Project - Assembly Simulation

These member attended in these projects with same research tasks from define the process, model logic and flow diagram, build model and validate it.

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Agenda

1. Introduction

2. Whole system overview

3. Model logic & Flow diagram

4. Model build & Code

4. Model animation

5. Model validation
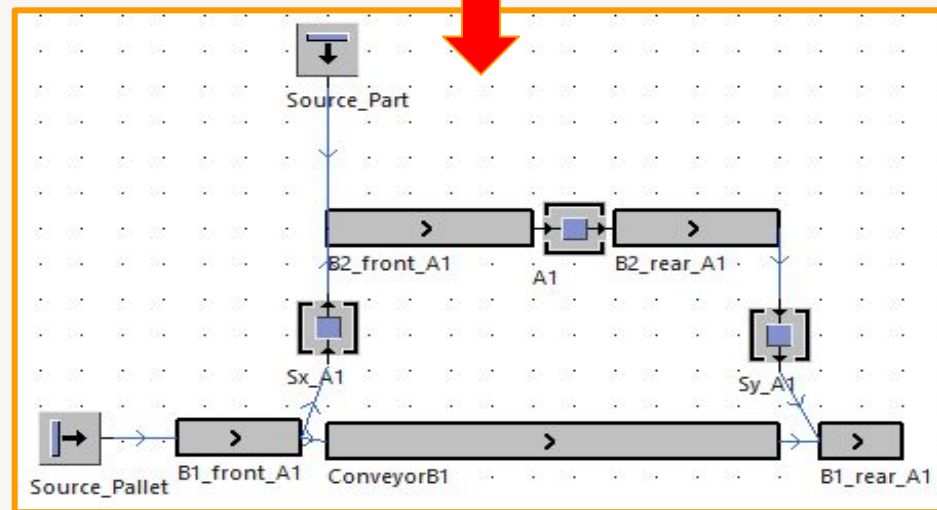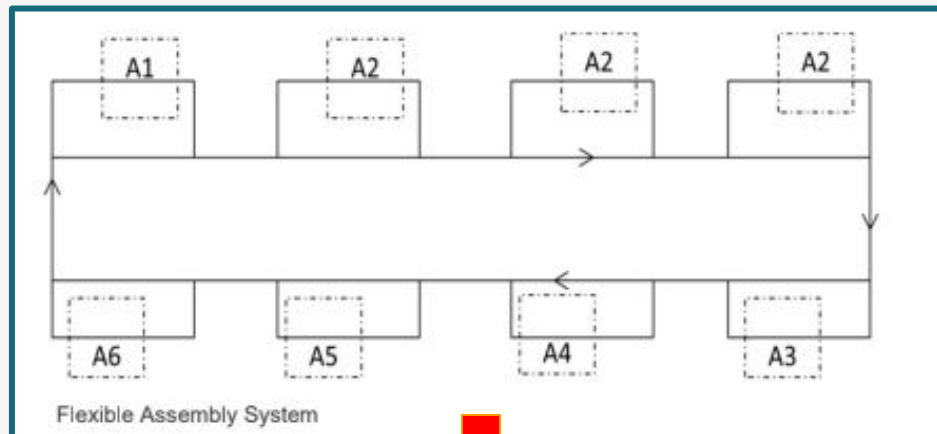
6. Simulation

7. Optimization

1. Introduction

- A1 will be used for load/unload part
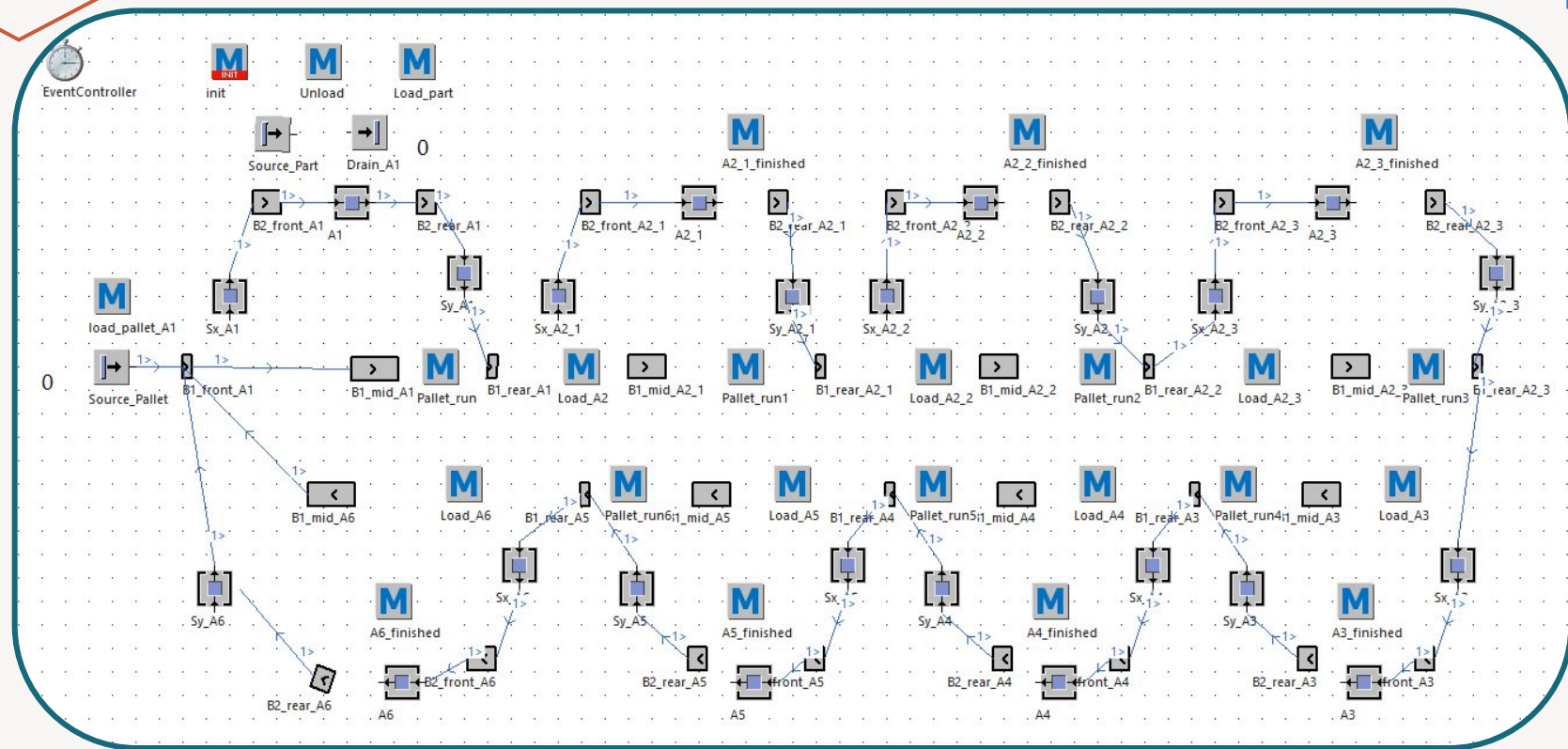
- Empty pallet run on B1 conveyor

- Pallet and part run on B2 conveyor

- 0.4m space between 2 operations
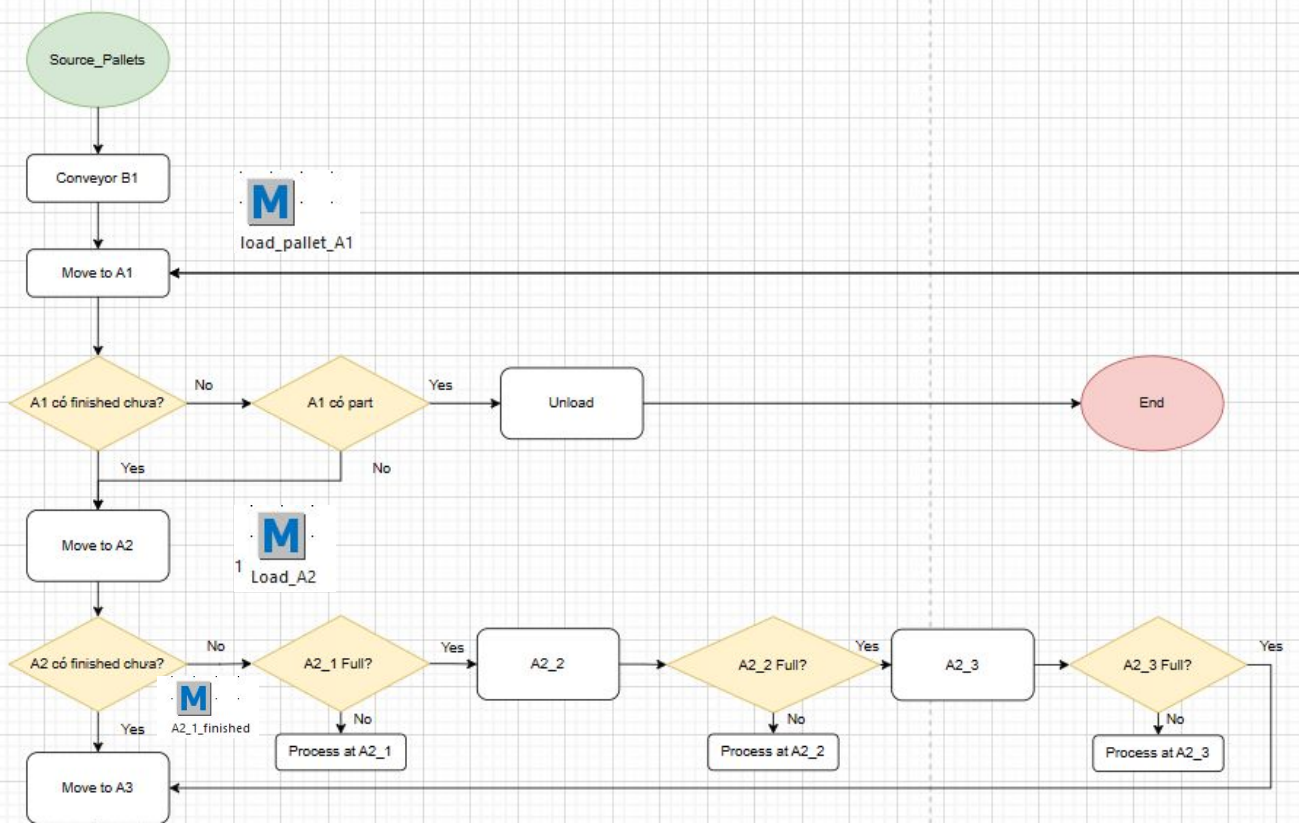
- Parts need to complete A2-A3-A4-A5

Flexible Assembly System

2. Whole system overview

3. Model logic & Flow diagram
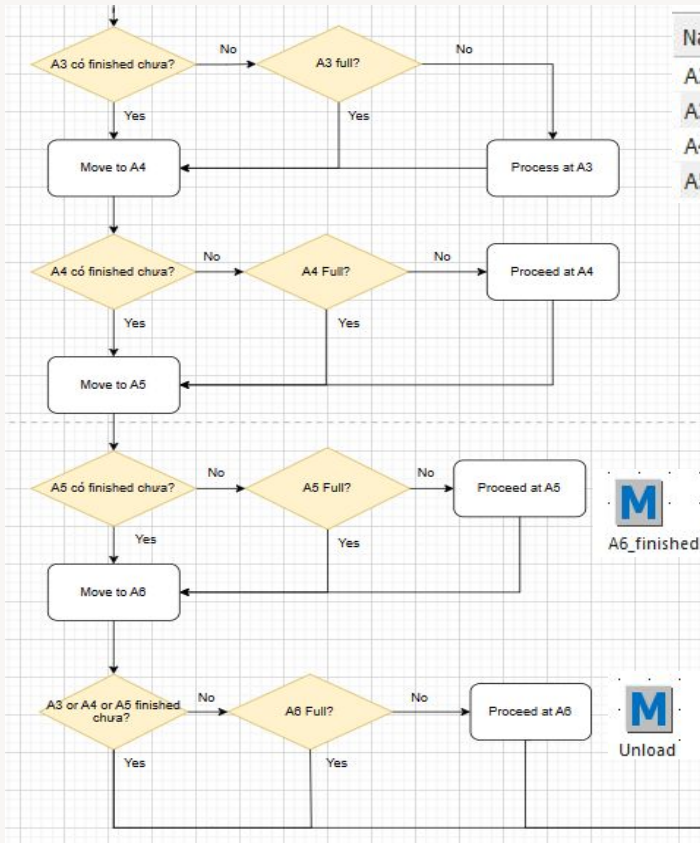
Name		Value	Type	C..	I...
A2		false	boolean	*	
A3		false	boolean	*	
A4		false	boolean	*	
A5		false	boolean	*	

```
if A6.occupied
    @.cont.A3 := true
    @.cont.A4 := true
    @.cont.A5 := true
    @.transfer(B2_rear_A6)
    end
```

```
If @.occupied and @.cont.A2 and @.cont.A3 and @.cont.A4 and @.cont.A5
    @.cont.transfer(Drain_A1)
    @.transfer(B2_rear_A1)
else @.transfer(B2_rear_A1)
end
```

4. Model built

5. Model validation

Simulation result for 1st part

Simulation time (m:ss)	3:37
-> To seconds:	217s

Validation: Manual calculation for time to do 1st part
⇒ Total: 213s

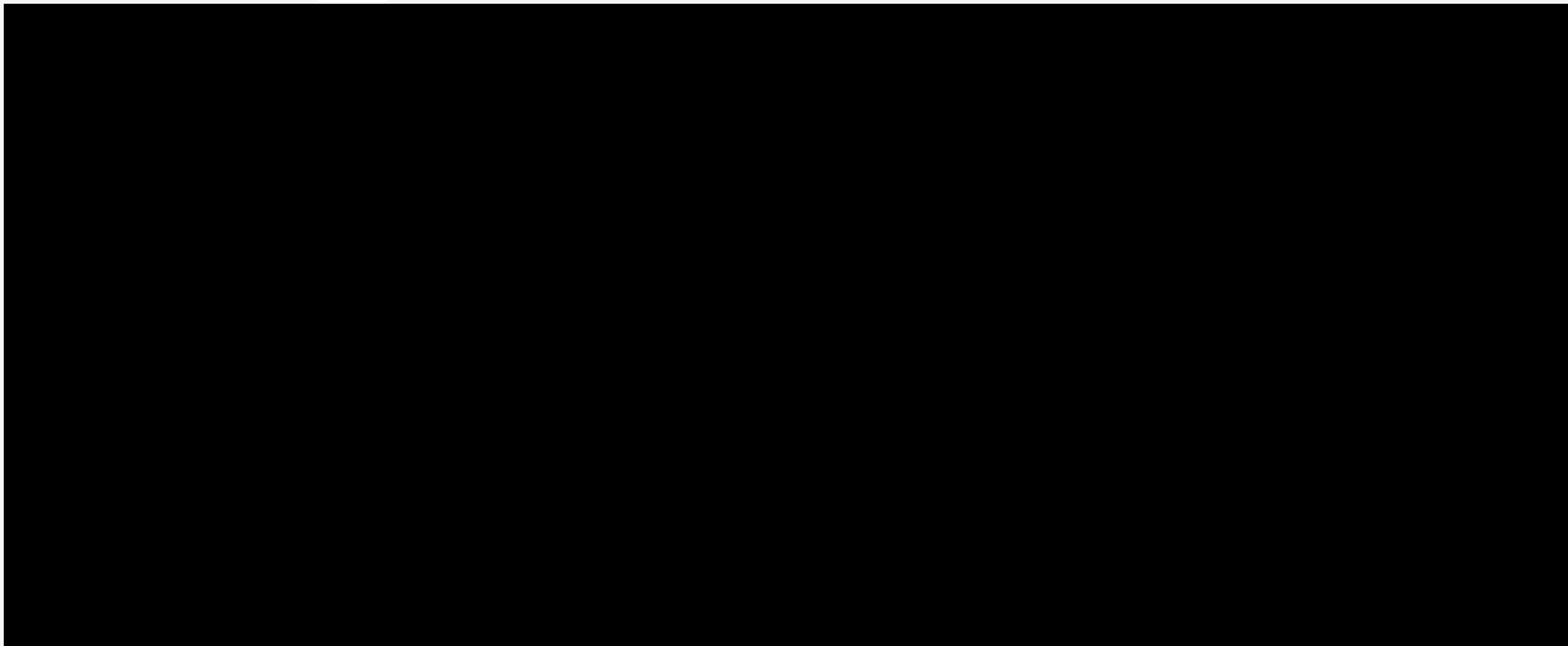| A1						
	Between_Ax	Sx	B2front	Station	B2rear	Sy
Conveyor distance	0.4		1.2		0.8	2
Time through each station	1.333333333	2	4	15	2.666666667	6.666666667
Total time (s)	31.66666667					

A2						
	Between_Ax	Sx	B2front	Station	B2rear	Sy
Conveyor distance	0.4		0.8		0.8	2
Time through each station	1.333333333	2	2.6667	60	2.666666667	6.666666667
Total time (s)	75.33333333					

A3						
	Between_Ax	Sx	B2front	Station	B2rear	Sy
Conveyor distance	0.4		0.8		0.8	2
Time through each station	1.333333333	2	2.6667	20	2.666666667	6.666666667
Total time (s)	35.33333333					

A4						
	Between_Ax	Sx	B2front	Station	B2rear	Sy
Conveyor distance	0.4		0.8		0.8	2
Time through each station	1.333333333	2	2.6667	20	2.666666667	6.666666667
Total time (s)	35.33333333					

A5						
	Between_Ax	Sx	B2front	Station	B2rear	Sy
Conveyor distance	0.4		0.8		0.8	2
Time through each station	1.333333333	2	2.6667	20	2.666666667	6.666666667
Total time (s)	35.33333333					

6.1 Model simulation & result

Simulation time / Number of pallets	2 hours	8 hours	10 hours
20 pallets	346 pcs	1428 pcs	1787 pcs
40 pallets	344 pcs	1420 pcs	1785 pcs
60 pallets	341 pcs	1421 pcs	1781 pcs

Table. Throughput in different simulation ranges of time.

In a nutshell, as the number of pallets decrease, there is a tendency for the throughput to increase.

As we increasing the simulation time and the number of pallets to an infinitely large value, the indicators show that the entire system will become **stuck after 5:25 minutes with 66 pallets**.

⇒ The system will become overloaded and congested if a large number of pallets are introduced into it.

After gradually reducing the number of pallets from 66 to 65, 64, and finally 63, it was observed that the system only operates infinitely when there are a **maximum of 63 pallets.**

7. **Optimization**

Min-Max intervals with quartiles

16 pallets (least pallet and highest throughput). The system's capacity after 2, 8, and 10 hours were 349, 1429, and 1789 pcs, respectively.

Experiment	Throughput in 8 hours
Exp 01	282
Exp 02	422
Exp 03	477
Exp 04	478
Exp 05	479
Exp 06	614
Exp 07	750
Exp 08	885
Exp 09	953
Exp 10	954
Exp 11	954
Exp 12	1073
Exp 13	1192
Exp 14	1310
Exp 15	1428
Exp 16	1429
Exp 17	1429
Exp 18	1429
Exp 19	1427
Exp 20	1428
Exp 21	1427
Exp 22	1427
Exp 23	1426
Exp 24	1431
Exp 25	1429
Exp 26	1429
Exp 27	1428
Exp 28	1430
Exp 29	1429
Exp 30	1429

Thank you