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# Introduction

Humans have sought to hide or improve their own odour from the beginning of recorded history by employing perfume, which mimics the pleasant aromas of nature. Many different natural and man-made materials have been used to produce perfume, which has been applied to the skin and clothing, included in cleansers and cosmetics, and sprayed into the air to fragrance the environment. Because everyone's body chemistry, temperature, and body smells are different, no two people will smell precisely the same when wearing the same perfume. Perfume is derived from the Latin words "per," which means "through," and "fumum," which means "smoke." Many ancient fragrances were created by pressing and boiling plants to extract natural oils, which were then used to create the fragrance. The oil was then used to perfume the air after it was burned. The majority of perfume today is used to fragrance bar soaps. Some items are even perfumed with industrial odorants to conceal undesirable odours or to make them look "unscented," as is the case with some cosmetics. While aromatic liquids applied to the skin are commonly referred to as perfume, real perfumes are defined as extracts or essences that contain a proportion of oil that has been distilled in an alcohol-based solution. In addition, water is utilised. With yearly sales of around 28.5 billion dollars (and that's just in the United States), the perfume business is one of the most successful in the world market.

Diagram, timeline

Description automatically generated

Figure 1: Co2 extraction

Harsh CO2 extraction is concerned with the production of oils at low temperatures and in a short period of time (i.e., only a few minutes), with no synthetic build-up associated with the end result. The extraction cycle takes place in a chamber that is completely fixed, and the entire oil is recovered, even the most unstable and sensitive components. Whatever the case, the centralization of pesticide buildups, starting with the first plant material, is much more notable than the characteristics achieved by other more conventional extraction procedures. In addition to the fact that CO2 is non-harmful, drab, and scentless, temperatures are kept low to prevent thermally labile combinations from being damaged; there are no 'really' flavours and more top notes; the true common smell and flavour qualities are retained. It completely recovers all of the nutrients from the plant material.

Laboratory Virtual Instrument Engineering (LabVIEW) to construct graphic-based programmes known as virtual instruments (VIs) that replicate genuine laboratory instruments. LabVIEW was developed by National Instruments and can be downloaded here. It is composed of two parts: the front panel and the rear panel of the instrument (Figure 1). When the front panel is on, the user may interact with the VI by seeing the program's outputs and providing inputs to it. The code for the rear panel is used by the VI to collect inputs from the front panel, act on the inputs, and show the results of the operation.

# Objective

The project's goal is to develop and simulate a perfume production system using LabVIEW software in order to complete the following tasks:

• Process Management: - This stage will include the modelling of the raw material system, the sequential flow process, and the delivery system, among other things.

• The creation of event reports in the write to file/read form Excel format. •

• Using the online publishing tool, keep track of the variables.

• The raw material price is displayed using the data socket read function.

# Program and description

**Flowchart**

Diagram

Description automatically generated

Figure 2: - Flow chart.

The software process begins with two while loops running in parallel, and if the user decides to stop the execution, both loops will come to a halt simultaneously. The kind of scent is chosen using a random number generator, which is a computer programme. Because there are four different perfume kinds, a range of 25 numbers is assigned to each type, and the number of the selected perfume is raised by one after each execution based on the number created. The incrementing of each kind is carried out in order to maintain track of the quantity of fragrances of each type that have been manufactured. A Co2 extraction flow sequence structure is conducted following the raw material processing. This illustrates the simulation of raw materials moving through the tiny pipe intake, with pressure being reduced and Co2 being returned to its container as the liquid is transferred to another tank. The mixing flats sequence structure is conducted, in which the oil created from the Co2 extraction is mixed with the liquor water and fragrance, and a tank indicator was picked to do this simulation in order to achieve the best results. Packaging and dispatch flat sequence structure were developed after that, with a conveyer belt being used to demonstrate packaging and a truck simulation being used to demonstrate dispatch.

Another while loop which simulates the temperature and pressure variables. For temperature random number is generated from 95 to 115 while for pressure random number is generated from 70 to 95. Live price of ethanol is executed in the while loop.

# Front Panel Design

Diagram

Description automatically generated

Figure 3: Raw material.

A picture containing text, indoor

Description automatically generated

Figure 4: Co2 Extraction.

Diagram, engineering drawing

Description automatically generated

Figure 5: Mixing process.

Graphical user interface

Description automatically generated with medium confidence

Figure 6: Product and Dispatch.

Graphical user interface

Description automatically generated

Figure 7: Information Panel.

Figure 3 shows the raw material design, the design is made on control using DSC module. An image is pasted on top of the horizontal slider, this process is repeated for all the four tanks and their colours are changed as per the perfume type. Four Boolean indicators are implemented to display the current selection of the tank. Figure 4 shows the Co2 extraction process where similar process to raw material was implemented and thermometer and gauge indicator was used for pressure and temperature measurement Figure 5 and Figure 6 are the mixing and dispatch process. Figure 7 shows the information panel which consists of two cluster, array for showing the events and other numerical indicator for variables display,

**Block diagram: -**

The designed LabVIEW program consists of arrays, cluster, sub Vis, Loops, structure, Write to File, Read from file, local variables, operators, Vis, Error handling, data socket, and Web publishing tool.

**LOOPS:-**

Graphical user interface, application, Word

Description automatically generated

Figure 8:- While loop

Figure 8 shows the while loop execution, there are several while loop implemented in the program. The stop condition of the while loop is set to false, which means the loop will keep working until the user press the explicit stop button.

Graphical user interface, application

Description automatically generated

Figure 9:- For loop

Figure 9 shows the for loop, which was used throughout the program, the for loop executes 10 times while the iteration number is provided as the input to the slider for simulating respective task. A time delay inside the loop is implemented throughout the program.

**Flat sequence and Case structure: -**

Flat sequence structure was used since the program requires a sequential process to occur, hence implemented using the flat sequence structure as shown in figure 10. The case structure is also another functional block used in the program multiple times. The case structure consists of several different cases and the selected case for the execution executes the block inside the case structure. In the program it was mostly used for the selection of the one out of several parameters.

Graphical user interface, text, application

Description automatically generated

Figure 10: Flat sequence and case Structure.

**Array, Clusters and Write to file.**

Diagram

Description automatically generated

Figure 11: Array and clusters

The difference between array and cluster is that array holds the same data types while cluster can hold different variables of different data types. Hence in the program while displaying the events and process consist of numerical, Boolean and string data type. Date and time output are in string while the number of perfumes dispatched are in numerical hence, and displaying the current selection of the perfume is Boolean, hence for these types clusters were used. The cluster are made using the bundle function block which takes the variables as an input and output the clusters. While for creating an array build array function is used which takes input the number of perfumes for each type and the output array is the input to the write spreadsheet function. Write spreadsheet function’s input is the directory where the csv file is stored, delimiter is provided and whether to append the file or not. All these parameters were provided and if there is any error occurred the error is thrown in cluster giving the error related information.

**Sub VIs and Data Socket**

Graphical user interface, text, application

Description automatically generated

Figure 12: SubVIs and data socket

The data socket SubVI is depicted in Figure 12. Program modularity in LabVIEW is done by dividing large portions of code into smaller parts of code known as subVIs. A subVI is a text-based programming language component that is analogous to a subroutine in terms of functionality. The ethanol live price is represented by the subVI above, which was accomplished with the use of the data socket function. The website address can be passed as an argument to the data socket. This function accepts the value returned by the data socket read function and uses the value returned by the data socket read function to search for a given string within the data socket. After that, by utilising the string to number function, the output of the function is turned into a number, and the numeric indicator is utilised to display both values. If an error is thrown, the error information is displayed in the error cluster to the right of the screen.

**Web Publishing Tool**

Web publishing tool in LabVIEW is to create HTML documents and embed VI front panel images. Figures 13, 14 and 15 shows the web publishing tool, Figure 13 shows information such as document title, header and footer is provided. Figure 14 shows the connected VI before execution while the Figure 15 shows the VI after execution.

Graphical user interface, application

Description automatically generated

Figure 13: Web publishing tool.

Graphical user interface

Description automatically generated

Figure 14: Web publishing before execution.

A picture containing graphical user interface

Description automatically generated

Figure 15: Web publishing Tool after execution.

# Discussion

The GUI and the block diagram were developed in accordance with the processes involved in the Perfume production process. The Front panel includes control which is for displaying the relevant information. DSC module was used for the development of several control, this module lets to select images form the image navigator option and let the user to create the Control for the front panel. The different process required for the manufacturing process was represented in different block. clusters. The processing system required both parallel and sequential processing, while loops and flat sequence structure is used to perform this type of operations. It was able to ensure that a block inside the sequence was executed before or after another sub block in the simulation by employing a flat sequence structure to perform sequential processing for the majority of the system. This helped to make the system flow smooth and easy to monitor. Case structure was useful whenever there was requirement of several different cases such as for the selection of the type of perfume.

“The array and cluster data types were found to be the most often used forms of variables for storage, with the array data type being the most frequently used type. In situations when there were several data types to include, such as strings and integers, and the array could not hold all of them, clusters were helpful. During the display of time and date along with the indicators of selected type of perfume cluster was used. The usage of the bundle function was used to get the desired clustering results. Since an array may only display one type of data at a time, number to string conversion was used whenever possible. For this specific project, array functions such as construct array, index array, and search 1d array, among others, were utilised. To get number of perfumes produced of each type of array was built also for displaying the data.”

To make the program easier to read and operate SUB VIs were used which were helpful in reducing the section of code from the main block diagram. Multiple SUB VIs was implemented such as for raw material preparation, for live price generation of ethanol. Write and read spreadsheet function was used in the program to generate an event report and get the report to the information panel, the type of file used was csv type. The data socket read function took use of a web scraping method, which allowed it to get real-time data from a given website by using a data socket. A web-based publication mechanism is also included, which allows for system status to be maintained from any location on the world, at any time of day or night. Using the internet in conjunction with LabVIEW, it may be able to give consumers with real-time value information, as well as other benefits.

Several systematic error and logical were occurred during the testing of the program. While using the write to spreadsheet function, after providing the correct address the error was thrown that the file is not available, trying several techniques it was found that if the csv file will be opened in the background the LabVIEW will not execute operations on it. When implementing parallel processing, there were some errors that occurred. For example, two while loops used for parallel processing did not work as expected because one loop did not allow the other to execute. This was corrected by incorporating those while loops into a flat sequence structure, which allowed the loops to execute parallelly. Another error that occurred was trying to output the web publishing tool, after each connect operation the Microsoft edge browser was stuck at the downloading stage and throw the error not supported. Searching for the operation it was turned out that the internet explorer is supported for web publishing tool.

# Conclusion

To conclude the perfume manufacturing processing was chosen as the assignment topic for chemical manufacturing process. The required parameter for the LabVIEW program was included and briefly explained in the block diagram content. Flow chart was made to display the execution of the program. The assignment requirement were achieved, the first objective was achieved by developing a GUI using the LabVIEW program as explained, second objective of event report generation was achieved using the write to and read from text file operation by creating a csv file and appending the values after each execution of the program, data socket operation fulfils the third objective of reading the raw material price from online, the last objective was achieved using the web publishing tool.

# References

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