Functional Specification

Modeling and Simulation of products Flow at Taif national dairy factory

Approved by : Dr. Hussain Abualkhair.

Prepared by :

Shahad Aljuaid

Safia AlQurashi

Nada Alnemari

Nehal Alharthi

Renad Hajed

Shatha Mohammed

Rafa Alqurashi

Table of Contents

1. Introduction

Each factory has production problems, which may be a reason for delaying the production of the product or even destroying the product and causing a loss of those resources and thus leads to a deterioration in the quality of service for those factories. Taif National Dairy Factory is one of those factories that need a study to reduce the expected problems above And by using simulation programs, this will help us in dealing with the entities (products) and knowing the procedures that will reduce those problems. Therefore, this study reviews the modeling and simulation of products in Taif National Dairy Factory.

1.1 Project objectives

Our objective from this simulation are:

- Increase productivity of Taif National Dairy Factory.
- Covering the demand promptly with the required quantities
- Decrease waiting time for the products.
- Improve production line.
- Improve the utilization of the machines.

1.2 Project Scope

Studying the flow of products for both buttermilk (2L) and yogurt (170g) for 5 destinations on one order, taking into consideration that each order contains more than 30 products.

1.3 Project Stakeholders

Stakeholders in the Taif National Dairy Factory study project:-

- The main stakeholder is the management of the Taif National Dairy Factory:

Taif National Dairy Factory is interested in providing its products with high quality according to the requirements of the Food and Drug Authority. It is also interested in delivering the products at the right time of delivery. Therefore, our study will help the factory management in achieving these points by providing an integrated analysis of the system, waiting times for products, problems that the factory may encounter during production, and the necessary improvements needed by the system. Therefore, the model will be presented and a detailed file of instructions for using the model for factory management to achieve the desired goals of the study.

- Entities to which the factory supplies (customers):

Customers will be directly affected by the improvements that aim to achieve customer satisfaction through the commitment to cover the customer's request in the required quantities and at the time specified by agreement between the customer and the stakeholder.

- Dr. Hussain Abualkhair:

This project has been done mainly to fulfill the requirements of the Industrial Systems Simulation course. The final work will be presented to the instructor of this course, Dr. Hussain Abualkhair.

2. System Description and Modeling Approach:

This section illustrates an overview of the system components and its operations.

2.1 System Resources:

The Taif National Dairy Factory has a lot of resources, including the resources listed below, which were included in the system's study. These resources are divided into:

Human Resources:

- Laboratory Technicians: They take random samples from each stage for testing in the laboratory.
- Machine operators: Workers who operate and supervise the operation of machines.

Equipment:

- San tung machine : For mixing.
- Nimco machine :
  Icon machine: Two liter milk filling machine.
  Carmichael machine: Milk filling machine 200ml

2.2 Entities Type

In this system, there are two types of entities, namely buttermilk-type products and yogurt-type products. There are no differences between them at the beginning of the production line, they both travel through all stations together, but at the point of mixing with yeast the difference appears, the yogurt will be liquid and then yeast is added to it while the buttermilk is prepared in tank mixed with yeast directly and then it is filled Chilled, during the above processes there is a difference in the temperatures to which both buttermilk and yogurt are exposed.

2.3 Transportation:

In this system there are two types of transport:

- Internal transport: The movement of raw materials or products between stations is considered internal transport. In other words, after the buttermilk filling process, it is transferred to the refrigerator and kept there, while the yogurt after filling, is transferred to the "incubation" area and then transferred again to the refrigerator for preservation.

- External transport: External transport includes transporting products to delivery trucks to transport them to customers in different places.
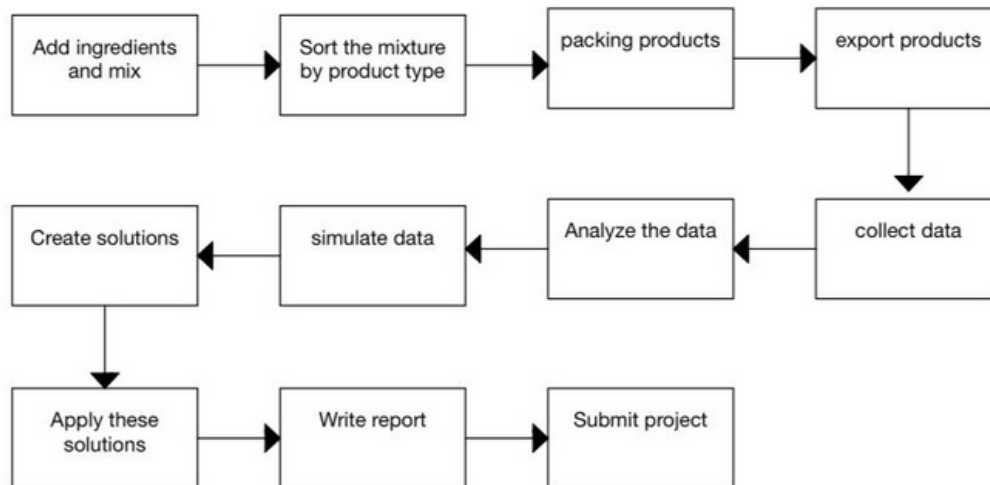
2.4 System Operations:
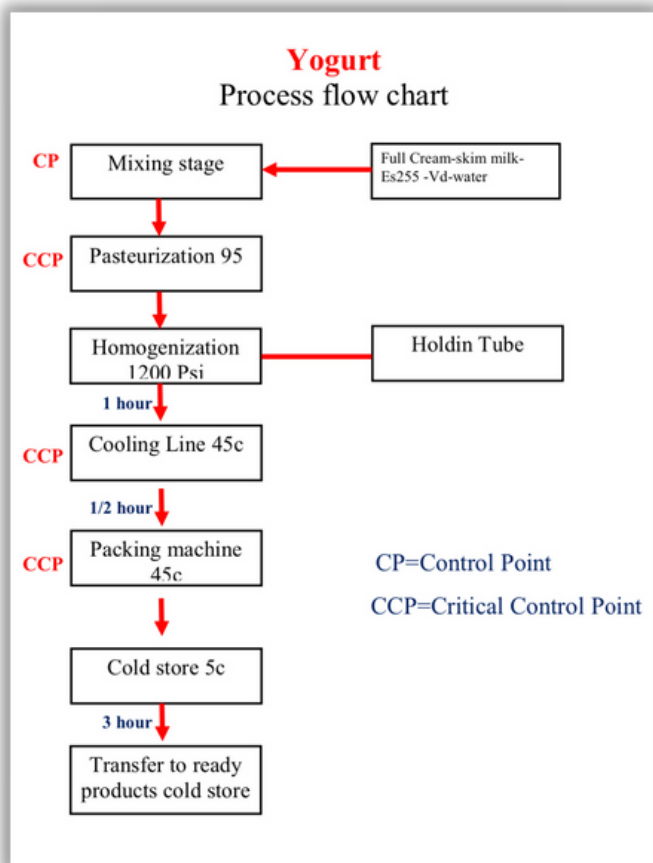

Fig 2.5.1 : The operations in the system

Fig 2.5.2 : Process Flow Chart (Yogurt)
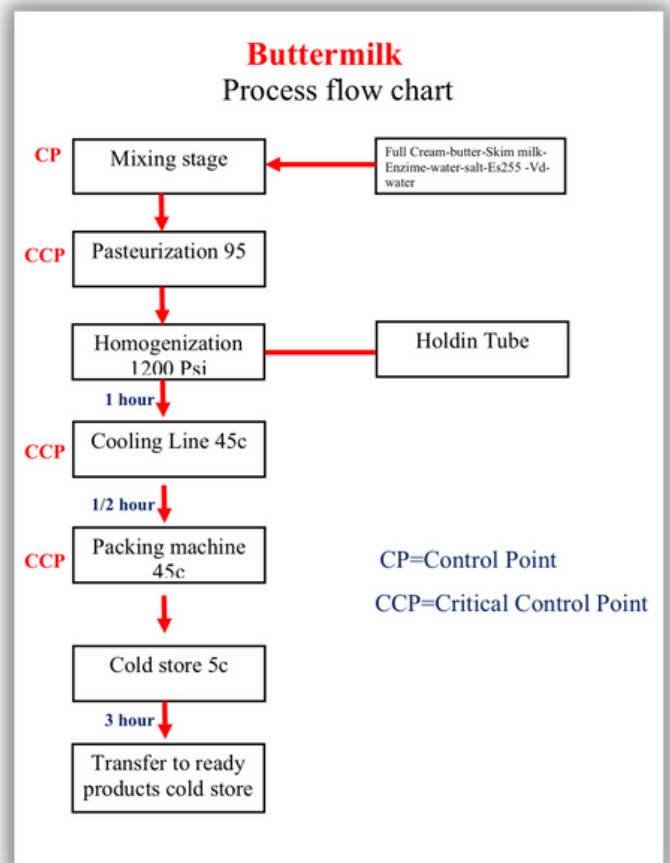

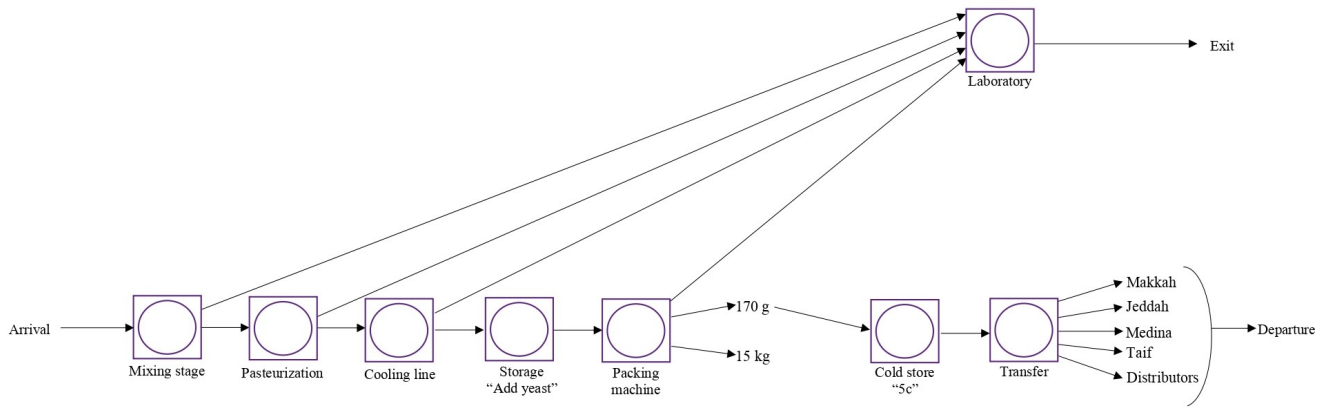**Fig 2.5.3 :** Process Flow Chart (Buttermilk)

Fig 2.5.4 : Queuing Network (Yogurt)
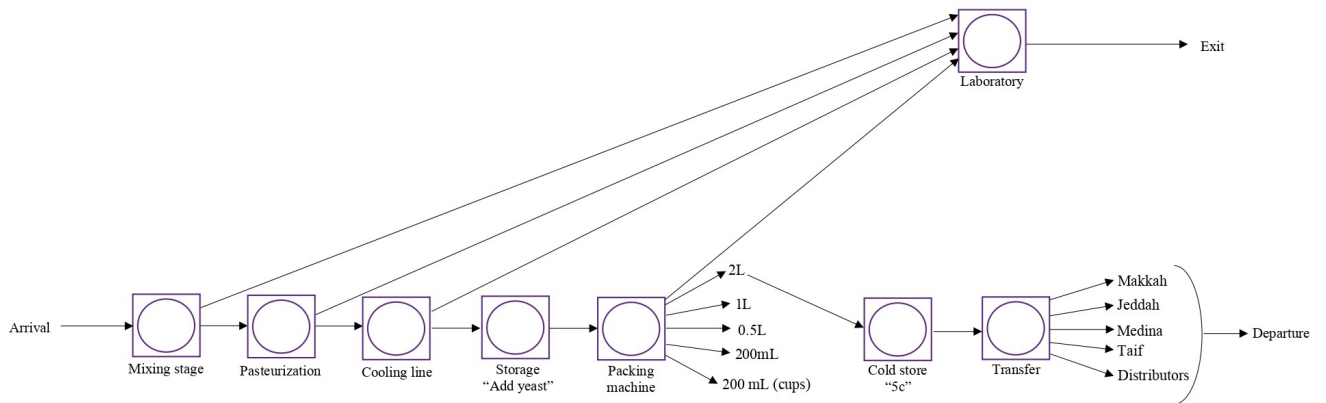
Queuing Network (Buttermilk)

Fig 2.5.5 : Queuing Network (Buttermilk)

Queue discipline:
FIFO

Queue Configuration:
Single line

The manufacturing process is divided into four main stages:

- Mixing
- Separating the mixture
- Packing
- Exporting

As shown in Fig 2.5.1; the four main stages. First, the stage of the mixture. At this stage, the ingredients needed to make the mixture are prepared. Then yeast is placed on the raw material, and from here the mixture will be separated into the first product (yogurt) and the second product (buttermilk) in two different production lines, after which the process of making the mixture ends with the next process , which is packaging, in this process the buttermilk will be packed directly into the containers, and the yogurt will be cooled for 3-4 hours, after which it is ensured that the production date and all the Food and Drug Authority tests necessary to ensure the quality of the product are then saved and stored, and finally, it reaches the export point and it is the exporting products to the customers.

3. Input Data:

What data should be considered for model input?

- Arrival time.
- Inter-arrival time to calculate arrival rate.
- Service time to calculate service rate.
- The products distribution (branching).
- Number of entities (products) in the production line.

Who will provide this information?
data from Team 1 based on observation and collection data.

When?
from 23-10-2022 to end of semester.

In what format?
Observation and collect data and record this manually data in a spreadsheet.

4. Output Data:

- Utilization of machines
- Products Waiting Time in the queue
- Products Waiting Time in the system
- Number of products in the queue
- Number of products in the system

This data will be presented, displayed and explained in detail to the Taif National Dairy Factory management in the form of visual graphics for better communication with them and a better understanding of how the system performs.

5. Project Deliverables:

The Taif Dairy Factory will receive three deliverables as a result of the project:

5.1 Documentation:

the factory will receive a report including the challenges in this project and proposed solutions as well as functional specifications; A document that describes exactly what will be delivered, when, how and by whom it will be delivered, and will also include instructions for how to use and make use of the form.

5.2 Software and Training:

- Simio: The simulator can train on this program through free training videos and educational programs, and there are virtual training classes to help learn how to use the Simio simulation program on the official website of the program.

- Microsoft Excel: The simulator can use Excel in simulation, where it can be trained easily because Excel is very popular among people.

5.3 Animation:

The system will be represented by a 3D animation model through the SIMIO program, which will help create better communication with the factory management and a better understanding of how the system works.

6. Project Phases:

6.1 The first phases :

6.1.1 The first stage in first phase:

(preliminary study), our study in the Taif National Dairy Factory includes a study of one demand for 5 destinations for (2L)of buttermilk and (170g) of yogurt
- Choose a factory.
- Collect and record the data.
- Preparing the functional specification document.

6.1.2 The second stage in first phase:

Giving the functional specification document to the main stakeholders (factory management and Dr.Hussein Abualkhair)
Delivery date : 26 / 10 / 2022

6.2 The Second phase:

6.2.1 The first stage in the second phase:

We will study and simulate the queuing system using Simio and Excel programs
- Apply queueing theory to Excel.
- System simulation using Simio.

6.2.2 The second stage in the second phase:

Obtaining and studying the results of the study
- If there is any problem, try to solve it and develop a solution to it.

6.3 The third phases :

6.3.1 The first stage in the third phase:

After simulating the project, we will finally create a plan to develop the manufacturing system to increase productivity and achieve the objective. If there are problems, try to develop them.

6.3.2 The second stage in the third phase:

Giving the results to the main stakeholders (factory management and Dr.Hussein Abualkhair) This effort is estimated by the students of industrial engineering at Taif University, there is no cost of money, but it will take approximately 3 weeks
Delivery date :End of the first semester of 2022

7. Approval :

This document has been approved as the first phase of the project of modeling and simulation of products Flow at Taif national dairy factory .

Title	Signature	Date
Taif national dairy factory		
Simulationist		