ASIA PACIFIC UNIVERSITY OF TECHNOLOGY &

INNOVATION

TECHNOLOGY PARK MALAYSIA

INDIVIDUAL ASSIGNMENT

EE038-2-2-ESA

ENGINEERING SOFTWARE AND APPLICATIONS

TITLE	**MILK PROCESSING PLANT**
NAME	**IMTIAZ AHMED**
TP NUMBER	**TP071302**
INTAKE	**APD2F2309EEE**
LECTURER	**IR. TS. DR. ALEXANDER CHEE HON CHEONG**
SUBMISSION DATE	**22-12-2023**

Table of Contents

LIST OF FIGURES

INTRODUCTION

A milk processing factory is a type of specialized establishment where raw milk is transformed into different dairy products fit for human consumption. When raw milk is delivered to the plant, it is first collected from nearby farmers or producers and then goes through first quality testing. After being approved, raw milk is put through a rigorous sequence of controls to guarantee the longevity, safety, and quality of the finished dairy products.

Clarification and separation are the first steps, during which contaminants are eliminated and the cream is separated from the milk. After standardization, the fat content can be changed to satisfy particular product requirements. The next step is homogenization, which breaks down fat globules to guarantee a consistent distribution of fat in the milk and avoid cream separation. Pasteurization, a heat treatment that kills dangerous germs and pathogens and prolongs the product's shelf life, is one of the crucial stages in the processing of milk.

After pasteurization, the milk is quickly chilled and kept in a controlled environment until it is time to start packing or processing again. Additional processing procedures, such as fermentation for yoghurt, curdling for cheese, or churning for butter, may be applied to the milk depending on the intended final products. The finished dairy products are subsequently packaged in several ways, such as pouches, cartons, or bottles, to maintain freshness and give customers convenience.

Quality control procedures are used all along the way to make sure that safety regulations and standards are followed. The dairy products are tested and observed on a regular basis to ensure that their quality remains constant. After being packaged, the goods are given to stores, supermarkets, and other establishments so that customers can purchase them. Milk processing facilities may modify their procedures to include environmentally conscious practices and sustainable practices as technology develops and consumer preferences change, reflecting the evolving dairy industry.

OBJECTIVES

Three key processes are prioritized when planning the development of a milk processing facility using simulation software such as LabVIEW: separation, pasteurization, and homogenization.

FLOWCHART

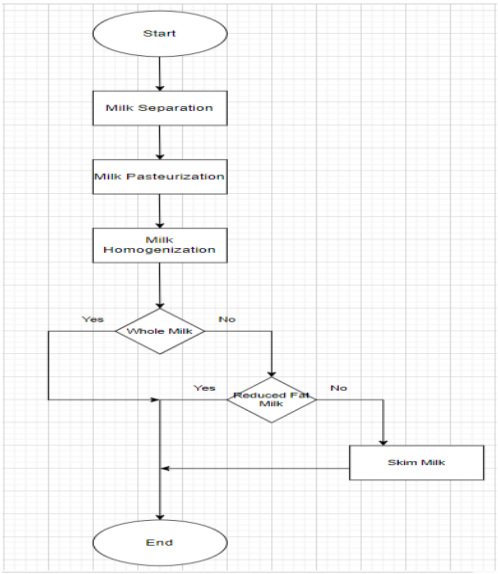

Figure 1-FLOWCHART

FRONT PANEL

BLOCK DIAGRAM

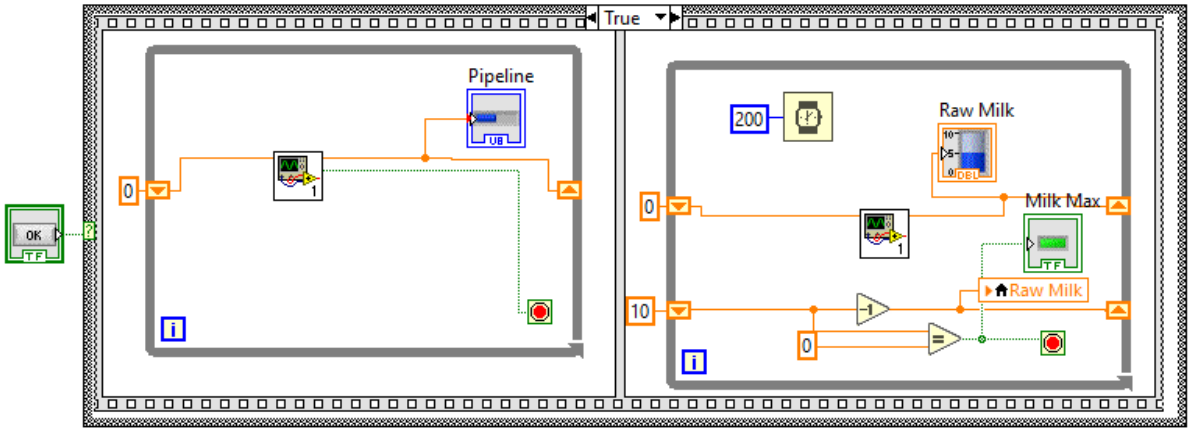

Figure 2-BLOCK DIAGRAM OF SEPERATION

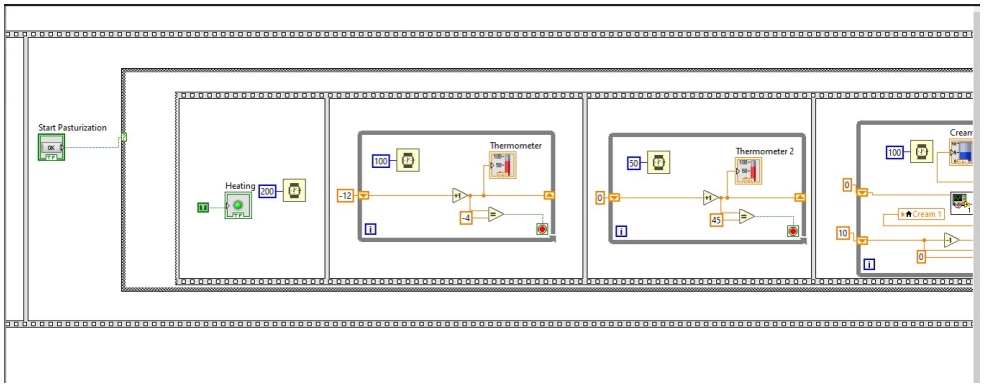

Figure 3-BLOCK DIAGRAM OF PASTEURIZATION

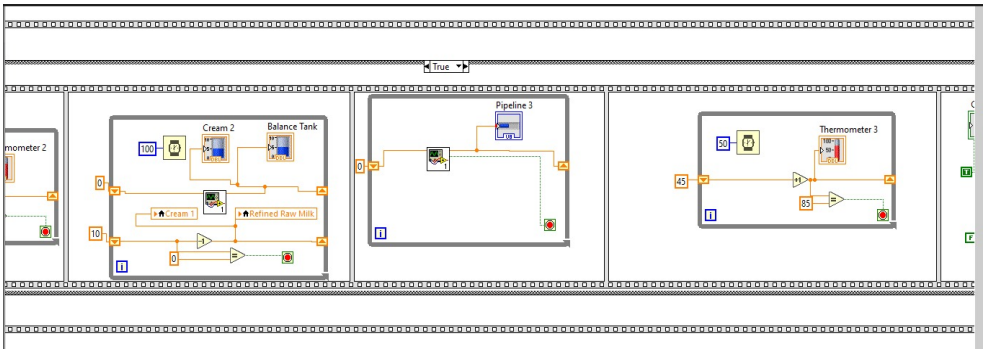

Figure 4-BLOCK DIAGRAM OF PASTEURIZATION

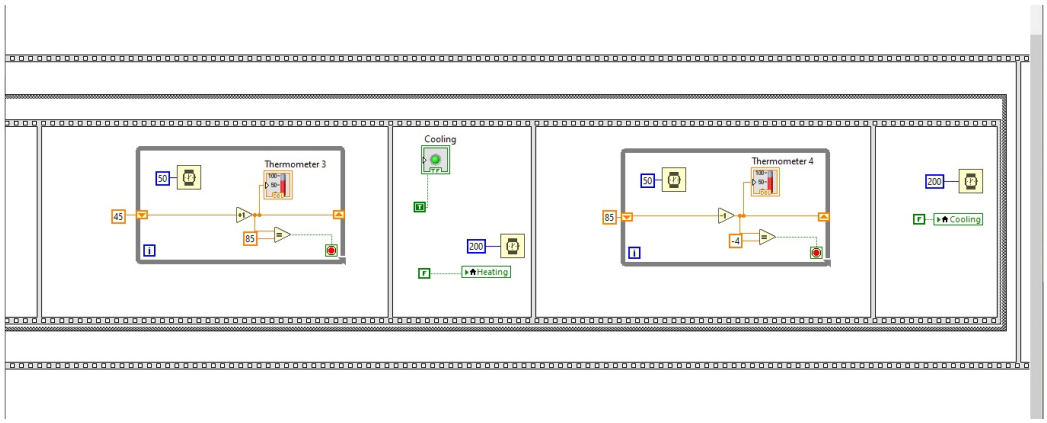

Figure 5-BLOCK DIAGRAM OF PASTEURIZATION

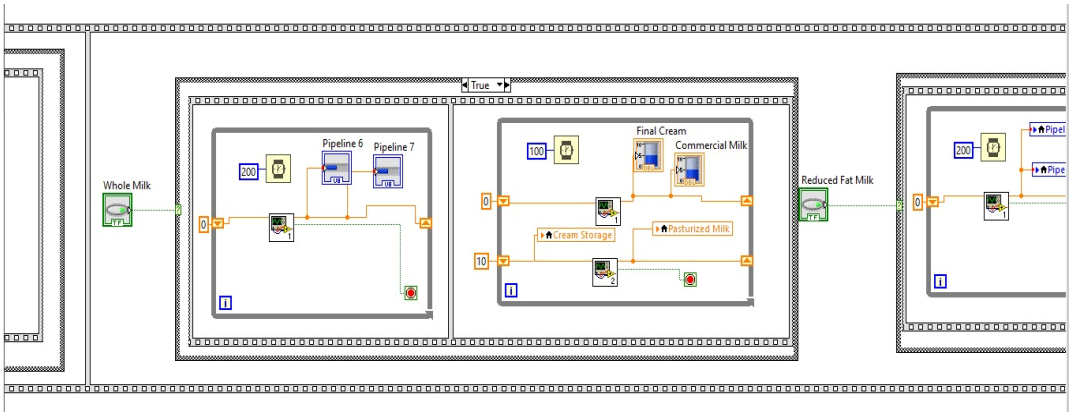

Figure 6-BLOCK DIAGRAM OF HOMOGENIZATION

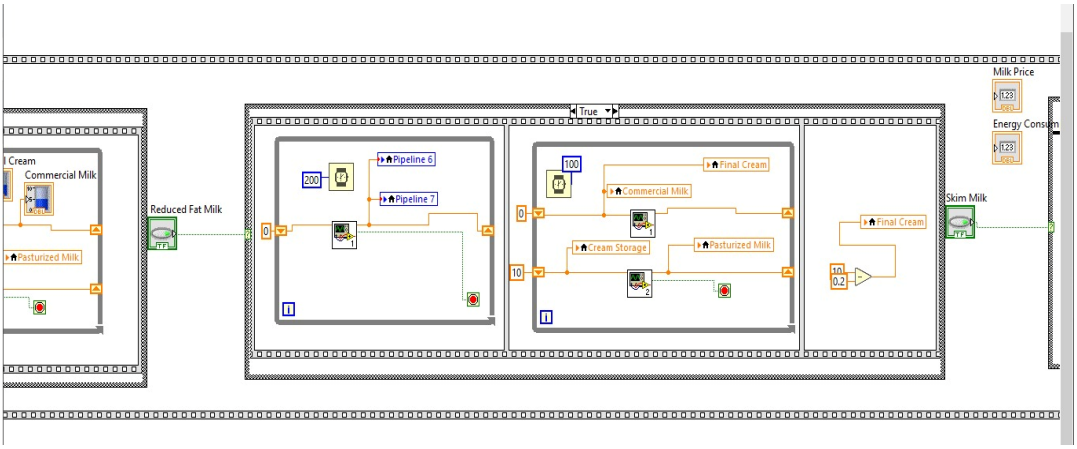

Figure 7-BLOCK DIAGRAM OF HOMOGENIZATION

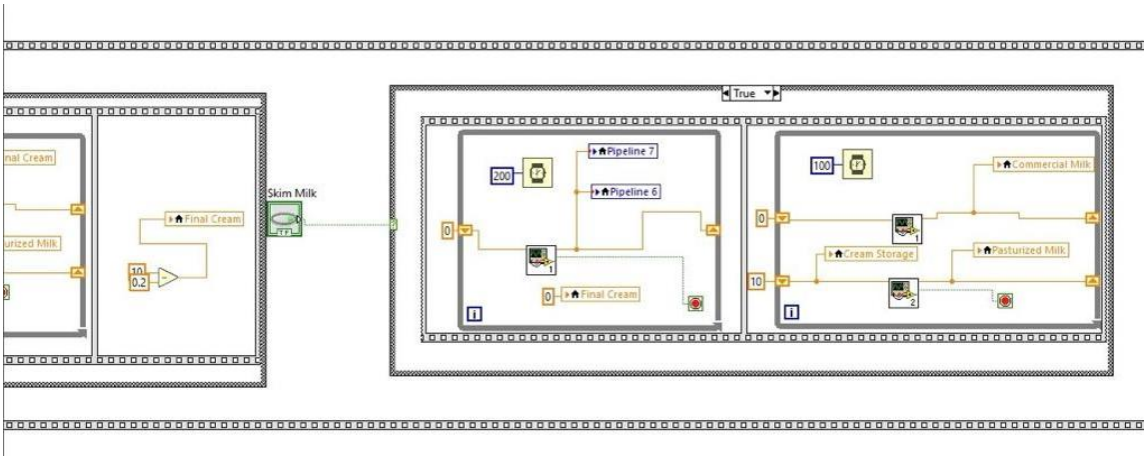

Figure 8-BLOCK DIAGRAM OF HOMOGENIZATION

RESULTS

Figure 9-MILK SEPERATION EMPTY

1.Open the software: When you press this button, the milk separation procedure begins.

2.Consumption of energy: This shows the system's current energy usage. The energy usage in this instance is zero.

3.Ok: Utilizing this button allows you to verify different system actions.

4.Filled: The state of being filled denotes the absence of any fuel.

5.Pipeline: The milk flow inside the system is depicted in this section. Raw milk flows into the separation tank after entering the system through the "Raw Milk" intake. The "Cream" and "Remains Separation" outlets are used to remove the separated milk and cream, respectively, following the separation process.

6.Milk Max: The milk tank's maximum capacity is probably indicated by this.

7.Fill Separation Tank: Press this button to add milk to the separation tank.

8.Start Separation: Press the "Start Separation" button to begin the process of separating milk.

9.Start: The system's numerous processes, such filling the tank or initiating the separation process, can be started with this button.

10.Germ Separation: The germs separation procedure can be initiated by pressing this button.

11.Fill the tank: Press the Fill the Tank button to add milk to the tank.

12.Stored Milk: This part displays the volume of milk that the system is keeping on hand. There isn't any stored milk in this instance.

Overall, the tank is empty, no processes are active, and the system is in an idle state right now.

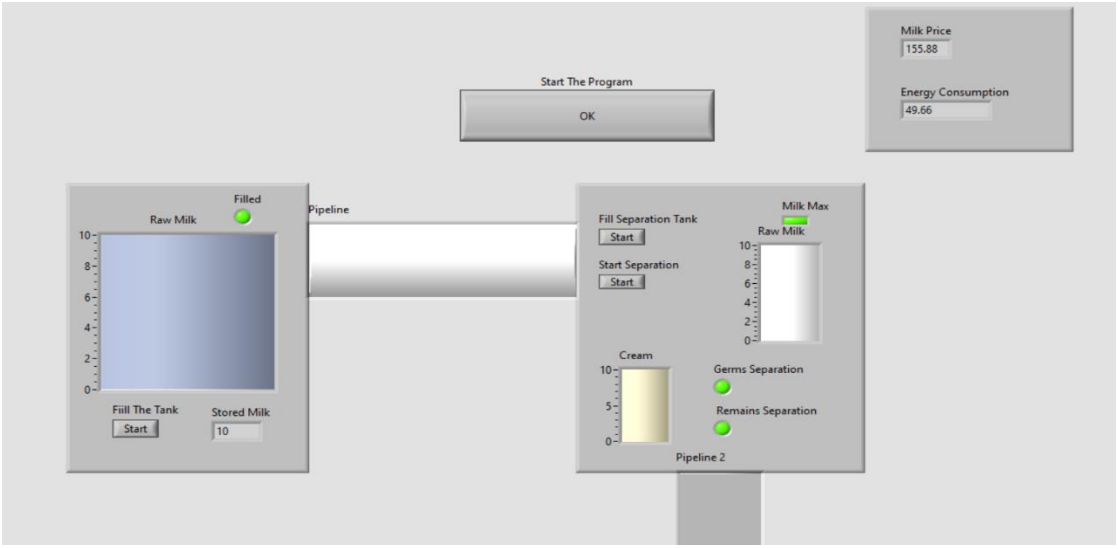

Figure 10-MILK SEPERATION FILLED

1.Launch the software: This button initiates the process of separating milk.

2.Energy Consumption: This shows the system's current energy usage. The energy consumption in this instance is 8642.

3.Alright: This button is used to verify different system actions.

4.Text: The text "Filled" signifies that the tank is full.

5.Pipeline: This section illustrates how milk moves through the apparatus. The "Raw Milk" input allows raw milk to enter the system, and it subsequently flows into the separating tank. Following separation, the "Cream" and "Remains Separation" outlets are used to extract the cream and skim milk, respectively.

6.Milk Max: The milk tank's maximum capacity is probably indicated by this.

7.Fill Separation Tank: Press this button to add milk to the separation tank. The tank is already full, though.

Press the "Start Separation" button to begin the process of separating milk.

8.Start: The system's numerous processes, such filling the tank or initiating the separation process, can be started with this button.

9.Germ Separation: The germs separation procedure can be initiated by pressing this button.

10.Fill the tank: Press the Fill the Tank button to add milk to the tank. The tank is already full, though.

11.Stored Milk: The quantity of milk that is presently kept in the system is displayed in this area. In this instance, the milk that is stored is ten liters.

Since the buttons are on and the tank is filled, the system is now prepared to begin the separating process.

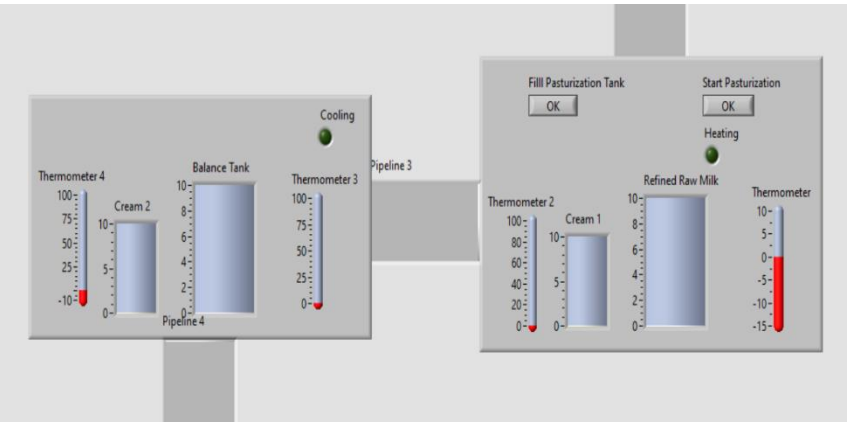

Figure 11-MILK PASTEURIZATION EMPTY

LEFT SIDE:

1.Thermometer 4: It shows the temperature at a particular system location, often the outflow. It is currently showing 15°C, which is lower than the normal temperature range for pasteurization, which is 63°C to 75°C.

2.Pasteurization: Before pasteurization, this tank probably contains milk or a milk-water mixture. Since the level is 100% at this moment, it is full.

3.Thermometer 3: This one shows the temperature somewhere else in the system, probably the pasteurization tank's entrance. Even with 10°C displayed, it is below the pasteurization temperature range.

4.Pipeline 3: From the balancing tank to the pasteurization tank, this pipe most likely transports milk or milk combination.

CENTER:

1.Pasteurization Tank: The milk is heated in this tank to destroy potentially dangerous microorganisms. Right now, it's empty.

2.Heating: The heating components that are used to pasteurize the milk are probably located in this area.

3.Pipeline 4: The heated milk is probably removed from the pasteurization tank by this pipe.

RIGHT SIDE:

1.Thermometer 2: This thermometer shows the temperature somewhere else in the system, probably following the heating element. The displayed temperature of 80°C falls within the pasteurization temperature range.

2.Thermometer 1: This one shows the temperature somewhere else, most likely the system's outlet. The displayed temperature of 60°C falls within the pasteurization temperature range.

3.Cooling: This section probably includes the ingredients that are used to cool the pasteurized milk.

4.Pipeline 1: The chilled milk is probably removed from the system through this pipe.

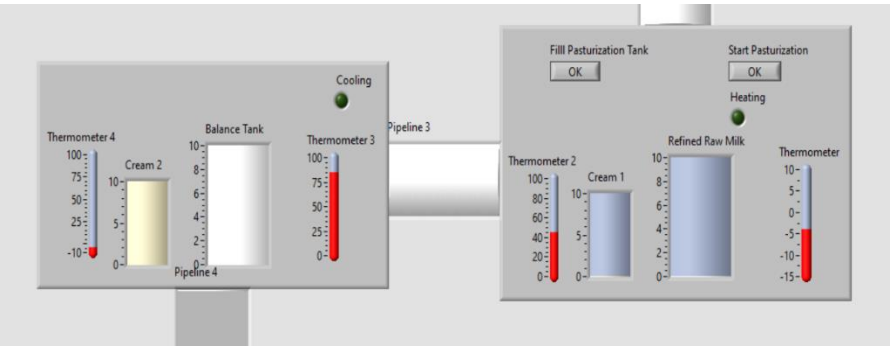

Figure 12-MILK PASTEURIZATION FILLED

LEFT SIDE:

1.Thermometer 2: This shows the temperature at a particular systemic point, most likely the pasteurization tank's output. It is currently reading 65°C, which is between 63°C and 75°C, the usual range for pasteurization.

2.Balance Tank: The balancing tank is probably used to store milk or a milk-water mixture prior to pasteurization. It's less than full, as indicated by the current level of 35%.

3.Thermometer 3: This thermometer shows the temperature at another systemic location, probably the pasteurization tank's entrance. The temperature displayed is 50°C, which is higher than the pasteurization tank's temperature but still falls below the pasteurization temperature range.

4.Pipeline 3: It is most likely this pipe that transports the milk to the pasteurization tank from the balance tank.

CENTER:

1.Pasteurization Tank: The milk is heated in this tank to destroy potentially dangerous microorganisms. The text "Full" indicates that it is currently full.

2.Heating: The heating components that are used to pasteurize the milk are probably located in this area. The green light next to the "Heating" label indicates that it is currently in use.

3.Pipeline 4: The heated milk is probably removed from the pasteurization tank by this pipe.

RIGHT SIDE:

1.Thermometer 4: This thermometer shows the temperature at a different systemic point, probably following the heating phase. The displayed temperature of 75°C falls within the pasteurization temperature range.

2.Thermometer 1: This one shows the temperature somewhere else, most likely the system's outlet. The displayed temperature of 60°C falls within the pasteurization temperature range.

3.Cooling: This section probably includes the ingredients that are used to cool the pasteurized milk. The red light next to the "Cooling" label indicates that it is not in use currently.

4.Pipeline 1: The chilled milk is probably removed from the system through this pipe.

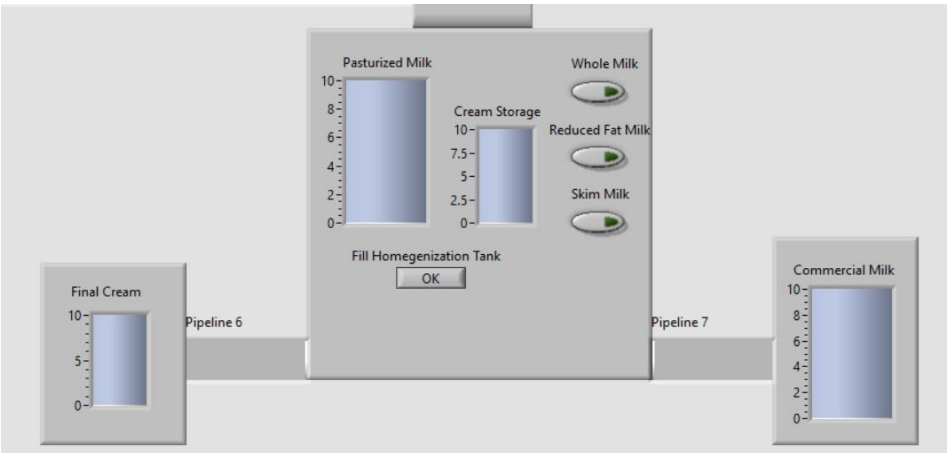

Figure 13-MILK HOMOGENIZATION EMPTY

TOP SECTION:

1.Milk Inlet: This is probably where the system gets its supply of raw milk.

2.Pressure Gauge: This gauge shows the homogenizer's internal pressure.

CENTER SECTION:

1.Homogenizer Valve: This valve regulates how much milk enters the homogenizer.

2.Homogenizer: This is the device that applies intense pressure to homogenize milk.

3.Homogenized Milk Outlet: This is the point of systemic milk exit.

BOTTOM SECTION:

1.Homogenization Tank: The homogenized milk would typically be stored in this tank before it is packed or processed further. It is now empty.

2.Pipeline: The milk is transported via a pipeline from the homogenizer to the homogenization tank.

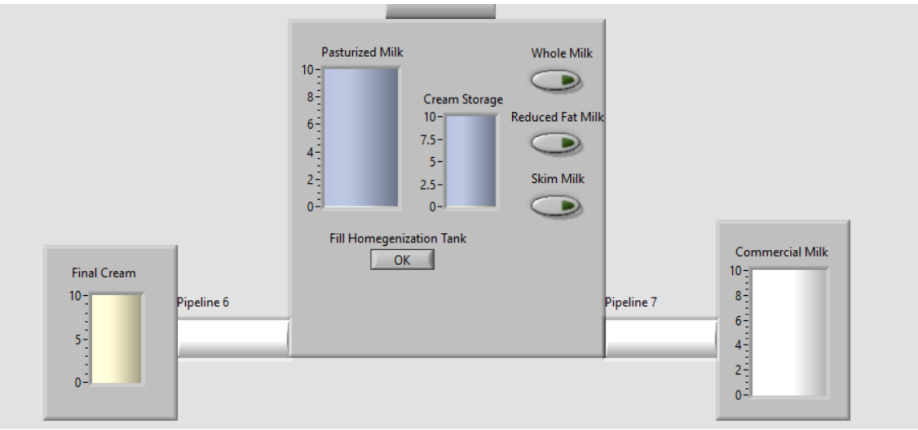

Figure 14-MILK HOMOGENIZATION FILLED

TOP SECTION:

1.Milk Inlet: This is probably where the system gets its supply of raw milk. Given that it is currently marketed as "Reduced Fat Milk," it appears that milk that has already undergone some skimming has been homogenized by this method.

2.Pressure Gauge: This gauge shows the homogenizer's internal pressure. The indicated pressure is 20 MPa, which is within the usual range (15–25 MPa) for homogenizing milk.

CENTER SECTION:

1.Homogenizer Valve: This valve regulates how much milk enters the homogenizer. The green light next to it indicates that it is open right now.

2.Homogenizer: This is the device that applies intense pressure to homogenize milk.

3.Homogenised Milk Outlet: This is where the system's homogenized milk leaves and enters the tank to the right.

BOTTOM SECTION:

1.Homogenization Tank: The text "Full" indicates that there is currently milk in this tank. This milk is already uniformly processed.
2.Pipeline: The milk is homogenized in this pipe, which connects the homogenizer to the tank.

DISCUSSION

The goal of this assignment was to design a factory using the simulation program LabVIEW and learn about the three essential processes that take place in a milk processing facility. The three main processes that were primarily focused on were separation, pasteurization, and homogenization. The task was successfully completed. In the beginning, the simulation starts by simulating the complex process of milk separation. This important stage is separating raw, unprocessed milk from its cream and fat components. The jumbo centrifuge is carefully filled with raw milk and placed inside a container. The milk within the airtight container spins quite quickly as soon as the machine is turned on. The cream and skim milk can be easily separated from the original milk composition thanks to the centrifugal force. The cream forms a distinct layer on top of the skimmed milk and rises to the top of the container due to its lighter density. And finally, the cream that has been separated is easily removed for use or processing, ending the first part of the simulation that focuses on the complex process of separating milk.

Once the first phase of milk separation is finished, pasteurization is the next critical step in the production process. Pasteurization is one of the most important procedures in the dairy industry. It is the process of carefully heating milk to high temperatures for brief periods of time. This process fulfils a vital function by seeking to significantly reduce or eradicate any pathogens, bacteria, or other potentially hazardous microorganisms present in raw milk. The method of pasteurization greatly improves the safety and shelf life of the finished dairy product by exposing it to this carefully regulated heat treatment, guaranteeing that it satisfies strict quality standards and legal requirements.

The last step in this thorough simulation is homogenizing milk, a crucial procedure that raises the dairy product's stability and consistency. To keep fat globules from separating and rising to the top during storage or consumption, homogenization involves breaking down the globules

within the cream. By encouraging the uniform dispersion of fat particles throughout the milk, this procedure inhibits the production of a noticeable cream layer. Milk is homogenized by applying high pressure, which efficiently lowers the size of fat globules and ensures their uniform distribution in the liquid. A more consistent and stable product is the result, which is particularly crucial when working with whole milk. Our dedication to delivering a consistent, high-quality dairy product is highlighted by this last step, which also guarantees a smooth and enjoyable customer experience.

CONCLUSION

Ultimately, the primary objective of employing simulation software to design and implement a milk processing plant was accomplished. To produce dairy products of the highest caliber, three crucial processes must be addressed in this simulation: separation, pasteurization, and homogenization. With LabVIEW, a flexible and powerful software platform that can simulate the complex workings of an actual milk processing plant, the system was painstakingly designed and implemented. Its potential for application in educational and industrial contexts is demonstrated by the system's successful implementation, which offers a practical and effective path for training, analysis, and optimization around milk processing technologies.

REFERENCES

T. (n.d.). *Separation of Milk*. Separation of Milk - Dairy Technology. http://dairy-technology.blogspot.com/2014/01/separation-of-milk.html

Pasteurization - an overview | ScienceDirect Topics. (n.d.). Pasteurization - an Overview | ScienceDirect Topics. https://doi.org/10.1016/B978-0-12-810530-6.00007-9

Pasteurization | Dairy Knowledge Portal. (n.d.). Pasteurization | Dairy Knowledge Portal. https://www.dairyknowledge.in/dkp/article/pasteurization

Milk Homogenization - an overview | ScienceDirect Topics. (n.d.). Milk Homogenization - an Overview | ScienceDirect Topics. https://doi.org/10.1016/B978-0-08-100294-0.00012-2

Homogenization | Definition & Examples. (n.d.). Encyclopedia Britannica. https://www.britannica.com/science/homogenization