American International University-Bangladesh (AIUB)

Department of Computer Science Faculty of Science & Technology (FST)

SOFTWARE ENGINEERING
Fall 23-24
Section: F

Group: 04

	Name	ID
1	Ahadul Islam Chowdhury	21-44953-2
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Lab-1

Title: Railway Anti-Collision System in Bangladesh

Background Description:

Bangladesh's railway system is one of its many public transportation options. People often use trains to avoid traffic jams and save time. Thus, it is most selected public transportation is having some bad side too, it has recently been involved in several collisions that have caused thousands of deaths and injuries. This is happening due to technical disadvantages and till now they are manually operating. There's a very small room to blame the system because of its manual operations. The illegal removal of fish plates is also a most seen case in our country. We don't have that kind of system to identify removed fish plates. The illegal removal of fish plates and collisions on the same track causes crashes. Collisions on the same tracks happen because of manual operation. We still track the train by calling on mobile phones.

To prevent this kind of casualty we are introducing our railway anti-collision system. In our proposed system, we monitor the tracks traffic flow via GPS for better transition, we detect trains on the same track via GPS, and we monitor the fish plates using power relays. Any unusual train movement or the removal of fish plates will be detected, and the control room and train dispatcher will be informed so that appropriate action can be taken.

Problem Domain:

We analyze many reasons for railways collisions in Bangladesh. But there are mainly 3 root causes of this problem are.

1. **Unwanted congestion on railway tracks:** We are still manually operating the total railway system in Bangladesh. That's why sometimes the delay of schedule can cost unwanted congestion on railway track.

2. **More than 1 train on a track:** Trains are still manually operated on Bangladesh Railway. As a result, if we rely solely on visual information, it is already too late to act. For a train to brake, at least half a mile is required. Therefore, it is impossible to prevent accidents at that moment if a train operator observes another train approaching on the same track.

3. **Removal of fish plates:** The removal of fish plates and racks is not currently being observed either. A railway dispatcher cannot guarantee a train's safe trip if they are unaware of whether the tracks are safe or not.

Objectives:

The Railway Anti-Collision System can change the current scenario of our weak railway management system which is basically a manually operated system. The system has several objectives which are discussed below.

1. **Automatic braking system:** Prevention of Head-on, Rear-end or side collisions by automatic braking system.

2. **GPS Tracking:** To monitor railway flows and abnormal train movement GPS

trackers will be installed in every train.

3. **Advance communication system**: Providing necessary information to the train dispatchers.

4. **Auto data tracking:** Notifying train engineer about unusual movement of trains.

5. **Sensor:** Monitoring of fish plates. If the plates were removed or face any casualties it will provide all the information to the system.

Solution of the problems:

A combined solution for collision between trains, a train derailment in curves and bends, and the automatic system of railway gates. The proposed Train Anti Collision System consists of a self-acting anti-collision technique that works round-the-clock to avert train collisions and accidents at the level crosses. This enhances safety in train operations by providing a signal additional safety overlay. The system operates with strong signaling and nowhere affects the vital functioning of the present safety systems deployed for train operations. The efficiency of the system is expected to be considerably increased as the proposed system takes inputs from the GPS navigation and from the level crossing gates. As more relevant data is included, it is expected that the present system may assist local drivers in averting accidents efficiently. As no change is necessary to be made to the infrastructure of the existing system, the cost of implementation of this system is also less.

Target users / User Benefits:

1. **Passengers:** Bangladesh's railway system is one of the country's major mass transportation systems. Passengers on trains will benefit the most from ensuring a safe journey.
2. **Train Dispatcher:** A train dispatcher is employed by a railroad to direct and facilitate the movement of trains over an assigned territory, which is usually part, or all, of railroad operating division. By using GPS tracking a train dispatcher can monitor every available train on that territory. By doing so, dispatching trains will be a lot easier. If they find any anomaly in the system, train dispatchers can solve that problem without any delay.

3. **Station Master:** The Station Master must inspect the station daily which must include the inspection of cabins, signals, level crossing gates, lamps, weighing machines, goods and station yard and vehicles standing therein, at least once a day. By using the system, the station master can check every crossing gate and lamp at once.

4. **Section Controller:** The tasks a Section Controller, Railway is expected to perform include controlling the movement of rail traffic within their section. Arranging the crossing of trains, efficient utilization of wagons and formation of goods trainset junction stations. By using the system section controller can easily monitor the traffic within their section. The system can detect if there’s any problem with the fish plates available in the area.

5. **Train Engineer:** Train engineers, also known as locomotive engineers, work onboard moving locomotives. They are responsible for operating trains, driving them safely between stations. Most train engineers start as brake operators, switch

operators or conductors, and earn promotion through experience and training. A train engineer can monitor traffic using the system. He can also check the fish plates and crossing gates for any anomalies.

Basic functionalities:

The basic functionalities of our proposed solutions are Safe Journey, Automatic braking, Providing necessary information's to the control room and corresponding People of a station, Train congestion management. Our project will use the best use of the technology like Machine learning and Artificial Intelligence to handle critical situations. Support for Desktop and Mobile applications to make the process easier. This whole system will make very significant impact on real life. For example, Accident rates will fall dramatically, the system's proper use will ensure safe travel, and Railway can control the proper flow of trains.

1. **Software Login:** The software shall allow users to login with their given username and password. The login credentials (username and password) will be verified with database records. If the login successful, the home page of the user account will be displayed. If the username and/or password has been inserted wrong, the random verification code will be generated and sent to the user's email address by the system to retry login.

2. **Automated Departure Signals:** System will automatically send signals to corresponding gate masters. The system will measure arrival times to each cross gate and inform corresponding gate master system will compute estimated time of arrival to stations of corresponding routes.

3. **Route Check:** System will check the routes before departure. If route check comes positive system shall allow train to dispatch. If route check comes negative system should stop departure and notify head office. Then the administrator will then take the necessary steps.

4. **Route Map:** System should allow user and admins to see routes congestion map. System should allow users to select specific routes to see current conditions. A sound wave of frequency 440 hz will be there on train if system detects congestion in route.

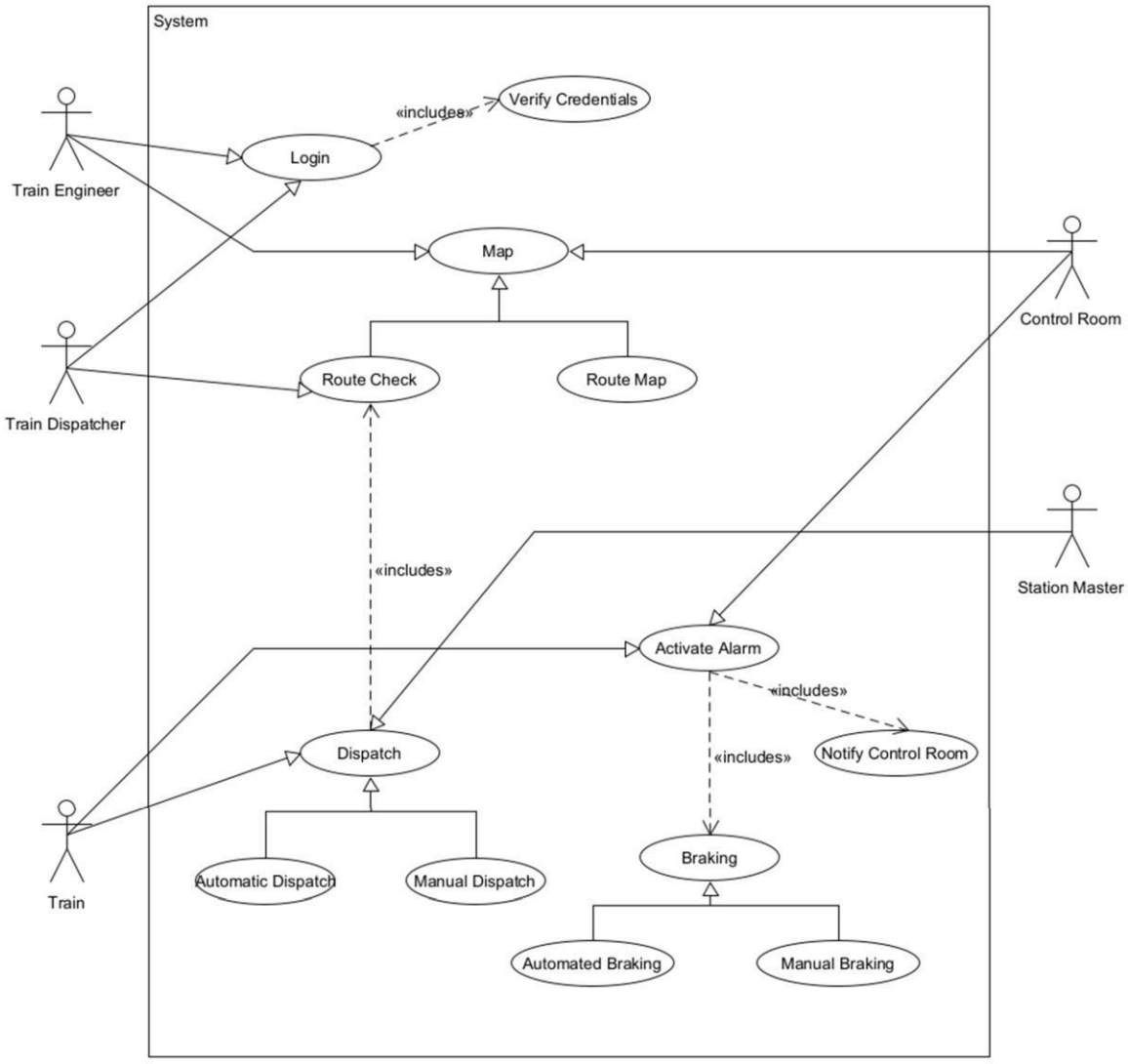
5. **Train flow control:** System shall control each train's speed. System shall control Congestion on routes. If a route is not safe the system will change the path of course.

6. **Payment System for employees:** User should receive their payments through the system**.** The system should allow users to check his/her payment statistics.

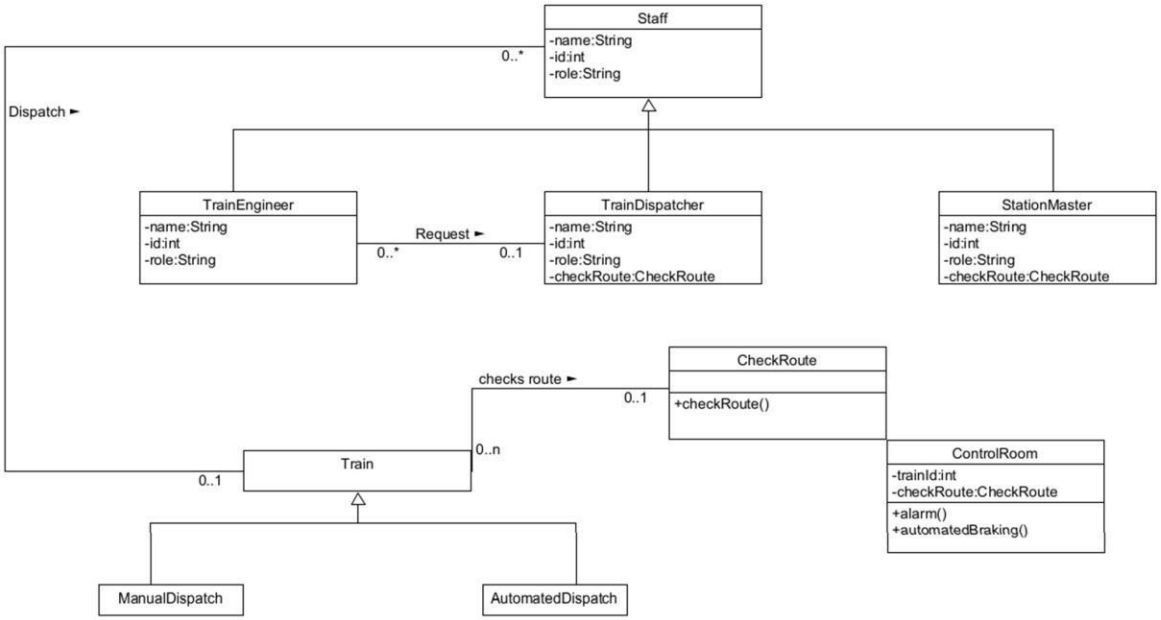
7. **Show Time and Distance:** Time will be shown all the time. Distance will be shown on the map with syncing with time and trains in tracks.

Lab-2

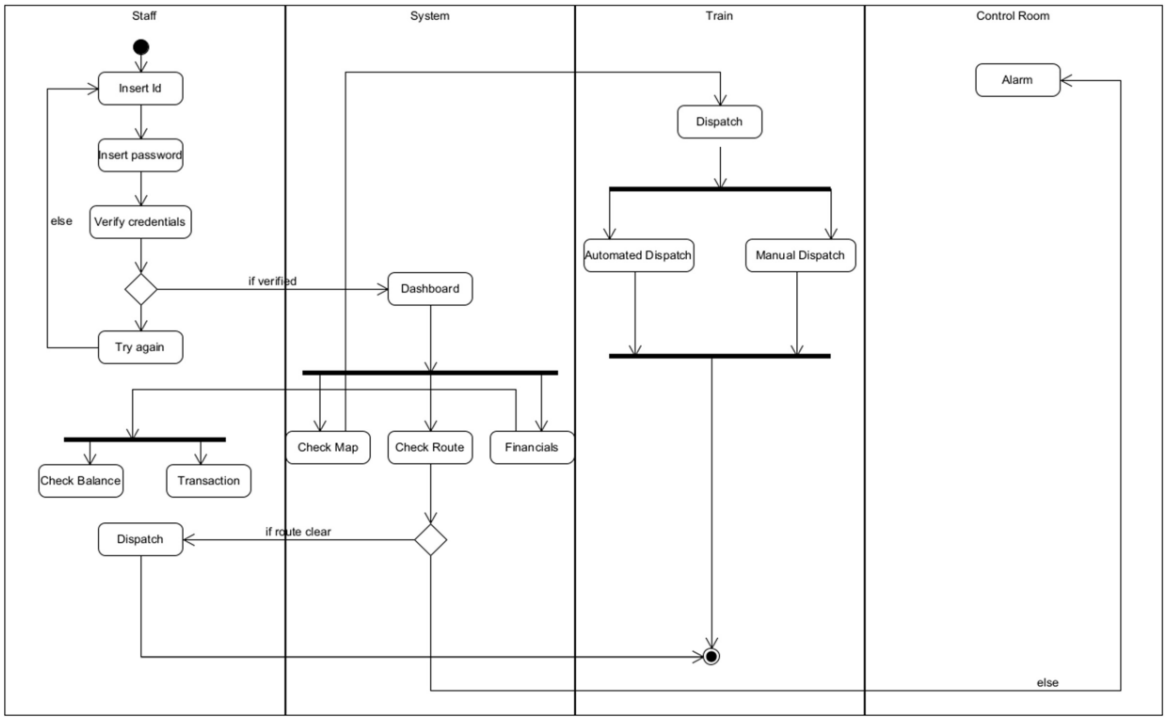
Use case Diagram:



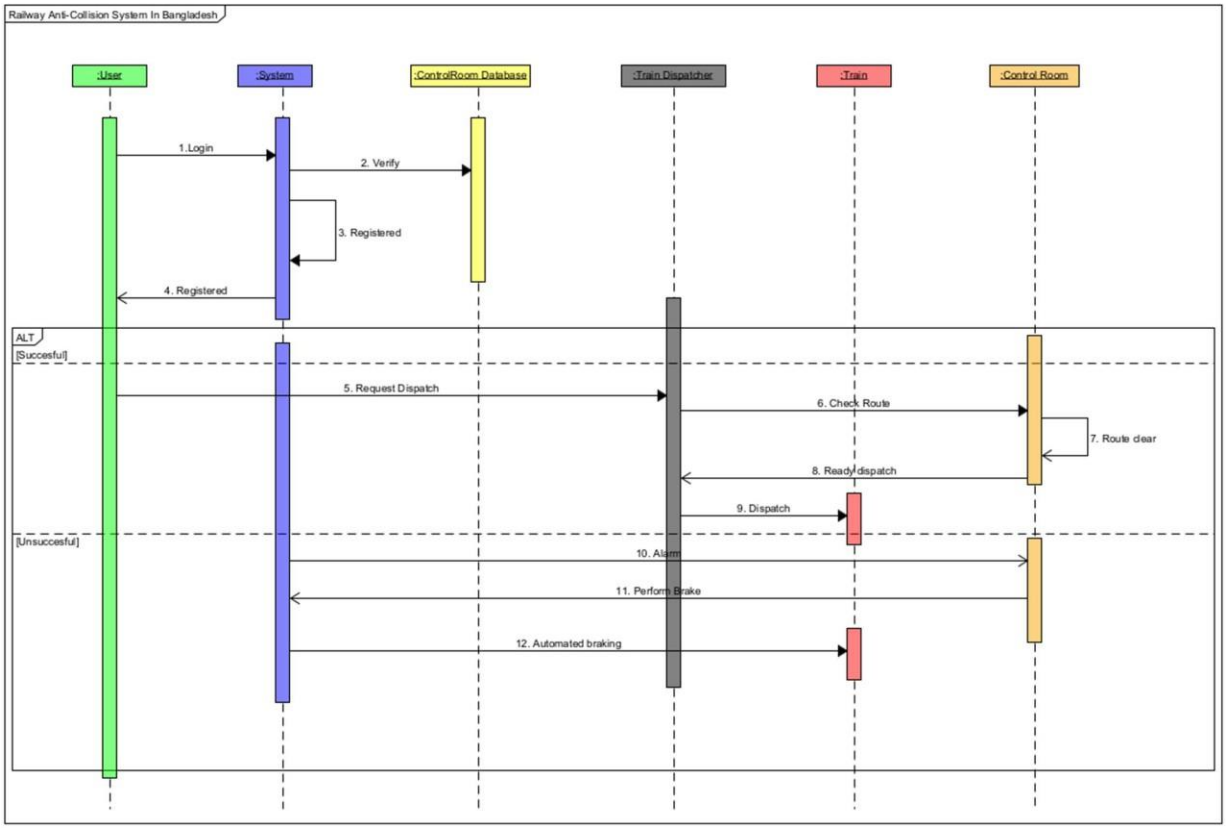
Class Diagram:



Activity Diagram:



Sequence Diagram:



Lab-3

Process Model:

Based on our analysis we selected the “Waterfall Process Model”. We think it is the best choice among all other methods to develop our proposed software. It is also referred to as a linear- sequential life cycle model. In a waterfall model, each phase must be completed before the next phase can begin and there is no overlapping in the phases. Waterfall approach was the first SDLC Model to be used widely in Software Engineering to ensure success of the project. In "The Waterfall" approach, the whole process of software development is divided into separate phases. In this Waterfall model, typically, the outcome of one phase acts as the input for the next phase sequentially.

Arguments: We’ve selected it because,

1. Requirements are very well documented, clear, and fixed.
2. Product definition is stable.
3. Technology is understood and is not dynamic.
4. There are no ambiguous requirements.

Cross Connection:

Our project is well documented, and all the requirements are very clear. So, there should be no change needed, that's why it is fixed. To use waterfall, model all requirements should be taken before starting construction. Because in this model back tracking is not possible. With proper documentation and fixed requirements, we have chosen to build our project with this model. Our project is stable, this is another reason for getting befitted from this model. The project is stable and technically well understood and it's not dynamic, that's this model is more efficient. Also, there are no fuzzy requirements. All of them are clear also no change in them. Even though our project is not large, and the waterfall model is an old model, that's true but still can handle small project perfectly.

Responsible Roles:

Manager, Designer, Developer, and Tester all play crucial roles in the development of this "Railway Anti-Collision System in Bangladesh."

Manager: A manager is a person who manages the whole project and manages time and every other aspect of this project.

1. Requirement gathering and analyze them.
2. Project estimating and scheduling.
3. Motivate teams to stay in a work flow and discipline.

System designer: System designer understand and solve complex problems logical and analytical approach to solving problems. Work independently or as part of a team and direct the work of others. Full-fill the requirements task, an architecture design task.

1. Diagram designing.
2. Architectural designing.
3. Component designing.

Developer: Developer implements the code and uses various source debuggers and visual development environments to modify, write, and debug software for client applications.

1. Code implementation.
2. Code testing.
3. Modify codes.

Tester: Testers are responsible for the quality of software development and deployment. They are involved in performing automated and manual tests to ensure the software created by developers is fit for purpose.

1. Design test scenarios for software usability.
2. Prepare reports on the software's effectiveness.
3. Create documentation.

Lab- 4

Requirement Analysis:

1. **Software Login:**

   1.1 The software shall allow users to login with their given username and password.

   1.2 The login credentials (username and password) will be verified with database records.

   1.3 If the login successful the home page of the user account will be displayed.

   1.4 If the username and/or password has been inserted wrong, the random verification code will be generated and sent to the user's email address by the system to retry login.

   1.5 If the number of login attempt exceed its limit (3 times), the system shall block the user account login for one hour [optional function]

   Priority Level: High

   Precondition: user have valid user id and password

2. **Automated Departure Signals:**

   2.1 System will automatically send signals to corresponding gate masters.

   2.2 System will measure arrival times to each cross gate and inform corresponding gate master.

   2.3 System will compute estimated time of arrival to stations of corresponding routes.

   2.4 In order to avoid accidents, automatic signaling has been found out. In this signal are operated by trains themselves.

   2.5 An electric current is conveyed through the track when a train occupies that particular track and this current puts the signal at danger position until the train has gone far ahead so as to require no further protection.

   Priority Level: High

   Precondition: An AI system must be on stations to capture train flow

3. **Route Check:**

   3.1 System will check the routes before departure.

   3.2 If route check comes positive system shall allow train to dispatch.

3.3 If route check comes negative system should stop departure and notify head office.

3.4 Then the administrator will then take the necessary steps.

3.5 If route check comes negative system should stop departure.

Priority Level: High

Precondition: An AI system must be there to check routes

4. Route Map:

4.1 The system should allow users and admins to see routes congestion map.

4.2 System should allow users to select specific routes to see current conditions.

4.3 A sound wave of frequency 440 hz will be there on train if system detects congestion in route.

4.4 System should define all the routes and find the free routes.

4.5 System should be only accessible for authorities.

Priority Level: High

Precondition: Only authorized user can use the system

5. Train flow control:

5.1 System shall control each train's speed.

5.2 System shall control Congestion on routes

5.3 If a route is not safe the system will change the path of course.

5.4 System shall monitor each train specifically.

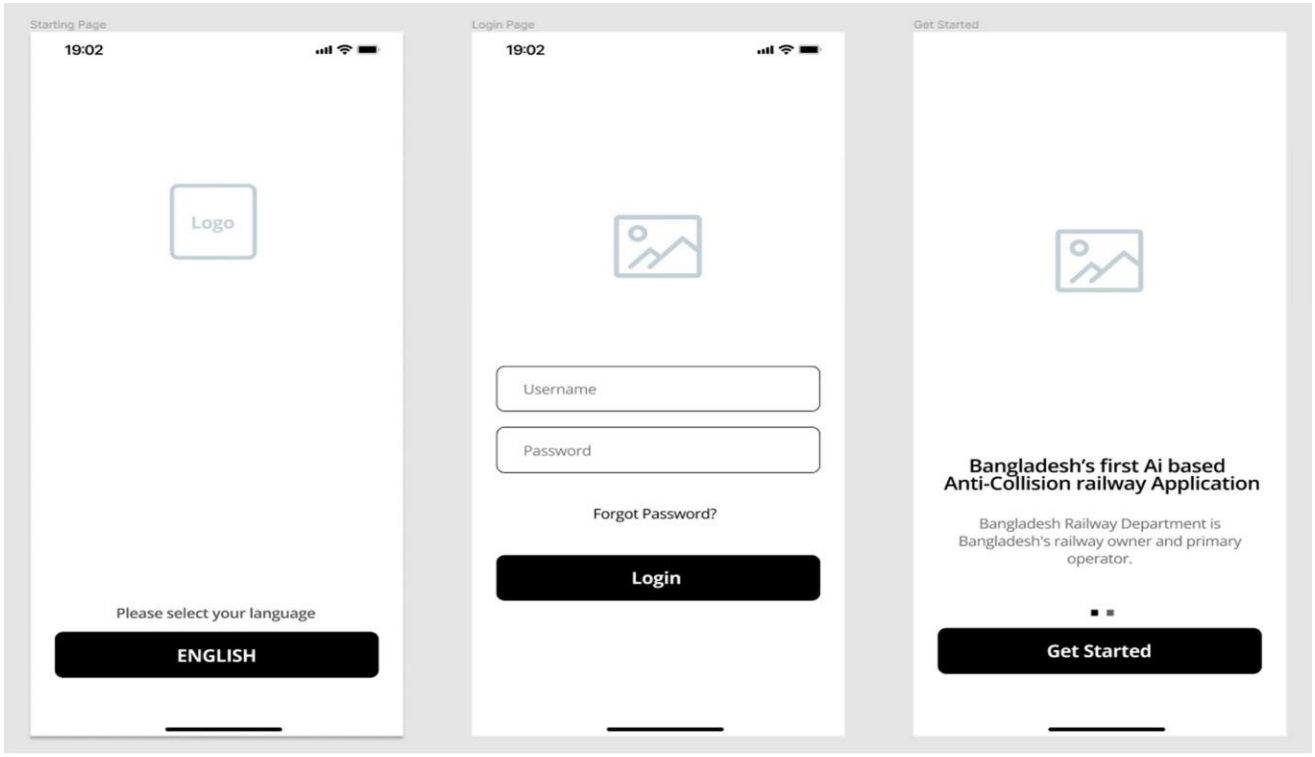
5.5 System shall have emergency alert mode to control train flow.

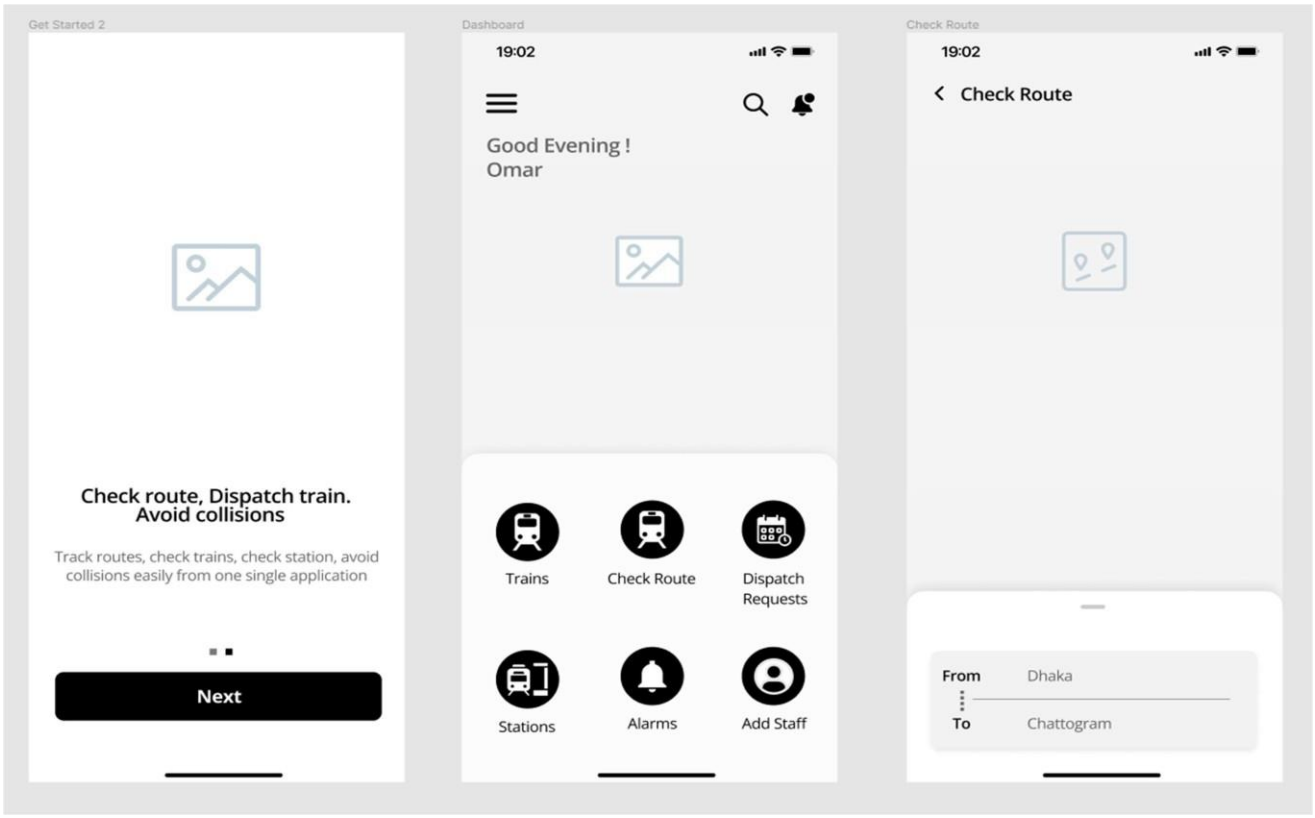
Priority Level: High

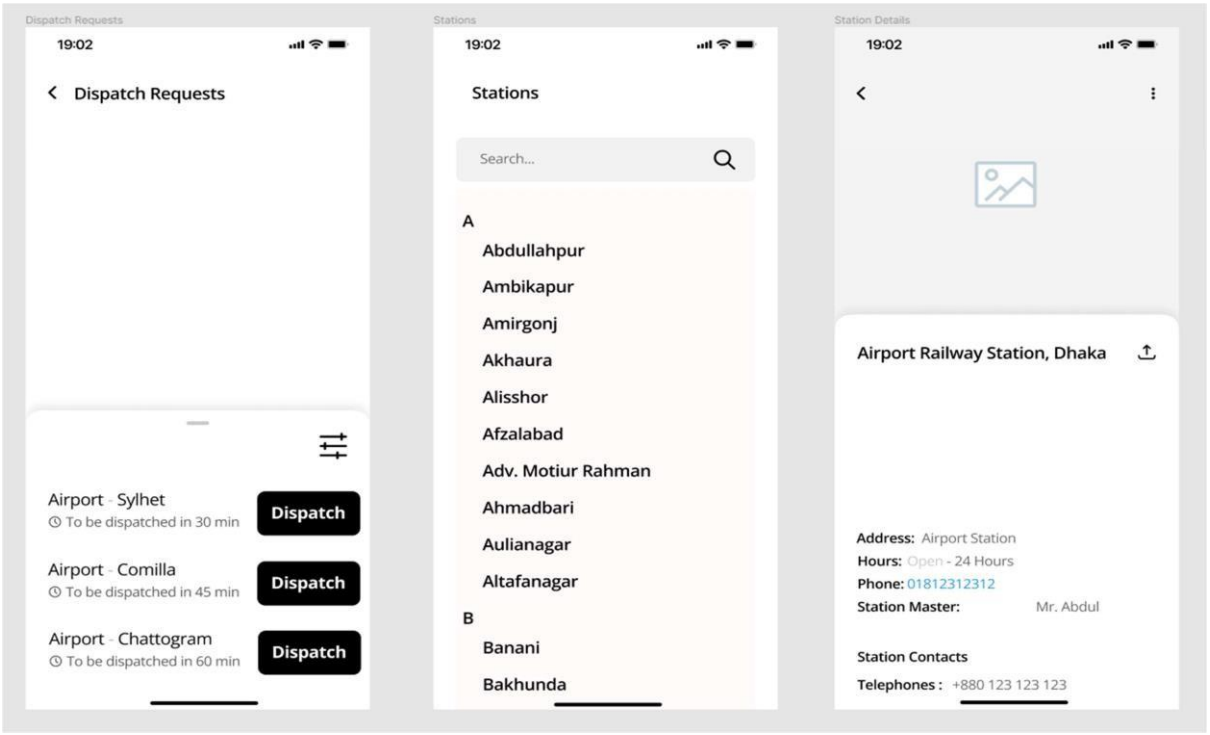
Precondition: Al system must be there to control train flow.

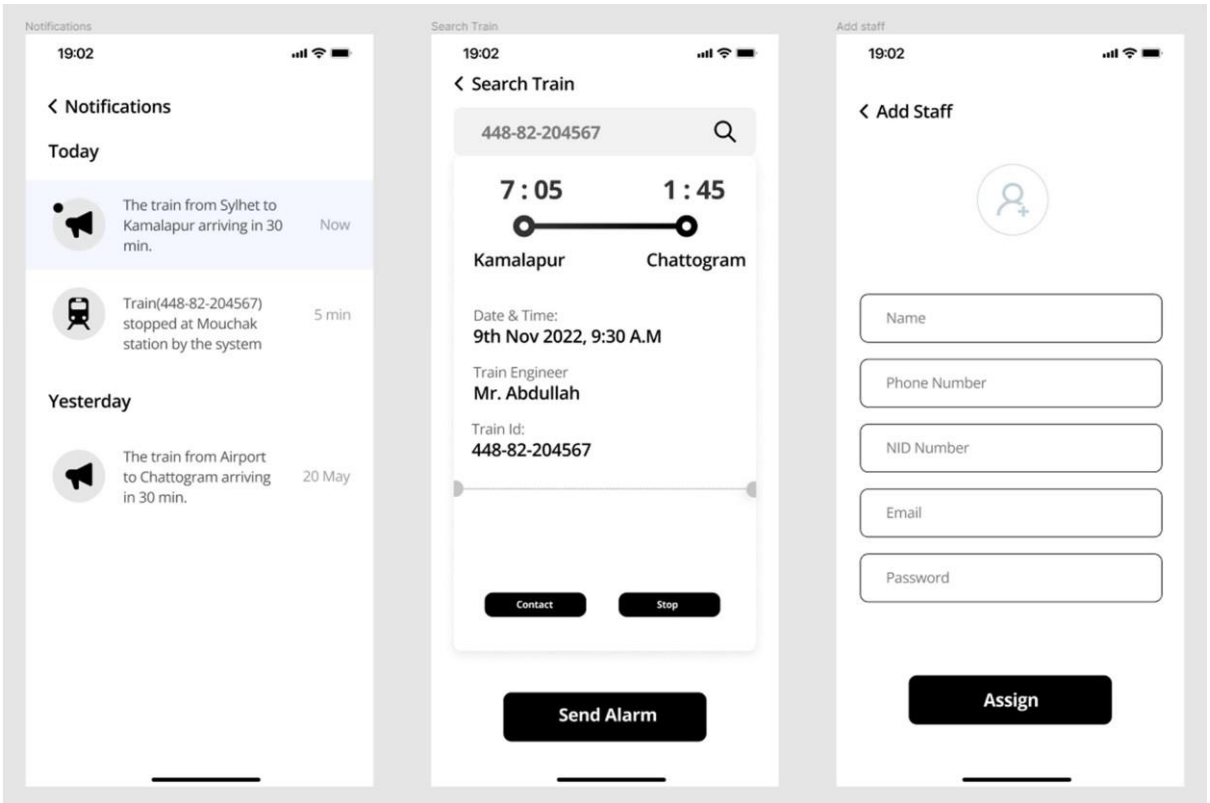
Lab- 5

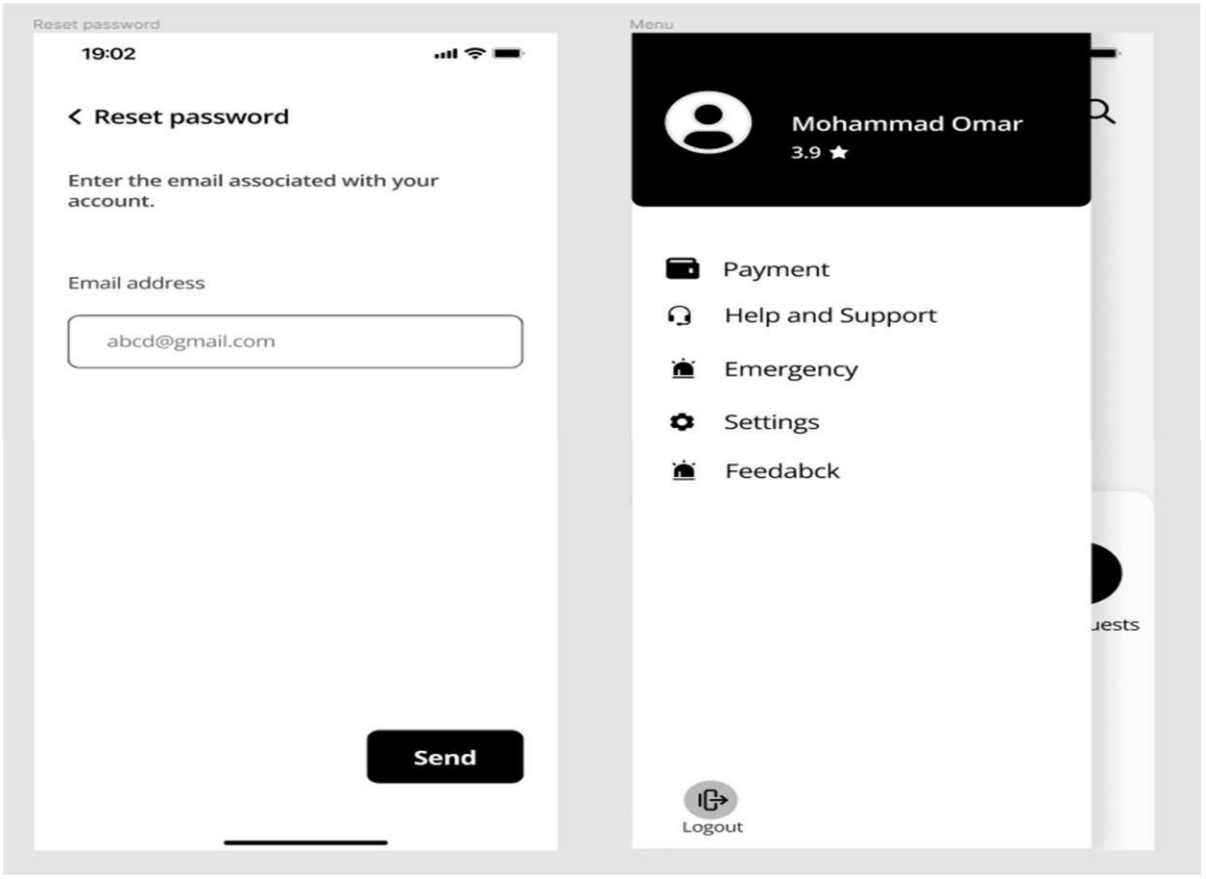
Prototype Design:

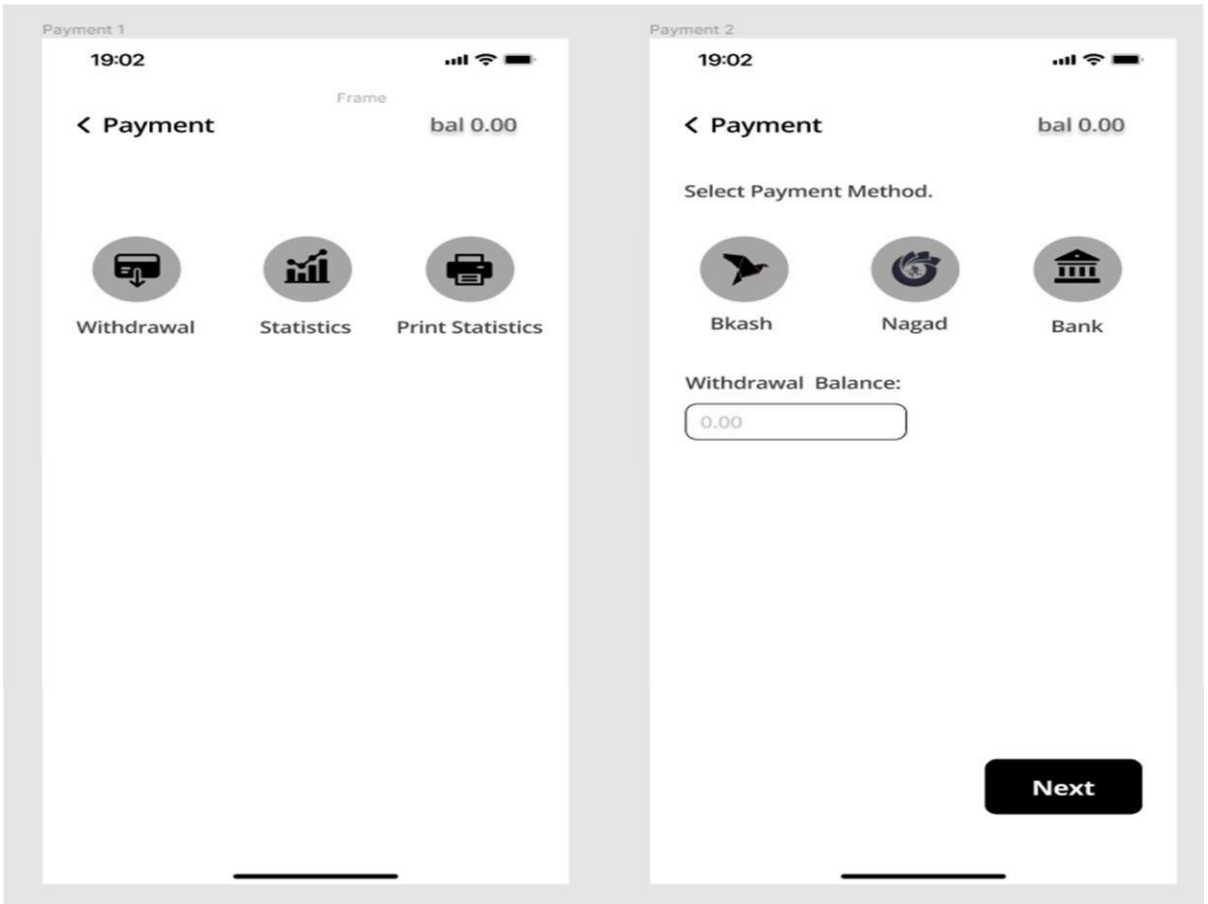





Dispatch Requests
19:02
Dispatch Requests
Airport - Sylhet
To be dispatched in 30 min
Dispatch
Airport - Comilla
To be dispatched in 45 min
Dispatch
Airport - Chattogram
To be dispatched in 60 min
Dispatch
Stations
19:02
Stations
Search...
A
Abdullahpur
Ambikapur
Amirgonj
Akhaura
Alisshor
Afzalabad
Adv. Motiur Rahman
Ahmadbari
Aulianagar
Altafanagar
B
Banani
Bakhunda
Station Details
19:02
Airport Railway Station, Dhaka
Address: Airport Station
Hours: Open - 24 Hours
Phone: 01812312312
Station Master: Mr. Abdul
Station Contacts
Telephones : +880 123 123 123


Notifications
19:02
Notifications
Today
The train from Sylhet to Kamalapur arriving in 30 min.
Now
Train(448-82-204567) stopped at Mouchak station by the system
5 min
Yesterday
The train from Airport to Chattogram arriving in 30 min.
20 May
Search Train
19:02
Search Train
448-82-204567
7 : 05
1 : 45
Kamalapur
Chattogram
Date & Time:
9th Nov 2022, 9:30 A.M
Train Engineer
Mr. Abdullah
Train Id:
448-82-204567
Contact
Stop
Send Alarm
Add staff
19:02
Add Staff
Name
Phone Number
NID Number
Email
Password
Assign


Reset password
19:02
Reset password
Enter the email associated with your account.
Email address
abcd@gmail.com
Send
Menu
Mohammad Omar
3.9
Payment
Help and Support
Emergency
Settings
Feedabck
Logout


Payment 1
19:02
Frame
Payment
bal 0.00
Withdrawal
Statistics
Print Statistics
Payment 2
19:02
Payment
bal 0.00
Select Payment Method.
Bkash
Nagad
Bank
Withdrawal Balance:
0.00
Next

Lab- 6

PROJECT TEST PLANING

Test Case 1:

Project Name: Railway Anti-Collision System In Bangladesh	**Test Designed by:**
Test Case ID: RAC_1	**Test Designed date:** 31.10.23
Test Priority (Low, Medium, High): Medium	**Test Executed by:**
Module Name: Login Session	**Test Execution date:** 31.10.23
Test Title: verify login with valid username and password	
Description: Test website login page	
Precondition (If any): User must have valid username and password	

Test Steps	Test Data	Expected Results	Actual Result	Status(pass/fail)
1. Go to the website 2. Enter username 3. Enter password 4. Click submit	Username: omar24 Password: pass13564	User should login into the application	As expected,	Pass

Post Condition: User is validated with database and successfully login to account. The account session details are logged in the database.

Test Case 2:

Project Name: Railway Anti-Collision System In Bangladesh	**Test Designed by:** Sumaiya Islam
Test Case ID: RAC_2.1	**Test Designed date:** 31.10.23
Test Priority (Low, Medium, High): High	**Test Executed by**: Sumaiya Islam
Module Name: Automated Departure Signals	**Test Execution date:** 31.10.23

Test Title: Automated Signals Testing

Description: Check dispatch signals

Precondition (If any): Must have login into application

An AI system must be on stations to capture train flow.

Test Steps	Test Data	Expected Results	Actual Result	Status(pass/fail)
1. Click on notification icon		User can check dispatch signal for each train on the specified station.	As expected	pass

Post Condition: User is validated with database and successfully login to account. The account session details are logged in the database.

Test Case 3:

Project Name: Railway Anti-Collision System	**Test Designed by:** Zannatul Ferdows Wafi
Test Case ID: RAC.3	**Test Designed date:** 31.10.23
Test Priority (Low, Medium, High): High	**Test Executed by:** Zannatul Ferdows Wafi
Module Name: Route Check	**Test Execution date:** 31.10.23
Test Title: Verify the routes works or not	
Description: Test route check	
Precondition (If any): Null	

Test Steps	Test Data	Expected Results	Actual Result	Status(pass/fail)
2. Login to the system 3. Open dashboard 4. Click on check routes	From: Dhaka To: Joypurhat	User Should See the route selection page	User can't see the route	Fail
Post Condition:				

Test Case 4:

Project Name: Railway Anti-Collision System In Bangladesh	T**est Designed by:** Nabila Anjum Banta Ahad
Test Case ID: RAC_1	**Test Designed date:** 31.10.23
Test Priority (Low, Medium, High): Medium	**Test Executed by:** Nabila Anjum Banta Ahad
Module Name: Route Map	**Test Execution date:** 31.10.23
Test Title: Verify that users can see route map	
Description: Test route map	
Precondition (If any): User must be a valid user	

Test Steps	Test Data	Expected Results	Actual Result	Status(pass/fail)
1. Go Application 2. Enter username 3. Enter password 4. Click submit 5. Click Check Route		User should see route map under check route option	As expected,	Pass

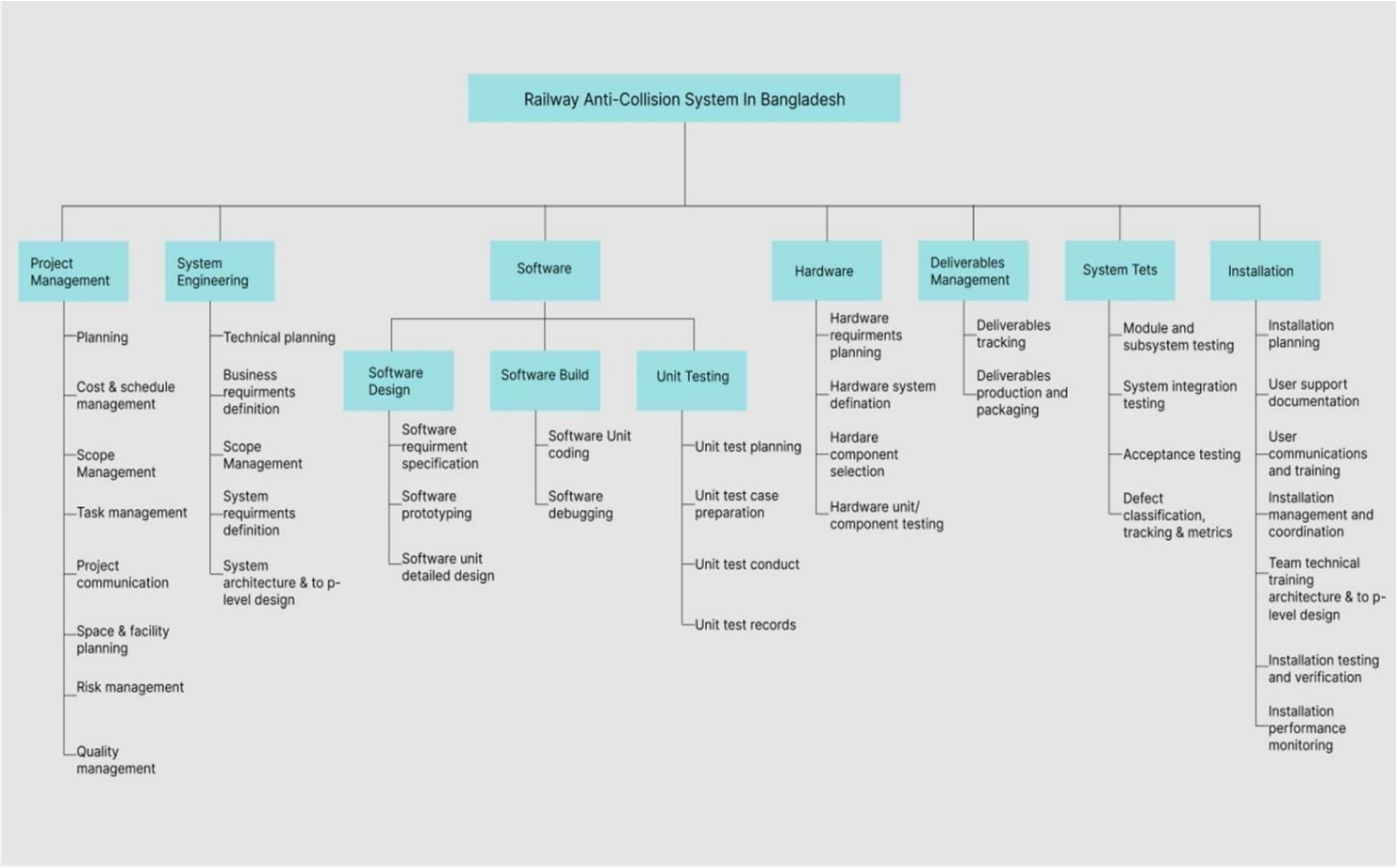
Post Condition: The account session details are logged in the database.

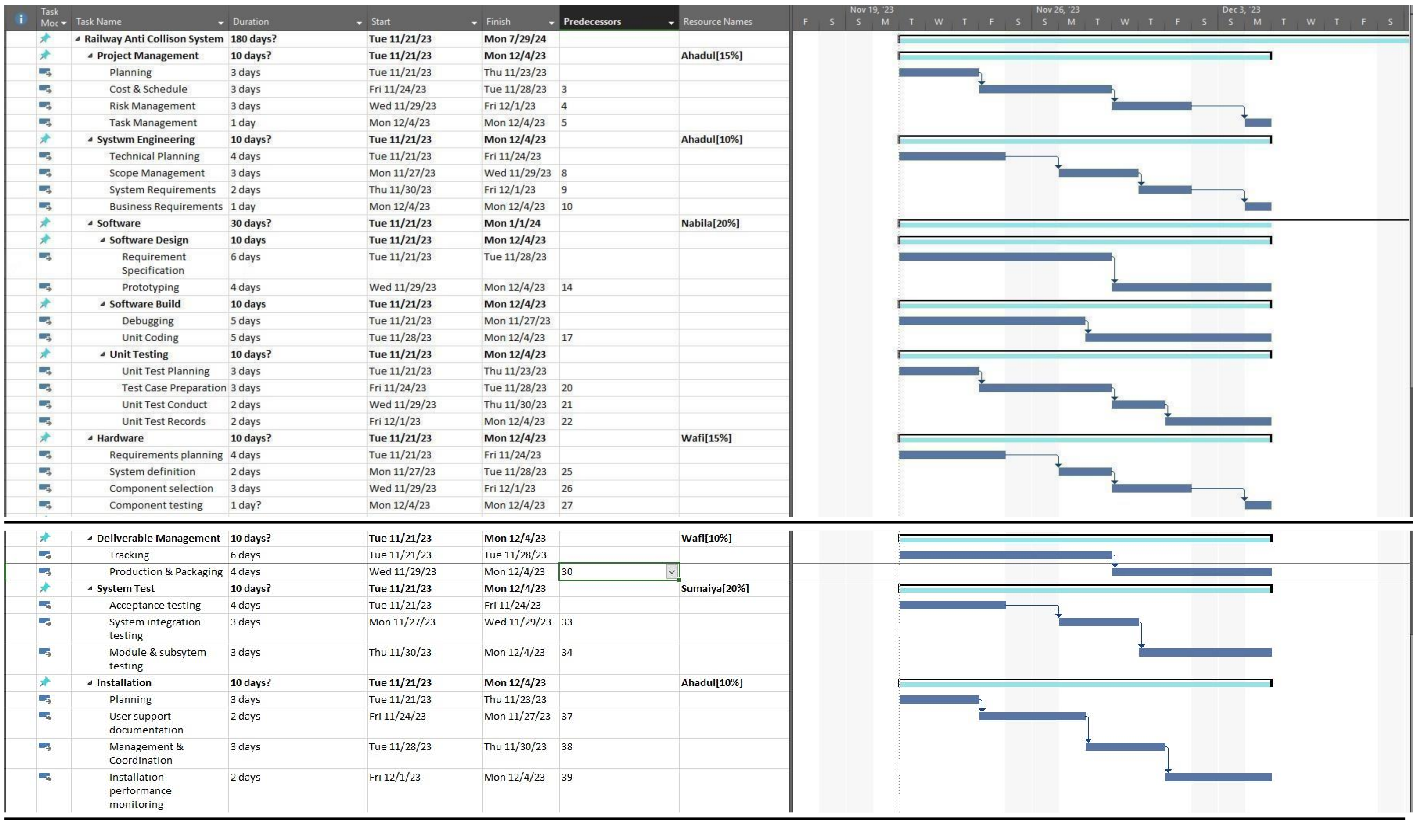
Test Case 5:

Project Name: Railway Anti-Collision System In Bangladesh			**Test Designed by:** Ahadul Islam Chowdhury	
Test Case ID: RAC_5			**Test Designed date:** 31.10.23	
Test Priority (Low, Medium, High): High			**Test Executed by**: Ahadul Islam Chowdhury	
Module Name: Train flow control			**Test Execution date**: 31.10.23	
Test Title: Control train flow				
Description: Check the train flow and control when needed				
Precondition: AI system must active to check the train flow				
Test Steps	**Test Data**	**Expected Results**	**Actual Result**	**Status(pass/fail)**
1. Login into the system 2. Open dashboard 3. Click trains		User should see the train flow	Train flow showed	pass
Post Condition:				

Lab- 7

WORK BREAKDOWN STRUCTURE





Task Mode	Task Name	Duration	Start	Finish	Predecessors	Resource Names
	Railway Anti Collison System	**180 days?**	**Tue 11/21/23**	**Mon 7/29/24**		
	Project Management	**10 days?**	**Tue 11/21/23**	**Mon 12/4/23**		**Ahadul[15%]**
	Planning	3 days	Tue 11/21/23	Thu 11/23/23		
	Cost & Schedule	3 days	Fri 11/24/23	Tue 11/28/23	3	
	Risk Management	3 days	Wed 11/29/23	Fri 12/1/23	4	
	Task Management	1 day	Mon 12/4/23	Mon 12/4/23	5	
	Systwm Engineering	**10 days?**	**Tue 11/21/23**	**Mon 12/4/23**		**Ahadul[10%]**
	Technical Planning	4 days	Tue 11/21/23	Fri 11/24/23		
	Scope Management	3 days	Mon 11/27/23	Wed 11/29/23	8	
	System Requirements	2 days	Thu 11/30/23	Fri 12/1/23	9	
	Business Requirements	1 day	Mon 12/4/23	Mon 12/4/23	10	
	Software	**30 days?**	**Tue 11/21/23**	**Mon 1/1/24**		**Nabila[20%]**
	Software Design	**10 days**	**Tue 11/21/23**	**Mon 12/4/23**		
	Requirement Specification	6 days	Tue 11/21/23	Tue 11/28/23		
	Prototyping	4 days	Wed 11/29/23	Mon 12/4/23	14	
	Software Build	**10 days**	**Tue 11/21/23**	**Mon 12/4/23**		
	Debugging	5 days	Tue 11/21/23	Mon 11/27/23		
	Unit Coding	5 days	Tue 11/28/23	Mon 12/4/23	17	
	Unit Testing	**10 days?**	**Tue 11/21/23**	**Mon 12/4/23**		
	Unit Test Planning	3 days	Tue 11/21/23	Thu 11/23/23		
	Test Case Preparation	3 days	Fri 11/24/23	Tue 11/28/23	20	
	Unit Test Conduct	2 days	Wed 11/29/23	Thu 11/30/23	21	
	Unit Test Records	2 days	Fri 12/1/23	Mon 12/4/23	22	
	Hardware	**10 days?**	**Tue 11/21/23**	**Mon 12/4/23**		**Wafi[15%]**
	Requirements planning	4 days	Tue 11/21/23	Fri 11/24/23		
	System definition	2 days	Mon 11/27/23	Tue 11/28/23	25	
	Component selection	3 days	Wed 11/29/23	Fri 12/1/23	26	
	Component testing	1 day?	Mon 12/4/23	Mon 12/4/23	27	
	Deliverable Management	**10 days?**	**Tue 11/21/23**	**Mon 12/4/23**		**Wafi[10%]**
	Tracking	6 days	Tue 11/21/23	Tue 11/28/23		
	Production & Packaging	4 days	Wed 11/29/23	Mon 12/4/23	30	
	System Test	**10 days?**	**Tue 11/21/23**	**Mon 12/4/23**		**Sumaiya[20%]**
	Acceptance testing	4 days	Tue 11/21/23	Fri 11/24/23		
	System integration testing	3 days	Mon 11/27/23	Wed 11/29/23	33	
	Module & subsytem testing	3 days	Thu 11/30/23	Mon 12/4/23	34	
	Installation	**10 days?**	**Tue 11/21/23**	**Mon 12/4/23**		**Ahadul[10%]**
	Planning	3 days	Tue 11/21/23	Thu 11/23/23		
	User support documentation	2 days	Fri 11/24/23	Mon 11/27/23	37	
	Management & Coordination	3 days	Tue 11/28/23	Thu 11/30/23	38	
	Installation performance monitoring	2 days	Fri 12/1/23	Mon 12/4/23	39	

Lab- 8

Resource Allocation

Resource Name	Type	Material	Initials	Group	Max.	Std.	Ovt.	Cost/Use	Accrue	Base
Ahadul	Work	microsoft project	A	Project Management	100%	$140.00/hr	$0.00/hr	$0.00	Prorated	Standard
Nabila	Work	Figma	N	Software Design	100%	$130.00/hr	$0.00/hr	$0.00	Prorated	Standard
Wafi	Work	JavaScript	W	Software Development	100%	$150.00/hr	$0.00/hr	$0.00	Prorated	Standard
Sumaiya	Work	Selenium	S	Software Testing	100%	$130.00/hr	$0.00/hr	$0.00	Prorated	Standard
Nabila	Work	Computer		Software Design	100%	$50.00/hr	$0.00/hr	$0.00	Prorated	Standard
Wafi	Work	Smartphones	W	Software Development	100%	$30.00/hr	$0.00/hr	$0.00	Prorated	Standard
Sumaiya	Work	Laptop	S	Software Testing	100%	$20.00/hr	$0.00/hr	$0.00	Prorated	Standard
Equipments	Material	sensors	E	Implementation		$10.00		$0.00	Prorated	
microsoft project	Material	Software	m			$20.00		$0.00	Prorated	
Jira	Material	Software	J			$20.00		$0.00	Prorated	
Figma	Material	Software	F			$20.00		$0.00	Prorated	
JavaScript	Material	Software	J			$20.00		$0.00	Prorated	
Selenium	Material	Software	S			$20.00		$0.00	Prorated	
Laptop	Material	Hardware	L			$20.00		$0.00	Prorated	
Smartphones	Material	Hardware	S			$20.00		$0.00	Prorated	
Computer	Material	Hardware	C			$20.00		$0.00	Prorated	
sensors	Material	Hardware	s			$10.00		$0.00	Prorated	

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Risk Analysis

Risks	Category	Probability	Probability	Impact	Impact	Risk Rating
Size estimate may be significantly low	PS	60%	High	Medium	2	Moderate
Larger number of users than planned	PS	70%	Very High	High	3	Critical
Legal risk may arise from legal and regulatory authorities	BU	20%	Very Low	Very Low	2	Severe
End-users resist system	BU	40%	Medium	Low	3	Severe
Market risk due to competition	BU	60%	High	Medium	1	Sustainable
Funding will be lost	CU	40%	Medium	Low	1	Sustainable
Technology will not meet expectations	TE	30%	Low	Low	1	Severe
Project purpose and need is not well defined	BU	30%	Low	Low	1	Moderate
Management and financial authority structure are not yet well defined	BU	60%	High	Medium	2	Severe
Overall project schedule delay	PS	60%	High	High	2	Moderate
Staff inexperienced	ST	60%	High	Medium	2	Sustainable

Impact		Very Low	Low	Medium	High	Very High
Probability	Very High	Moderate	Severe	Severe	Critical	Critical
	High	Sustainable	Moderate	Severe	Critical	Critical
	Medium	Sustainable	Moderate	Moderate	Severe	Critical
	Low	Sustainable	Sustainable	Moderate	Severe	Critical
	Very low	Sustainable	Sustainable	Sustainable	Moderate	Severe

Impact		Very Low	Low	Medium	High	Very High
Probability	Very High				3	
	High			4	2	
	Medium		3	2		
	Low	1	2			
	Very low	2				