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An Undergraduate Internship report on UShuttle

By

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Autumn, 2022

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Department of Computer Science & Engineering

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February 1, 2023

Dissertation submitted in partial fulfillment for the degree of Bachelor of Science in Computer Science

Department of Computer Science & Engineering

Independent University, Bangladesh

Attestation

I Md Shakil Ahmed bearing ID-1730295 state that this report is completely made by myself under the supervision of my respected faculty member Md. Asif Bin Khaled. I have completed and submitted this document for the partial fulfilment of the requirement for the Degree of Computer Science and Engineering from Independent University, Bangladesh (IUB).

All the works here are the result of my work experience in "Excellent Soft" and study from different blogs, research papers etc. that are referenced in the report.

Shakil — Signature

02.02.2023 — Date

Md Shakil Ahmed

Name

Acknowledgement

I would like to express my heartfelt gratitude to all those who assisted me during my course. I am thankful for their inspiring guidance, valuable feedback, and helpful advice. I am especially grateful to my faculty and internship supervisor, Md. Asif Bin Khaled, for their mentorship and unwavering support.

Also I extend my sincere thanks to Independent University, Bangladesh (IUB) for providing me this opportunity and for the direction and supervision they have provided.

My gratitude extends to my external supervisor, Mr. Faruq Muttakin, for the guidance and support he has given me throughout my internship and project. I am also thankful to the team at Excellent Soft for their kindness, time, and direction during my internship.

Last but not least, I would like to thank my parents for their financial support and belief in me. They have always motivated me to achieve my goals and I am truly grateful to them.

Letter of Transmittal

Date:February 1, 2023
Md. Asif Bin Khaled
School of Computer Science and Engineering
Independent University Bangladesh.
Subject: Submission of Internship Report.

Dear Sir,
It is a great pleasure to submit my report on my Internship at Excellent Soft. I have tried to narrate my project works, achievements, and experiences in this report. All the work presented here are done with utmost sincerity and honesty.

During the internship period, I have served in Excellent Soft for three months where I have not only gained real-life work experience but understood the process of the department and its various aspects. This report includes a detailed review of the office as well as the functionalities of the department. As a document of my effort during the internship periods I have conducted all the project works that I have done during my internship periods, especially their requirement, functionalities, and technical specifications.

I pray and hope this report will be quite interesting and fulfil your expectations. I have tried my best to avoid my deficiencies and hope that my report will satisfy you. I also would like to thank you again for giving me the opportunity to submit this report.

Sincerely,
Md Shakil Ahmed
ID- 1730295

Evaluation Committee

Payel 30-02-22
.....
Signature

Md. Mahmudul Kabir Payel
.....
Name

.....
Internal Examiner-1 / Panel Member-1

.....
Signature

Mahmudul Islam
.....
Name

.....
External Examiner-2 / Panel Member-2

Asif Bin Khaled
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Signature

Asif Bin Khaled 30-01-23
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Name

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Supervisor of the intern

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Signature

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Name

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Head, Department of Computer Science & Engineering

Abstract

The "UShuttle" project is a shuttle bus service for students in Bangladesh that offers live bus tracking, digital ticket purchase, and other convenient features. The aim of the project is to provide a reliable and convenient transportation option for students, while also reducing traffic congestion and promoting sustainable transportation.

To develop and implement the "UShuttle" project, we used a combination of mobile app development, database management, and backend tasks. The mobile app, which was developed using Flutter, allows users to track the location of shuttle buses in real-time, purchase and use tickets, view announcements, and see the schedule. The database, which was built using Firebase, stores user data, ticket information, and other relevant information. The backend, which was implemented using Node.js, handles tasks such as ticket validation and data processing.

Overall, the "UShuttle" project has been successful in developing and implementing a convenient and reliable shuttle bus service for students in Bangladesh. Test results have been very positive and demonstrate that the system is functioning correctly and meeting the needs of our users and stakeholders. We believe that the "UShuttle" project has the potential to make a positive impact on the community and we look forward to seeing how it continues to evolve and grow in the future.

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Chapter 1

Introduction

1.1 Overview of the Work

The Ushuttle app is a transportation solution designed to meet the demands for efficient and convenient travel for students. It features live bus tracking, a virtual ticketing system, and Firebase authentication for secure user access. The live bus tracking allows users to stay informed on the location of their bus in real-time. The virtual ticketing eliminates the need for physical cards. The app also provides emergency resources such as emergency numbers, police stations, hospitals, and pharmacies for user safety. The report will analyze the design and development process of the Ushuttle app, its performance and user feedback, and its impact on student transportation. Overall, the Ushuttle app provides a convenient, efficient, and safe mode of transportation for students.

1.2 Objectives

The objective of this project is to design and develop the Ushuttle app, a transportation solution for students. The app will utilize various technologies and features such as live bus tracking, virtual card usage, and emergency resources, to provide a convenient and efficient mode of transportation for students. The project aims to address the transportation needs of students in a more streamlined and user-friendly way. The project will also include user testing and analysis of usage data to evaluate the performance of the app and gather feedback to make any necessary improvements. The ultimate goal of the project is to launch a fully functional and efficient Ushuttle app to meet the transportation needs of students.

1.3 Scopes

The scope of the "UShuttle" project includes the following:

1. Live bus tracking: Users will be able to track the real-time location of their shuttle bus through the mobile app, ensuring they know when the bus will arrive at their stop.
2. Digital ticket purchase: Users will be able to purchase tickets digitally through a secure payment system, eliminating the need for paper tickets.
3. Secure and controlled environment for passengers: Safety measures such as background checks for drivers and regular vehicle maintenance will be implemented to ensure a secure and controlled environment for passengers.
4. Efficient routes and schedules: The service will provide efficient routes and schedules for the shuttle buses, coordinating with schools and universities to determine the most efficient pick-up and drop-off points.
5. Mobile Application: A mobile application will be developed using Flutter, which will allow users to track the location of the shuttle buses in real-time, purchase and use tickets, view announcements, and see the schedule.
6. Database management: A database will be created using Firebase, which will store user data, ticket information, and other relevant data.
7. Backend tasks: Backend will be implemented using Node.js, which will handle tasks such as ticket validation and data processing.
8. Bus driver App: An app will be developed for the bus driver, which will upload live GPS data, scan user ticket and grant more tickets to any passenger by scanning a QR code and also add new announcements.
9. Online payment system: The service will include an online payment system for users to easily and securely purchase tickets.
10. User-friendly interface: The service will have a user-friendly interface, with clear instructions and intuitive navigation, making it easy for users to use the service.
11. Strong security measures: The service will have strong security measures in place to protect user data and prevent unauthorized access.
12. Accessibility: The service will be accessible, with support for a range of mobile devices

13. Reliability: The service will be reliable, with a high uptime and minimal downtime.
14. Scalability: The service will be scalable, with the ability to handle an increasing number of users and routes as the service grows.

The "UShuttle" project aims to provide a safe and convenient transportation option for students in Bangladesh, while also reducing traffic congestion and promoting sustainable transportation. It will be developed using agile methodologies to ensure a flexible and efficient development process.

Chapter 2

Literature Review

2.1 Relationship with Undergraduate Studies

This project is a culmination of all the knowledge and skills I have acquired throughout my computer science and engineering journey. My previous work on various projects has helped me to develop this mobile application. One of the most important courses that I took was CSE213, which introduced me to object-oriented programming. This course was the foundation of my proper application development journey and I still use the concepts I learned in it daily. Another important course was CSE303, which focused on database management. This course provided me with insights on how an application works internally and gave me a strong understanding of databases, including the E-R model, normalization, data security, and optimizations. Lastly, CSE309, which was the first step in my full-stack application development journey helped me to learn and use a full stack system, meaning both the front end as well as back-end.

2.2 Related works

The origin of shuttle bus service is not clear and it is difficult to determine the exact location where it first started. However, shuttle bus services have been used for many years to transport people from one location to another, particularly in airport, university, and corporate settings. These types of services have been in use for many decades and have evolved over time to meet the changing needs and demands of passengers.

Chariot, a shuttle bus service that was acquired by Ford, was founded in 2014. The company was based in San Francisco, California and provided transportation services to commuters in the San Francisco Bay Area. Chariot used a combination of crowd-sourced routes and fixed routes to provide convenient and affordable transportation to its customers. The company aimed to provide a solution to the challenge of commuting in a

densely populated city and to reduce traffic congestion by offering a shared transportation option.

In terms of Bangladesh, the first ride sharing service, Pathao was founded in 2015 and is based in Dhaka, Bangladesh. It offers a variety of services including ride-sharing.Pathao's ride-sharing service allows users to book rides through its mobile app and track their drivers in real-time.

Following pathao , Uber launched its services in Bangladesh in November 2016. The company provides ride-sharing services in Dhaka, Chittagong, and Sylhet. Through its mobile app, users can book rides, track their drivers, and pay for their trips using their phones.

In 2023, we are launching Ushuttle. Our service will provide shuttle bus for the public.With live bus tracking and digital ticketing system.

Chapter 3

Management & Financing

3.1 Work Breakdown Structure

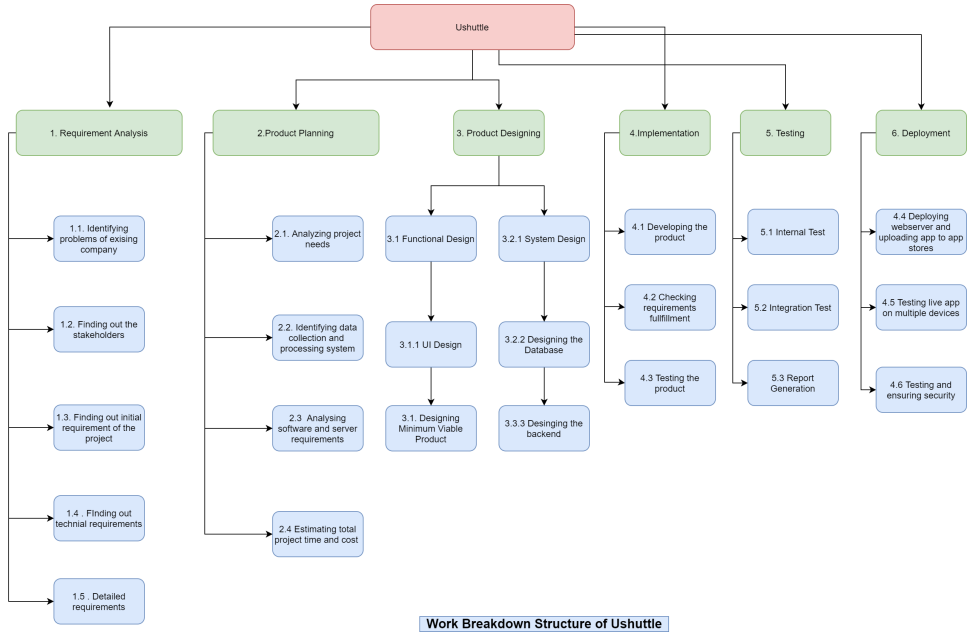


Figure 3.1: Work Breakdown structure

3.1.1 Activity wise Time Distribution

ID	Name	Start Date	End Date	Duration	Dependency
1	Proposal	Oct 17, 2022	Oct 25, 2022	7 days	
2	Acceptance	Oct 26, 2022	Nov 01, 2022	5 days	1FS
3	Collecting Requirements	Nov 02, 2022	Nov 08, 2022	5 days	2FS
4	Project Planning	Nov 09, 2022	Nov 15, 2022	5 days	3FS
5	Ui Ux design	Nov 17, 2022	Nov 18, 2022	2 days	4FS+1 day,3FS
6	Adding live Map	Nov 21, 2022	Dec 08, 2022	14 days	5FS
7	Adding Server	Dec 09, 2022	Dec 12, 2022	2 days	6FS
8	Designing Database	Nov 09, 2022	Nov 15, 2022	5 days	3FS
9	Adding Database	Nov 16, 2022	Nov 17, 2022	2 days	4FS,8FS
10	Server Intregration	Dec 13, 2022	Dec 19, 2022	5 days	9FS,7FS
11	Testing	Dec 20, 2022	Dec 26, 2022	5 days	9FS,10FS,6FS,5FS
12	Fixing Bugs	Dec 27, 2022	Jan 02, 2023	5 days	11FS
13	Re Testing	Jan 03, 2023	Jan 04, 2023	2 days	12FS
14	Final testing and fixing	Jan 05, 2023	Jan 18, 2023	10 days	13FS
15	Deployment	Jan 19, 2023	Jan 25, 2023	5 days	14FS

Figure 3.2: Activity wise Time Distribution

3.2 Gantt Chart

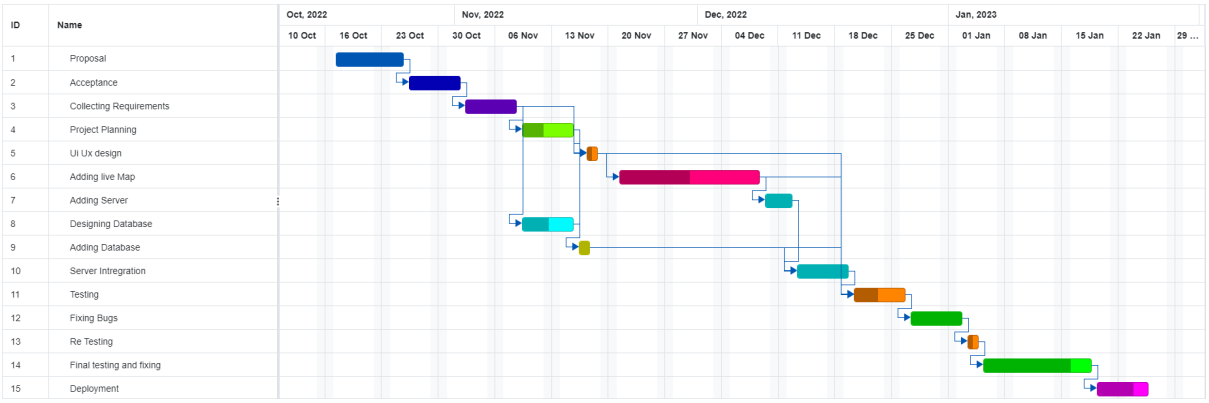


Figure 3.3: Gantt Chart

Explanation : This is the initial Gantt chart for UShuttle timeline. Here , the tasks are assigned to indexes for simplicity. Time is represented as green bars in the chart. And the tasks are denoted by indexes.

3.3 Estimated Costing

Table 3.1: Estimated Costing

Project Name : Ushuttle	
Technology used : Flutter , Firebase , Node.js , Android , IOS,Open Street Map	
Item/ Technology	Cost Tk
Map Api (Free tier)	zero
Domain (Free service)	zero
Hosting (Free Service)	zero
Flutter	zero
Firebase (Free tier)	zero
Android (Own Device)	zero
Total	0.00 Tk

Explanation : As we have used all free services for the project there were no cost associated with the app.

Chapter 4

Methodology

For the "UShuttle" project, we utilized an agile development methodology. This approach allowed us to develop and deploy the "UShuttle" service, while also allowing us to easily adapt to changing requirements and priorities quickly and iteratively. There are several other software development methodologies, such as Waterfall, V-Model, and Spiral, that could have been used to develop the Ushuttle app.



Figure 4.1: Caption for the image

We chose to use the Agile (Extreme Programming) method when developing the Ushuttle app because it is an efficient and flexible approach to software development that prioritizes customer satisfaction and rapid delivery of working features. Agile also promotes active collaboration between development teams, stakeholders, and customers,

which was crucial for our project as we were developing a subscription-based shuttle bus service that required close coordination with our clients.

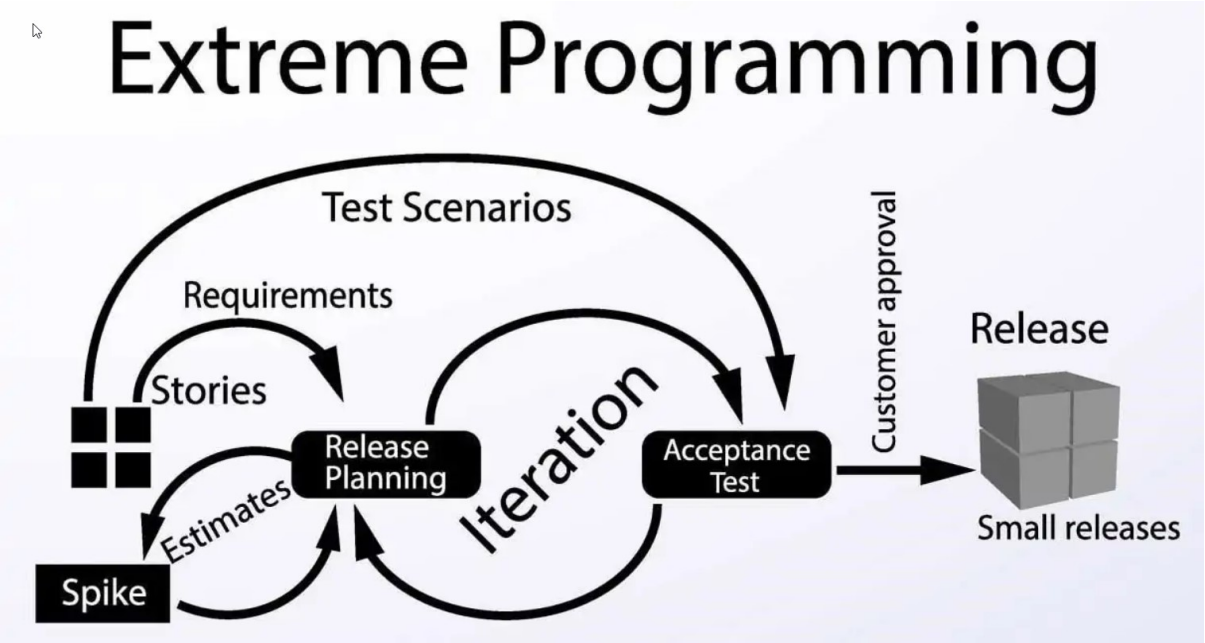


Figure 4.2: Caption for the image

As the development team behind the Ushuttle app, we implemented the Agile methodology in order to ensure a smooth and efficient development process. The Agile approach allowed us to continuously adapt and respond to changes and requirements, as well as gather and incorporate user feedback during the development process.

We organized our work into short sprints and regularly held meetings to review progress, prioritize tasks, and make any necessary adjustments. This approach allowed us to prioritize the most important and pressing features, such as the live bus tracking and virtual ticketing system, while also being able to effectively respond to any challenges that arose during development.

We also made sure to involve stakeholders, such as the students and working class people who would be using the app, in the development process through regular user testing and feedback sessions. This helped us to better understand the needs and expectations of our users and incorporate those insights into the app.

Overall, the Agile methodology allowed us to stay flexible and responsive throughout the development of the Ushuttle app, resulting in a transportation solution that meets the needs of students and working class people in a densely populated city. [2]

Chapter 5

Body of the Project

5.1 Work Description

The "UShuttle" project is a shuttle bus service designed specifically for students in Bangladesh. Its main goal is to provide a reliable and convenient transportation option for students, as well as address issues such as a lack of reliable public transportation and long commute times that many students face. To achieve this, the "UShuttle" service offers a range of useful features, such as live bus tracking and digital ticket purchase. With the live bus tracking feature, students can see the real-time location of their bus and know exactly when it will arrive at their stop. This is a huge convenience, as it eliminates the need to wait around at the bus stop not knowing when the bus will arrive. The digital ticket purchase feature also makes it easy for students to purchase and access their tickets through their smartphones, eliminating the need to carry physical tickets or cash. Overall, the "UShuttle" project aims to make it easier for students to get to and from school or university by providing a more convenient and efficient transportation option. This report will provide a detailed look at the design and implementation of the "UShuttle" service, as well as an evaluation of the user experience and impact of the service to date. By understanding the successes and challenges of the "UShuttle" project, we hope to identify ways to improve and expand the service in the future, ultimately benefiting more students in Bangladesh. [3] [4]

5.2 Requirement Analysis

5.2.1 Rich Picture

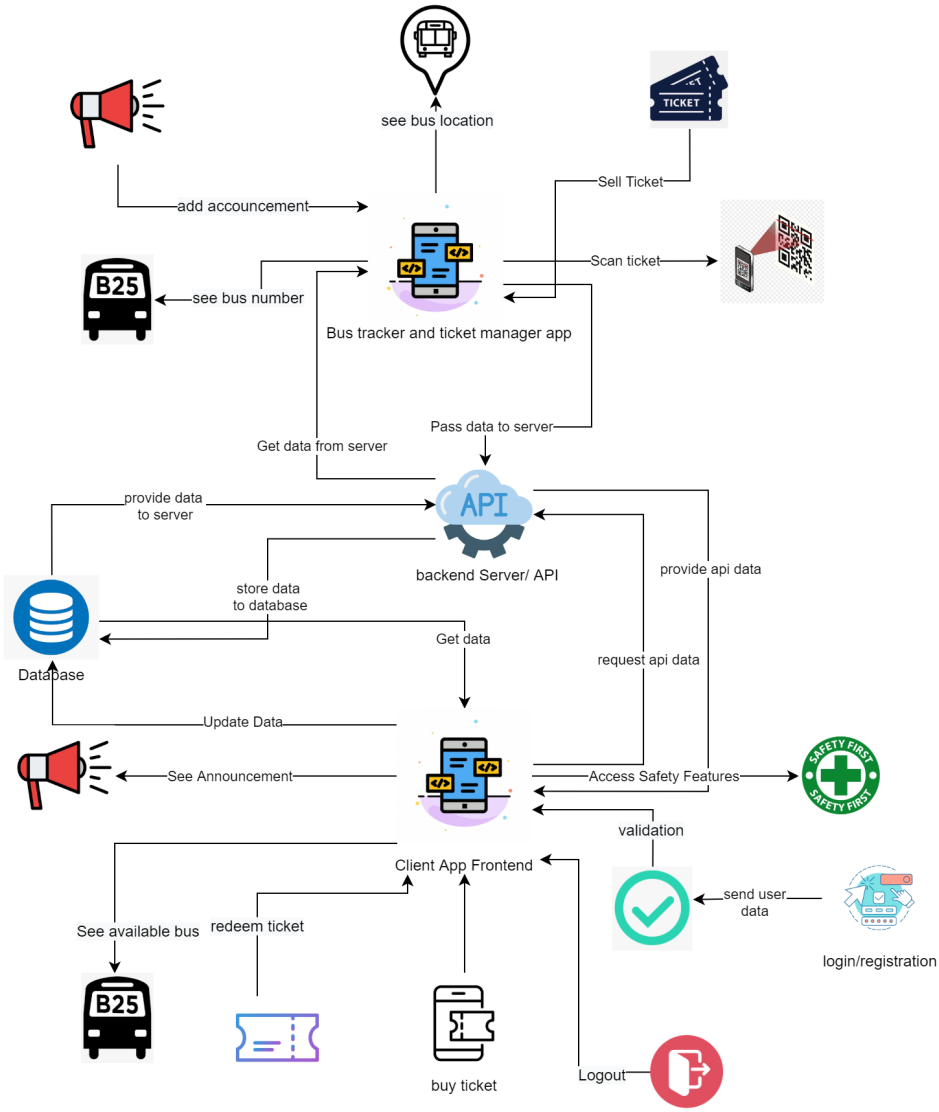


Figure 5.1: Rich Picture

5.2.2 Functional and Non-Functional Requirements

Functional Requirements:

- The "UShuttle" service must allow users to track the real-time location of their shuttle bus through a mobile app.
- The service must allow users to ride cashless using virtual methods.

- The service must provide a secure and controlled environment for passengers, with safety measures such as background checks for drivers and regular vehicle maintenance.
- The service must provide efficient routes and schedules for the shuttle buses, coordinating with schools and universities to determine the most efficient pick-up and drop-off points.

Non-Functional Requirements:

- The "UShuttle" service must be reliable, with a high uptime and minimal downtime.
- The service must be scalable, with the ability to handle an increasing number of users and routes as the service grows.
- The service must have a user-friendly interface, with clear instructions and intuitive navigation.
- The service must have strong security measures in place to protect user data and prevent unauthorized access.
- The service must be accessible, with support for a range of devices and web browsers

5.3 System Analysis

5.3.1 Six Element Analysis

Table 5.1: Six element analysis

Process	System Roles					
	Human	Non-Computing Hardware	Computing hardware	Software	Database	Network and communication
Login/registration	Admin and user can register and login	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet
Live bus tracking	Admin and user can see live update	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet and GPS
Purchase ticket	Users can purchase ticket	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet
Use ticket	Users can use available tickets	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet
Sell ticket	Bus manager can sell ticket	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet
Scan ticket	Bus manager can scan passenger's ticket	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet
Add Announcement	Bus manager can add important announcement	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet
See bus stoppages	Users can see available bus stoppages	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet
See bus fares	Users can see available bus fares	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet
See bus Schedules	Users can see available bus Schedules	N/A	Android or iOS smartphone	Vs Code, android studio, node.js, XCode	Firebase	Internet

5.3.2 Feasibility Analysis

Technical Feasibility:

- The use of GPS tracking and digital payment systems in the "UShuttle" service is technically feasible, as these technologies are widely available and have been successfully implemented in other transportation services.
- The team has the necessary expertise and resources to design and develop the "UShuttle" service, including the integration of GPS tracking and payment systems.

Financial Feasibility:

- The initial costs of implementing the "UShuttle" service, such as purchasing buses and developing the GPS tracking and payment systems, are significant. However, these costs can be offset by revenue generated through ticket sales.
- The demand for the "UShuttle" service is likely to be high, as it addresses a need for reliable and convenient transportation for students. This suggests that the service has the potential to generate sufficient revenue to cover its costs and potentially turn a profit. [5]

Operational Feasibility:

- The "UShuttle" service requires the management of a fleet of buses and the coordination of pick-up and drop-off schedules. However, the team has the necessary experience and resources to effectively manage the operations of the service.
- The demand for the "UShuttle" service is likely to be high, as it addresses a need for reliable and convenient transportation for students. This suggests that the service is likely to be in high demand and could be successful in the long term.
- Overall, the "UShuttle" project appears to be technically, financially, and operationally feasible. With the necessary expertise and resources, as well as strong demand for the service, the "UShuttle" project has the potential to be a successful and sustainable transportation option for students in Bangladesh.

5.3.3 Problem Solution Analysis

Problem: Lack of reliable public transportation options for students in Bangladesh. Solution: The "UShuttle" project aims to provide a reliable and convenient transportation option for students using a fleet of shuttle buses and live bus tracking. Problem: Long commute times for students. Solution: The "UShuttle" service can help to reduce

commute times for students by providing a direct transportation option that can bypass traffic and make multiple stops along a specific route. Problem: Safety concerns when using public transportation. Solution: The "UShuttle" service can help to address safety concerns by providing a secure and controlled transportation environment for students. The use of GPS tracking and digital payment systems can also help to enhance safety by providing real-time tracking and contactless payment options. Overall, the "UShuttle" project aims to address the lack of reliable and convenient transportation options for students in Bangladesh using innovative technologies and a focus on safety. By conducting a problem-solution analysis, the team can identify and address potential issues that may arise during the development and implementation of the project.

5.3.4 Effect and Constraints Analysis

Effects:

- Positive effects: The "UShuttle" project has the potential to have several positive effects, including:
  - Providing a reliable and convenient transportation option for students, which can reduce commute times and enhance safety.
  - Generating revenue through ticket sales.
  - Improving the overall transportation infrastructure for students in Bangladesh.
- Negative effects: The "UShuttle" project could also have some negative effects, such as:
  - Increased traffic and congestion on the roads, as the shuttle buses will be using the same routes as other vehicles.
  - Potential environmental impact, such as air pollution, if the shuttle buses are not fuel-efficient.
  - Potential financial risk if the service is not successful or does not generate sufficient revenue to cover costs.

Constraints:

- Technical constraints: There may be technical constraints to the "UShuttle" project, such as:
  - The availability and cost of GPS tracking and digital payment systems.
  - The need for specialized hardware, such as shuttle buses, to implement the service.

  - The need for a skilled team of engineers and transportation experts to design and develop the service.

- Financial constraints: The "UShuttle" project may also be constrained by financial considerations, such as:
  - The initial costs of implementing the service, including purchasing shuttle buses, and developing GPS tracking and payment systems.
  - The ongoing costs of operating the service, such as fuel and maintenance expenses.
  - The potential for revenue generation through ticket sales.
- Operational constraints: There may be operational constraints to the "UShuttle" project, such as:
  - The need to coordinate with schools and universities to determine the most efficient routes and schedules for the shuttle buses.
  - The logistics of managing a fleet of shuttle buses, including maintenance, scheduling, and hiring drivers.
  - Potential regulatory constraints, such as requirements for operating a transportation service.

5.4 System Design

5.4.1 UML Diagrams



Figure 5.2: Use Case Diagram [1]

5.4.2 Architecture

The Ushuttle app is built using a multi-tier architecture, which separates the different components of the application into distinct layers. The Presentation Tier is the front-end of the application, which interacts with the user and includes the user interface, forms, and controls. The Application Tier, also known as the business logic tier, contains the business rules, logic, and processes that govern the application. It communicates with the presentation and data tiers to perform specific functionality. Finally, the Data Tier is responsible for storing and retrieving data, it includes the database, data access objects, and any other data storage and retrieval mechanisms. This approach allows for better flexibility and scalability, as well as easier maintenance and testing. Additionally, it allows for better security as different layers can be secured differently and allows for better performance as different layers can be optimized for different purposes. This multi-tier architecture was implemented to make sure that the Ushuttle app is easy to use and efficient, while providing a seamless experience for the users.

[6]

5.5 Implementation

Our product “UShuttle” is a cross platform mobile app built using Flutter. Alongside flutter, for the backend we have used Node.js and firebase. We have used many native components such as GPS and Camera module. For the ”UShuttle” project, the implementation phase was divided into several steps to ensure that the mobile app and backend system were developed, tested, and deployed efficiently and effectively. [7] [8]

First, the design of the mobile app and backend system was finalized. This involved creating detailed UML diagrams and writing code using the Flutter framework for the mobile app and the Node.js platform for the backend. The design of the system was based on the requirements and constraints of the project, as well as the goals and objectives of the team. [9]

Next, the mobile app and backend system were developed according to the design. This involved writing code, configuring servers, and integrating the Firebase database and any necessary third-party systems or services. The development process was carefully managed to ensure that all required functionality was implemented, and that the system was scalable, flexible, and secure.

After the mobile app and backend system had been developed, they were thoroughly tested to ensure that they were functioning correctly and meeting the requirements of the project. This involved unit testing, integration testing, and acceptance testing, with the goal of identifying and fixing any issues before the system was deployed.

Once the mobile app and backend system had been tested and were ready for use, they were deployed to a production environment. This involved installing the system on servers, setting up any necessary infrastructure, and configuring any necessary third-party systems or services.

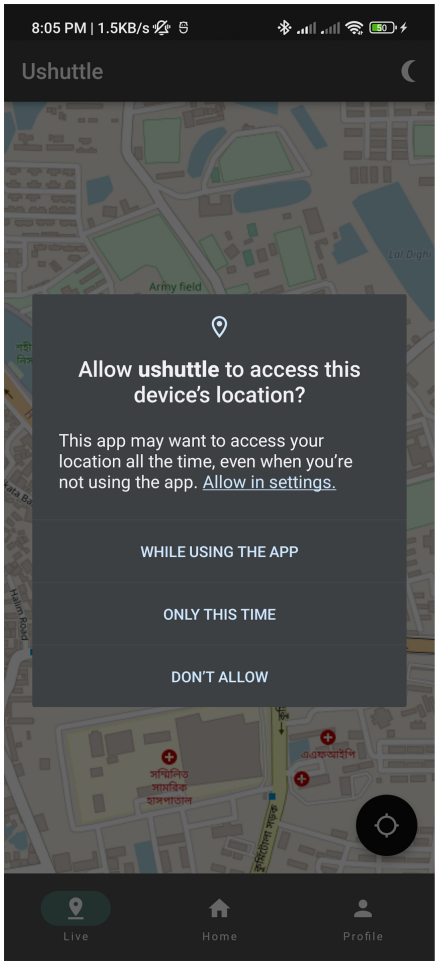
Finally, the mobile app and backend system were monitored and maintained to ensure that they were able to meet the needs of users and stakeholders. This involved monitoring system logs, fixing bugs, and updating the system as necessary.

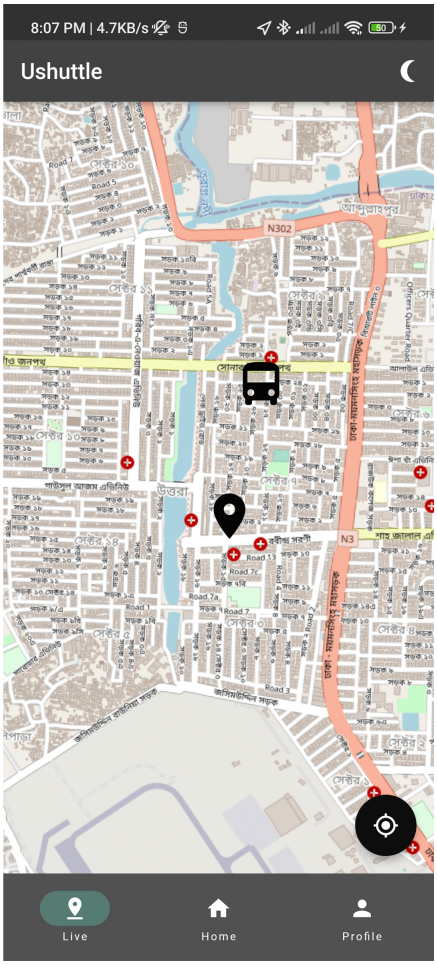
Overall, the implementation of the ”UShuttle” project was successful, resulting in a mobile app and backend system that were able to meet the needs of users and stakeholders and support the long-term success of the project.

Chapter 6

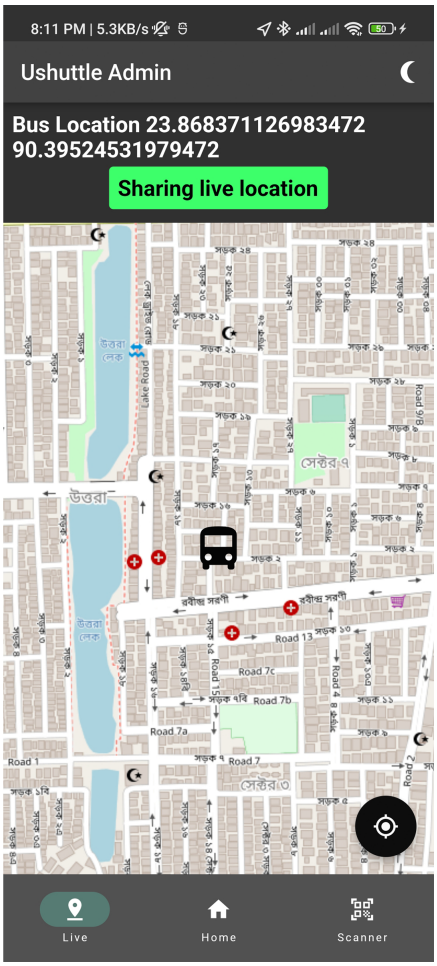
Testing

6.1 Testing screens









[10]

6.1.1 Input

Designing Test Cases

As part of the development and implementation of the "UShuttle" project, we designed a set of test cases to ensure that the various features and functions of the system were working correctly. These test cases covered a range of scenarios and tested the different components of the system to ensure that it was reliable and effective. For example,We tested the live bus tracking functionality to ensure that the location data being displayed on the map was accurate and up to date. We tested different scenarios, such as different locations and different times of day, to ensure that the system was functioning correctly.

We also tested admin side map features and the GPS server functionality thoroughly to ensure that our location data is accurate enough.From our tests we found that our GPS is accuracy varies from 1-10 metres depending on the scenario.

We also tested that bus location is being shown to the proper users. As our app can handle multiple users from multiple routes it is crucial to show proper bus to proper user.

Overall, designing and implementing these test cases was an important step in ensuring the quality and reliability of the "UShuttle" system. By testing a wide range of scenarios and covering all the key features and functions of the system, we were able to ensure that the "UShuttle" project was able to meet the needs of our users and stakeholders.0

6.1.2 Output

Test Results

Table 6.1: Test results

Features	Status
Live Map (Client)	OK
Live Map (Admin)	OK
live Bus location (Single bus)	OK
Live bus location (Multiple bus)	OK
GPS server	OK

Chapter 7

Results & Analysis

Table 7.1: Test Results

Features	Attempted	Success	Failure	Success rate	Final Status
Live Map (Client)	10	8	2	80%	OK
Live Map (Admin)	10	10	0	100%	OK
Live bus location (single user)	10	10	0	100%	OK
Live bus location (Multi user)	5	5	0	100%	OK
GPS server	5	5	0	100%	OK

Analysis:
Based on our testing "Ushuttle" app has achieved majority of its functionalities.Almost all of the required components are working as expected. There is aome missing features as well. Mostly that requires payment system.From our test we can conclude that about 80% of the functionalities are implemented and working as expected.

Chapter 8

Project as Engineering Problem Analysis

8.1 Sustainability of the Project

8.1.1 Sustainability

Sustainability is an important consideration for the "UShuttle" project. Ensuring the sustainability of the project involves developing a business model that allows the service to generate enough revenue to cover its operating costs and continue to grow and improve over time.

Potential Strategies

There are several potential strategies that could be used to ensure the sustainability of the "UShuttle" project. These include:

- Charging a fee for using the service: One way to generate revenue for the "UShuttle" project is to charge a fee for using the service. This could include a per-trip fee for purchasing tickets, as well as any additional fees for special services such as luggage storage or wheelchair access.

- Partnering with sponsors: Another option for generating revenue is to partner with sponsors. This could involve securing sponsorships from local businesses or organizations, which could provide funding in exchange for branding and marketing opportunities on the "UShuttle" app and buses.

- Offering additional services: In addition to its core shuttle bus service, the "UShuttle" project could consider offering additional services to generate revenue. For example, the project could offer a carpooling service for students or a shuttle service for special events.

Overall, there are many different strategies that could be used to ensure the sustainability of the "UShuttle" project. By carefully considering these options and developing a business model that allows the service to generate sufficient revenue to cover its operating costs, the project can be positioned for long-term success.

8.2 Social and Environmental Effects and Analysis

The "UShuttle" project may have both social and environmental effects that should be considered as part of the project's analysis.

- On the social side, the "UShuttle" project could have several positive effects. For example, by providing a convenient and reliable shuttle bus service for students, the project could help to reduce traffic congestion and improve air quality in the area. The project could also contribute to the local economy by creating jobs and generating revenue for the community.
- On the environmental side, the "UShuttle" project could also have several positive effects. By providing a shuttle bus service, the project could help to reduce the number of individual vehicles on the road, which could in turn lead to a reduction in carbon emissions and other pollutants. The project could also consider incorporating environmentally friendly practices into its operations, such as using fuel-efficient vehicles or sourcing materials sustainably.

It is important to consider both the social and environmental effects of the "UShuttle" project as part of the analysis process. By identifying and addressing any potential negative impacts, the project can strive to maximize its positive effects and minimize any negative impacts on the community and the environment.

8.3 Addressing Ethics and Ethical Issues

Addressing ethics and ethical issues is an important aspect of any project, including the "UShuttle" project. Ethics refers to the principles and values that guide the behavior of individuals or organizations, and ethical issues are situations that involve questions of right and wrong. To address ethics and ethical issues in the "UShuttle" project, it is important to establish a clear set of ethical principles and guidelines that will govern the behavior of the project team and stakeholders. These principles should be communicated to all parties involved in the project and should be used as a basis for decision-making and problem-solving. Some key ethical issues that may arise in the "UShuttle" project include:

- Data privacy: With the "UShuttle" project involving the collection and storage of personal data, it is important to ensure that the privacy of users is protected. This may involve implementing measures such as secure servers, encrypted data storage, and clear privacy policies.

- Responsibility to the community: As a service that operates in the community, the "UShuttle" project has a responsibility to consider the needs and concerns of the community. This may involve working with community stakeholders to address any issues or concerns and being responsive to the needs of the community.

By addressing ethics and ethical issues in a proactive and transparent manner, the "UShuttle" project can ensure that it is operating in a responsible and ethical manner and contributing positively to the community.

Chapter 9

Lesson Learned

9.1 Problems Faced During this Period

During the development and implementation of the "UShuttle" project, we faced several problems, particularly with regards to the map and live data functionality of the system as well as the QR code generation and reading functionality.

- One issue we encountered was difficulty integrating these features with the rest of the "UShuttle" system. This involved connecting to the necessary APIs and integrating the data with the database and was a complex process that required careful planning and coordination.

- Another problem we faced was ensuring the accuracy of the live data being displayed on the map. We had to ensure that the GPS data being provided by the bus drivers was accurate and up-to-date, and that the map was able to accurately reflect the real-time location of the buses. This was a critical requirement of the "UShuttle" system, as users rely on live data to track the location of their shuttle bus.

- In addition to these issues, we also had to ensure the security of the live data being handled by the "UShuttle" system. This included implementing measures such as secure servers, encrypted data storage, and robust access controls to prevent unauthorized access to the data. Ensuring the security of this sensitive data was a top priority for us, as it was essential for the privacy and safety of our users.

- We also had to develop and implement the QR code generation and reading functionality for the "UShuttle" project. This involved integrating this feature with the Firebase database and ensuring that it was able to generate unique QR codes for each ticket and accurately read QR codes when scanned by the bus driver app.

Overall, the "UShuttle" project faced several challenges with regards to the map and live data functionality, QR code generation and reading, and the integration of these

features with the rest of the system. However, by addressing these issues in a proactive and systematic manner, we were able to overcome these challenges and ensure that these features were able to meet the needs of our users and stakeholders

9.2 Solution of those Problems

To solve the problems that we faced during the development and implementation of the "UShuttle" project, we implemented several solutions.

- In addition to these issues, we also had to ensure the security of the live data being handled by the "UShuttle" system. This included implementing measures such as secure servers, encrypted data storage, and robust access controls to prevent unauthorized access to the data. Ensuring the security of this sensitive data was a top priority for us, as it was essential for the privacy and safety of our users.

- To address the integration issues with the map and live data functionality, we developed a detailed integration plan that outlined the steps necessary to connect to the necessary APIs and integrate the data with the database. We also set up regular check-ins and progress reviews to ensure that the integration process was on track and to identify and address any issues as they arose.

- To ensure the accuracy of the live data being displayed on the map, we implemented a robust testing and quality assurance process that included unit testing, integration testing, and acceptance testing. This allowed us to identify and fix any issues with the data accuracy before the system was deployed.

- To ensure the security of the live data being handled by the "UShuttle" system, we implemented several security measures, including secure servers, encrypted data storage, and robust access controls. We also conducted regular security audits to ensure that the system was secure and to identify and address any potential vulnerabilities.

- To develop and implement the ticketing system, we worked closely with the relevant teams to ensure that this feature was integrated seamlessly with the rest of the "UShuttle" system. We also conducted extensive testing to ensure that the tickets were being generated correctly and that the scanning functionality was accurate and reliable.

Chapter 10

Future Work & Conclusion

10.1 Future Works

There are several potential areas for future work on the "UShuttle" project. Some possibilities include:

- Expanding the service area: One potential area for future work is expanding the service area of the "UShuttle" project. This could involve adding additional routes or covering a wider geographic area to meet the needs of more students and community members.
- Improving the user experience: Another potential area for future work is improving the user experience of the "UShuttle" service. This could involve implementing new features or functionality based on user feedback or optimizing the existing features to make them more user-friendly and efficient.
- Adding additional services: The "UShuttle" project could also consider adding additional services in the future. For example, the project could explore offering a carpooling service for students or a shuttle service for special events.
- Enhancing the sustainability of the project: Ensuring the long-term sustainability of the "UShuttle" project will also be an important area for future work. This could involve developing new revenue streams or implementing cost-saving measures to ensure that the project is able to continue to operate and grow over time.

Overall, there are many potential areas for future work on the "UShuttle" project, and it will be important for the project team to carefully consider these options and identify priorities for future development.

10.2 Conclusion

In conclusion, the "UShuttle" project has the potential to make a significant positive impact on the community by providing a convenient and reliable shuttle bus service for students. By offering features such as live bus tracking and digital ticket purchase, the "UShuttle" project can meet the needs of students and make the shuttle bus experience more efficient and enjoyable. While there were certainly challenges faced during the development and implementation of the "UShuttle" project, we were able to overcome these challenges and successfully launch the service. By implementing solutions such as a detailed integration plan, robust testing and quality assurance processes, and strong security measures, we were able to ensure that the "UShuttle" project was able to meet the needs of our users and stakeholders. Looking to the future, there are many potential areas for growth and improvement for the "UShuttle" project. By expanding the service area, improving the user experience, adding additional services, and enhancing the sustainability of the project, we believe that the "UShuttle" project has the potential to make a lasting positive impact on the community.

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The student modified the internship final report as per the recommendation made by his or her academic supervisor and/or panel members during final viva, and the department can use this version for achieving.

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