INDIVIDUAL ASSIGNMENT

SYSTEM PROGRAMMING AND COMPUTER CONTROL

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Introduction

This car wash controller demonstrates how automated washers may be operated using just a system. This is intended to establish an effective method for cleaning the automobile when they enter the car wash. Users can interact with the system by selecting all of the wash choices they want. This device has an LED indication to monitor the car washing process. Using a slider should determine if the user is suitably positioned depending on each station displayed in the system. The car wash controller system can meet the majority of the fundamental needs of vehicle washing services without the need to contact customer care. On the server side, it is necessary to track the logging file when consumers visit the vehicle wash. Meanwhile, on the client side, it is necessary to let the customer experience the convenience of washing their automobile.

Assumption

Before entering the vehicle wash lane, the customer must select their wash service selections. After initiating the system, consumers may drive to the correct station using the light indication, which changes every 5 seconds. When the “Vehicle Out of Position” light illuminates, it indicates that the vehicle is in the incorrect position and must be moved to the appropriate station. Finally, after completing all of the cleaning stages that have been chosen, they can depart the vehicle wash. Customers can also do an emergency stop, and all of the wash choices that have been selected will be entered into the logging file, along with their time and date.

System Design (Client/Server)

Storyboards

User must first log in to their account before selecting wash options. If a user doesn't have an account, they can visit the register page to create one and then proceed to the wash option selection section. After selecting their wash options, customers must start the system at the entrance station. In the event that a customer begins the system without first selecting wash choices, it will default to a "High-Pressure Wash" " While waiting for the car to proceed to the next station, the light indication will remain in the "Vehicle Out of Position".

Figure1: Customer entering Car Wash

Customers in this storyboard scenario are selecting options such as underbody wash, pre-soak, high-pressure wash, and air dry.

Figure 2: Customer in Station 1

Following the automobile's entry into the car wash, the customer will proceed to station 1. At this point, the underbody wash indication will illuminate, and a timer will commence for a duration of 5 seconds time-lapse. After a duration of 5 seconds, the indicator for the underbody wash will cease, and the indicator for the "Vehicle Out of Position" activate till we proceed to the subsequent station.

Figure 3: Customer in Station 2

The vehicle will go to the pre-soak and high-pressure wash station2. The automobile is waiting to be moved to the next station once the pre-soak indicator lights up and the high-pressure wash turns on for five seconds.

Figure 4: Customer in Station 3 and going to exit

Finally, an air drying procedure will be conducted once the indication I activated and the specified duration has passed. This is the final stage of the service that has been rendered. The customer required to depart from the car wash.

Use-Case Diagrams

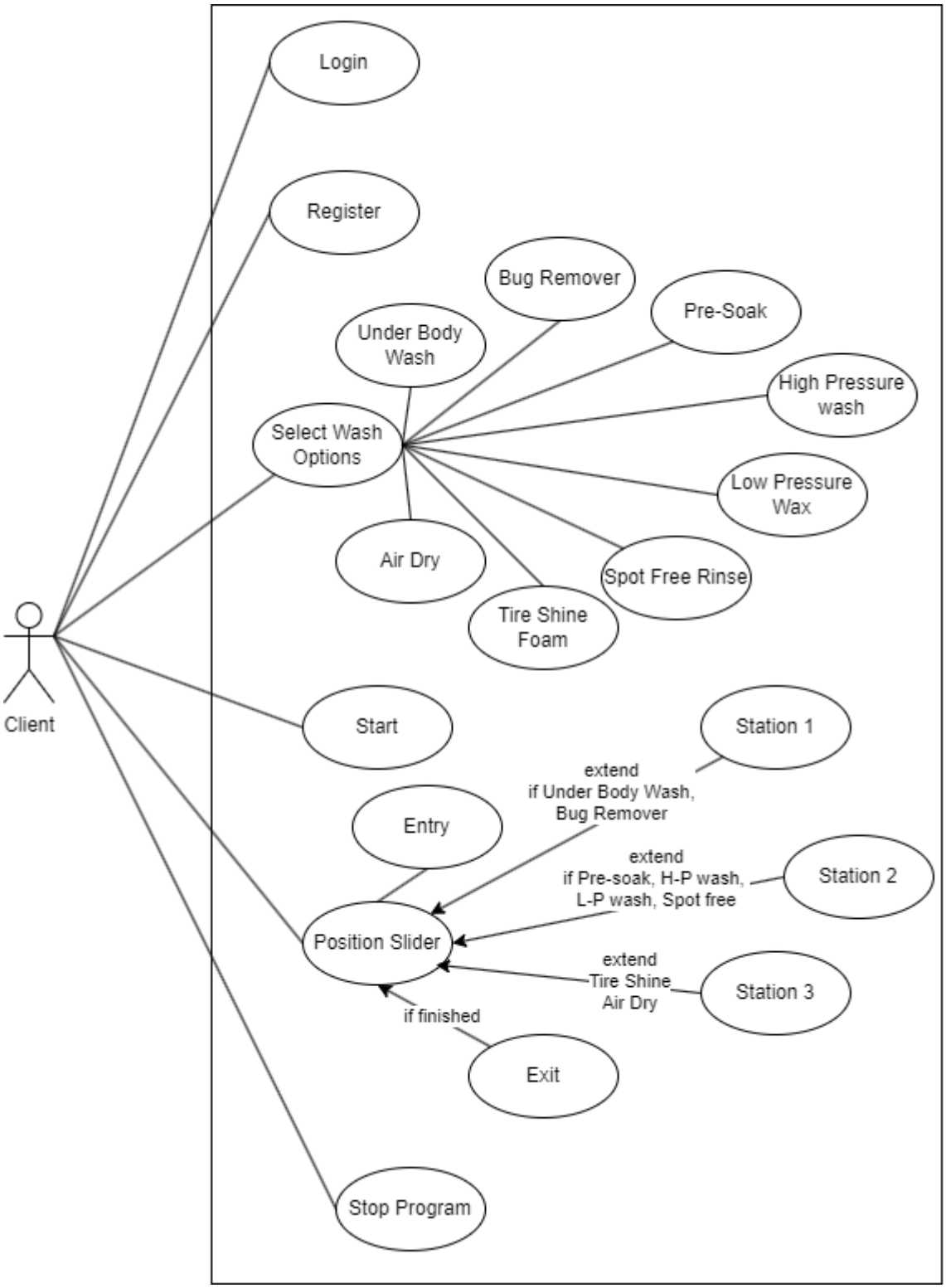

Figure 5: Use case diagram

Use-Case Descriptions

Use Case	**Login**
Brief Descriptions	The client will have to login using their account in the beginning.
Actors	User
Preconditions	Having the user have an account
Main Flow	The system will wait until the user successfully login to start
Alternative flow	Go to the ‘Register’ page if the user doesn’t have an account

Use Case	**Register**
Brief Descriptions	The client can register using their desired username and password, which will be recorded in the text file
Actors	User
Preconditions	No preconditions
Main Flow	Input username and password from the user into a txt file
Alternative flow	Go to the ‘Login” page if the user has an account

Use case	**Selected Wash Options**
Brief Description	The customer can choose from a variety of wash choices in this use case, including Air Dry, Spot Free Rinse, Tire Shine Foam, Pre-Soak, High Pressure Wash, Low Pressure Wax, and Underbody Wash.
Actors	User
Preconditions	No Precondition
Main Flow	a) The car wash waits for the customer to choose from eight offered wash options. b) The user must complete must complete the whole chosen wash options washing cycle for five seconds.
Alternative Flows	The system will stay inactive while it waits for user interaction.

Use case	**Start**
Brief Description	This use case enables the user to get the value of the position slide and activate the indication.
Actors	User
Preconditions	Having the user select the wash options
Main Flow	The car wash will wait for the position slider altering the position to make the system start running.
Alternative Flows	The system will wait for user interactions after selecting the wash options.

Use case	**Position Slider**
Brief Description	The use case enables the user to enter the position of their wash cycle.
Actors	User
Preconditions	Having chosen the start button.
Main Flow	The system will examine the control to see whether any of the wash settings have been switched. a) If the position slider is in the proper position, the system will start the car wash. b) If the car is in the erroneous position, the system will display “Vehicle Out of Position” and prompt the user to relocate to the correct position.
Alternative Flows	The “Vehicle Out of Position” will remain active until it is in the right position.

Use case	**Stop Program**
Brief Description	This allows the user to stop the entire wash cycle immediately.
Actors	User
Preconditions	When the wash options have been selected
Main Flow	Will stop the entire program in one button click.
Alternative Flows	No Alternative Flows

Activity Diagrams

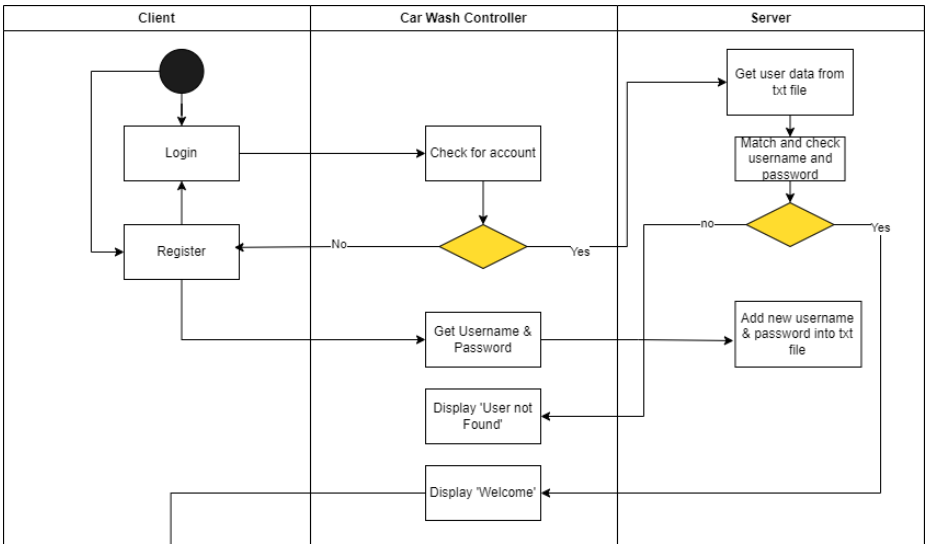

Figure 6: Login & Register activity diagram

At the start of the activity diagram, the customer must log in or register. In the car wash controller part, it will verify and get your user data from the text. file; if it matches, you will see a " Welcome' display; otherwise, it will say "User Not Found"; this client can register. The controller will get the login and password and save them in a Txt file.

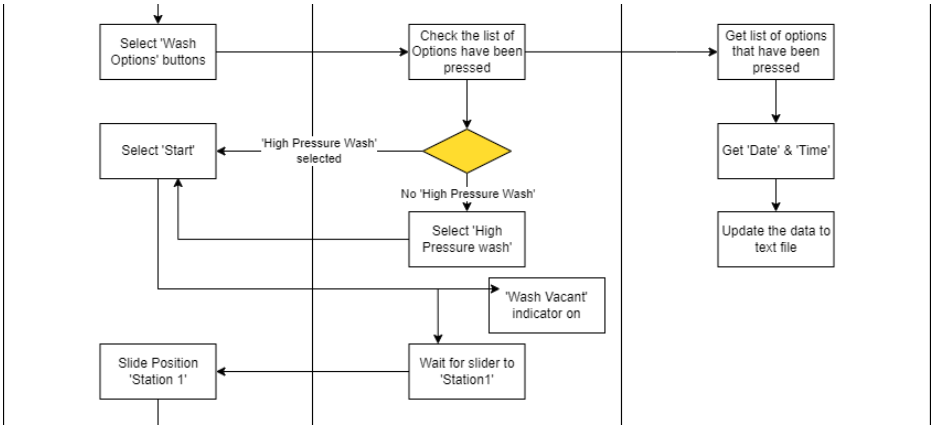

Figure 7: Select and Start activity diagram

Starting at the beginning of the car wash cycle, the customer must pick the buttons offered by the system based on their demands. Following this, the car wash controller will review the list of possibilities depending on the client's selection. There are certain restrictions: if the client does not pick the 'High-Pressure Wash', it will be selected automatically. After selecting all

of the requirements, the customer may finally start the system, and the ‘Wash Vacant’ sign will light up. Meanwhile, on the server side, after reviewing the list of client options, it will retrieve the list, date, and time, which all be changed or saved to the text file.

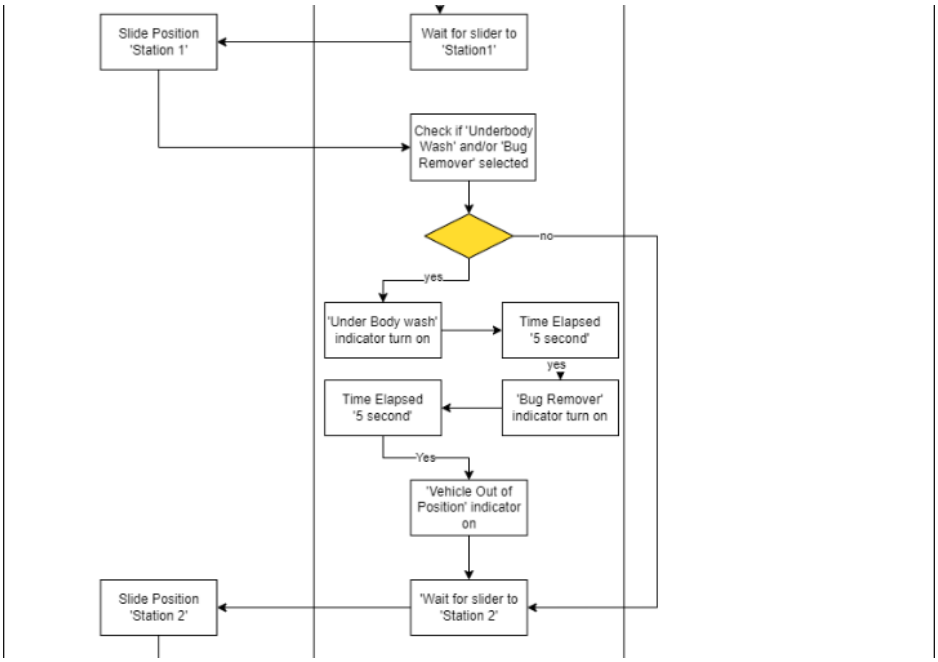

Figure 8: Station 1 activity diagram

In this case diagram, all of the options will be selected, and the user will be able to run the system. The system will identify the need and wait for the client to move the slider to the station. This allows checking if ‘Under Body Wash’ and ‘Bug Remover’ is selected; if so, the ‘Under Body Wash' indicator will turn on and time will lapse for 5 seconds. After that, the timer will reset for the next indication, ‘Bug Remover’, and then lapse for 5 seconds. Finally, the ‘Vehicle Out of Position’ indicator will light up. If no choice is accepted from the first station, it will go the the next station.

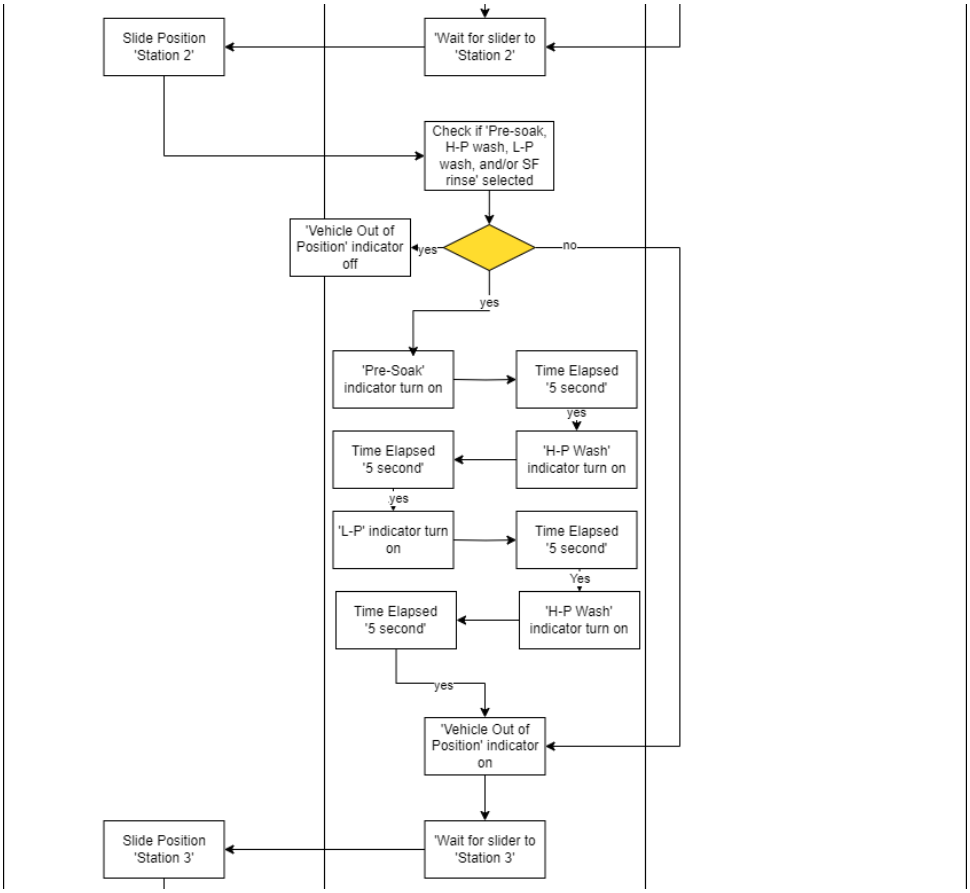

Figure 9: Station 2 activity diagram

After going to station 2, it will check if ‘Pre-Soak, ‘High-Pressure Wash’, ‘Low-Pressure Wax’, and ‘Spot Free Rinse’ are enabled, just as it did at station 1. If yes, ‘Vehicle Out of Position’ will be turned off, and the client will be guided through the process of turning on or off each indication, as well as the time-lapse and reset time-lapse. By completing all of the washing at the station, ‘Vehicle Out of Position’ will return and wait for the customer to go to the next station.

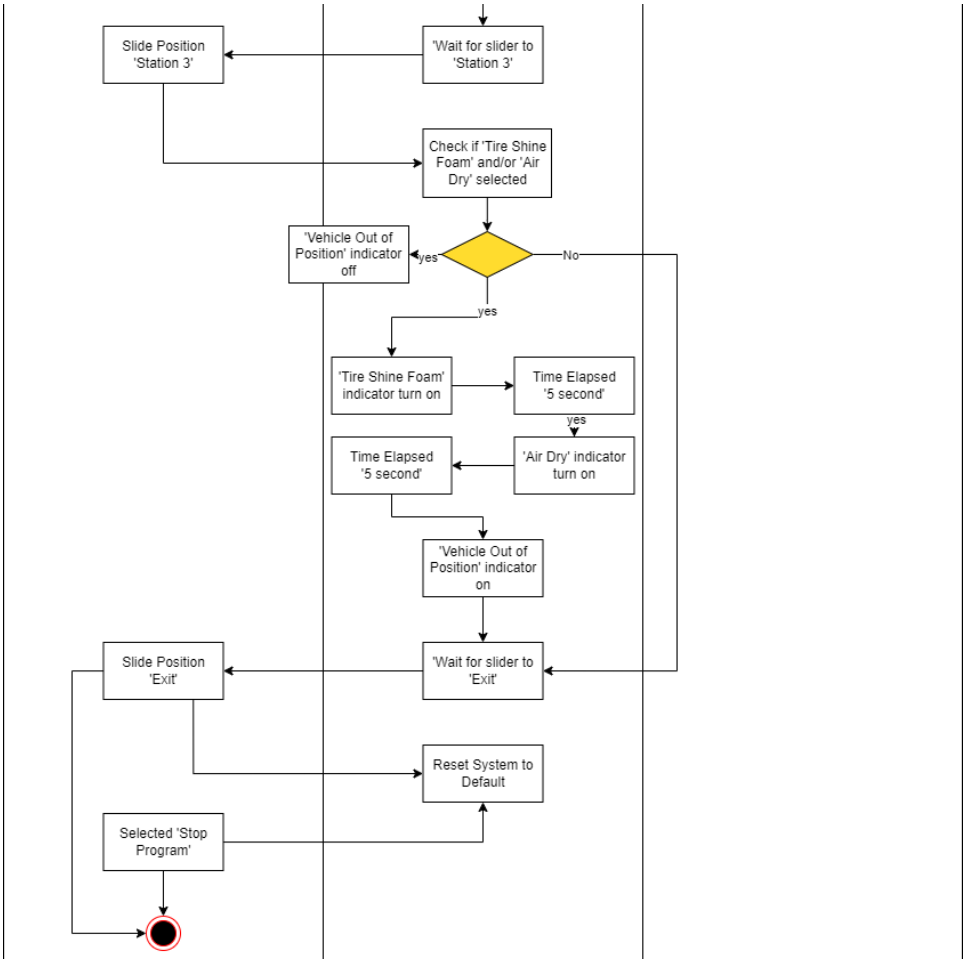

Figure 10: Station 3 and Exit activity diagram

If the ‘Tire Shine Foam’ and ‘Air Dry’ buttons are chosen, station 3 will check for them at the end of the washing cycle. The indicator and time-lapse will run step by step until the ‘Vehicle Out of Position’ indicator turns on. When it gets to the end, the system will wait until the client travels to the next slot, ‘Exit’. This will reset the system to its default settings. In addition, there is a ‘Stop Program’ that allows you to reset the system.

Protocol Design (Client/Server)

Server Side

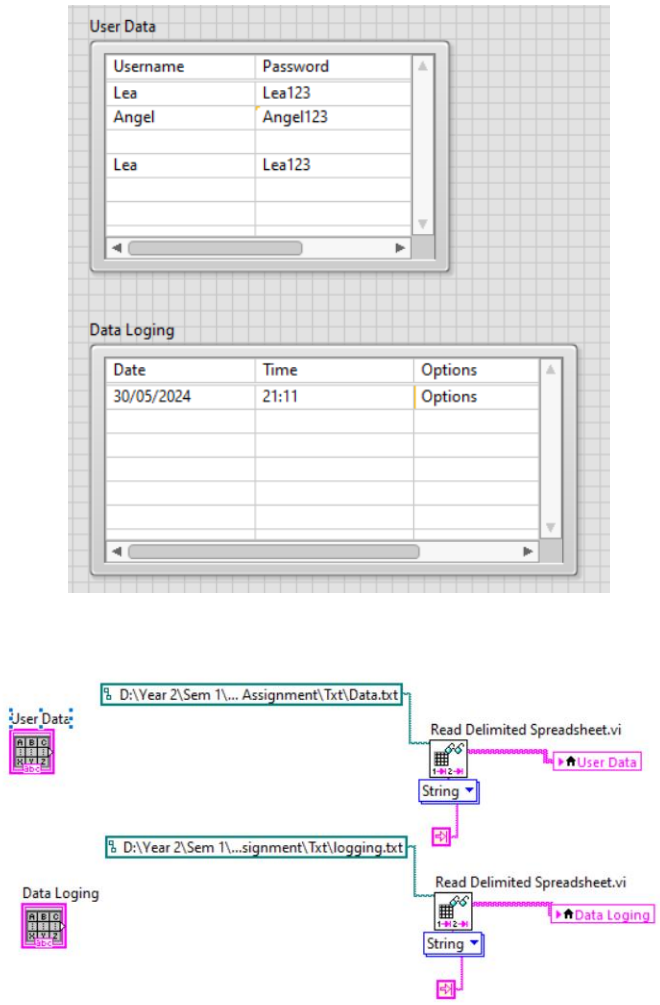

Figure 11: Server Front Panel and Block Diagram

Staff on the server side can check the user's username and password. This implies that when a client registers their account, it is automatically registered in the table. In the 'Userdata' Table it is connected to the path 'Data.txt' meanwhile in the logging, it is connected to the 'Logging.txt'. Furthermore, data recording will display real-time information about when and how clients utilize the system.

Client Side

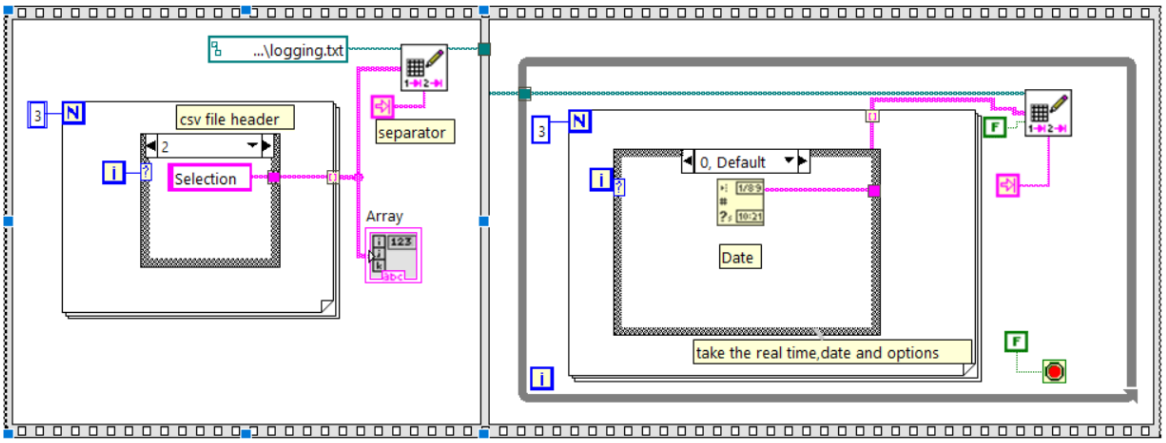

Figure 12: Client Logging append data block diagram

Meanwhile on the client side, when the client uses the vehicle wash system, the data of the time, date, and options will be logged in the 'logging.txt', this information will also be updated on the server.

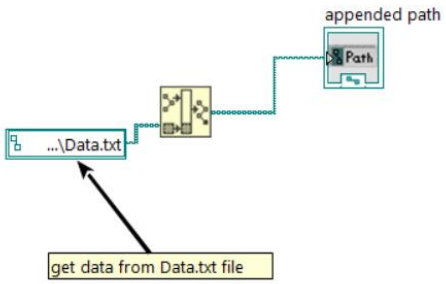

Figure 13: Client Login get data block diagram

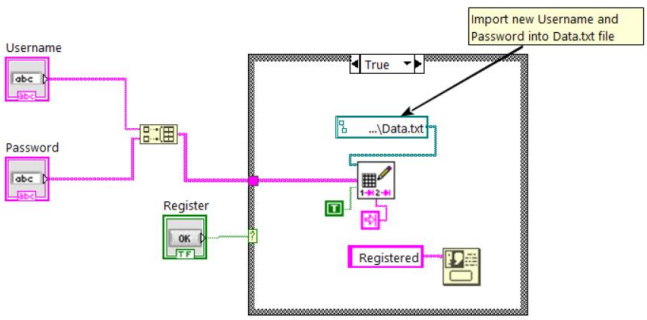

Figure 14: Client Register appending data block diagram

Similar to the registration section, data such as username and password will be appended to the txt file ‘Data.txt’. Using the same file, users may log in using the data that is presently in the file; if no user is not found, they can try again or create a new account on the ‘Register’ page.

Health and Safety Considerations

Regular Cleaning

Car wash brushes are essential while washing a car since they are the workhorses of all cleaning operations. Considerations can be made:

Inspection: A routine assessment of the brushes. Check for broken or loose bristles that might cause harm. Brushes should be washed or replaced after a given number of cycles or specific duration.

Water Pressure Safety

If the water that comes out of the high-pressure washer is not correctly managed, it may scratch or damage the vehicle. Consideration can be made:

Optimal Water Pressure: Keep the water pressure and distance balanced so that stubborn dirt may be removed without harming the vehicle. Furthermore, the addition of changeable water pressure levels allows for the cleaning of specialized tasks.

Emergency Stop

It is critical to have an emergency stop mechanism in this automated car wash since it provides for fast shutdown in the event of malfunction or safety problems. It is necessary to examine the following:

Vehicle or System Malfunction: if a car or the car wash system develops a mechanical problem during the wash cycle, the emergency stop button will be pressed instantly, stopping the whole operation. This enables the attendant to address and resolve the issue that sparked the emergency stop.

Electrical Safety

Since this car wash controller system will be implemented in wet environment, electrical safety is critical. Consideration can be made:

Proper Wiring: Ensure that all electrical wiring in the car wash uses water-resistant wires. It is advised that all electrical equipment be properly planted in the ground to avoid harmful voltage; nevertheless, this should be monitored on a regular basis to assure safety.

Implementation

Touchscreen Display

By using a well-designed interface with clear icons, straightforward menus, and easy-to-read text. It is planned to be touch-responsive, with clear instructions on how to select wash choices and start the cycle. Given that this will be used in a wet environment, the touchscreen display should made of a sturdy, water-resistant material.

Light Indicator

Light Indicators are not just used to track automobile movement. It also functions as a status indicator, with different colored lights indicating the current stage of the wash cycle. This will make the user aware of when they should start moving from their present position.

Waterproof Positioning Sensor

The attendant will identify when the automobile enters the wash bay and track the customer’s location from the entrance to leave. The system can automatically activate different wash stages at the appropriate station. This is critical to ensuring proper operations from one station to the other station.

Conclusion

This car wash controller system is an excellent choice since it increases convenience for both clients and employees while facilitating car wash services. It saves customers time by eliminating the need to constantly look for personnel, while workers will always be aware of the customer’s whereabouts. However, there are several limitations beyond its implementation, such as the lack of a payment mechanism,. A payment system can make the work more efficient by eliminating the need for the client to leave their car to travel to the cashier to pay for the service; instead, they can pay directly through the system. As a result, there is a potential future upgrade, namely a payment mechanism. This payment method may be simply cash-in into the machine, e-wallet, QR payment, or RFID payment, which is an excellent implementation for the current era of digitalization. Furthermore, implementing an application or software might be a practical option for automobile services with a long waiting list. This program may be used as an online booking car wash slot for the customer to Acknowledge their current queue number, this case allows the customer to not have to wait for a long time at the car wash.

References

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Appendix

User Manual

Login

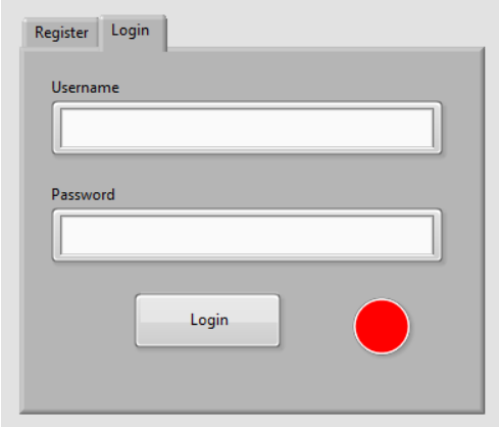

Figure 15: Login page

In the initial phase of the system, the client must log in using their account in order to utilize the system, which will display the message “Welcome’ if successful otherwise “User Not Found”.

Register

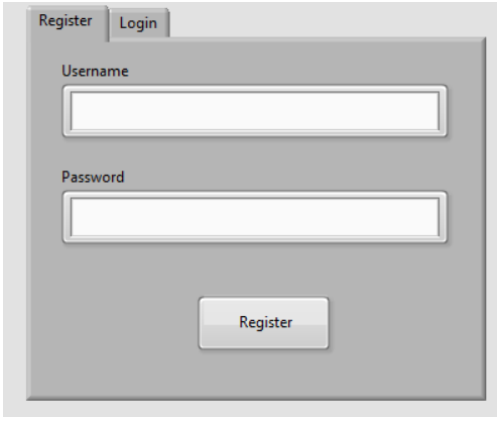

Figure 16: Register page

The register is accessible for clients who do not have an account; by entering the data and clicking register, all of the user data will be saved in a file.

Entry Console (Wash Options)

Figure 17: Entry Console UI

The client can pick all of the options shown in the above image; however, if no options are selected and the system is started, it will default to “High-Pressure Wash”, and even if the customer does not selected it, it will automatically be selected. Selecting ‘Start’ allows it to proceed to the next phase.

Car Position Simulation

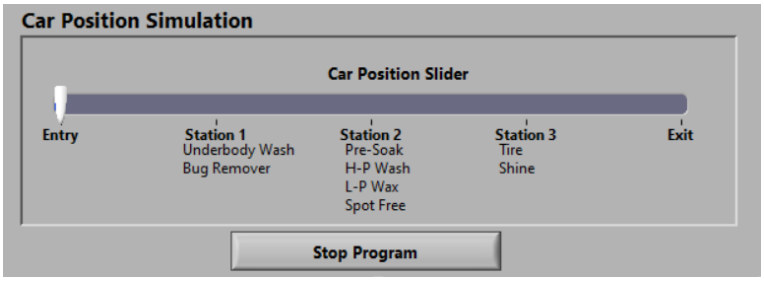

Figure 18: Car Position Slider UI

The car position slider must be at an accurate station based on the label given by the system. There will be a red light indicator with “Vehicle Out of Delivery”, indicating that the automobile is an improper place and must go onward.

Car Wash Display

Figure 19: Car Wash Display

According to the illustration above, hitting ‘Start’ changes ‘Wash Vacant’ to a ‘Wash In Progress’ red light. When each slider is moved to the correct position, the light indicator will turn on step by step from up to the button (Under Body Wash to Air Dry).

Elapsed Time

Figure 20: Elapsed Time UI

The above indicator indicates that each vehicle wash indicator that lights up at the same time will lapse the timer for 5 seconds and reset for the next ongoing indicator.

Stop Program

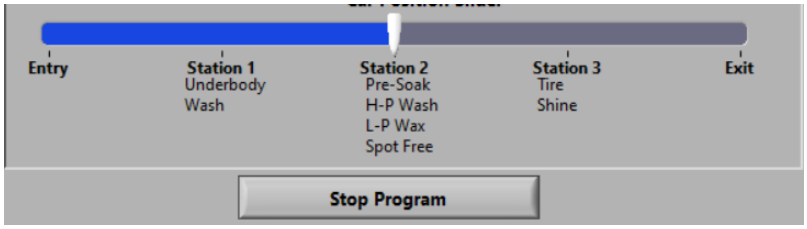

Figure 21: Stop Program UI

Finally, the stop program allows the system to reset everything including buttons, indicator, time, and slider into default.