Verification and Validation Report: Sayyara

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1 Revision History

Table 1: Revision History

Date	Developer(s)	Change
February 22, 2023	Arkin Modi	Add Automated Testing Section
March 3, 2023	Joy Xiao	Add Tests Evaluations for Legal and Cultural Requirements
March 3, 2023	Joy Xiao	Add Services and Appointments Test Evaluations
March 4, 2023	Leon So	Add Introduction
March 4, 2023	Arkin Modi	Add Tests Evaluation for Security Requirements
March 4, 2023	Arkin Modi	Update Look and Feel Requirements Tests
March 4, 2023	Arkin Modi	Add Unit Testing Summary Table
March 4, 2023	Leon So	Add NFR Tests for Operational and Environmental Requirements
March 4, 2023	Timothy Choy	Add Test Evaluations for Usability and Humanity Requirements
March 4, 2023	Timothy Choy	Add Test Evaluations for Performance Requirements
March 5, 2023	Leon So	Add Functional Requirement Tests for Shop Profile
March 5, 2023	Timothy Choy	Add Test Evaluations for Maintainability and Support Requirements
March 6, 2023	Leon So	Add Functional Requirement Tests for Authentication
March 6, 2023	Leon So	Add Functional Requirement Tests for Employee Management

2   Symbols, Abbreviations and Acronyms

symbol	description
API	Application Programming Interface
CD	Continuous Deployment
CI	Continuous Integration
CLS	Cumulative Layout Shift
FCP	First Contentful Paint
FID	First Input Delay
LCP	Largest Contentful Paint
ms	Milliseconds
PII	Personal Identifiable Information
PWA	Progressive Web Application
s	seconds
SRS	Software Requirements Specification
T	Test
TTFB	Time to First Byte
VnV	Verification and Validation

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3 Introduction

3.1 Project Summary

Sayyara is a Progressive Web Application (PWA) which acts as a single platform for independent auto repair shops and vehicle owners. This platform allows independent auto repair shops and vehicle owners to interact in various ways. Using Sayyara, vehicle owners can search for auto repair shops and services based on a variety of search filters; request quotes for service; book, view, and manage service appointments. On the application, auto repair shop owners have full shop management capabilities such as: adding and managing a list of employees; managing a list of service types and corresponding service appointment availabilities; managing store information such as location, hours of operation, and contact information. Auto repair shop owners and employees will be able to manage quotes, service appointments, and work orders from a single application.

3.2 Purpose of Document

This document outlines the validation and verification process for the application, Sayyara, and a detailed summary of results for the planned tests defined in the VnV Plan.

3.3 Scope of Testing

As defined in the VnV Plan, the tests reported aim to verify and validate functional and nonfunctional requirements listed in the SRS.

In addition, the testing reported in this document aims to validate that the application provides adequate usability and to verify that system is in a functional state for the end users. The testing and validation will aid in ensuring that the product fulfills the system requirements, intended use, and goals of stakeholders.

4 Functional Requirements Evaluation

4.1 Authentication

1. **FRT-BE1-1**

   Control: Manual

   Initial State: Customer with no existing account

   Input: Customer submits sign up form with valid email, password, name, and phone number

   Output: Redirect to vehicle owner landing page upon successful registration

   Test Case Derivation: New customer wants to sign up for a new account with valid sign up information provided

   How test will be performed: The tester will register and sign up for a new customer account using valid sign up information

   Results: Passed

2. **FRT-BE1-2**

   Control: Manual

   Initial State: Shop owner with no existing account

   Input: Shop owner submits sign up form with valid email, password, name, phone number, shop name, shop address, shop phone number, and shop email

   Output: Redirect to shop owner landing page upon successful registration

   Test Case Derivation: New shop owner user wants to sign up for a new account with valid sign up information provided

   How test will be performed: The tester will register and sign up for a new shop owner account using valid sign up information

   Results: Passed

3. **FRT-BE1-3**

   Control: Manual

   Initial State: Employee with no existing account

   Input: Employee submits sign up form with valid email, password, name, phone number, and shop ID

   Output: Redirect to employee landing page upon successful registration

   Test Case Derivation: New employee user wants to sign up for a new account with valid sign up information provided

   How test will be performed: The tester will register and sign up for a new employee account using valid sign up information

   Results: Passed

4. **FRT-BE2-1**

   Control: Manual

   Initial State: Customer with existing account and not logged in

   Input: Customer submits login form with valid email, password, and vehicle information

   Output: Redirect to vehicle owner landing page upon successful login

   Test Case Derivation: Customer wants to login to existing with valid login credentials provided

   How test will be performed: The tester will login to an existing customer account using valid login credentials

   Results: Passed

5. **FRT-BE2-2**

   Control: Manual

Initial State: Shop owner with existing account and not logged in

Input: Shop owner submits login form with valid email and password

Output: Redirect to shop owner landing page upon successful login

Test Case Derivation: Shop owner wants to login to existing with valid login credentials provided

How test will be performed: The tester will login to an existing shop owner account using valid login credentials

Results: Passed

6. **FRT-BE2-3**

    Control: Manual

    Initial State: Employee with existing account and not logged in

    Input: Employee submits login form with valid email and password

    Output: Redirect to employee landing page upon successful login

    Test Case Derivation: Employee wants to login to existing with valid login credentials provided

    How test will be performed: The tester will login to an existing employee account using valid login credentials

    Results: Passed

7. **FRT-BE3-1**

    Control: Manual

    Initial State: Customer with existing account and logged in

    Input: Customer requests to logout

    Output: System logs the user out and transitions to home page

    Test Case Derivation: Customer wants to logout

    How test will be performed: The tester will request to logout on a customer account

    Results: Passed

8. **FRT-BE3-2** Control: Manual

    Initial State: Shop owner with existing account and logged in

    Input: Shop owner requests to logout

    Output: System logs the user out and transitions to home page

    Test Case Derivation: Shop owner wants to logout

    How test will be performed: The tester will request to logout on a shop owner account

    Results: Passed

9. **FRT-BE3-3**

   Control: Manual

   Initial State: Employee with existing account and logged in

   Input: Employee requests to logout

   Output: System logs the user out and transitions to home page

   Test Case Derivation: Employee wants to logout

   How test will be performed: The tester will request to logout on an employee account

   Results: Passed

4.2 Appointments

1. **FRT-BE4-1**

   Control: Manual

   Initial State: Customer account which received a quote from an auto shop

   Input: Enters service request information and selects an available appointment time slot

   Output: A new appointment request is created with service details linked to the quote. Shop Owner/Employee Accounts will receive the appointment request

   Test Case Derivation: The appointment will be requested with the details the user entered

   How test will be performed: The tester will go through the appointment booking process through the user interface through quotes

   Results: Passed

2. **FRT-BE4-2**

   Control: Manual

   Initial State: Customer account selects a canned job at an auto shop

   Input: Enters service request information and selects an available appointment time slot

   Output: A new appointment request is created with service details. Shop Owner/Employee Accounts will receive the appointment request

   Test Case Derivation: The appointment will be requested with the canned job details as well as details the user entered

   How test will be performed: The tester will go through the appointment booking process through the user interface by selecting a canned job

   Results: Passed

3. **FRT-BE4-3**

   Control: Manual

   Initial State: Shop Owner/Employee Account with appointment requests

   Input: Accept an appointment request

   Output: Appointment booking displayed for Shop Owner/Employee accounts and Customer account

   Test Case Derivation: The appointment request is accepted and appointment booking is completed

   How test will be performed: The tester will accept an appointment request through the user interface

   Results: Passed

4. **FRT-BE5-1**

   Control: Manual

   Initial State: Customer Account has a service appointment scheduled

   Input: Selects an appointment to edit and selects a new available time slot for the appointment

   Output: A new appointment request is made with the new time slot. Shop Owner/Employee Accounts will receive the appointment request

   Test Case Derivation: The user is able to change their appointment to any of the available time slots displayed

   How test will be performed: The tester will go through the user interface to edit an appointment booking

   Results: Failed. Cannot edit an appointment at the moment but can cancel and reschedule an appointment

5. **FRT-BE5-2**

   Control: Manual

   Initial State: Shop Owner/Employee Account has a service appointment scheduled

   Input: Selects an appointment to edit and selects a new available time slot for the appointment

   Output: The appointment booking is updated to the new time slot

   Test Case Derivation: The user is able to change their appointment to any of the available time slots displayed

   How test will be performed: The tester will go through the user interface to edit an appointment booking time slot

   Results: Failed. Cannot edit an appointment at the moment but can cancel and reschedule an appointment.

6. **FRT-BE5-3**

   Control: Manual

   Initial State: Shop Owner/Employee Account has a service appointment scheduled

   Input: Selects an appointment to edit service details

   Output: The appointment booking is updated with the updated service details

   Test Case Derivation: The user is able to update the appointment details

   How test will be performed: The tester will go through the user interface to edit appointment details

   Results: Passed

7. **FRT-BE6-1**

   Control: Manual

   Initial State: Customer Account has a service appointment scheduled

   Input: Selects an appointment to cancel

   Output: The appointment booking is cancelled and removed from the customer and shop owner/employee schedules

   Test Case Derivation: The appointment should be removed from the calendar when it is cancelled

   How test will be performed: The tester will go through the user interface to cancel an appointment

   Results: Passed

8. **FRT-BE6-2**

   Control: Manual

   Initial State: Shop Owner/Shop Employee has a service appointment scheduled

   Input: Selects an appointment to cancel

   Output: The appointment booking is cancelled and removed from the customer and shop owner/employee schedules

   Test Case Derivation: The appointment should be removed from the calendar when it is cancelled

   How test will be performed: The tester will go through the user interface to cancel an appointment

   Results: Passed

9. **FRT-BE7-1**

   Control: Manual

   Initial State: Shop Owner selects appointment availability

Input: Sets appointment availabilities

Output: The appointment availability is updated in the database

Test Case Derivation: The appointment availability will be saved and availability time slots to book appointments will be updated

How test will be performed: The tester will go through the user interface to set appointment availabilities

Results: Passed

4.3 Employee Management

1. **FRT-BE24-1**

   Control: Manual

   Initial State: Shop Owner has a shop profile

   Input: Shop owner wants to retrieve shop ID to invite employee

   Output: Shop ID is displayed

   Test Case Derivation: The system shall allow the shop owner to retrieve their shop ID to invite their employee

   How test will be performed: The tester will use a shop ID displayed on the shop owner's employee management page and go through the sign up flow as an employee. The tester will verify that the shop ID is displayed and correct.

   Results: Passed

2. **FRT-BE24-2**

   Control: Manual

   Initial State: Shop Owner has a shop profile

   Input: Employee signs up using invalid user sign up information and shop ID

   Output: Message indicating that the inputs are not valid

   Test Case Derivation: The system shall not allow the employee to sign up with the information provided

   How test will be performed: The tester will use invalid user sign up information and invalid shop ID to sign up as an employee

   Results: Passed

3. **FRT-BE25-1**

   Control: Manual

   Initial State: Shop owner account with employees listed under the shop

   Input: The user enters search text to search for an employee

Output: System displays a list of employees whose name or email matches the search text

Test Case Derivation: The system shall allow the user to enter search text to search for an employee; the system shall display a list of employees whose name or email matches the search text

How test will be performed: The tester will use a shop owner account with employees listed under the shop and enter search text to search for an employee

Results: Passed

4. **FRT-BE26-1**

Control: Manual

Initial State: Shop owner account with employees

Input: The user attempts to view the list of employees

Output: Table of employees details and employee management options

Test Case Derivation: The shop owner with employees wants to view the list of employees

How test will be performed: The tester will use a shop owner account with employees listed under the shop and attempt to view the list of employees

Results: Passed

5. **FRT-BE27-1**

Control: Manual

Initial State: Shop owner account with employees

Input: The user attempts to remove an employee

Output: Table of employees details and employee management options updates with employee removed; the remove employee's access should be revoked

Test Case Derivation: The shop owner with employees wants to remove an employee

How test will be performed: The tester will use a shop owner account with employees listed under the shop and attempt to remove an employee

Results: Passed

4.4 Services

1. **FRT-BE28-1**

Control: Manual

Initial State: Shop Owner has a shop profile

Input: Shop Owner adds available services

Output: Shop services are sent to the database and displayed on the shop profile

Test Case Derivation: The user can add available auto shop services to their shop profile

How test will be performed: The tester will add a service to the shop profile and confirms it shows up on the shop profile

Results: Passed

2. **FRT-BE29-1**

Control: Manual

Initial State: Shop Owner/Shop Employee searches for auto repair or maintenance services

Input: Enters specific auto service in the search bar

Output: Auto shops with relevant services displayed

Test Case Derivation: Services corresponding to the auto shop will be displayed

How test will be performed: The tester will search for shop services through the user interface and confirms that all of the shop's services matching the search criteria are listed

Results: Passed

3. **FRT-BE30-1**

Control: Manual

Initial State: Shop Owner with services listed on their shop profile

Input: Updates the details of a service listed on their profile

Output: The service is updated with the entered details

Test Case Derivation: The shop profile will list the service with the updated details

How test will be performed: The tester will update the details of a shop service through the user interface and confirms that the shop profile is updated

Results: Passed

4. **FRT-BE31-1**

Control: Manual

Initial State: Shop Owner with services listed on their shop profile

Input: Deletes a service listed on their shop profile

Output: Service is removed from the shop profile. Other services that were not deleted continue to be listed on the shop profile

Test Case Derivation: The service that is deleted is removed from the shop profile

How test will be performed: The tester will delete a shop service through the user interface and confirms that the shop profile is updated

Results: Passed

4.5 Shop Profile

1. **FRT-BE33-1**

   Control: Manual

   Initial State: Shop Owner/Employee Account with a registered shop

   Input: Request to view shop profile

   Output: Information regarding the shop, which includes the shop's address, phone number, and email

   Test Case Derivation: The system shall display information about the shop upon request

   How test will be performed: The tester will go through the user interface to view a shop profile

   Results: Passed

2. **FRT-BE34-1**

   Control: Manual

   Initial State: User wants to view a shop's profile

   Input: Request to view shop profile

   Output: Information regarding the shop, which includes the shop's address, phone number, email, and hours of operation (if any)

   Test Case Derivation: The system shall display information about the shop upon request

   How test will be performed: The tester will go through the user interface to view a shop profile

   Results: Passed

3. **FRT-BE35-1**

   Control: Manual

   Initial State: Shop Owner wants to add/update hours of operation of their shop

   Input: Request to add and edit hours of operation with valid hours of operation

   Output: Updated hours of operation

   Test Case Derivation: The system shall allow the shop owner to add/edit their hours of operation

   How test will be performed: The tester will go through the user interface to add/edit a shop

   Results: Passed

5 Nonfunctional Requirements Evaluation

5.1 Look and Feel Requirements

1. **NFRT-LF1-1**

   Type: Dynamic, Manual

   Initial State: The application is accessible through the Google Chrome web browser

   Input/Condition: The window size is changed

   Output/Result: The application shall adjust and scale to fit the new window size

   How test will be performed: The tester will access the application through Google Chrome on their desktop/laptop and change the windows through the use of Google Chrome DevTools Device Toolbar

   Results: Passed

2. **NFRT-LF2-1**

   Type: Dynamic, Manual

   Initial State: The application is accessible through the web browser

   Input: The application is opened in a full screened web browser window

   Output: All text on the screen shall be readable

   How test will be performed: The tester open the application in a full screened web browser window, navigate to all pages, and judge if all text on the screen is readable from sitting 50 centimeters away from the monitor

   Results: Passed

3. **NFRT-LF3-1**

   Type: Dynamic, Manual

   Initial State: The application is accessible through the web browser and there is a completed work order and quote on the user's account

   Input: The user opens the work order details and the quote details

   Output: All currency shall be rounded to two decimal places

   How test will be performed: The tester will navigate to the work order and quote and verify that all values of currency are rounded to two decimal places

   Results: Passed

5.2 Usability and Humanity Requirements

1. **NFRT-UH1-1**

   Type: Dynamic, Manual

How test will be performed: The testers will complete the manual system tests for functional requirements on a MacOS desktop/laptop device, a Windows desktop/laptop, an iOS mobile device, and an android mobile device.

Results: Passed. Testers were asked to write down which device they used to test to ensure all devices and operating systems were covered.

2. **NFRT-UH2-1**

Type: Dynamic, Manual

Initial State: Device is connected to the internet and application is not open.

Input/Condition: The user launches the application on a web browser.

Output/Result: The system can be assessed through the web browser.

How test will be performed: The testers will attempt to launch the application on a web browser, using a device that is connected to the internet.

Results: Passed. The testers were able to access the application using the web browser while connected to the internet.

3. **NFRT-UH3-1**

Type: Dynamic, Manual

Initial State: Device is connected to the internet and application is open.

Input/Condition: User disconnects from the internet.

Output/Result: The system notifies the user that there is no network connection.

How test will be performed: The testers disconnects from the internet while the application is open.

Results: Passed. Testers were greeted with a toast when they disconnected from the internet.

5.3   Performance Requirements

1. **NFRT-PR1-1**

Type: Dynamic, Manual

How test will be performed: A function will be added to the application which logs web metrics of the system. Testers will go through each of the pages and functions, making sure that the metrics meet current web standards as stated in this article. These criteria include:

- LCP < 2.5s
- FID < 100ms
- CLS < 0.1
- TTFB < 0.5s
- FCP < 1.8s

Results: Passed. Testers were able to view logs of their progress and record results which met or exceeded current web standards for the metrics.

5.4   Operational and Environmental Requirements

1. **NFRT-OE-1**

   Type: Dynamic, Manual

   Initial State: The application is accessible through the Google Chrome web browser

   Input: The user navigates across all pages and dialogs, and performs all manual system tests for functional requirements

   Output: All pages and dialogs should be fully operational on the below listed device dimensions

   How test will be performed: The testers will complete the manual system tests for functional requirements on Google Chrome using various device dimension options listed in the Google DevTools Device Toolbar. At minimum, the testers will test with the following dimensions: Responsive, iPhone 12 Pro (390×844), iPhone SE (375×667), and iPad Air (820×1180). This set will provide a reasonable variety of different device dimensions.

   Results: Failed. Manually tested to verify whether the application supports the above device dimensions. Shop lookup page does not work on iPad Air (820×1180) dimensions. Chat window does not work on iPhone SE (375×667) dimensions.

5.5   Maintainability and Support Requirements

1. **NFRT-MS1-1**

   Type: Manual

   How test will be performed: Every document will have to pass a review by every developer before the document is finalized. The review will include running through the system and linking every module to proper documentation.

   Results: Passed. This requirement has been maintained throughout the entire project.

5.6   Security Requirements

1. **NFRT-SR1-1**

   Type: Dynamic, Automatic

   Initial State: An account with a created appointment

   Input/Condition: An HTTP request to the application's backend to get the appointment by appointment ID

   Output/Result: The request is rejected with a 403 Forbidden error message

How test will be performed: Through Jest an HTTP request will be sent to the server

Results: Passed.

2. **NFRT-SR2-1**

Type: Dynamic, Manual

Initial State: One Shop Owner account and two Customer accounts with one customer having an appointment at the shop registered under the same Shop Owner account

Input/Condition: Request available time slots at the Shop Owner's store using the Customer without an appointment's account

Output/Result: The Customer should only be able to view the time slot taken by the other customer and no other extra information

How test will be performed: The tester will view the available time slots page as the Customer without an appointment

Results: Failed. Extra information is returned from the API call that is not needed for this endpoints and exposes data that does not belong to user. None of the data contains PII.

5.7 Cultural Requirements

1. **NFRT-CR1-1**

Type: Static, Manual

Initial State: The application is accessible through the web browser

Input: The user navigates across all pages and dialogs, and performs all end-to-end tests

Output: There should be no offensive texts or images

How test will be performed: The testers will go through end-to-end tests for the entire program and will confirm that any texts or images are not offensive.

Results: Passed. Manually tested to verify that there are no offensive images or text.

2. **NFRT-CR2-1** Type: Static, Manual

Initial State: The application is accessible through the web browser

Input: The user navigates across all pages and dialogs, and performs all end-to-end tests

Output: All text should be displayed in English

How test will be performed: The testers will go through end-to-end tests for the entire program and will confirm that the text displayed is in English.

Results: Passed. Checked that everything is written in English in the implementation, documentation, and anything visible to the user.

5.8   Legal Requirements

1. **NFRT-LR1-1**

   Type: Static, Manual

   Input: The user navigates all source code and project documents

   Output: Appropriate credits and/or copyright licenses are used, and MIT License requirements should be adhered to

   How test will be performed: The testers will go through the source code of the project and project documents to determine if any open source resources were used and check that appropriate credits and/or copyright licenses are used.

   Results: Passed. Checked the MIT License requirements and that the project adhered to all the requirements.

6 Unit Testing

Table 2: Unit Tests Results Summary

✓ = Pass, X = Fail					
Test ID	**Result**	**Test ID**	**Result**	**Test ID**	**Result**
FRT-M3-1	✓	FRT-M3-2	✓	FRT-M3-3	✓
FRT-M3-4	✓	FRT-M3-5	✓	FRT-M3-6	✓
FRT-M3-7	✓	FRT-M3-8	✓	FRT-M3-9	✓
FRT-M3-10	✓	FRT-M4-1	✓	FRT-M4-2	✓
FRT-M4-3	✓	FRT-M4-4	✓	FRT-M4-5	✓
FRT-M3-6	✓	FRT-M4-7	✓	FRT-M4-8	✓
FRT-M4-9	✓	FRT-M4-10	✓	FRT-M4-11	✓
FRT-M4-12	✓	FRT-M4-13	✓	FRT-M4-14	✓
FRT-M4-15	✓	FRT-M4-16	✓	FRT-M4-17	✓
FRT-M5-1	✓	FRT-M5-2	✓	FRT-M5-3	✓
FRT-M5-4	✓	FRT-M5-5	✓	FRT-M5-6	✓
FRT-M5-7	✓	FRT-M5-8	✓	FRT-M5-9	✓
FRT-M5-10	✓	FRT-M5-11	✓	FRT-M5-12	✓
FRT-M5-13	✓	FRT-M5-14	✓	FRT-M6-1	✓
FRT-M6-2	✓	FRT-M6-3	✓	FRT-M6-4	✓
FRT-M6-5	✓	FRT-M6-6	✓	FRT-M6-7	✓
FRT-M7-1	✓	FRT-M7-2	✓	FRT-M7-3	✓
FRT-M7-4	✓	FRT-M7-5	✓	FRT-M7-6	✓
FRT-M8-1	✓	FRT-M8-2	✓	FRT-M8-3	✓
FRT-M8-4	✓	FRT-M8-5	✓	FRT-M8-6	✓
FRT-M8-7	✓	FRT-M8-8	✓	FRT-M8-9	✓
FRT-M8-10	✓	FRT-M8-11	✓	FRT-M8-12	✓
FRT-M8-13	✓	FRT-M8-14	✓	FRT-M8-15	✓
FRT-M9-1	✓	FRT-M9-2	✓	FRT-M9-3	✓
FRT-M9-4	✓	FRT-M9-5	✓		

7 Changes Due to Testing

8 Automated Testing

All automated testing was carried out by Jest, a JavaScript testing framework. Each module has its own corresponding test file located within the "test" folder. The "test" folder has the same structure as the "src" folder, creating a one-to-one mapping of a module and its corresponding test. For example, the module "src/server/services/userService.ts" has its tests located in "test/server/services/userService.test.ts". There are two Jest test runs, with the only difference being whether the testing environment is connected to a real database or not (i.e., whether the database needs to be seeded or mocked in each test case). As part of the CI/CD pipeline, the full test suite is run and information regarding pass/fail and code coverage is reported on every pull request to the main branch and to every push to the main branch.

9 Trace to Requirements

10 Trace to Modules

11 Code Coverage Metrics

12 Appendix

12.1 Reflection

The information in this section will be used to evaluate the team members on the graduate attribute of Reflection. Please answer the following question:

1. In what ways was the Verification and Validation (VnV) Plan different from the activities that were actually conducted for VnV? If there were differences, what changes required the modification in the plan? Why did these changes occur? Would you be able to anticipate these changes in future projects? If there weren't any differences, how was your team able to clearly predict a feasible amount of effort and the right tasks needed to build the evidence that demonstrates the required quality? (It is expected that most teams will have had to deviate from their original VnV Plan.)