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# Introduction

Soap is a classic washing chemical derived from oil fats and caustic alkali, and it is still used today. When used as a cleaning agent, it is an everyday need. Among the many specialised soaps available are washing soaps, castile soaps, sandal soaps, flavoured soaps, medicinal soaps, toilet soaps, and baby soaps, just to name a few. The increase in the number of families, particularly those with children, has a proportionate influence on the expansion of the manufacturing sector of the industry. The soap business is vibrant, diverse, creative, and challenging, and it has the potential to create a rewarding career. With rising popularity has come an increase of prospective rivals, but there is still room for further exploitation of the phenomenon.

Besides the raw ingredients, the soap production process also includes various components such as the mixer, the CSTR, the filter-press and the cooling system, as well as a cutting machine, a drying machine, and stamping. It is made up of oil, alkali, brine, and water. A mixer mixes this material for a specific length of time, which varies from maker to manufacturer, and then the finished product is packaged. When raw materials are introduced into a continuous-flow stirred-tank reactor (CSTR), they are instantly and evenly mixed throughout the reactor. CSTRs are used in chemical engineering and are also known as continuous-flow stirred-tank reactors. Color and scent are pumped into the CSTR machine as part of the process. A cooling procedure follows, during which all of the combined components are brought down to their original temperatures. The next phase is the cutting process, which involves cutting the hardened materials into the desired shape of soap. After that, the soap is sent to the drying area, where it is dried for several hours to get its final shape. Finally, the soap is branded and checked for proper packing.

LabVIEW is the programme that was utilised for the process design and simulation. By using a graphical programming approach, you may visualise every aspect of an application, including hardware configuration, measurement data, and debugging. With this visualisation, the integration of measurement equipment from any vendor, the depiction of complex logic on a diagram, the creation of data analysis algorithms, and the design of tailored engineering user interfaces are all made simple and straightforward. Our projects may be developed with the help of the numerous tools and simulation framework provided by LabVIEW. (Instruments, 2018 )

# Objective

The aim of this project is to develop and design a soft drink processing system using LabVIEW software, to accomplish the following tasks:

* Process Management: - This step will consist of simulation of raw material system, sequential flow process, and delivery system.
* Event report generation using write to file/read form excel format.
* Monitoring variables using the web publishing tool
* Utilizing data socket read function to display the price of raw material.

# Program and description

**Flowchart**

Diagram

Description automatically generated

Figure 1: - Flow chart.

According to the flow chart of the overall system, there are two while loops for the programme; the first loop is the loop that executes the simulation of the soap manufacturing processes while the second loop is for the simulation of the soap manufacturing processes while the third loop is for gathering and displaying the data of the soap production using the cluster and data socket operation for gathering the raw material. First, the software asks for the username and password, and it will display an error message until both pieces of information are input correctly. Once the information entered matches the system, the rest of the program's internal blocks will function as intended.

It is necessary to create a random number to pick the type of oil; there are a total of three possible scenarios for the selection of oil type operation. This is followed by another random number being produced to pick the kind of fragrance variable, which may be chosen from three options: rose, lavender, and strawberry. The cstr process is the next operation. Following that, the mixing process is simulated, and the variables are written to a csv file based on the data that has been selected. The process continues until the user presses the stop button.

# Design

Chart, bubble chart

Description automatically generated

Figure 2: Raw material and CSR design panel.

A screenshot of a computer

Description automatically generated with low confidence

Figure 3: Cooling and packaging design panel.

Graphical user interface, application

Description automatically generated

Figure 4: Designed panel for data display.

Figure 2 shows the GUI designed for the raw material and csr information, this block contains mostly of square and round led, a thermometer and a numerical gauge. Figure 3 shows the GUI designed for the cooling and packaging which contains of square and round led, a thermometer, numerical gauge, and horizontal graduated bar. Figure 4 shows the GUI designed for displaying the information of the variables. This panel consist of cluster panel which consists of numerical and string indicator.

**Block diagram: -**

**Login Block (While loop, Case structure, User prompt, Boolean and numeric Operators)**

Graphical user interface, application

Description automatically generated

Figure 5: Login block.

Graphical user interface, application

Description automatically generated

Figure 6: Login block information

The login block action is depicted in figures 5 and 6. The login block is implemented within the case structure because we only want the while loop to execute once if the user inputs the proper username and password. The configuration of the login block is depicted in figure 6. When it comes to matching the login and password, the equal and Boolean operators are utilised. Another case structure block, which contains the primary execution of the programme, receives the output, and forwards it to the next case structure block.

**Data socket and Cluster block (Random number generator, SubVI, Data socket read, bundle cluster, Time delay)**

A picture containing text

Description automatically generated

Figure 7: Data panel while loop.

Figure 7 depicts yet another while loop, which works in conjunction with another while loop to allow for simultaneous execution. This block contains two random number generators for temperature simulation, a time delay for executing the loop after a specified amount of time, a SUBVI that contains the prices for raw materials coconut and olive oil as well as local variables, the get date and time functions as well as the bundle Cluster function and the cluster indicator. Use of the Get Date/Time Function in Seconds function, which returns the timestamp of the current time, as an input for the Get Date/Time string function, which transforms a timestamp value to a date and time string, has been demonstrated in this example. Different data types such as numerical and string are collected and displayed in a single bundle cluster for ease of use.

Text, letter

Description automatically generated

Figure 8: Data socket SubVI.

Figure 8 depicts the data socket SubVI; there are two data sockets in use, one for the price of olive oil and the other for the price of coconut oil. This method reads data from a data socket and accepts the website address as an argument. This function receives the value from the data socket read function and searches for a specified string using the value obtained from the data socket read function. In the end, the result of the function is transformed to a number by using the string to number function, and the numeric indicator is used to display both values.

**Raw material block (Flat sequence structure, Case structure, local variable, random number generator, time delay)**

Graphical user interface, application

Description automatically generated

Figure 9: - Raw material Block.

Figure 9 shows the Raw material block, the simulation for the raw material is done by using a random number generator, the generated number is sent to case structure. The condition of the case structure set one of the Boolean variables to True representing the selected type of oil. For saving the selection type as a string an oil process local variable is set by providing a constant string for each different condition. Time delay is used for each of the simulated process.

**Station logic block (Build array, Search array, increment operator, numerical**

**Operator, Quotient and remainder)**

Diagram

Description automatically generated with medium confidence

Figure 10: - Station logic block.

Figure 10 shows the block diagram of the station logic block, build array is used to gather the values of the state of selected aroma, the output of the build array which is a 1d array containing a true variable. To know which index contains the true state, search 1d array is used, which returns the index of the array. Each station is assigned to the specific aroma, once the station is reaching its maximum capacity it will turn on the led of the respective dispatch and set its variable to zero (Figure 11).

Graphical user interface, application

Description automatically generated

Figure 11: Station logic SubVI.

**Report Generation**

Graphical user interface, text, application

Description automatically generated

Figure 12: Event Report.

It is shown in Figure 11 that variables from the cluster are used to generate an event report. The cluster's unbundled variable is provided as an input to the build array functions and is then used to generate an array. The generated array is then passed to the Write Delimited Spreadsheet function, which converts the provided data to a delimited type of document (delimited type of document). The function is given with the path to the file, and the delimited type is specified to be a comma.

**Web Publishing Tool**

Using the online publishing tool and its output are depicted in Figures 13, 14 and 15, where the first step is to pick the project that must be published on the internet, the second step is to supply the website information, and the third and final step is to obtain the website address. Figure 15 depicts the outcome when the simulation is activated, and the data is shown in a manner like that of the front panel.

Graphical user interface, text, application

Description automatically generated

Figure 13: Web publishing tool.

Graphical user interface, application

Description automatically generated

Figure 14: Web publishing tool preview.

Graphical user interface

Description automatically generated

Figure 15: Labview Web publishing output.

# Discussion

The GUI and the block diagram were developed in accordance with the processes involved in the soap production process. It is clear that the graphical user interface (GUI) display was created in such a way that it accurately depicts the operation of the system. Displaying the data is accomplished through the use of numerical indicators, string indicators, Boolean indicators, gauges, thermometers, and clusters. Because the processing system required both parallel and sequential processing, a block diagram was used to depict the system's architecture. Using a flat sequence structure to perform sequential processing for the majority of the system, it was possible to ensure that a block inside the sequence was run before or after another sub block in the simulation, which helped to make the system flow smooth and simple to monitor. Meanwhile, the parallel processing was accomplished through the use of two while loops which is a common and easiest way to achieve this in LabVIEW.

The array and cluster data types were the most often utilised types of variables for storage, with the array data type being used most frequently. Clusters were useful when there were many data types to include, such as string and integer, which the array could not accommodate. Clustering was accomplished through the use of the bundle function. Because an array may only display one form of data at a time, number to string conversion was employed wherever it was necessary. array functions such as build array, index array, and search 1d array were employed for this particular project among others. When selecting an oil type or a particular fragrance, the case structure function was employed to make the necessary selections at the moment.

Using the Sub VI, which is a smaller section of code that consists of front panels and block diagrams, it is possible to reduce the amount of space taken up by a main VI while also facilitating the structure and presentation of the code. The data socket read function made advantage of a web scraping approach, which allowed it to obtain live data from a specified website. It also includes a web publishing mechanism that may be used to maintain a system's status from any point on the planet at any time. Additionally, by utilising the internet in conjunction with LabVIEW, it may be possible to provide customers with real-time value information.

The problem that happened was with the online Web publishing tool; after completing the procedures, whenever the connect button was hit, the programme used to open in the Google Chrome browser, but it was not supported. The integration of the LabVIEW web extension was not supported by the Google Chrome browser. After then, further attempts were made using the Microsoft Edge browser, but each time the website not supported message was given. Upon investigating the issue, it was discovered that the internet explorer browser may be utilised in conjunction with the online publishing tool.

The login menu was executing after every iteration making the system crash, to deal with this a variable is set at an initial condition to 0 and compare it 0 constant, but after the user enters the correct name and password the variable increased by 1 hence making the login block to run just once.

# Conclusion

To conclude the Soap manufacturing processing was chosen as the assignment topic for chemical manufacturing process. The project's objectives have been met since the simulated graphical user interface (GUI) comprises of a raw material process panel, a process panel, a packaging panel, a discharge panel, and a data panel. The write to spreadsheet function was used to present specific data in the event report goal, such as the date, time, oil type, and aroma kind, in the excel format using the write to spreadsheet function. The data socket read function was utilised to complete the process monitoring goal. Two data socket read functions were employed, one for the live price of Olive oil and another for the live price of Coconut oil. Every aspect of the LabVIEW that was necessary for this project is covered in detail in the assignment. Login, arrays, clusters, for loop, case structure, while loop, time delay, date and time function, data socket function, SubVI, online publishing, operators, and so forth are all included.

# References

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| --- | --- | --- |
| **Resources** | **In-Text Citation** | **End-Text Referencing (Reference List)** |
| **Book:**  **Two Author** | LabVIEWis a graphical programming language ….Travis, J. (2009). | Travis, J. (2009). *LabVIEW for everyone*. Pearson Education India. |