

MANUFACTURING

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Introduction

This presentation gives an overview of the simulation, a manufacturing line simulation done using the SimPy library in Python. The simulation represents a process of manufacturing with a set of stages: loading, machining, assembling, inspecting, and packaging. The goal is to simulate the flow of parts through these stages, accounting for potential machine breakdowns and repairs.



Code overview

These define the number of workers available at each stage, the length of a work shift, the total simulation time, and the number of different product types being processed.

The **ManufacturingLine** class models the entire manufacturing process. It has the following methods:

`_init_(self, env)`: This will initialize the manufacturing line. It will prepare resources for each stage and for a repair team.

`process_part(self, part, product_type)`: It will simulate how a part should be progressed to go through all stages.

`repair_machine(self, stage)`: It will simulate the repair process for a machine.

```
main.py ×  
1 import simpy  
2 import random  
3 import pandas as pd  
4  
5 PROCESSING_TIMES = {  
6     'loading': 5,  
7     'machining': 10,  
8     'assembling': 8,  
9     'inspecting': 6,  
10    'packaging': 4  
11 }  
12 MAINTENANCE_TIME = 3  
13 BREAKDOWN_RATE = 0.1  
14  
15 NUM_WORKERS = {  
16     'loading': 2,  
17     'machining': 3,  
18     'assembling': 4,  
19     'inspecting': 2,  
20     'packaging': 3  
21 }
```

Part Manufacturer and Setup Functions

The ManufacturingLine class uses `simpy.Resource` to initialize resources for each stage of the process. It also sets up a repair team that can handle two breakdowns simultaneously.

The `process_part` method is in charge of handling a part as it passes through the stages. For each stage:

A request is made for the resource of the stage, indicating the number of workers.

The part is worked on for a time associated with the particular part type.

If a breakdown occurs (with a random determination), the repair process is called.

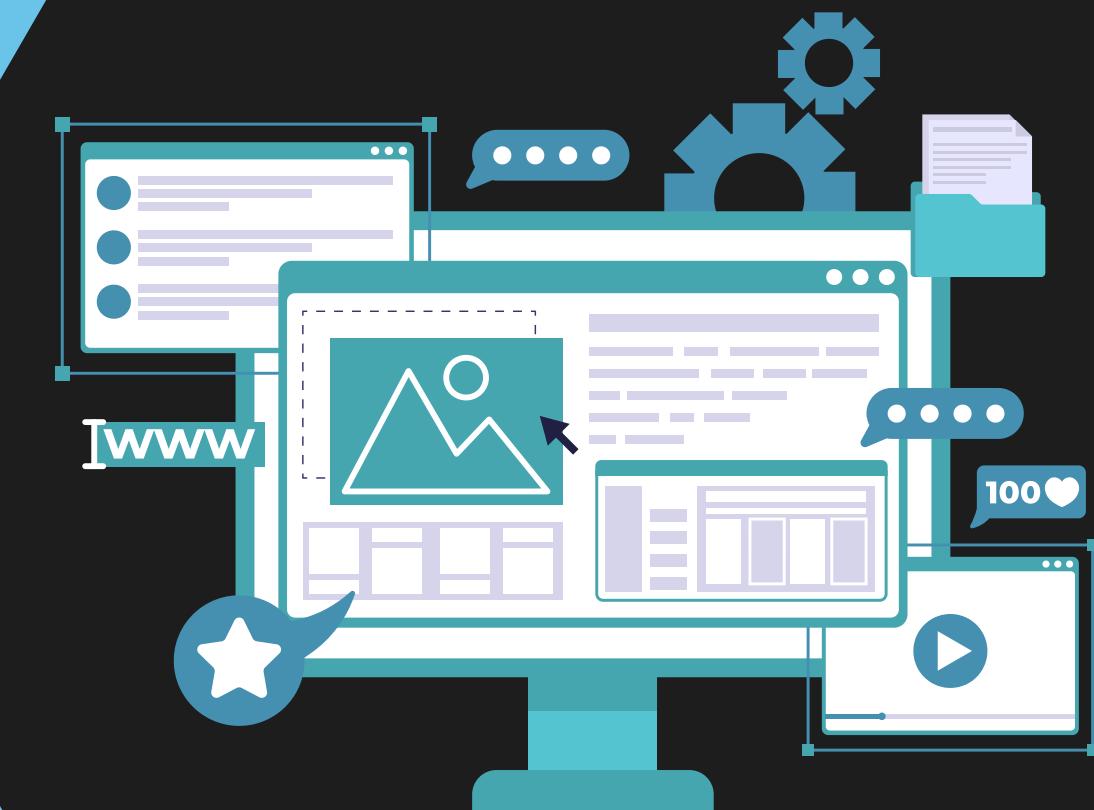
The `repair_machine` method is in charge of repairs to the machine. It achieves that by making a request for the repair team resource. Meanwhile, it passes the time given as the maintenance time.



Running the Simulation

This creates the environment, and sets up the process is initiated. The simulation runs for the given duration, and the results are dumped into a DataFrame, which is printed out.

This simulates, in detail, the manufacturing process: staging, probable breakdown, and repair. By using SimPy, the event-based simulation is made extremely efficient, and now with the help of the pandas DataFrame, the results are analyzed. This can be extended and modified to run for different manufacturing instances to optimize the flow.



P Y T H O N