tank

Filling Head

Capper

Conveyer

Bottles

Object Aggregation

Peripheral to the System

System to be Designed
System to be Designed

Bottle Filling System

Filling Management

Filler Management

Tank Management

Product Source

Filling

Capping

Conveyance Management

Conveyance

Containing

Information Management

Filling Control

Head Management

Functional Decomposition
Physical Objects and Their Interconnections
order = [start | stop | quantity + lifetime ]

User

order

numBottles

Filling Management

level: 0 to LMax

cmdVT: (open, close)

cmdHeadSpeed: -hSpdMax to +hSpdMax

hPosition: 0 to PHMax

cmdCapDate: date

cmdVB: (open, close)

Tank

Tank Flow

Filling Head

Bottle Flow

bottlePosition: 0 to BPMax

Bottles + Conveyer

Interfacing With the Environment
User Interface Management

Tank Control

Head Control

order
numBottles

level: 0 to LMax
cmdVT: (open, close)
cmdHeadSpeed: -hSpdMax to +hSpdMax
cmdVB: (open, close)
hPosition: 0 to PHMax
cmdCapDate: date

Expiration Date
Fill Time

Run

Expiry

numBottles

order

Expiration Date
Fill Time

Functional Synthesis
User Interface Management

Date Calculation

Display Number of Bottles

Geographic Interface

CMD = [start | stop | expiration data]

Command Interpretation

Head Control

Expiration data

run

definitionLevel

date

level

clock

Tank Control

bottlePosition

hPosition

Date

numBottles

date

Display

Message = numBottles

Geographic Distribution

Geographic Distribution

Filling Control

numBottles

cmdCapDate

cmdVB

cmdHeadSpeed

cmdVT
PC Type
Master Control
Computer

keyboard and mouse

Microprocessor
RAM
ROM
PWM

incConveySpd
LV1, LV2
Zero, P1, P2

clock

network interface

display

Capper Message - Serial
Valve Control - VB, VT
PWM - Motor Control

Hardware
Implementation
order = [start | stop | quantity + lifetime ]

Network Comms

Cmd Interpreter

Eval. Head Position

Eval Bottle Position

Head Control

Tank Control

Master Control

Software Implementation