SMART LOGISTICS OPTIMIZATION APPLICATION

Section E

PREAPARED BY :

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Department of Software Engineering

Project Title:
Smart Logistics Optimization Application

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Project Description

The Kingdom faces significant challenges in managing logistics operations due to its vast area and the increasing demand in the food and beverage sectors. Efficient transportation of goods, especially perishable products, requires improved logistics solutions. Traditional transportation methods often lead to inefficiencies such as high fuel consumption and excessive time on the road. This project aims to develop an innovative application that enhances the efficiency of logistics operations in the Kingdom, especially in the food and beverage sector. The application will focus on optimizing transportation routes, reducing fuel consumption, and reducing delivery times.

Problem Definition

The Kingdom is one of the largest Arab countries in terms of area, estimated at 2.15 million square kilometers, which poses challenges for logistics companies to cover the product transportation network and plan transportation routes, especially in the food and beverage sector with the advancement of the national industry and the increase in the need for transportation and logistics services.

Proposed Solution

An application that works to increase the efficiency of logistics operations by reducing fuel consumption and required time, which can be achieved by improving the selection of capacities and the loading mechanism.

Background:

In Saudi Arabia, the logistics sector is vital to economic development, supporting industries ranging from oil and gas to retail and manufacturing. However, the sector faces challenges related to fuel consumption and transit times.. Current logistics operations often lack advanced tools to optimize these factors, leading to high operational costs and environmental impact.

Content:

The Smart Logistics Optimization application tackles logistics challenges with a state-of-the-art platform designed to boost operational efficiency. A standout feature of this application is:

Dynamic Route Planning:

This feature leverages real-time GPS and traffic data to optimize transportation routes dynamically. By continuously analyzing road conditions, traffic patterns, and potential disruptions, the system ensures:

- Reduced Transit Times: Identifies the quickest and most efficient routes to deliver goods promptly.
- Minimized Fuel Consumption: Shortens travel distances and avoids congested areas, cutting down fuel costs and environmental impact.
- Adaptability to Changing Conditions: Instantly recalculates routes in response to unexpected roadblocks, traffic jams, or weather conditions, keeping deliveries on schedule.

With Dynamic Route Planning, logistics companies can achieve faster deliveries, lower operational costs, and greater reliability in their transportation operations.

Motivation:

The primary motivation behind this project is to enhance the efficiency of logistics operations in Saudi Arabia, which is critical to the country's growing economy. By improving fuel consumption and reducing transit times, the application will help logistics companies reduce costs, increase operational efficiency, and contribute to environmental sustainability. Additionally, improved logistics efficiency will lead to faster delivery times and better service quality for businesses and consumers alike.

This project is in line with the goals of Saudi Arabia's Vision 2030 to promote technological innovation and improve infrastructure to support economic diversification and sustainability.

Stakeholders and Users Identification

The Client: Food Supply Company

The Customer: Food Supply Company

The Other Stakeholders: Administrators, Managors, Drivers, Supermarket Worker

The Hands-On Users of the Product: Drivers, Managers

Scope

The scope of this project focuses on developing an innovative logistics application tailored to the Kingdom's vast geographic area, with particular attention to the food and beverage sector. The primary goal is to optimize transportation operations, particularly for perishable goods, by addressing common inefficiencies such as high fuel consumption and long delivery times. The application will integrate advanced technologies like route optimization algorithms, real-time vehicle tracking, and predictive analytics to reduce fuel consumption, improve delivery times, and ensure efficient use of resources. The solution will also incorporate dynamic updates based on real-time factors such as weather and traffic conditions, allowing for continuous optimization. Environmental sustainability will be a key consideration, aiming to reduce the carbon footprint associated with logistics operations.

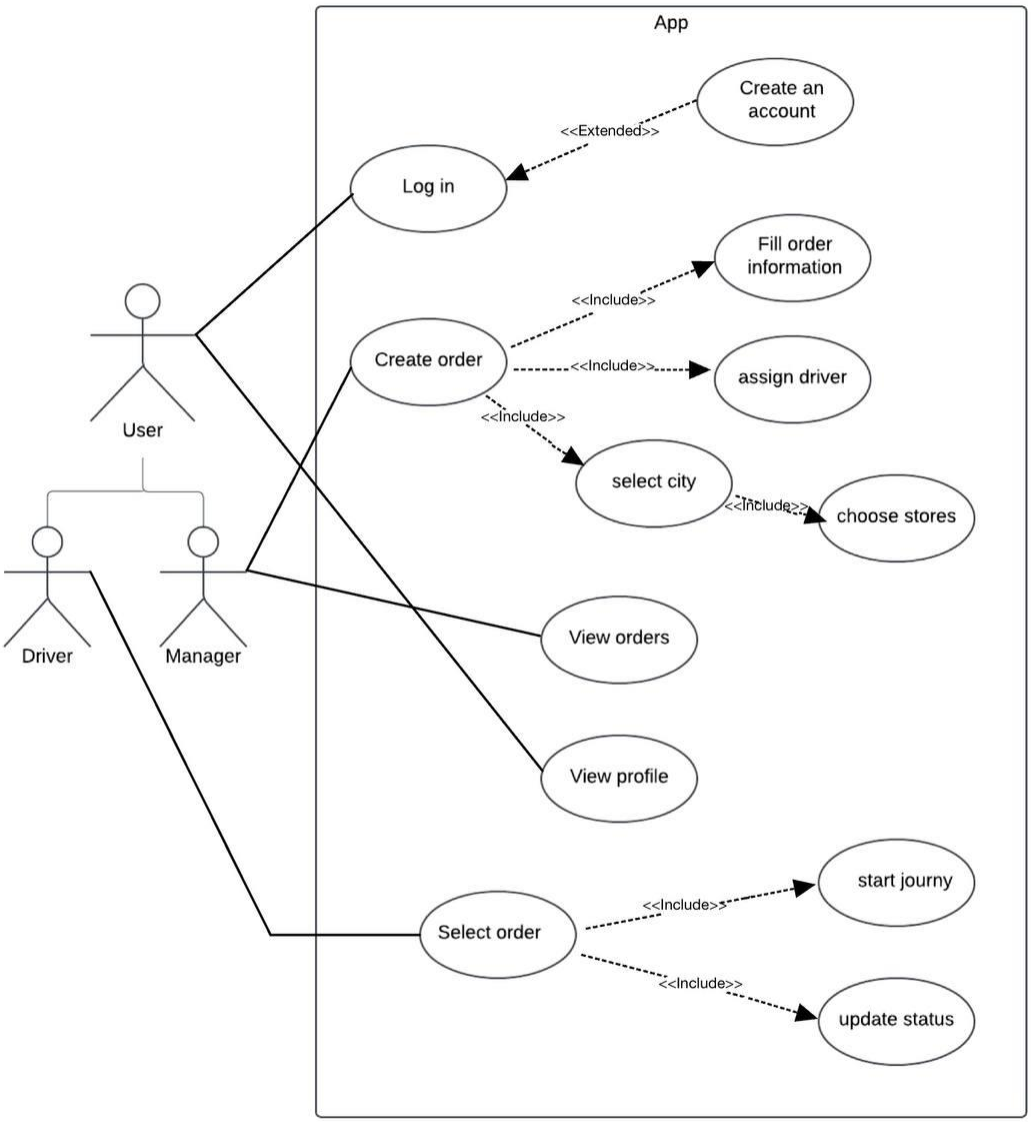
Functional Requirements

Feature	Req Num	Requirement	Priority
User Registration	FR1	Users must be able to create an account with roles such as logistics managers, and drivers.	High
Login after Registration	FR2	Users must be able to log in after registering in the sign up page based on their roles (Manager or Driver).	Low
Order Creation	FR3	The manager must be able to create new orders	High
Route Optimization	FR4	The system calculate the distance then uses Google Direction API to find the best route for the driver based on the order details and suggest the most efficient routes based on real-time traffic data, distance, road conditions, prior.	High
Status Updates	FR5	The system should provide notifications that update the status of order for the manager.	Medium

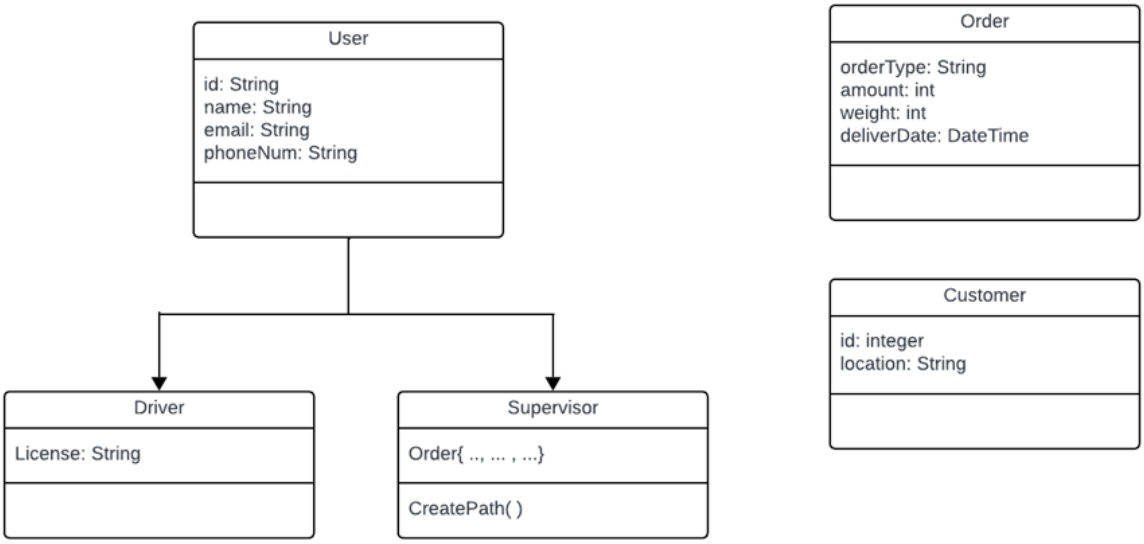
Non-Functional Requirements

Category	Req Num	Description	Priority
Performance	NFR1	The system must process route optimization requests and provide results within 3 seconds to ensure timely decision-making.	High
	NFR2	The system must respond to user actions (e.g., entering order details) within 2 seconds	High
Scalability	NFR3	The system should support up to 1,000 concurrent users, including logistics managers, drivers, and administrators, without a decrease in performance.	High
Availability	NFR5	the system must support continuous operations and ensure that logistics processes can be accessed and managed from different zones in Saudi Arabia	High
Usability	NFR6	the system should provide intuitive and easy-to-use interfaces for users at different levels, from warehouse workers to supply chain managers	Medium
Security	NFR7	The system must Ensure the confidentiality and integrity of sensitive data through encryption and secure access controls	High

Use Case Diagram



Class Diagram



Tools Used in this Project

1. Diagrams: Lucidchart

2. The IDE: Android Studio

3. The agile planning tool: Jira

4. Repository: Github

5. Communication: Slack

6. FireBase

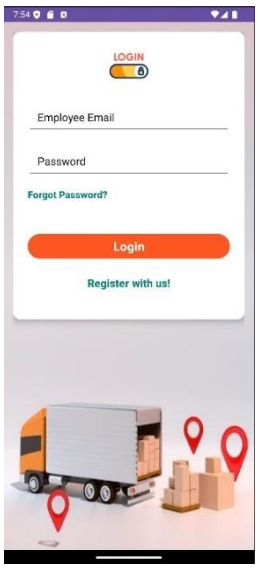
Sprint 1

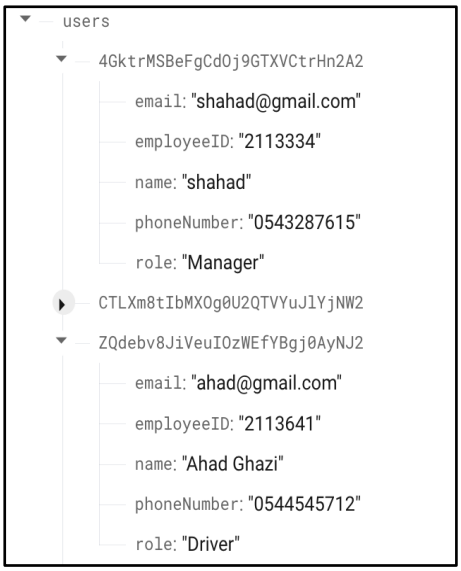
Introduction

In this sprint, we focused on developing the core authentication and navigation features for our Android application, laying the groundwork for secure user access and tailored user experiences. Key achievements include integrating Firebase Authentication to manage user logins and registrations, as well as implementing a role-based system where users, upon registration, can select either a Manager or Driver role. This distinction allows us to customize the app interface based on user roles, supporting different functionalities as required.

Additionally, we set up Firebase Realtime Database to store essential user information such as names, roles, and contact details, enabling data retrieval for a more personalized experience. We also added validation checks to improve data accuracy during login and registration.

These implementations form a strong foundation for future sprint developments, ensuring that our app can securely manage user roles and data as new functionalities are added.





Sprint Backlog

User Story	Description	Priority	Status	Estimated Hours	Completed Hours
Create a login page	Design login screen UI	Medium	Done	2	2
Create a signup page for new employees	Design sign up screen UI	Medium	Done	2	2
Testing successful account creation and login	Write and execute tests for registration	Medium	Done	2	2
Database Schema for user information	Set up database for users	High	Done	4	4

Sprint 1 Meeting 1

Project Name: Smart Logistics Optimization Application

Project Members: Ahad Alqahtani-Raghad Mujahed-Asma Alnounou-Omnia Ahmed-Joud Omar

_____ **Sprint 1 Stand up Meeting - [10/1/2024]**_____

Sprint Duration: 2 Weeks

Scrum Master: Ahad Alqahtani

Client: University of jeddah

Pair Programmers:

Ahad Alqahtani, Raghad Mujahed, Asma Alnounou, Omnia Ahmed, Joud Omar

Stories:

User Registration:

Users must be able to create an account with roles such as logistics managers, and drivers.

Component Name	**Story Sequence Number**	**Use Cases (e.g., functionalities)**
Create an account	1	- Input validation (email, password) - Email & password registration - Firebase authentication setup - Error handling and feedback (e.g., invalid email format)
Select the role	2	- Role selection in registration form - Role-based authentication and data storage in Firebase - User data (role) storage in Firebase

Sprint 1 Meeting 2

Project Name: Smart Logistics Optimization Application

Project Members: Ahad Alqahtani-Raghad Mujahed-Asma Alnounou-Omnia Ahmed-Joud Omar

_____ **Sprint 1 Stand up Meeting - [10/15/2024]**_____

Sprint Duration: **1 Weeks**

Scrum Master: **Ahad Alqahtani**

Client: **University of jeddah**

Pair Programmers:

Ahad Alqahtani, Raghad Mujahed, Asma Alnounou, Omnia Ahmed, Joud Omar

Stories:

Login after Registration:

Users must be able to log in after registering in the sign up page based on their roles (Manager or Driver).

Component Name	**Story Sequence Number**	**Use Cases (e.g., functionalities)**
Data is saved to database for authentication	1	- Input validation (email, password) - Email & password registration - Firebase authentication setup - Error handling and feedback (e.g., invalid password format)
Login successfully	2	-Feedback about status of signing in - User data (role) storage in Firebase

Follow-up meetings questions:

1. What has been completed since the last meeting?

Since the last meeting, we have successfully developed and implemented both the login and sign-up pages, establishing a foundational user authentication system for new employees. The login page enables existing employees to securely access the system, while the sign-up page allows new employees to create an account by providing necessary credentials. These pages include error handling for incorrect inputs and verification checks to enhance security.

2. What are you going to be working on next?

Next, we will focus on developing dedicated pages for managers and drivers, tailored to each user's specific needs and functionalities. This includes saving registration information for both user types in the database for secure access and management. Each page will incorporate features specific to the role, with certain functionalities integrated with Google Maps to enable location-based services. Additionally, we will prioritize designing user-friendly interfaces with a polished, professional appearance to enhance the user experience on both pages.

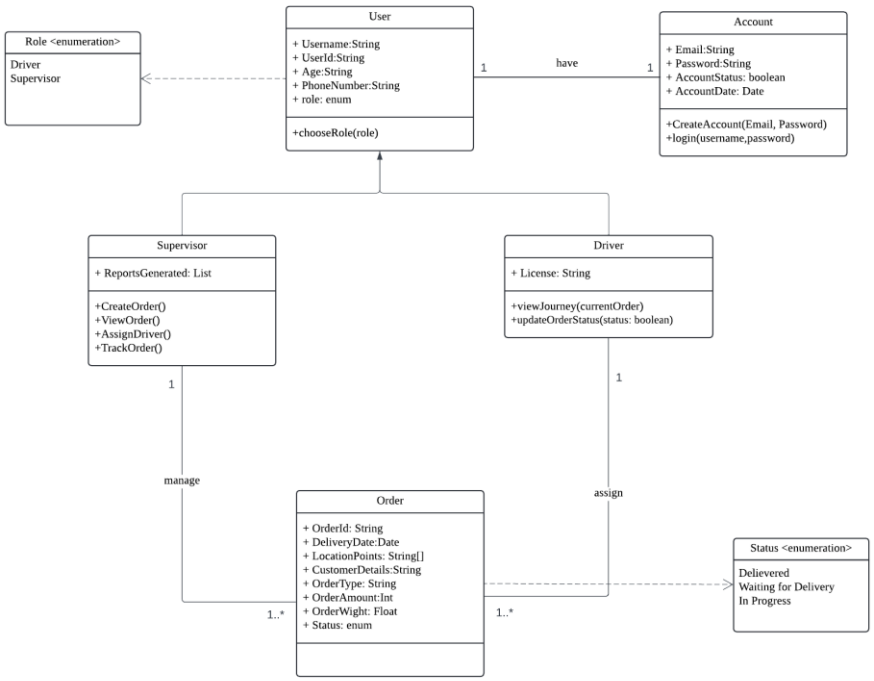
3. Do you have any issues/impediments?

Yes, we encountered several challenges during the implementation process, particularly with the Java code and its integration with the database. One of the primary issues was related to database functionality, where we faced problems such as data duplication and instances where data was not being recorded correctly. These issues hindered our progress and required additional debugging to ensure proper data handling and synchronization between the application and the database.

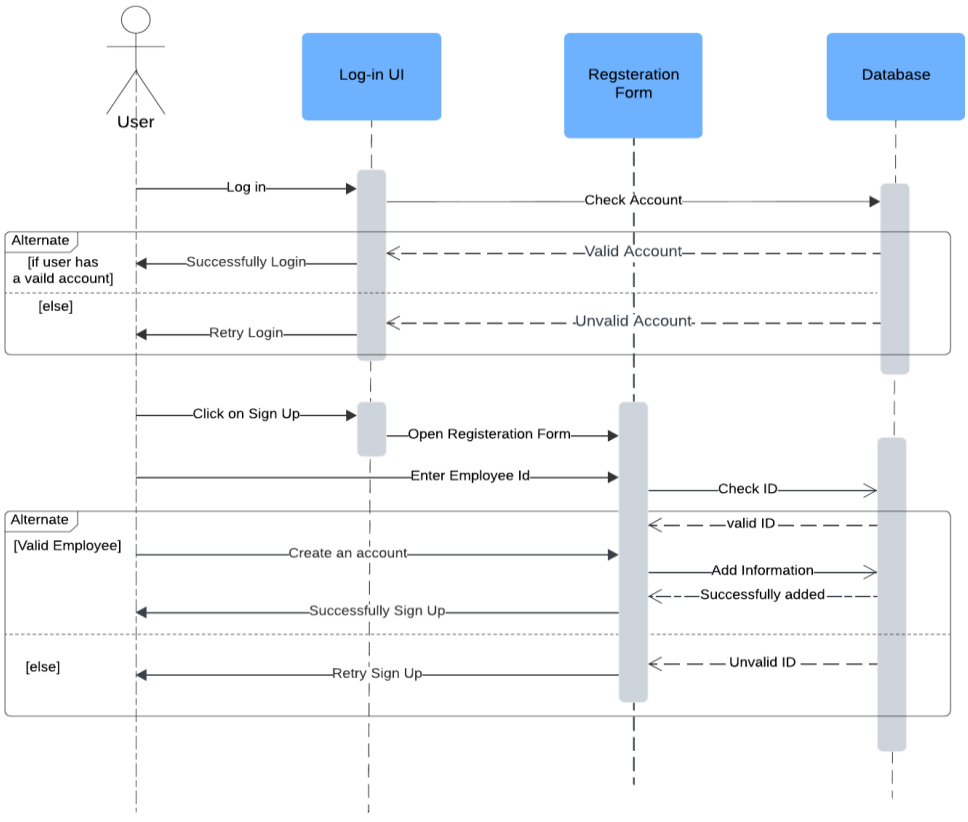
Scrum's Master comments based on the above questions:

The scrum master acknowledges that database issues are a challenge and may hinder development. It's suggested that in-depth research into database configuration and data handling best practices is required. At the same time, it's advised to the team to record specific database issues to help identify and prevent similar problems in the future.

Class Diagram(update)



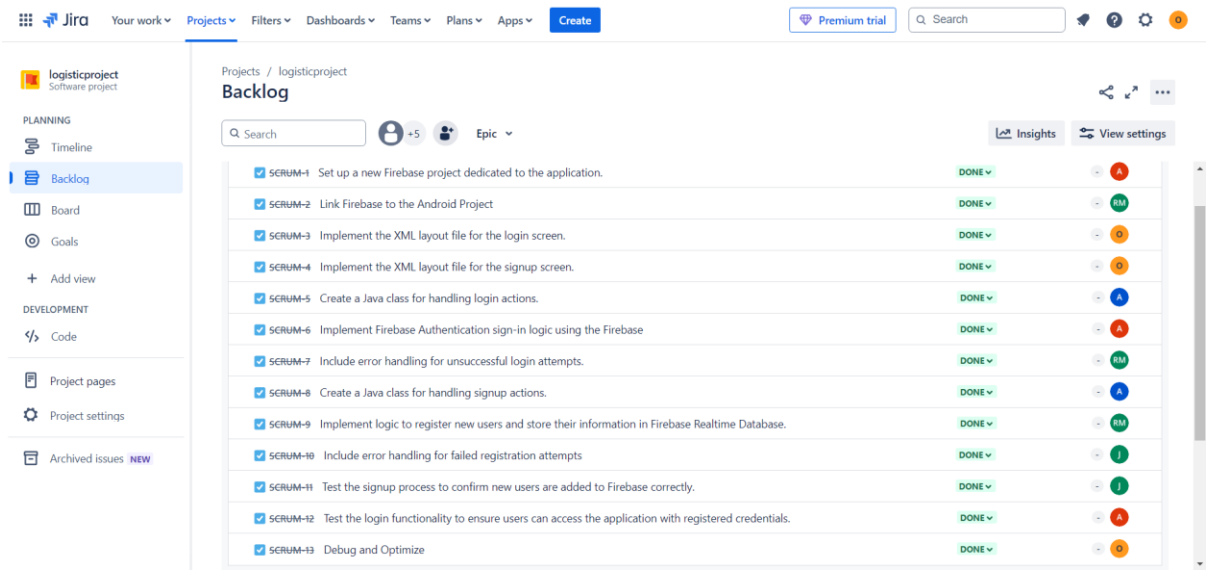
Sequence Diagram



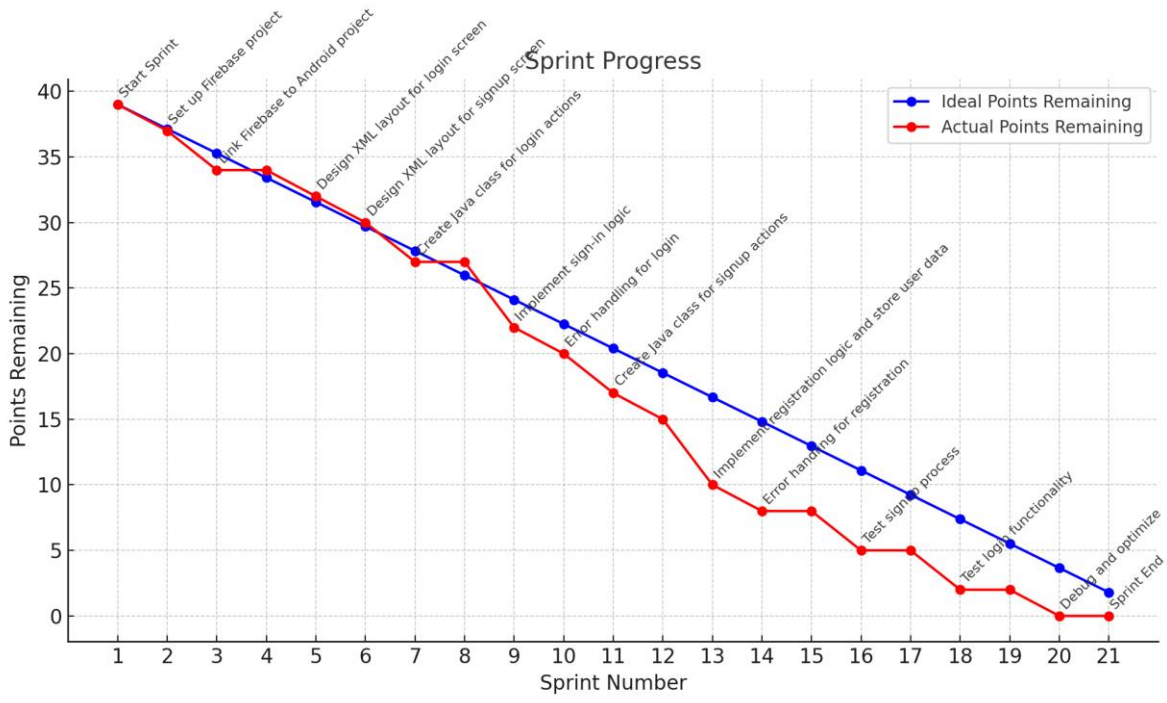
Test Cases

Test Case No.	Test Case Description	Expected Results	Outcome (Pass / Fail / Other (Comments))
TC01	User enters an email and password, but the account doesn't exist.	Pop up message telling user to register, as email is not registered through authentication.	Pass
TC02	User taps 'Register with us!'	User should be displayed with a Sign Up page that prompts user to input their information	Pass
TC03	User enters First Name and leaves all other fields blank on the registration screen and taps the 'Register' button.	User should be displayed with a message: "Full name is required"	Pass, same goes for the rest of the data required
TC04	User enters more than/less than 7 numbers, and uses non-numeric for their employee ID.	User should be displayed with a message: "Employee ID must be 7 digits long and numeric"	Pass
TC05	User enters more than/less than 10 numbers, and uses non-numeric for their phone number	User should be displayed with a message: "Phone number must be 10 digits long and numeric"	Pass
TC06	User does not choose their role, either Manager or Driver	User should be displayed with a message: "Please select a role"	Pass
TC07	User information is sent to the database authentication, and shows user that registering is successful	User should be displayed with a pop that says "User registered successfully"	Pass
TC08	User is registered successfully	User should go back to login page, and is able to login successfully	Pass

Agile Project Planning Tool for Task Allocation



Burndown Chart



Sprint 2

Introduction

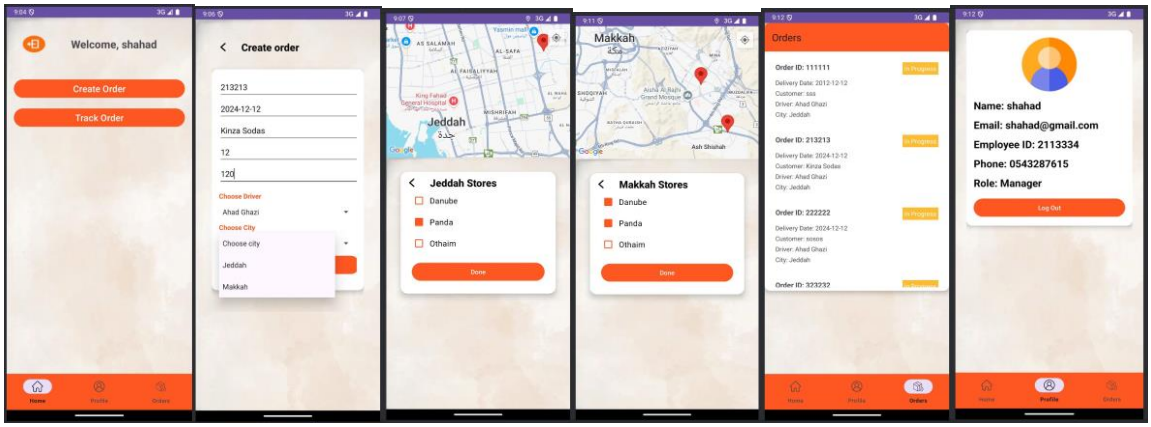
In this sprint, we focused on developing user authentication and access to functions within our system based on roles (manager and driver) to ensure that users can seamlessly log in while accessing functions specific to their specific roles, enhancing the overall user experience and security of the system and creating manager page that includes a navigation menu with "Profile" and "Orders" sections and create order button.

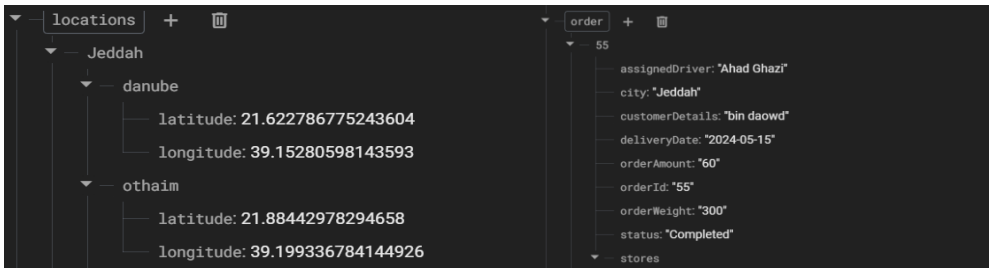
Managers now have the ability to create orders, enter order details, assign drivers, and choose cities and stores. They can also view all orders they've created to keep track of everything. This data is saved in Firebase, ensuring that all order information is securely stored and can be easily accessed.

Additionally, the system will retrieve the stored data from Firebase and display it in the orders view list, allowing managers to easily see and manage all their orders in one place.

We also added Google Maps to show store locations in Jeddah and Makkah, with markers and simple layouts to make navigation easier.

The tasks completed in this sprint set up important features, including Firebase integration and the ability to view order data, that will help make the logistics system work smoothly and will allow us to add even more features in sprints3.





Sprint Backlog

User Story	Description	Priority	Status	Estimated Hours	Completed Hours
Manager Page	Create a manager-specific page that includes a navigation menu with "Profile" and "Orders" sections and create an order button.	High	Done	5	5
Profile Section	Implement a "Profile" section to display manager details (name, email,etc).	High	Done	4	4
Orders Section	Implement an "Orders" section to display all orders	High	Done	4	4
Create Order	Enable managers to create orders with details	High	Done	4	4
Stores Maps for Jeddah and Makkah	Implement the maps for Jeddah and Makkah, integrating location	High	Done	4	4
Database Schema for orders information	Set up database for orders	High	Done	2	2

Sprint 2 Meeting 1

Project Name: Smart Logistics Optimization Application

Project Members: Ahad Alqahtani-Raghad Mujahed-Asma Alnounou-Omnya Ahmed-Joud Omar

_____Sprint2 Stand up Meeting - [10/22/2024]_____

Sprint Duration: 2 Week

Scrum Master: Joud omar

Client: University of jeddah

Pair Programmers:

Ahad Alqahtani, Raghad Mujahed, Asma Alnounou, Omnya Ahmed, Joud Omar

Stories:

Order Creation:

The manager must be able to create new orders.

Component Name	Story Sequence Number	Use Cases (e.g., functionalities)
Manager Page	1	1.1 Create a manager-specific page with a navigation menu containing "Profile" and "Orders" sections and a "Create Order" button.
Profile Section	2	2.1 Display manager information
Orders Section	3	3.1 Display all orders

Sprint 2 Meeting 2

Project Name: Smart Logistics Optimization Application

Project Members: Ahad Alqahtani-Raghad Mujahed-Asma Alnounou-Omnya Ahmed-Joud Omar

_____ **Sprint 1 Stand up Meeting - [11/5/2024]**_____

Sprint Duration: **1 Week**

Scrum Master: Omnya Ahmed

Client: **University of jeddah**

Pair Programmers:

Ahad Alqahtani, Raghad Mujahed, Asma Alnounou, Omnya Ahmed, Joud Omar

Stories:

Order Creation:

The manager must be able to create new orders.

Component Name	**Story Sequence Number**	**Use Cases (e.g., functionalities)**
Create Order	4	4.1 Enable managers to create orders with details
stores maps for Jeddah and Makkah	5	5.1 Displaying stores location for Jeddah and Makkah
Database Schema	6	6.1 Design and implement the database schema to store and manage order information.

Follow-up meetings questions:

1. What has been completed since the last meeting?

creating a manager page that includes a navigation menu with "Profile" and "Orders" sections and a create order button to create a new order with details.

2. What are you going to be working on next?

We will focus on refining the route optimization with google directions API to ensure drivers receive the most efficient paths, minimizing travel time and fuel consumption. This includes integrating real-time traffic data and adjusting the routes dynamically based on road conditions and creating a driver page that also includes a navigation menu with "Profile" and "Orders" sections.

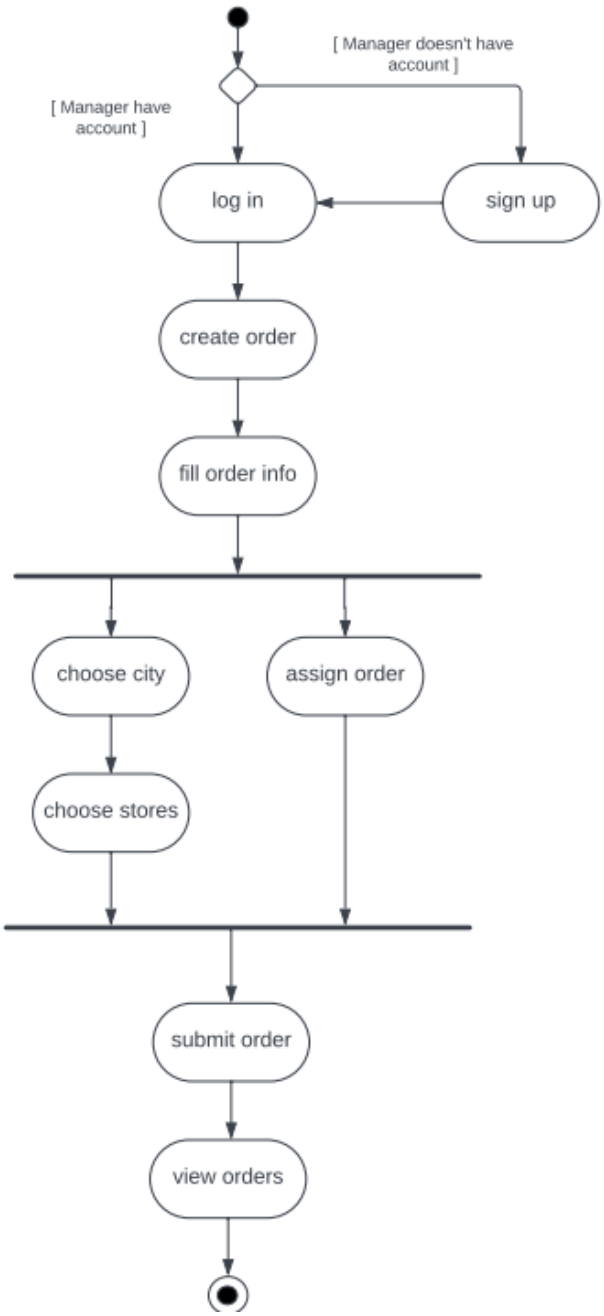
3. Do you have any issues/impediments?

Integration with Google Directions API: We are still finalizing integration with the mapping service for optimized routes. There's some delay due to API configuration and test setup, which might push back the planned implementation for route optimization.

Scrum's Master comments based on the above questions:

The role-based authentication was completed successfully and is working as expected. We've now clearly separated the Manager's and Driver's access rights, ensuring they can only access the relevant functionalities.

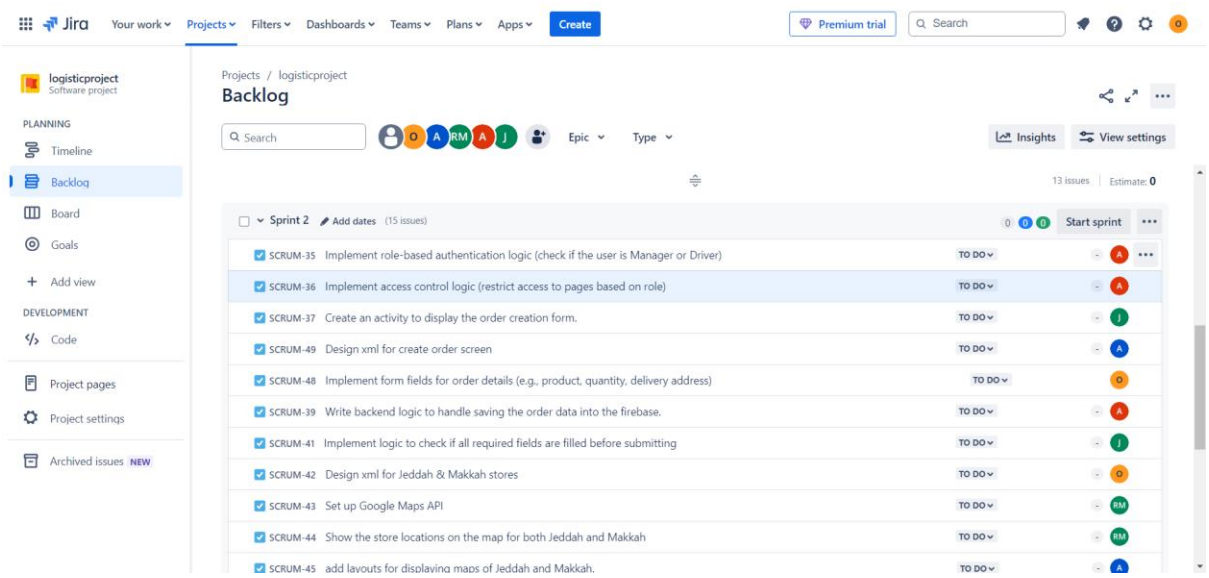
Activity Diagram

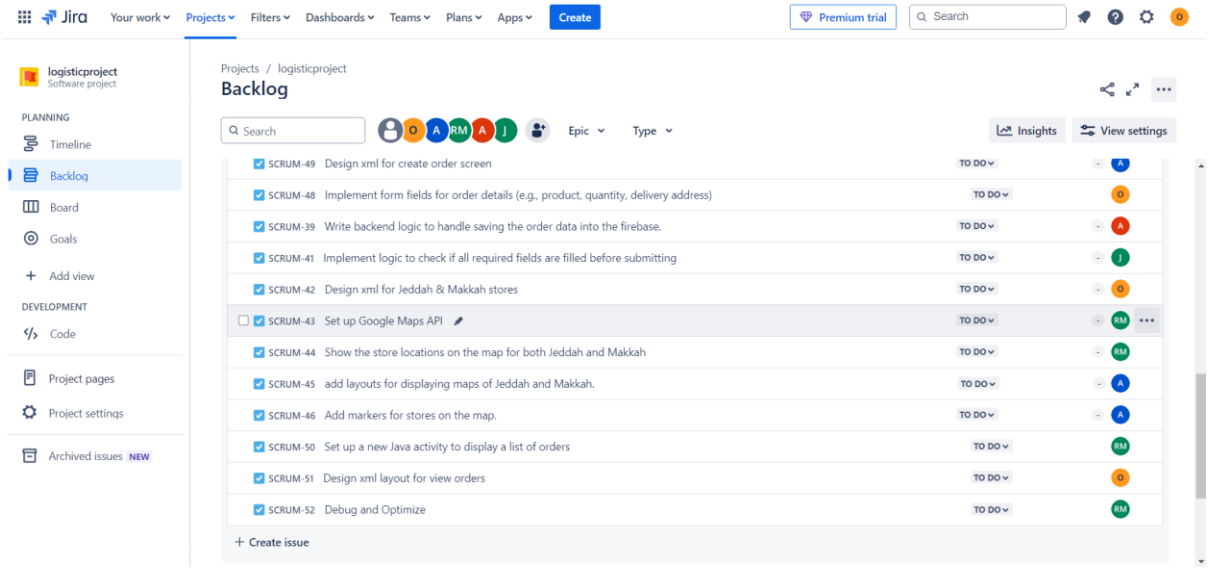


Test Cases

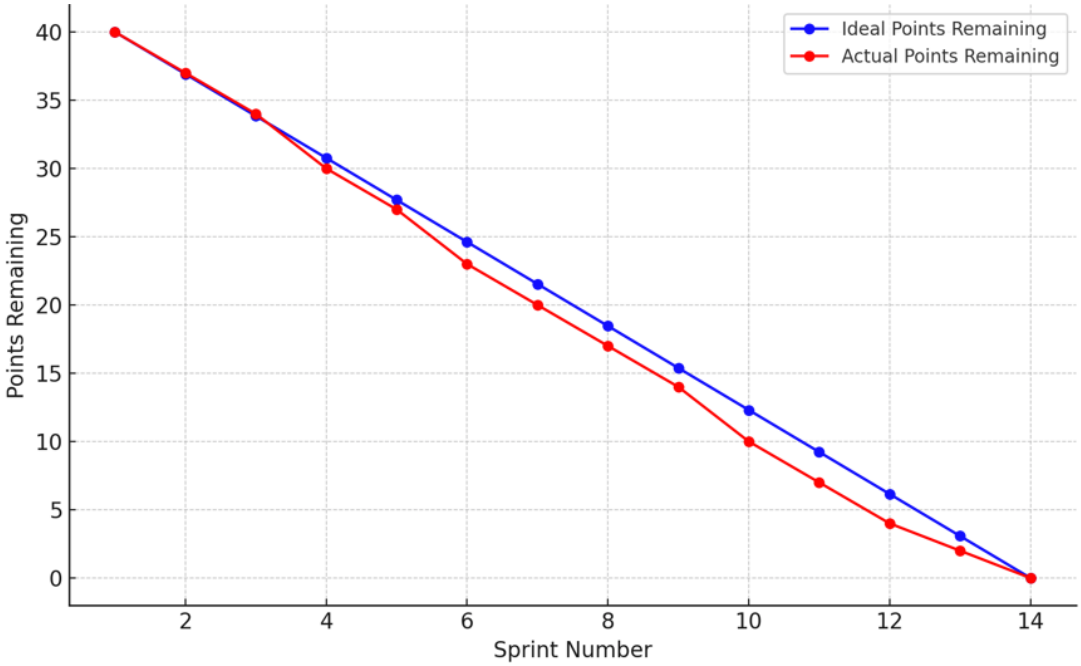
Test Case No.	Test Case Description	Expected Results	Outcome (Pass / Fail / Other (Comments))
TC01	Attempt to create order as a Driver.	Access should be restricted, and the system should display an appropriate error or redirection message	Pass
TC02	"Create Order" page should load successfully .	The login page should load successfully.	Pass
TC03	The manager must be able to create new orders.	New order appears in the order list with correct details	Pass
TC04	Fill in all mandatory fields and Click "Submit."	The system should save the order successfully to Realtime database	Pass
TC05	Missing Mandatory Fields Validation	The system should display validation error messages indicating the missing fields, and the order should not be created.	Pass
TC06	orders information is sent to the database	should be displayed message says “created order successfully”	

Agile Project Planning Tool for Task Allocation





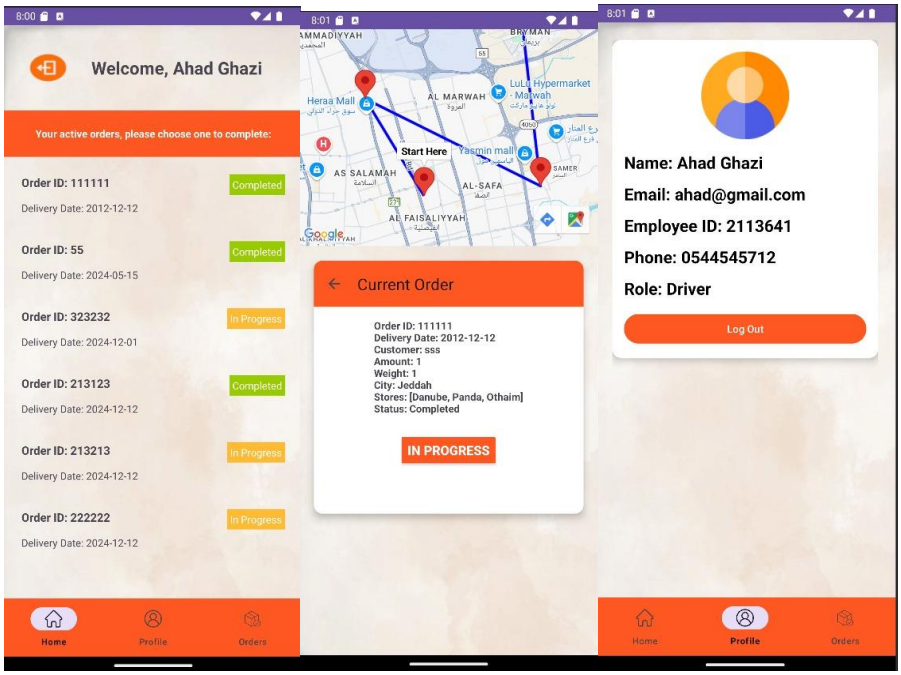
Burndown Chart



Sprint 3

Introduction

In this sprint, we concentrated on developing the Driver's Page, which now serves as a comprehensive hub for drivers to manage their assigned orders effectively. The page displays all orders allocated to the driver, with detailed information such as delivery addresses and order specifics. When a driver clicks on an order, then the button start ,the system automatically displays the best delivery route, using real-time GPS and traffic data to ensure the shortest travel time and least effort. Once an order is completed, drivers can update its status to “Complete,” notifying mangers instantly and ensuring real-time progress tracking. Additionally, we integrated a navigation menu on the Driver's Page, including two main sections: “Profile,” which displays driver information, and “Orders,” where drivers can view and manage all assigned tasks. Beyond functionality, we also redesigned the application’s interfaces to improve aesthetics and user experience. The new design features a modern layout, intuitive navigation, and consistent design elements, ensuring the application is both visually appealing and user-friendly. These enhancements collectively optimize driver workflows, improve transparency, and contribute to a seamless logistics operation.



Sprint Backlog

User Story	Description	Priority	Status	Estimated Hours	Completed Hours
Driver Page	Create a driver-specific page with a navigation menu containing "Profile" and "Orders" sections for easy access.	High	Done	3	3
Profile Section	Implement a "Profile" section to display driver details	High	Done	2	2
Orders Section	Develop an "Orders" section to list all orders assigned to the driver	High	Done	2	2
Best Route	Enable drivers to view the best delivery route for an order using mapping services for optimized time and effort.	High	Done	2	2
Update Order Status	Allow drivers to update an order's status to "Complete" after finishing the delivery, with real-time system updates.	High	Done	2	2

redesigned the application interfaces	- Focus on improving visual design elements (typography, colors, icons). - Simplify and streamline user flow, especially for accessibility.	High	Done	4	4

Sprint 3 Meeting 1

Project Name: Smart Logistics Optimization Application

Project Members: Ahad Alqahtani-Raghad Mujahed-Asma Alnounou-Omnya Ahmed-Joud Omar

_____Sprint 3 Stand up Meeting [11/12/2024] _____

Sprint Duration: 5 days

Scrum Master: Raghad Mujahed

Client: University of Jeddah

Pair Programmers:

Ahad Alqahtani, Raghad Mujahed, Asma Alnounou, Omnya Ahmed, Joud Omar

Stories:

2.1 The system calculates the distance then uses Google Direction API to find the best route for the driver based on the order details and suggest the most efficient routes based on real-time traffic data, distance, road conditions, prior.

2.2 The system should provide notifications that update the status of order for the manager.

Component Name	**Story Sequence Number**	**Use Cases (e.g., functionalities)**
Driver Page	1	1.1 Create a driver-specific page with a navigation menu containing links to the "Profile" and "Orders" sections.
Profile Section	2	2.1 Display driver informations
Orders Section	**3**	3.1 Show all orders assigned to the drive

Sprint 3 Meeting 2

Project Name: Smart Logistics Optimization Application

Project Members: Ahad Alqahtani-Raghad Mujahed-Asma Alnounou-Omnya Ahmed-Joud Omar

_____Sprint 3 Stand up Meeting - [11/16/2024]_____

Sprint Duration: 2 week

Scrum Master: Asma Alnounou

Client: University of jeddah

Pair Programmers:

Ahad Alqahtani, Raghad Mujahed, Asma Alnounou, Omnya Ahmed, Joud Omar

Stories:

2.1 The system calculate the distance then uses Google Direction API to find the best route for the driver based on the order details and suggest the most efficient routes based on real-time traffic data, distance, road conditions, prior.

2.2 The system should provide notifications that update the status of order for the manager.

Component Name	Story Sequence Number	Use Cases (e.g., functionalities)
Best Route	1	1.1 Provide drivers with the most efficient delivery route when they select an order 1.2 Optimize the route to minimize time and effort using mapping services.
Update Order Status		2.1 Drivers to mark an order as "Complete" after delivery.

Follow-up meetings questions:

1. What has been completed since the last meeting?

create a driver page that includes a navigation menu with "Profile" and "Orders" sections and Integrated mapping services to calculate and display the most efficient route for each order and implemented functionality allowing drivers to mark orders as "Complete" after finishing and We redesigned the application interfaces and improved their appearance.

2. What are you going to be working on next?

We will strive to develop the application and add many useful functions such as: Implement notifications to alert drivers of new orders, updates to assigned requests, or urgent tasks.

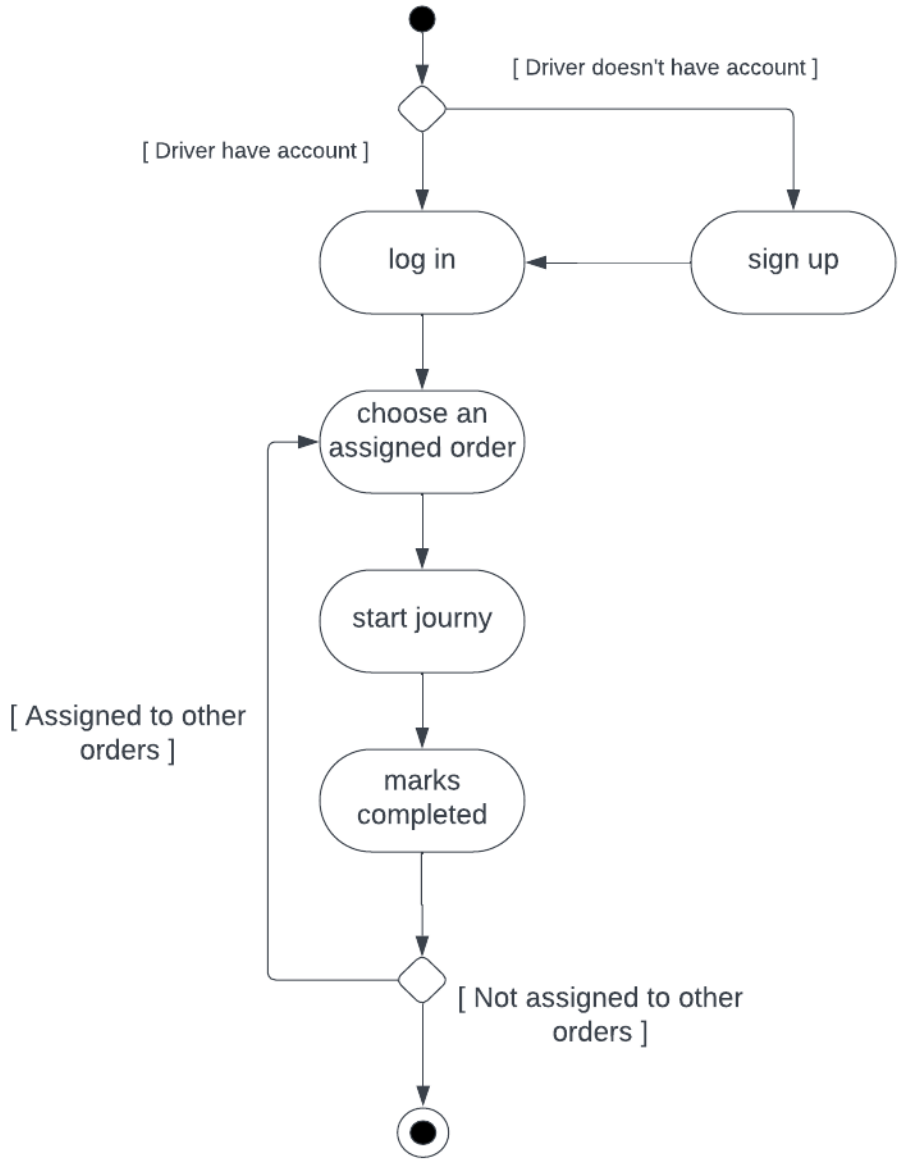
3. Do you have any issues/impediments?

There have been some technical difficulties in ensuring the Best Route feature consistently accounts for real-time traffic and dynamic route updates and Addressing inconsistencies in updating order statuses between the driver interface and the database.++.

Scrum's Master comments based on the above questions:

The progress so far has been commendable, with significant deliverables completed. The team demonstrates a clear plan for upcoming tasks, addressing both functional enhancements and system refinements.

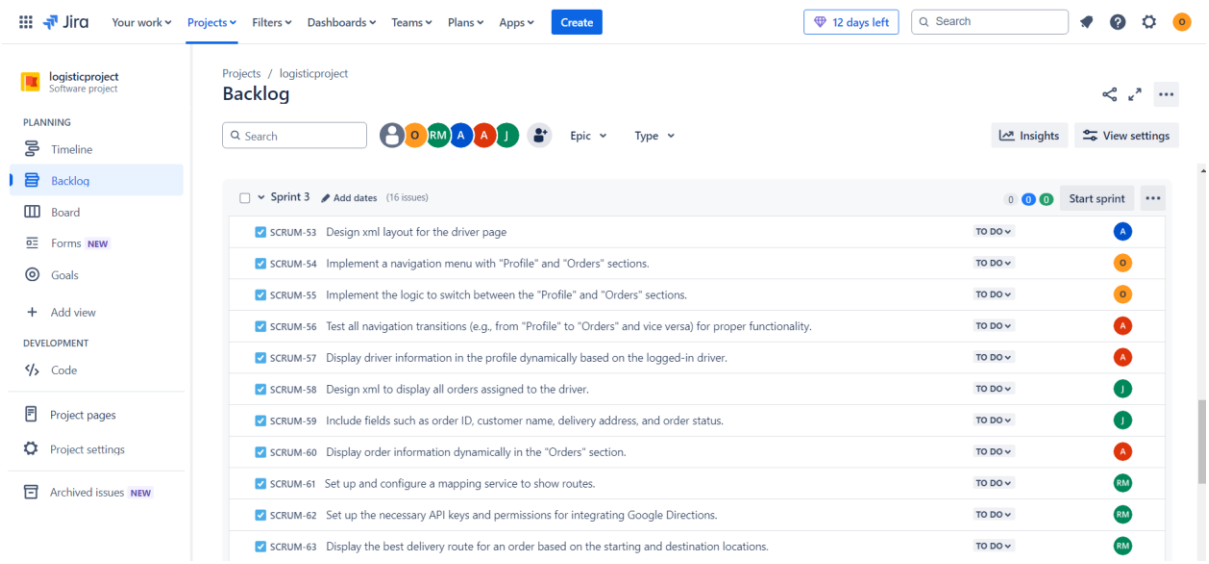
Diagram

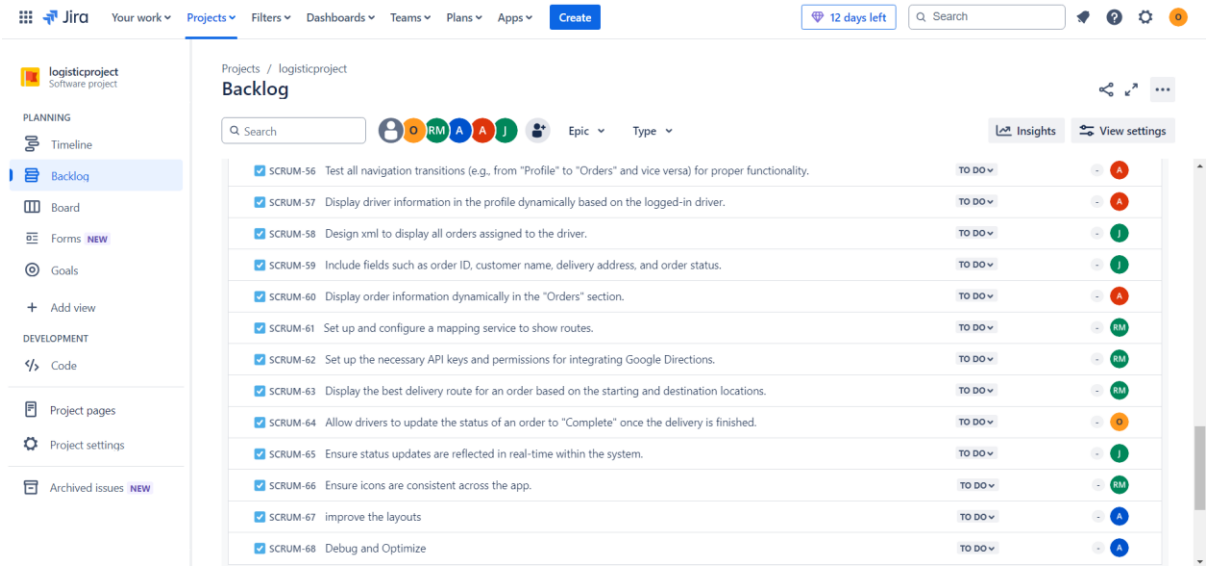

[Driver doesn't have account]
[Driver have account]
log in
sign up
choose an assigned order
start journy
[Assigned to other orders]
marks completed
[Not assigned to other orders]

Test Cases

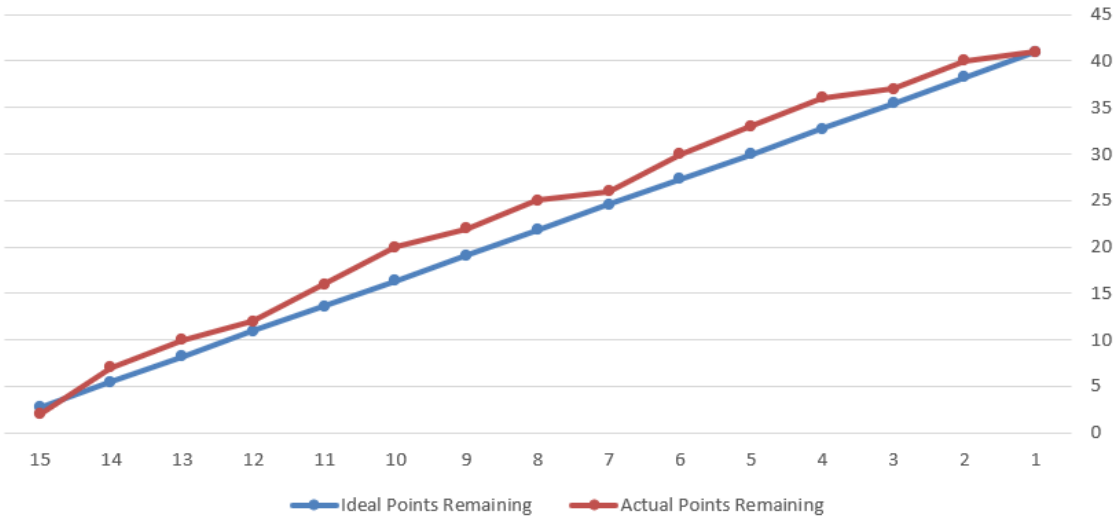
Test Case No.	Test Case Description	Expected Results	Outcome (Pass / Fail / Other (Comments))
TC01	The system must calculate the best route for the driver based on the order details and suggest the most efficient routes considering real-time traffic data, distance, road conditions, size and type of shipment, and prior delivery history.	The system calculates and displays the best route with the shortest time and lowest distance, factoring in live traffic and road conditions.	Did not Pass Completely
TC02	The system should provide notifications that update the status of the order for the manager.	The manager receives notifications in real-time about the status change	pass
TC03	The system must update the route in case of new traffic conditions	The updated route suggests alternative paths avoiding the incident, minimizing delays.	Did not pass
TC04	The system must provide the driver with real-time notifications about road conditions and alternative routes based on live data	The driver receives timely notifications about road closures or detours	Did not pass

Agile Project Planning Tool for Task Allocation





Burndown Chart



Github Link

https://github.com/ahadgalqahtani/projectR