

Wolfie's Bike

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Abstract— Students of stony brook university love to use bikes to go from one point to another. However, there are times when a student gets to the bike station and sees that there is no cycle available, and eventually, waits for the bike to get available or chooses another way to go from one place to another. This project presents a solution to this problem by introducing a design and development of an Android application where a student can check the availability of bikes at a particular bike stand at Stony Brook University and plan the commute accordingly. The components of designed and developed system include (1) Android Application named Wolfie's Bike (2) Firebase Database hosted on Google Console (3) Various application programming interfaces (API) that would take requests from the Android application, query the database and serve the results back to the Android application. The android application is developed using Android Studio in conjunction with android SDK tools. Users of this application would be able to check how many bikes are available, reserve the bike, and drop off the bike accordingly. An android app from the admin side is also developed where an emergency request is passed on....

Keywords - Android Application, Firebase, Bike scheduling app, Java.

I. INTRODUCTION

Android is the operating system that powers all Android devices. Just like how the Windows operating system powers laptop and desktop computers, or Apple's iOS powers iPhones and iPads. Android is an open source technology based on the Linux open source platform and Oracle's Java, one of the world's most popular programming languages. Android is not available only for smartphones, but also for new and emerging consumer electronic devices that are network-compatible such as iTVs and home media centers. According to Google's Android chief, about 500,000 Android devices are activated every single day. These statistics indicate that Android devices are fast gaining popularity amongst smartphone users.

Firebase is a comprehensive mobile and web development platform provided by Google. It offers a range of tools and services for building and managing apps. Firebase includes features such as a realtime database that allows developers to store and sync data across multiple clients in real time. It also provides a robust authentication system, making it easy to implement user authentication with various providers. Firestore, Firebase's document-oriented database, offers flexible querying and real-time synchronization capabilities. Firebase Storage allows developers to store and retrieve user-generated content such as images and videos. The platform also includes cloud functions for writing serverless functions, hosting for deploying web applications, and analytics for

tracking app usage and user engagement. Additionally, Firebase offers tools like remote configuration, performance monitoring, and crash reporting to enhance app functionality and stability. It is a popular choice among developers for its ease of use, scalability, and the wide range of features it provides for app development.

This project aims to take advantage of the fast growing popularity of Android devices by developing an Android application that would retrieve and display the bikes available in stony brook university at every bike stand, thus enabling users to get up to date information anywhere they are once they have the application installed on their Android device as well as an active internet connection. The scope of this android application is to make a hassle free booking of bikes using the android application where a user can check and plan its travel ahead of time.

The goal of this project is to develop an Android application that would retrieve and display the real time changes in the Wolfie Bike System of Stony Brook University using a firebase database.

II. PROBLEM STATEMENT

The common problem faced by students at Stony Brook University regarding the availability of bikes at various bike stands on campus. This issue often leads to inconvenience, wasted time, and the need for alternative transportation options. By developing the Wolfie's Bike Android application, we aim to provide an efficient and user-friendly solution to this problem.

III. MOTIVATION

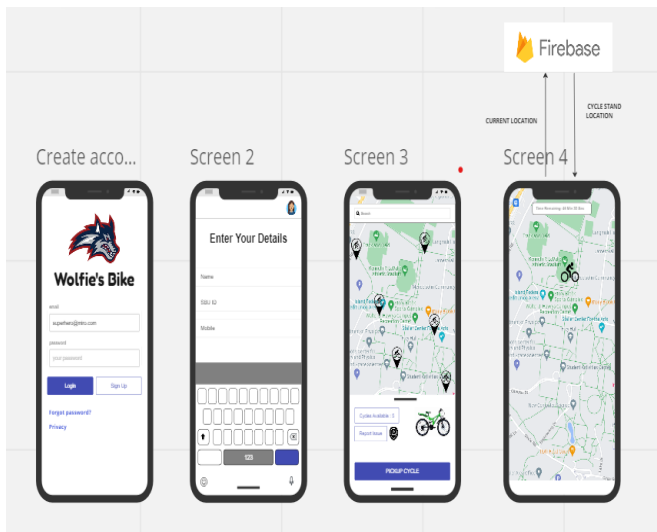
One of the primary motivations for this project is to enhance the overall experience of students at Stony Brook University. By offering a convenient tool for students to check the availability of bikes at specific bike stands, they can plan their commutes effectively, avoiding unnecessary waiting times and making informed decisions about their transportation options. This will streamline their daily routines and contribute to a more efficient campus environment.

Furthermore, this project aligns with the goal of promoting sustainable transportation options. Bicycles are an environmentally friendly mode of transportation, and by encouraging their use, we can reduce carbon emissions on campus.

The project also addresses the challenges associated with campus mobility. Stony Brook University is a large campus with multiple points of interest, and efficient mobility is crucial for students to navigate between classes, residences, and other facilities. By providing real-time information on bike availability through the Wolfie's Bike

application, students will have a valuable resource to optimize their daily commutes, saving time and effort.

IV. DESIGN



The Design of the Application is shown. The design consists of the Android Application, firebase platform. The application is developed by using Java programming language, and the application is securely connected to the Google Firebase using different APIs.

The Wolfie's Bike Android application will be developed using Android Studio, a robust integrated development environment (IDE) specifically designed for Android app development. The user interface (UI) of the application will prioritize usability, incorporating intuitive navigation and visually appealing design elements. The UI will consist of screens dedicated to bike stand selection, real-time bike availability display, bike reservation, and bike drop-off. Leveraging various Android SDK tools and libraries, the application will efficiently handle user interactions, retrieve data from the Firebase database, and provide seamless real-time information to the users. To ensure data security and user privacy, the application will implement a secure user authentication system, allowing only authorized users to access bike reservation and drop-off functionalities.

The system will utilize Firebase, a powerful and scalable cloud-based platform provided by Google, as the database solution. The Firebase database will serve as the central repository for storing and managing data related to bike availability at different bike stands on the Stony Brook University campus. The database will consist of a collection dedicated to bike stands, with each document representing a specific bike stand and containing pertinent information such as stand name, location, and maximum capacity.

The Firebase database will enable real-time data synchronization, allowing the Android application to receive immediate updates on bike availability whenever changes occur in the database, ensuring accurate and up-to-date information for users.

The system will incorporate various application programming interfaces (APIs) to establish seamless communication between the Android application and the Firebase database. These APIs will facilitate the handling of user requests originating from the Android application, including retrieving bike availability data, reserving bikes, and updating the database with bike drop-off information. Proper authentication mechanisms will be implemented to ensure secure access to the Firebase database and protect sensitive user information. The APIs will query the Firebase database based on the received requests, retrieving the necessary data, and delivering the results back to the Android application in a structured format, typically JSON. By integrating these APIs, the system will enable efficient and reliable data exchange between the Android application and the Firebase database, providing users with accurate and real-time bike availability information.

To ensure the robustness and reliability of the system, comprehensive error handling and exception management mechanisms will be implemented. The Android application will incorporate error handling routines to gracefully handle network connectivity issues, server errors, and invalid user inputs. The Firebase database and server-side APIs will implement robust error handling routines, detecting and managing unexpected scenarios, such as data inconsistencies or unexpected server behaviors.

V. IMPLEMENTATION

In the Wolfie's Bike App, there are multiple Activities, and they are as follows:-

1. Main Activity: The Main Activity consists of Login form and sign up button. In this Activity, a Login page is created in Layout's page, where a form is used to type the email and password.
2. Sign Up Activity: The signup activity is used by the user to sign up into the application, and use that credentials to login.
3. Maps Activity: As soon as a user successfully logged in into the wolfie's bike app, a map fragment is shown with different bike stands and markers representing them on the map. This Map fragment is used by the user to read current bikes on a specific bike stand, and plan its commute accordingly.
4. State Class: This Class is used to store states of the Bicycle, LoggedInUser, and used to define different functions in the App.

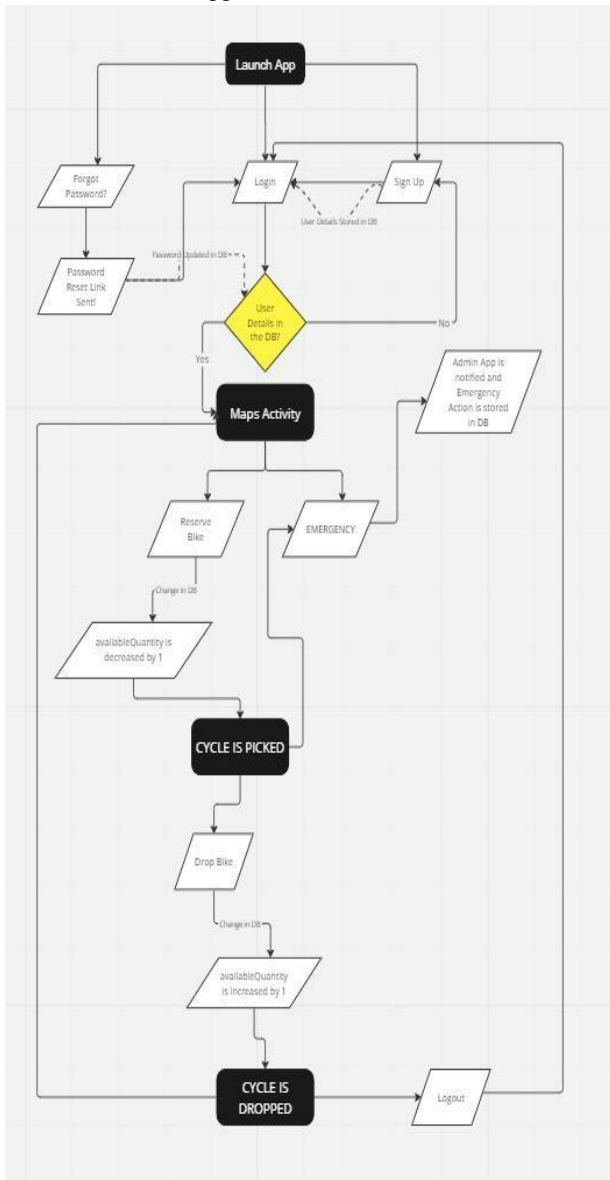
On the Firebase Side, There are three collections in the firebase, and they are as follows:-

1. User Collection: This Collection has documents named with the first name of the user, and consist of data fields such as email, name, phone, and SBU Id. Each user has its own transaction list that contains the dateTime, location, pickup, timestamp, and mode details when a user reserves or drops the bike.
2. Cycles: This collection has the documents as the names of the bike stands. Each stand has three fields i.e.

Latitude, Longitude, and the quantity of cycles available at the stands.

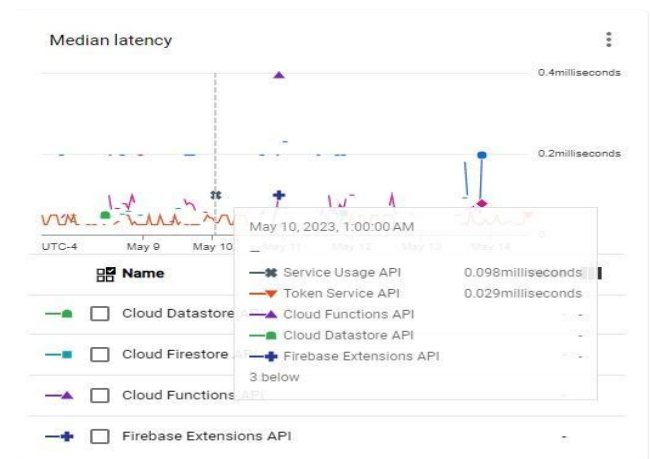
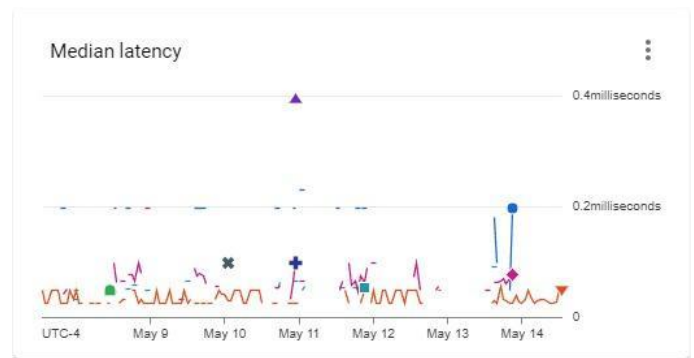
3. Emergency: This collection has the records that are emergency requests sent by users to admins. These requests consist of fields, contact number, location, email, and name.

Flow Chart of the App:



VI. RESULTS & EXPERIMENTS:

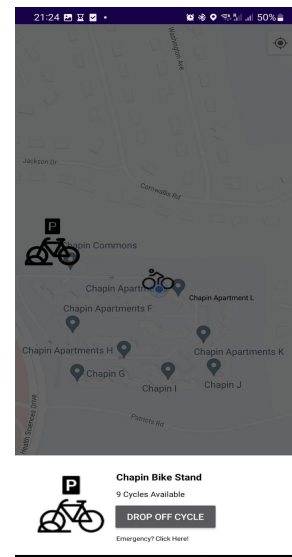
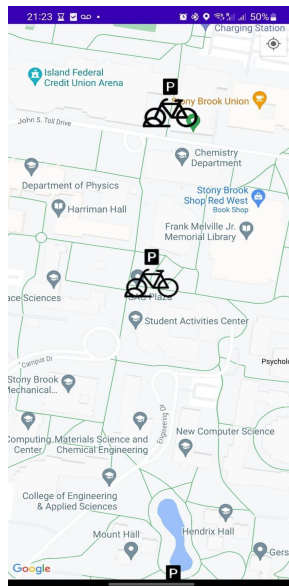
1. Performance Evaluation: -
1. Median Latency:-



The Median Latency of the project is shown. In that, the Service usage API latency is 0.098 ms, and the Token Service API latency is 0.029 ms.

2. User Application:
- i. Login Activity

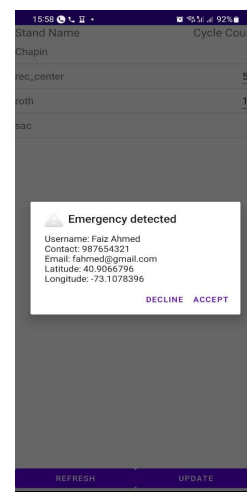
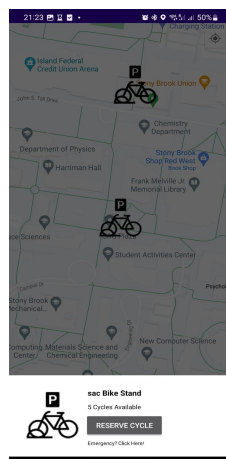
ii. Maps Activity:



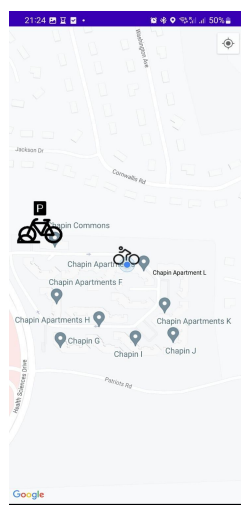
2. Admin Application:

i. Emergency Request Page:-

iii. Bottom Sheet Layout for Reserving Cycle:



iv. Movement of Cycle:-



ii. Admin Action:-

Stand Name	Cycle Count
Chapin	10
rec_center	58
roth	16
sac	4

v. Drop-Off Cycle Bottom Sheet Layout:-

VII. FUTURE SCOPE

The Wolfie's Bike Android application and Firebase-based system can be further enhanced to provide an even better biking experience for students at Stony Brook University. Potential avenues for expansion include incorporating additional user features such as navigation assistance and alternative transportation options, implementing advanced analytics for gaining insights into bike usage patterns, integrating with campus services like scheduling systems, enabling bike maintenance reporting, introducing gamification and reward systems, expanding the system to other campuses or educational institutions, integrating with smart bike locks for seamless bike access, and integrating with public transportation services for comprehensive multimodal transportation options. These future developments aim to improve functionality, user experience, and the overall impact of the system, adapting it to the evolving needs and preferences of the student community.

VIII. Conclusion

The design and development of the Wolfie's Bike Android application in conjunction with the Firebase database present a comprehensive solution to address the problem of bike availability for students at Stony Brook University. By providing real-time information on bike availability, reservation capabilities, and efficient drop-off options, the system aims to enhance the overall biking experience on campus. The Android application offers a user-friendly interface, seamless integration with the Firebase database, and secure authentication mechanisms. The Firebase database serves as a reliable storage and management system for bike and bike stand data, ensuring accurate and up-to-date information for users. The integration of server-side APIs facilitates communication

between the Android application and the Firebase database, allowing for smooth data retrieval, reservation handling, and real-time updates. Future scope opportunities, such as incorporating additional features, advanced analytics, and expanding the system to other campuses, offer avenues for further improvements and cater to the evolving needs of the student community. Overall, the designed system presents a practical and efficient solution to address the bike availability issue, promoting sustainable transportation and enhancing the convenience of students' commutes at Stony Brook University.

IX. REFERENCES

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