System Validation Project Report

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1 Introduction

This is the introduction.

2 Requirements

2.1 System Components

- Lamp/Projector: L
- Inner Doors: DI1, DI2
- Outer Doors: DO1, DO2
- Input Stacks: I1, I2
- Output Stacks: O1, O2
- Airlocks: A1, A2
- Outer Robots: R1, R2
- Inner Robot: R3

2.2 Functional Requirements

- The wafers move along the production line from their Initial state (on the Input Stack), are printed on by the Lamp and reach the Final state (on the Output stack).
- As long as the Output Stack is not full, wafers keep moving along the production line.

2.3 Safety Requirements

- Both the Inner and Outer Doors of an Airlock MUST NOT be open at the same time.

2.4 Sequence

Initial Conditions: All Doors are closed. Lamp is off. Robots R1 and R2 are near the Input Stacks. Robot R3 waits at Lamp. Airlocks A1, A2 are closed. Input Stacks are not empty and Output Stacks are not full.

2.4.1 I/O Retrieval Sequence

- Check if Ix Stack not empty
- Robot Rx moves to Ix
- Robot Rx picks up the wafer at Ix
- Open the Outer Door DOx
- Move to DOx
- Place wafer at Ax
- Close DOx
- Wait till DOx opens
- Check if Ox Stack not full
- Pick (finished)wafer from Ax
- Close DOx
- Move to Ox

- Place (finished)wafer at Ox
- GOTO 1

2.4.2 Printing Sequence

- Detect wafer at Ax
- Check if DOx is closed
- Open DIx
- R3 moves to DIx
- Pick wafer at Ax
- Close DIx
- Robot R3 places wafer on Lamp L
- Lamp L turns on
- Detect completed wafer on Lamp L [Assumption: Lamp has turned off]
- Check if DOx is closed
- Open DIx
- R3 moves to DIx
- Place wafer at Ax
- Close DIx
- Open DOx
- GOTO 1

2.5 System Requirements

These are the individual component's constraints:

1. Lamp L
    - The Lamp should be undisturbed during printing.
    - The Lamp will be turned off after completion of printing.

2. Inner Doors: DI1, DI2
    - The Inner Doors may be opened only if the Outer Doors are closed.
3. Outer Doors: DO1, DO2
    - The Outer Doors may be opened only if the Inner Doors are closed.
4. Output Stacks: O1, O2
    - No Wafer shall be put on a full Output Stack.
5. Outer Robots: R1, R2
    - The Outer Robots will pick up a wafer from its corresponding Input stack.
    - The Outer Robots will place the Input wafer on its corresponding Airlock.
    - The Outer Robots will pick up a finished wafer from its corresponding Airlock.
    - The Outer Robots will place the finished wafer on its corresponding Output stack.
    - The Outer Robots will pickup the next Input wafer only after delivering a finished wafer to it's corresponding Output Stack.
6. Inner Robot: R3
    - The Inner Robot will pick up a detected Input wafer from an Airlock.
    - The Inner Robot will place the Input wafer on the Lamp only when it is empty
    - The Inner Robot will pick up a finished wafer from the Lamp.
    - The Inner Robot will place the finished wafer on its corresponding Airlock.
    - The Inner Robot will pickup the next Input wafer only after delivering a finished wafer to it's corresponding Airlock.

3 Interactions

3.1 Commands to Actuators

The following are the commands given by the controller to the actuators of the system. The meaning can be interpreted as: Function(Target actuator, Command/Action)

- MoveToStacks(Rx, Move1)
- MoveToAirlock(Rx, Move2)
- PickupWafer(Rx, Pick)
- PlaceOnAirlock(Rx, Put)
- PickFromAirlock(Rx, Pick)
- OpenInnerDoor(DIx, Open)
- CloseInnerDoor(DIx, Close)
- OpenOuterDoor(DOx, Open)
- CloseOuterDoor(DOx, Close)
- PickFromAirlock(R3, Pick)
- PlaceOnLamp(R3, Put)
- PickFromLamp(R3, Pick)
- PutWafer(Rx, Put)
- ReachPosition(Rx, Reach:a) [a : I/O stack index]

3.2 Reading Sensors

The following are the commands used by the controller to read the current data from the sensors of the system. The meaning can be interpreted as: Function(Target sensor, Return Value by sensor)

- SenseInputStack(Ix, a) [a is stack index with wafer; a=0 if empty stack]
- SenseOutputStack(Ox, a) [a is stack index corresponding to empty position; a=0 if full stack]

- SenseLamp(L, a) [a : busy, completedPrinting]
- SenseAirlock(Ax, a) [a : WaferPresent, WaferAbsent] // if wafer present close outer door, open inner door; else inner door remains closed, and outer remains open?? optimisation??

4 Architecture