FOOD FLAG - PLATFORM TO DONATE AND RECEIVE FOOD

PROJECT REPORT

Submitted by

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CERTIFICATE

This is to certify that, the report entitled **FOOD FLAG** submitted by **JOBY JOHN (TKM23MCA-2034)** to the **APJ Abdul Kalam Technological University** in partial fulfillment of the requirements for the award of the Degree of **Master of Computer Applications** is a bonafide record of the project work carried out by him under my guidance and supervision.This report in any form has not been submitted to any other University or Institute for any purpose.

Internal Supervisor

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DECLARATION

I undersigned hereby declare that the project report **FOOD FLAG** submitted for partial fulfillment of the requirements for the award of degree of Master of Computer Applications of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of **Prof. Sheera Shamsu**. This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title of any other University.

Kollam

11/11/2024

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Joby John

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ABSTRACT

The "Food Flag" project introduces a socially impactful food donation application developed using Flutter, Firebase, and Google Maps API, addressing the challenges faced by conventional food distribution systems. Traditional donation approaches often lack coordination, accessibility, and tracking, limiting efficient delivery to those in need. Food Flag overcomes these challenges by providing a streamlined, secure, and location-based platform for food donation. The application enables users to locate nearby donations on a map, claim available meals, and track donation activities through intuitive flag-based markers. The frontend, built with Flutter, offers a seamless and interactive user experience, while Firebase, powering the backend, provides real-time database capabilities, robust user authentication, and efficient data handling. Key features of Food Flag include location-based accessibility, allowing users to find donations nearby; enhanced security through Firebase's authentication and QR code verification; and effective tracking of donations, ensuring transparency and reliability in the donation process. This solution fosters community engagement, encouraging users and restaurants to participate in a modern and scalable donation network, transforming food donation into an accessible and organized initiative.

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Chapter 1

Introduction

In today's world, where social impact and community welfare have gained prominence, ensuring accessible and effective methods for food distribution to the needy has become essential. The "Food Flag" application addresses this need by providing a convenient, secure, and interactive platform for food donation. Designed to facilitate food sharing among individuals and communities, Food Flag enables users to donate meals directly from their location, ensuring food reaches those in need with efficiency and transparency. The app's intuitive map interface allows users to easily locate food donations nearby and track their progress in real-time.

Food Flag is tailored for various contributors, including individuals and restaurant operators, each of whom can raise "flags" indicating available meals. These flags appear as markers on a map, displaying different colors based on donation status, ensuring that donors and recipients can navigate the donation process effectively. Signed-in users have specific roles: they can donate, claim, or verify meals based on their needs and permissions, while non-logged-in users and restaurant staff have limited access, enhancing the app's security and functionality.

Central to Food Flag's design are its security and usability features. Leveraging Firebase for real-time database functionality and secure user authentication, the application safeguards data and restricts actions based on user roles, ensuring that only eligible individuals can claim or manage flags. QR code functionality further enhances security, allowing seamless verification of donations, while Firebase's backend infrastructure supports scalability as user engagement grows.

By adopting mobile technology and geolocation services, Food Flag promotes community engagement and simplifies the food donation process. It encourages individuals and businesses to actively participate in reducing food waste and supporting those in need. Ultimately, Food Flag is not only a tool for facilitating donations but a platform that strengthens social bonds and fosters a community-driven approach to food security and accessibility.

1.1 Existing System

Traditional food donation systems often rely on in-person events or collection points, where donors bring food to designated locations and recipients collect it. While this approach has its merits, it also presents several challenges in terms of accessibility, efficiency, and coordination. Donors and recipients may face issues with timing and location, as food drop-off points are not always accessible or conveniently located. This can result in unused or spoiled food, reducing the overall impact of the donation efforts.

Additionally, traditional systems lack transparency and real-time tracking. Donors and recipients have limited means to communicate directly or monitor donation availability, which can lead to missed opportunities for food distribution. This often results in an inefficient donation process where food may remain unused, especially when urgent needs arise.

In many cases, there is also a lack of security and verification in existing food donation practices. Donors may not know if their donations are reaching those in genuine need, and recipients may lack assurances about the safety or quality of donated items. Moreover, without a digital infrastructure, tracking and managing multiple donations becomes cumbersome for organizers, who may rely on volunteers or manual record-keeping.

While some initiatives have incorporated technology through simple online listings or social media platforms, these systems do not offer real-time updates, secure authentication, or detailed tracking capabilities, limiting their effectiveness. Food Flag addresses these gaps by providing a streamlined, location-based, and secure mobile solution for both donors and recipients, enhancing the efficiency and reach of food donations within communities.

1.2 Problem Statement

In the context of addressing food insecurity and reducing food waste, traditional food donation systems face numerous challenges that limit their efficiency, accessibility, and impact. These systems often rely on in-person drop-offs at specific locations, which can be inconvenient or inaccessible for both donors and recipients. This approach can result in unclaimed food donations, inefficient distribution, and missed opportunities to provide timely support to those in need.

Additionally, traditional donation methods lack transparency, tracking, and secure verification. Donors have limited insight into whether their contributions are reaching individuals who genuinely need assistance, and recipients may face uncertainties about food availability or safety. Without a streamlined way to connect donors and recipients in real time, food donations may go underutilized, and the potential impact of these contributions remains unmet.

As communities seek modernized and scalable solutions for food assistance, there is a clear need for a system that enhances accessibility, provides secure verification, and facilitates real-time communication between donors and recipients. The proposed "Food Flag" application aims to address these issues by creating a location-based, user-friendly platform that enables individuals and restaurants to donate food effectively, track donations in real time, and contribute meaningfully to local food security efforts. This application seeks to maximize food donation efficiency, promote community engagement, and reduce food waste through a coordinated, accessible approach.

1.3 Proposed System

The proposed "Food Flag" application is designed to modernize food donation efforts by creating a secure, accessible, and efficient platform that directly connects donors with those in need. Leveraging mobile technology and real-time location-based services, Food Flag aims to address the shortcomings of traditional donation systems, enhancing both the availability and effectiveness of food distribution while minimizing waste.

At its core, Food Flag provides a user-friendly interface that allows donors—individuals or businesses—to quickly register, list available food items, and pin their location on an interactive map. This location-based approach enables recipients to easily identify nearby food donations in real time, making it convenient for them to locate and collect food that might otherwise go to waste. With role-based functionality, Food Flag ensures that donors can list items efficiently, while recipients can view, claim, and confirm the collection of food securely.

For enhanced security, Food Flag incorporates Firebase Authentication to verify users and assign them appropriate roles within the app. This prevents misuse of the platform and ensures that donations are genuine. To further streamline the process, the application

generates unique QR codes for each donation, which recipients can scan to confirm collection. This QR-based system not only helps validate donations but also allows donors to track and ensure that their contributions reach intended recipients, building transparency and trust in the process.

In addition to its focus on accessibility and security, Food Flag leverages Firebase's real-time database to keep donation listings, user interactions, and location data up-to-date. This real-time functionality enables donors to update their listings instantly and ensures recipients can see accurate, available items at all times. By fostering a connected and responsive community for food sharing, Food Flag seeks to reduce food insecurity, encourage meaningful community engagement, and make a lasting impact on food waste reduction efforts.

1.4 Objectives

1. Increase Donation Accessibility: Develop a mobile application that enables users to easily list and locate available food donations in real time, enhancing access for those in need and encouraging wider community participation.

2. Ensure Security and Trust: Implement secure user authentication and QR-based verification to confirm donation authenticity and prevent misuse, ensuring the integrity of the food distribution process.

3. Streamline Donation Management: Provide donors with intuitive tools to create, update, and manage food listings efficiently, while allowing recipients to locate, claim, and verify donations seamlessly.

4. Promote Transparency and Trust: Build transparency into the donation process by allowing donors and recipients to track food donation status and by generating QR codes for secure collection confirmation.

5. Enhance Community Engagement: Encourage community involvement by creating a simple, interactive map feature that visually displays donation locations and availability, fostering a connected support network.

6. Reduce Food Waste: Enable businesses and individuals to quickly list surplus food items on the platform, reducing food waste and directing resources to those who need them most.

7. Support Diverse Users: Design the application to cater to both individual donors and organizations, creating a versatile solution that can scale for different types of food donation scenarios, from small food items to larger quantities from restaurants or events.

8. Provide User Assistance and Training: Offer resources such as in-app guidance, FAQs, and customer support to help donors and recipients understand and effectively use the application, promoting smooth adoption and usage.

These objectives aim to create an impactful and reliable platform that simplifies food donation and increases accessibility for recipients, contributing to a meaningful reduction in food waste and fostering a sense of community responsibility.

Chapter 2

Literature Survey

A literature survey, also known as a literature review, involves analysing scholarly sources related to a particular subject. Examining the available literature, it provides a comprehensive overview of the state of the field, allowing you to identify relevant theories, approaches, and gaps in the existing body of knowledge. When conducting a literature review from an audit perspective, the main focus is on evaluating the relevant literature. This process covers information that has been published in a specific field of study and sometimes includes information published within a specific time frame.

2.1 Purpose of Literature Survey

1. It gives readers easy access to research on a particular topic by selecting high quality

articles or studies that are relevant, meaningful, important and valid and summarizing them into one complete report.

2. It provides an excellent starting point for researchers beginning to do research in a new area by forcing them to summarize, evaluate, and compare original research in that specific area.
3. It ensures that researchers do not duplicate work that has already been done.
4. It can provide clues as to where future research is heading or recommend areas on which to focus.
5. It highlights the key findings.

2.2 Related Works

The study of prior research relevant to the Food Flag project focuses on four critical areas:

1. **Food Donation Platforms and Their Impact** : Research on existing food donation platforms, such as Olio and Feeding America, has highlighted the importance of accessible and streamlined applications that facilitate food redistribution. Studies show that digital tools can significantly increase the efficiency of food recovery efforts, particularly when they simplify donation processes and improve accessibility for both donors and recipients.

2. **Geolocation and Mapping for Resource Distribution:** Leveraging location-based services in mobile applications has been shown to enhance the distribution of resources, such as food and shelter. Geolocation enables users to locate nearby resources easily, and mapping technology aids in visualizing these resources in real time, which is critical for efficient and timely access.

3. **Security and Verification in Resource Sharing Platforms**: Previous research has examined various security measures in resource-sharing platforms to ensure trust and transparency. QR code verification, for example, has proven effective in confirming the authenticity of donations and reducing fraud. Implementing such features can enhance user trust and accountability within food donation ecosystems.

4. **User Engagement and Accessibility in Donation Apps**: Studies on UX design for donation and charity applications emphasize the importance of intuitive interfaces and engaging user experiences to boost adoption and retention rates. User-centered design principles and

accessibility features, such as straightforward navigation and clear labels, have been shown to encourage participation and increase user satisfaction in food-sharing platforms.

By analyzing these related works, the Food Flag project aims to incorporate proven methodologies and innovative features to create an efficient, secure, and user-friendly platform for food donation and distribution.

2.2.1 Survey on Security Methodologies in Food Donation Platforms

The study conducted by Arvind Kumar Pandey and Pratik Patel explores the development of a mobile Android application, "Donatify," aimed at connecting individuals in need of food with those willing to donate surplus food. The paper highlights the importance of security in food donation platforms, particularly in the context of mobile applications. It focuses on the integration of secure user authentication, real-time tracking of donations, and the protection of user data to ensure the transparency and trustworthiness of the platform. The study also underscores the need for robust encryption methods to protect sensitive information, ensuring a secure transaction process for both donors and recipients.

2.2.2 UX Design for Food Donation Apps

The research by Ruchi Masani and Sidhant Kumar emphasizes the role of user experience (UX) design in food donation platforms. The study examines how intuitive and user-friendly interfaces can enhance accessibility for all users, particularly those with limited technical skills. The paper advocates for simple navigation, clear labels, and assistive technologies to ensure that everyone, regardless of their background, can easily participate in food donation efforts. It also explores how well-designed food donation apps can improve user engagement and retention by fostering a sense of community and trust among donors and recipients.

2.2.3 User Engagement and Behavioral Patterns in Food Donation Apps

The research conducted by Pratik Patel and Sagar Patidar investigates how user behavior influences the frequency and consistency of donations in food donation apps. The paper examines the impact of motivational features such as gamification, notifications, and rewards on user participation. By analyzing user engagement patterns, the study provides valuable insights into optimizing donation platforms to encourage long-term commitment and increase

the effectiveness of food redistribution. Additionally, the research emphasizes the importance of fostering trust and community within the app to sustain participation.

Chapter 3

Methodology

The methodology for the **Food Flag** mobile application focuses on developing an intuitive, secure, and scalable platform that facilitates food donation and distribution. The project will begin with an in-depth **requirements analysis** to understand the needs of potential users, including food donors, recipients, and administrative personnel. This will involve stakeholder interviews, surveys, and user feedback to identify key features and pain points.

The **design phase** will concentrate on creating an easy-to-navigate and accessible interface. Usability testing will be conducted with diverse user groups, ensuring that the app is accessible for individuals with varying levels of technological proficiency. Particular attention will be given to integrating assistive technologies for users with disabilities and providing a smooth experience for all users.

In the **development phase**, the project will use an **iterative approach** to allow for constant feedback, evaluation, and refinement. Key features such as **geolocation services** for tracking food availability, **QR code verification** for ensuring donation authenticity, and **secure user authentication** will be integrated to promote trust and safety. Additionally, the app will allow users to track the impact of their donations, encouraging continued participation in the food donation cycle.

Once the application is live, **real-time monitoring and analytics** will be implemented to track donation patterns, ensuring that food distribution is both efficient and effective. Finally, the results of the donation process will be made accessible to users, providing transparency and fostering confidence in the app's integrity. Continuous support and updates will be provided to adapt to user needs and improve the donation experience.

3.1 Architecture

The architecture of the **Food Flag** application is designed to facilitate a seamless and secure food donation and distribution process. It is composed of three primary layers: the **User Interface (UI) Layer**, the **Application Layer**, and the **Data Storage Layer**, each playing a critical role in ensuring a smooth and efficient user experience while maintaining security and integrity.

1. **User Interface (UI) Layer**:
The UI layer is focused on delivering an intuitive and accessible experience for all

users, including both food donors and recipients. The design is optimized for mobile devices, featuring clear navigation, responsive design, and easy-to-understand instructions. Accessibility features such as high-contrast text, voice-over support, and simple button layouts ensure that users with diverse abilities can use the app without difficulties. This layer enables users to browse food availability, make donations, and receive food requests in a simple and efficient manner.

2. **Application Layer**:
Behind the scenes, the application layer is responsible for handling core functionalities, such as **user authentication**, **food request management**, and **donation verification**. Security is a primary focus in this layer, with features like **QR code verification** to ensure the authenticity of donations, **secure login mechanisms** for users (such as social media integration or phone number verification), and **real-time location tracking** to connect donors with nearby recipients. The application layer manages the workflow of donations, from posting available food to confirming the donation with recipients, all while prioritizing data privacy and minimizing fraud.

3. **Data Storage Layer**:
The data storage layer is where all user information, food donation details, and transaction data are securely stored. This layer utilizes **encrypted databases** to protect sensitive user data, such as personal information and food donation details. It also includes **audit trails** to ensure transparency, allowing users and administrators to track the history of donations and verify the integrity of each transaction. Additionally, this layer supports real-time data updates, ensuring that all users have access to the most up-to-date information regarding available donations and their status.

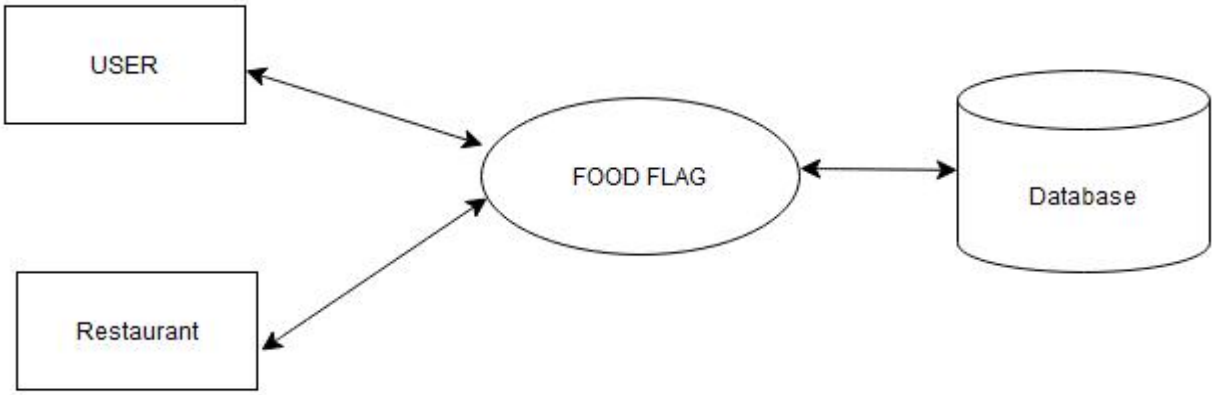
This architecture ensures that **Food Flag** offers a user-friendly and secure platform, promoting trust and transparency while maintaining the integrity of the food donation and distribution process.

3.1.1 System Design

The Food Flag application involves three primary actors: Users(Donors, Recipients), and Restaurants. The process begins with Donors who can register on the app, create food donation flags, and specify the type of food available for donation. Recipients can browse available donations on the map, select donations, and confirm their food collection. Restaurants, as the third actor, can list food donations donors raised through them, monitor claims, and manage donation availability.

The system ensures seamless interactions between these actors through a real-time database that updates available donations and claims instantly. Security measures such as QR code scanning for verification ensure the authenticity of donations, while the app's intuitive design provides easy access to information for all users. The system fosters a collaborative food donation ecosystem by linking donors, recipients, and restaurants, ensuring efficient food distribution and reducing waste.

Figure 3.1 System overview



3.2 Software Requirements and Specifications

1. **Flutter**: For cross-platform mobile application development.

2. **Firebase**: For backend services such as authentication, real-time database, and cloud storage.
3. **Google Chrome**: For testing and debugging web-based components.
4. **Android Studio**: Integrated development environment (IDE) for building and running the app
5. **Dart**: The programming language used for writing the Flutter app.
6. **Google Maps API**: For integrating geolocation and displaying maps for food donation locations.

3.2.1 Flutter

Flutter is a versatile framework created by Google for building cross-platform applications from a single codebase, covering mobile (Android and iOS), web, and desktop. Written in the Dart programming language, Flutter offers native-like performance by compiling directly to machine code. Its “hot reload” feature stands out, allowing developers to instantly view changes in the app without restarting it, thus enhancing productivity. Flutter's rich library of customizable widgets simplifies the development of aesthetically consistent UIs across platforms, with dedicated widgets for both Android (Material Design) and iOS (Cupertino).

Another key feature is Flutter’s layered architecture, which offers full control over UI rendering and customization. This flexibility makes it easy to create complex animations and tailor visual elements precisely. Moreover, Flutter supports plugins and integrations with services like Firebase, Google Maps, and device APIs, making it suitable for feature-rich applications. The framework is supported by a large community, extensive documentation, and continuous updates from Google, helping developers stay up-to-date and troubleshoot effectively. With its balance of performance, flexibility, and ease of use, Flutter is an increasingly popular choice for businesses and developers aiming for consistency and efficiency in cross-platform app development.

3.2.2 Firebase

Firebase is a robust backend-as-a-service platform provided by Google that supports the development of web and mobile applications. It offers a suite of tools and services that streamline backend functionality, allowing developers to focus more on building engaging user experiences. A key feature of Firebase is its Authentication service, which simplifies user login with support for email and social logins like Google and Facebook. Firebase also

provides powerful, cloud-hosted databases: Firestore for structured data and Realtime Database for applications that need data updates in real-time across multiple users.

Beyond data storage, Firebase includes Cloud Functions**,** which enable server-side code execution in response to app events, reducing the need for traditional backend infrastructure. Cloud Storage in Firebase is ideal for handling and serving large files such as images or videos, and Firebase Hosting offers fast, secure deployment for web applications and static content. Additionally, Firebase Analytics allows developers to monitor app performance, user engagement, and events, while Crashlytics offers detailed reports to address app crashes and improve stability. Finally, Firebase's Machine Learning Kit makes it easy to incorporate AI features like image recognition or text analysis with minimal setup.

Together, these features make Firebase highly scalable and flexible, catering to both small projects and large-scale enterprise applications. Its seamless integration with Google's ecosystem also allows developers to leverage other services like Google Cloud, making Firebase an all-in-one platform that is well-suited to modern app development needs.

3.2.3 Google Chrome

Google Chrome is a fast, secure, and widely-used web browser developed by Google, designed to provide an efficient and smooth browsing experience. Known for its speed and minimalist design, Chrome was built with the WebKit rendering engine and later switched to Google's Blink engine, which enhanced its performance and loading speeds. Chrome supports cross-platform compatibility, available on Windows, macOS, Linux, Android, and iOS.

Its core features include automatic updates**,** incognito mode for private browsing, tabbed browsing with individual process isolation for each tab, and a robust security system that includes phishing and malware protection. Chrome also seamlessly integrates with Google services, such as Google Drive, Gmail, and Google Docs, offering a unified experience for users in the Google ecosystem.

The browser supports a wide range of extensions and add-ons through the Chrome Web Store, allowing users to customize functionality, from productivity tools to ad blockers. Chrome's sync feature enables users to save bookmarks, passwords, and history across multiple devices when logged into their Google account.

3.2.4 Android Studio

Android Studio is an integrated development environment (IDE) developed by Google for building Android applications. Based on IntelliJ IDEA, it provides a suite of tools tailored for Android development, including a powerful code editor, a real-time preview of user interface changes, and extensive debugging options. Android Studio supports features like Gradle-based build system for managing dependencies, emulators for testing on various devices, and code templates for quick setup of standard Android components.

One of its standout features is Android Jetpack integration, which includes libraries, tools, and guidance to help developers reduce boilerplate code and focus on creating robust applications. Android Studio also provides profiling tools for performance optimization, allowing developers to monitor CPU usage, memory, and network activity. Furthermore, it supports Kotlin and Java for Android app development and integrates seamlessly with Firebase for backend services like authentication and real-time database.

With continuous updates from Google, Android Studio remains the official and most comprehensive IDE for Android development, providing the resources to build, test, and optimize applications on a variety of Android devices.

3.2.5 Dart

Dart is an open-source, general-purpose programming language developed by Google. It’s designed to be optimized for building fast, scalable, and high-performance applications, particularly for front-end development on both web and mobile platforms. Dart powers Flutter, Google's popular UI toolkit, making it especially favoured for cross-platform app development. With a syntax similar to languages like JavaScript and Java, Dart is easy for developers to learn and adopt.

Key features include AOT (Ahead-of-Time) and JIT (Just-in-Time) compilation, which boosts application startup speed and enables hot-reloading, allowing developers to see code changes in real-time during development. Additionally, Dart’s asynchronous programming support simplifies handling of operations such as network requests and file I/O, which are common in mobile and web applications.

Dart has a rich standard library that supports tasks like data manipulation, networking, and file handling, and the language emphasizes strong typing and sound null safety to reduce runtime errors. Its combination of ease of use, efficient performance, and cross-platform capabilities makes Dart a powerful choice for modern app development.

3.2.6 Google Maps API

The Google Maps API is a set of application programming interfaces (APIs) that enables developers to embed Google Maps functionality into their web and mobile applications. It offers powerful features for visualizing geographical data, creating interactive maps, and integrating location-based services.

Key features of the Google Maps API include map embedding, geolocation, route planning, and the ability to place markers, polygons, and polylines on maps. It supports a variety of map styles and customization options, making it ideal for tailoring maps to fit specific user needs and design aesthetics. The API also provides capabilities for searching places, getting directions, and performing distance calculations, which are essential for navigation and resource distribution apps like Food Flag.

One of the core benefits of the Google Maps API is its geocoding and reverse geocoding capabilities, which enable developers to convert addresses into geographic coordinates and vice versa. This is particularly useful for applications involving location-based services such as food donation, where users need to find nearby locations or food resources.

The API is designed to work seamlessly across platforms, including web and mobile, and supports a variety of programming languages and frameworks, making it versatile and easy to integrate with other technologies. With extensive documentation, developer tools, and a strong community, the Google Maps API provides the foundation for building location-aware applications that are both robust and scalable.

3.3 Dependencies

The dependencies for the Food Flag project include:

1. Firebase Core
2. Firebase Auth
3. Firebase Firestore
4. Google Maps Flutter
5. QR Code Scanner
6. Provider

3.3.1 Firebase Core

Firebase Core is a foundational module within Firebase that connects your application to Firebase's backend services. It provides essential functions like app initialization, configuration, and connection to Firebase services. By integrating Firebase Core, developers gain access to tools like analytics, cloud messaging, authentication, and storage, enabling them to build feature-rich, scalable applications quickly. Firebase Core is compatible with various platforms, including Android, iOS, and web applications, and is a critical entry point for leveraging the robust ecosystem of Firebase services.

3.3.2 Firebase Auth

Firebase Auth is a powerful authentication tool within Firebase that simplifies user sign-in and authentication processes in mobile and web applications. It supports various authentication methods, including email and password, phone numbers, and third-party providers like Google, Facebook, and Apple. Firebase Auth handles complex backend processes, such as token management and user session persistence, making it easier for developers to secure user data while providing a seamless login experience. Additionally, Firebase Auth integrates with Firebase's other services, allowing for a cohesive development experience with robust security and usability.

3.3.3 Firebase Firestore

Cloud Firestore is a flexible, scalable NoSQL cloud database designed for mobile, web, and server development. It allows developers to store, sync, and query data for their applications in real time. With features like automatic scaling, offline support, and real-time updates,

Cloud Firestore simplifies data management for apps. Its powerful querying capabilities and structured data organization help developers create responsive user experiences while ensuring data consistency across different platforms. Integration with other Firebase services further enhances its functionality, making it a robust choice for modern applications.

3.3.4 Google Maps Flutter

Google Maps Flutter is the plugin used to integrate Google Maps functionality into the Food Flag app. It provides users with a visual representation of food flags on a map, allowing them to easily locate available food nearby. The API enables features like geolocation, marker placement, and map styling, making it a vital component of the app for location-based food donation and verification.

3.3.5 QR Code Scanner

The QR Code Scanner package is essential for the Food Flag app's verification process. Donors and recipients can scan QR codes to confirm food flag details and verify actions such as flag creation and claiming. This ensures the authenticity of the donation process and reduces the chances of fraud.

3.3.6 Provider

Provider is used for state management in the Food Flag app, allowing the app to manage and update the user state (such as logged-in users or flagged locations) in an efficient manner. By using Provider, the app can dynamically update views and data across different screens and components, improving the overall performance and responsiveness of the app.

3.4.1 Hardware and experimental environment

This project was developed and tested on an Intel i5 Dell laptop with 8 GB RAM, running on Windows 10 64-bit operating system. The laptop was used for both development and testing the application. The experimental environment was set up using Flutter and Firebase in Android Studio for mobile app development. The application was tested on multiple Android

devices, including a Samsung Galaxy A52 and a Google Pixel 4. Additionally, testing was carried out on an Android emulator to ensure compatibility across different screen sizes and Android versions.

Chapter 4

Result and Discussions

The results of the Food Flag application project demonstrate a functional and user-friendly mobile platform for facilitating food donation and distribution. Testing has shown that the app effectively connects food donors, recipients, and restaurants through a streamlined interface, ensuring that food donations reach those in need. The app's core functionality, including food flag creation, real-time map updates, and QR code verification, has been successfully implemented and tested across multiple devices.

Security mechanisms, such as user authentication through Firebase and QR code validation, have been proven effective in protecting user data and ensuring donation authenticity. Users, including donors and recipients, can easily register, manage their profiles, and interact with the system without encountering security vulnerabilities.

The platform’s backend, powered by Firebase, efficiently handles user data, food flag details, and map interactions. Real-time updates allow users to track donation status, and location-based services ensure that recipients can find nearby donations. The map’s dynamic behavior, such as displaying different flag statuses, is working as expected and offers real-time location updates.

Performance evaluations indicate that the app remains responsive under various network conditions and user loads, ensuring a smooth experience during peak usage times. User feedback has been generally positive, with particular praise for the app’s intuitive interface, ease of navigation, and its potential for making a real-world impact. Users have expressed confidence in the system's ability to improve food distribution in their local communities, emphasizing its accessibility and the value it adds to food security efforts.

Overall, the Food Flag project successfully delivers a practical, secure, and scalable solution for food donation and distribution, demonstrating the potential of mobile technology to address pressing social issues. The system's simplicity, combined with the power of real-time data, makes it a powerful tool for improving access to food resources for those in need.

4.1 MAP PAGE

The map page in the Food Flag application serves as a central hub for users to view and interact with food donation flags in real time. The map dynamically displays markers representing food donations, with color-coded flags indicating the donation status (e.g., available, claimed, or expired). Each marker is linked to a specific location, allowing recipients to easily locate nearby food donations. The map's interface is designed for ease of use, with zoom and pan features to navigate different areas, making it simple for users to find food donations close to their location.

To enhance the user experience, the map page integrates Google Maps API for accurate and responsive location services. Users can toggle between different views (e.g., satellite or terrain) to better understand the environment around them. The map automatically updates to reflect new donations or changes in the donation status, ensuring real-time information is always available.

For security and privacy, markers are displayed only when the donor or restaurant has chosen to make the donation visible to the community, and QR codes are used for verification when donations are claimed. Additionally, the map page supports filtering and search functions, allowing users to find donations based on proximity or specific criteria, such as donation status or food type.

The map page design focuses on simplicity and accessibility, ensuring that both tech-savvy and less-experienced users can navigate and interact with the platform. Clear, intuitive icons

and labels guide users through the donation process, whether they are donors, recipients, or restaurant partners. Overall, the map page is a critical component of the Food Flag app, facilitating seamless interaction between users and fostering a transparent, efficient food donation system.

4.1.1 MAP PAGE

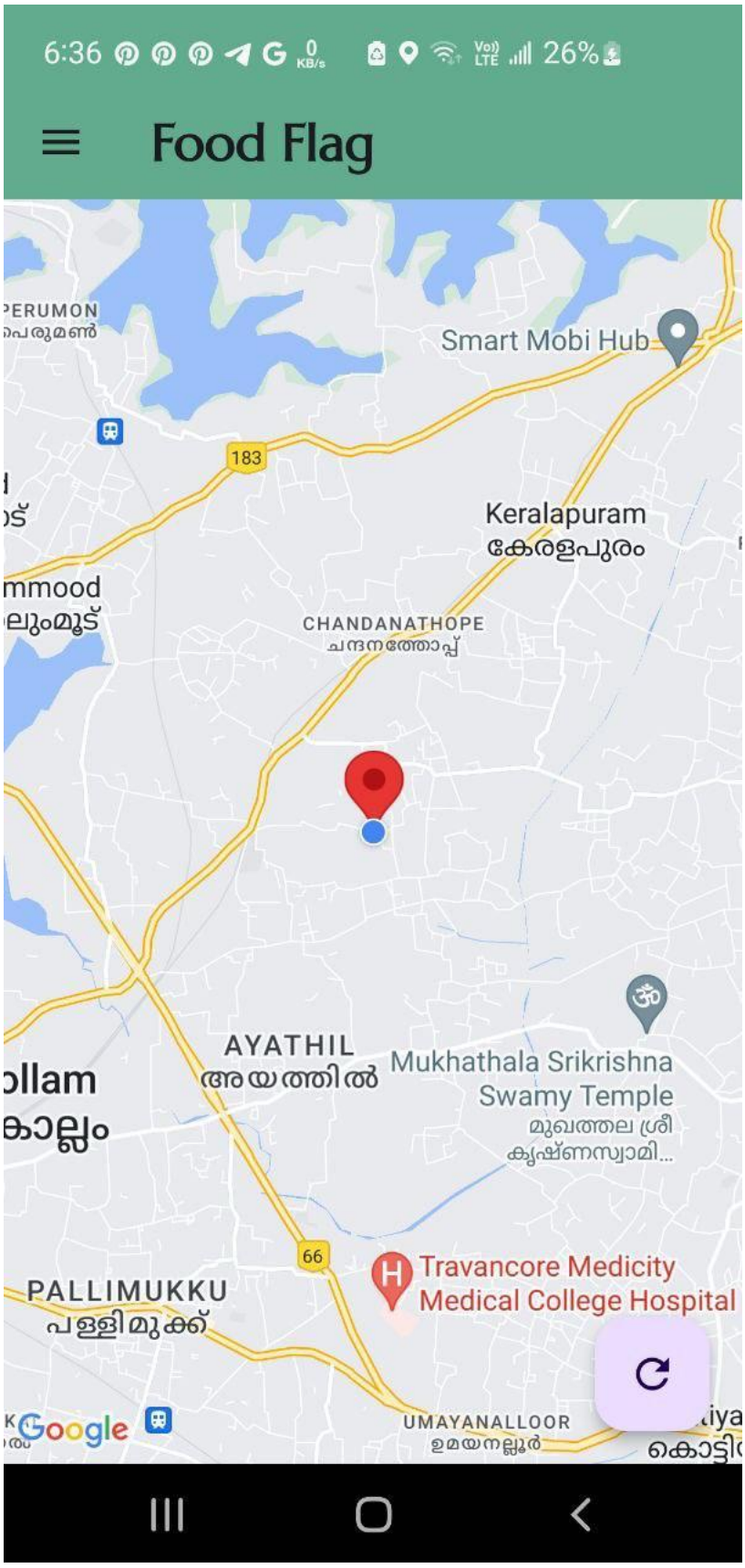


Figure 4.1.1 MAP PAGE

4.2 DRAWER

The drawer page in the Food Flag application serves as the main navigation menu, providing users with easy access to various sections of the app. The drawer is accessible from anywhere within the app and slides out from the left side of the screen, offering quick links to key features such as the home screen, map page, profile settings, donation history, and logout options. It also displays user-specific information, such as the name and role of the logged-in user, whether they are a donor, recipient, or restaurant user.

The design of the drawer prioritizes clarity and simplicity, ensuring that users can navigate the app efficiently without being overwhelmed by too many options. Each menu item is clearly labeled, and icons are used alongside text to enhance recognition and usability. Additionally, for better accessibility, the drawer supports visual contrast and font size adjustments, catering to users with different accessibility needs.

For authenticated users, the drawer dynamically updates to reflect personalized options. For example, a donor will be able to access options related to creating new donation flags, while a restaurant user will have options to manage their restaurant profile, including adding or claiming donations. The drawer also includes a logout option to securely end the user session, ensuring that all sensitive data is protected when users finish their session.

The drawer page design also incorporates smooth animations for transitions, making the navigation experience seamless and responsive. Furthermore, it uses Firebase authentication to fetch and display the user’s name and role from the Firestore database, ensuring the app remains personalized for each user.

Overall, the drawer page enhances the usability of the Food Flag app by providing users with an organized and intuitive way to navigate the platform, manage their profiles, and access key features, all while maintaining a consistent and accessible user interface.

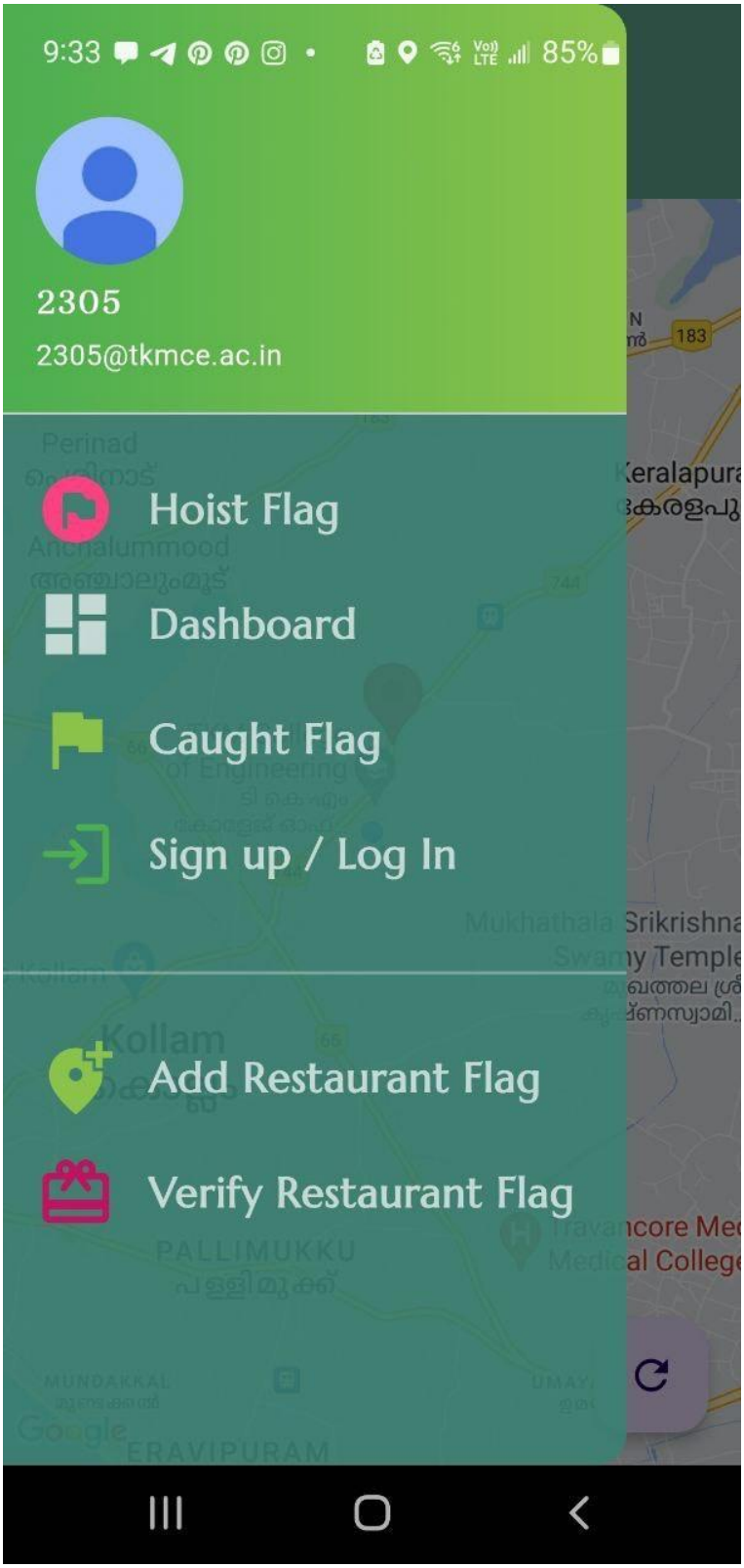


FIG 4.2 DRAWER

4.3 HOIST PAGE

The Hoist page in the Food Flag application is a central feature that allows users to create and manage donation flags. The page is designed to facilitate the process of donating food to those in need, and it allows donors to easily share information about available food donations with recipients. The primary purpose of the Hoist page is to encourage food donations by providing a straightforward and user-friendly interface for both donors and recipients.

When a donor wishes to create a new donation flag, they begin by entering key information such as the type of food available, quantity, location, and any special instructions or conditions for pickup. The page includes input validation to ensure that all required fields are filled out correctly, preventing errors and enhancing the user experience. Once the donor submits the information, the app generates a new flag, which is displayed on the map page and can be claimed by eligible recipients nearby.

To ensure a smooth and secure experience, the Hoist page integrates Firebase for user authentication, enabling the platform to authenticate and verify donors and recipients. The page also incorporates real-time updates through Firestore, ensuring that the most current information about available donations is reflected in the app as soon as changes are made. This also allows the system to track who has claimed a flag and manage the state of each flag (claimed or available).

4.3.1 HOIST-PAGE: SELF PREPARED

The The **Self-Prepared Flag** section of the **Hoist Flag** page allows users to raise flags for meals they have personally prepared and wish to donate. This feature empowers individuals to contribute to the cause of food donation by making meals themselves, rather than relying on a restaurant.

When users access the **Self-Prepared Flag** option, they are presented with two meal categories to choose from: **Vegetarian** and **Non-Vegetarian**. Upon selecting their preferred meal type, the user can then click the **Raise** button. This action will generate a flag on the map that indicates the availability of the meal.

The **Self-Prepared** Flag section is designed to be simple and user-friendly. It caters to individuals who wish to contribute their homemade meals to those in need, providing a quick way to offer support to the community. It ensures that users can participate in food donation regardless of whether they are connected to a restaurant or not, giving them full control over their flag creation process.

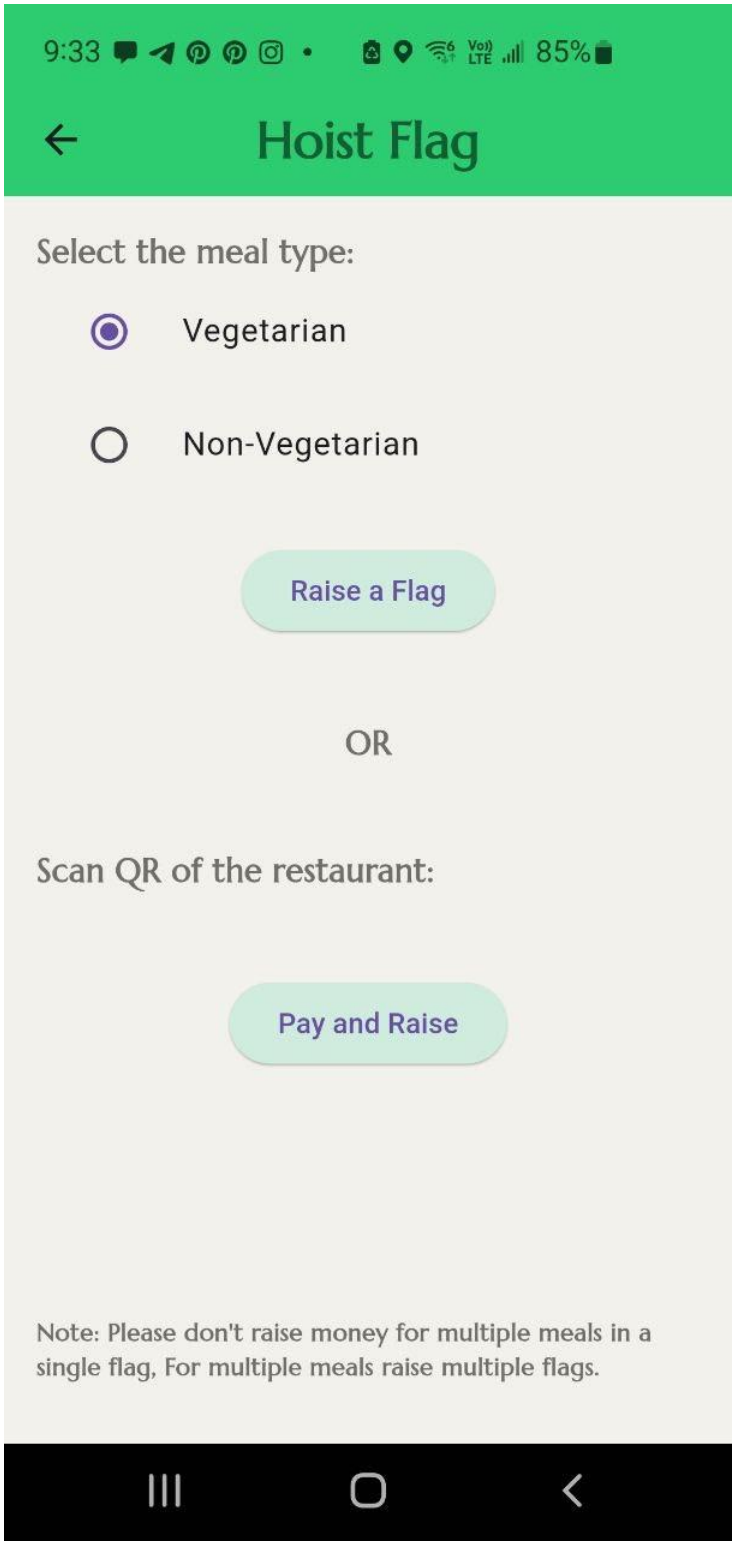


Figure 4.3.1 HOIST PAGE

4.3.2 PAY AND RAISE

The **Pay and Raise** section of the **Hoist Flag** page provides users with the option to raise flags for food donations by leveraging a **QR code**. This feature is designed to make it easier for users to raise flags by tying the donation to a specific cause or event, such as a birthday, celebration, or special occasion, enhancing the personalization and impact of the donation.

When users select the **Pay and Raise** option, they are directed to a page with a text field where they can enter the **cause** or reason for their food donation (e.g., "Birthday", "Charity", "Celebration", etc.). After entering the cause, users click the **Create QR Code** button, which generates a unique QR code. This QR code contains not only the cause entered by the user but also other relevant data that links the donation to the user's account.

The generated **QR code** serves as a key element in the donation process. When the user presents this QR code to a restaurant, the restaurant operator can scan it through their system to initiate the flag creation process on behalf of the user. This allows the restaurant to create a specified **count** of flags, which will be available for collection by others, and the user can track these flags through their dashboard.

The **Pay and Raise** feature is designed to enhance the efficiency and flexibility of the flag-raising process, making it possible for users to contribute to food donations in a simple, personalized, and easily trackable manner. It also fosters a sense of community by linking donations to specific causes, allowing users to feel more connected to the impact of their contributions.

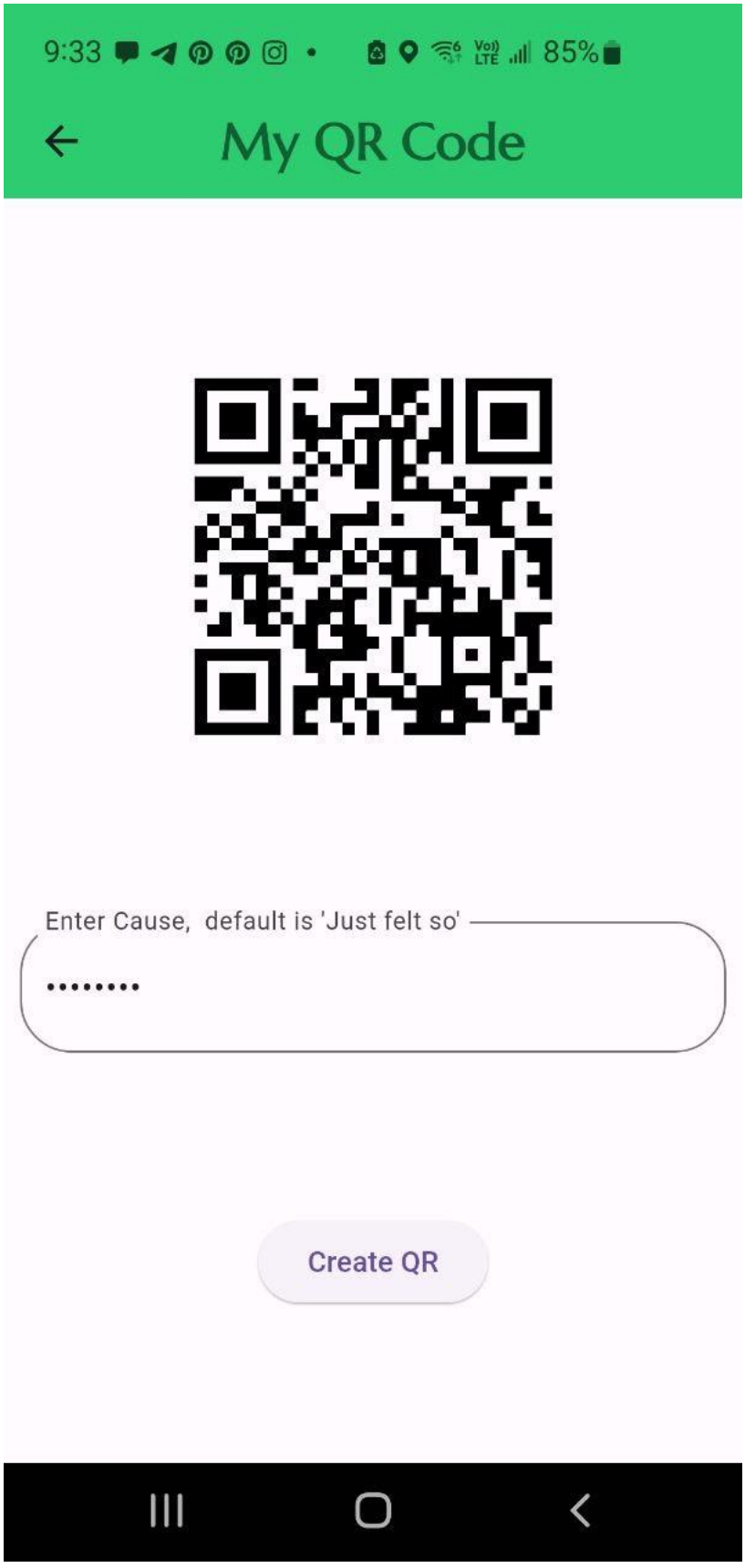


Figure 4.3.2 PAY AND RAISE

4.1 DASHBOARD

The **Dashboard** section of the Food Flag app provides users with an overview of their food donation activity and enables them to manage their flags more effectively. The Dashboard is designed to be an essential tool for users to track the status of their donations, verify collected flags, and manage ongoing food donation interactions in a seamless, user-friendly manner. It is only accessible to signed-in users, ensuring that the information presented is personalized and secure.

Upon accessing the Dashboard, the first feature visible is the **Scan and Verify** button. When users click on this button, an **alert box** appears containing a QR scanner. This scanner is used to verify the authenticity of flags that others have collected and are now returning to the user for validation. Once the QR code is scanned, the user can choose to either **Verify** or **Cancel** the action. If the code is valid, the user can proceed with verifying the flag, which updates their donation count and allows them to finalize the meal handoff to the flag collector. If the QR code is invalid or expired, the user can simply cancel the action and return to the Dashboard.

Below the **Scan and Verify** section, the Dashboard displays a series of informative metrics, including:

Total Donated Flags: This text updates whenever a flag raised by the user is successfully verified, reflecting the total number of donations the user has completed.

Flying Flags: This metric shows the number of flags the user currently has active on the map. These flags are available for collection by others and are still in circulation.

Running Flags: This text displays the number of flags that have already been collected by someone else and are currently on their way to the user for final verification and meal handover.

The Dashboard provides users with a centralized view of their involvement in the food donation process, making it easy to track the flow of flags from creation to verification. It

also supports a streamlined process for verifying donations and managing real-time interactions with those who are claiming meals.

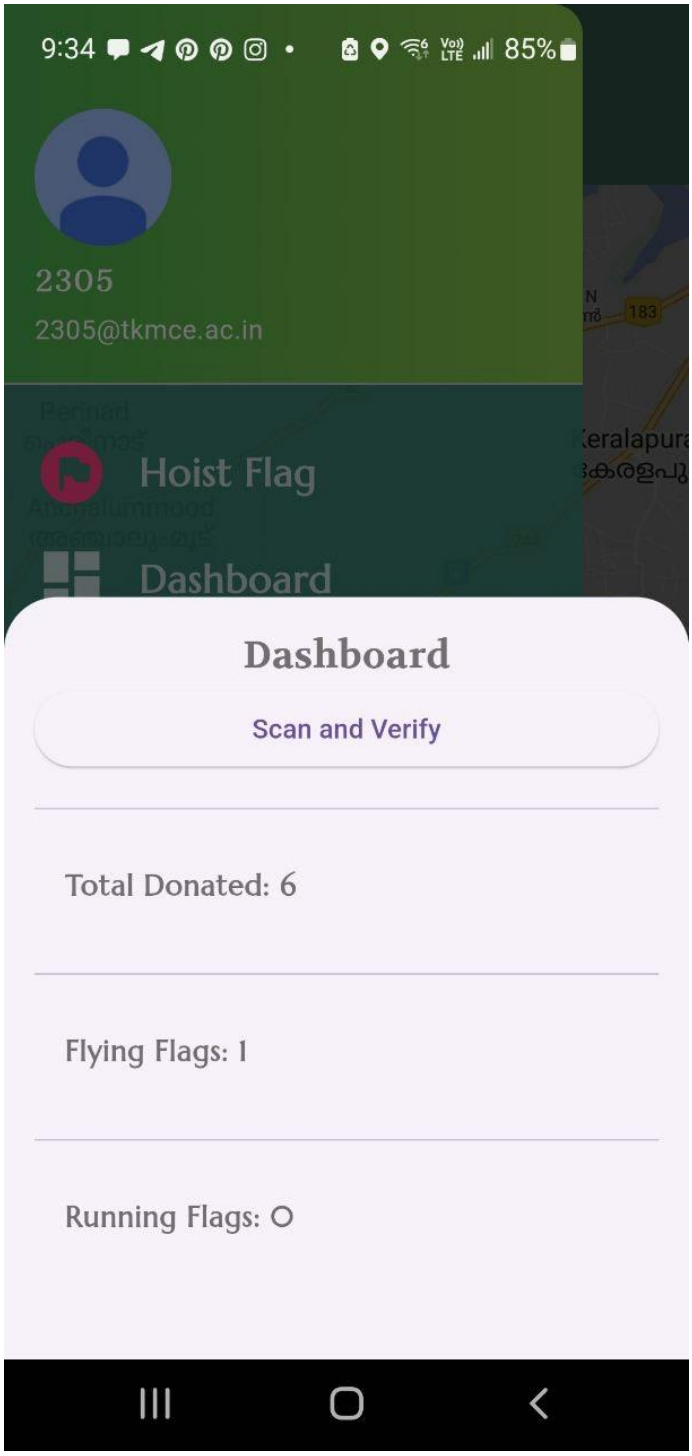


Figure 4.4 DASHBOARD

4.1.1 DASHBOARD: SCAN AND VERIFY

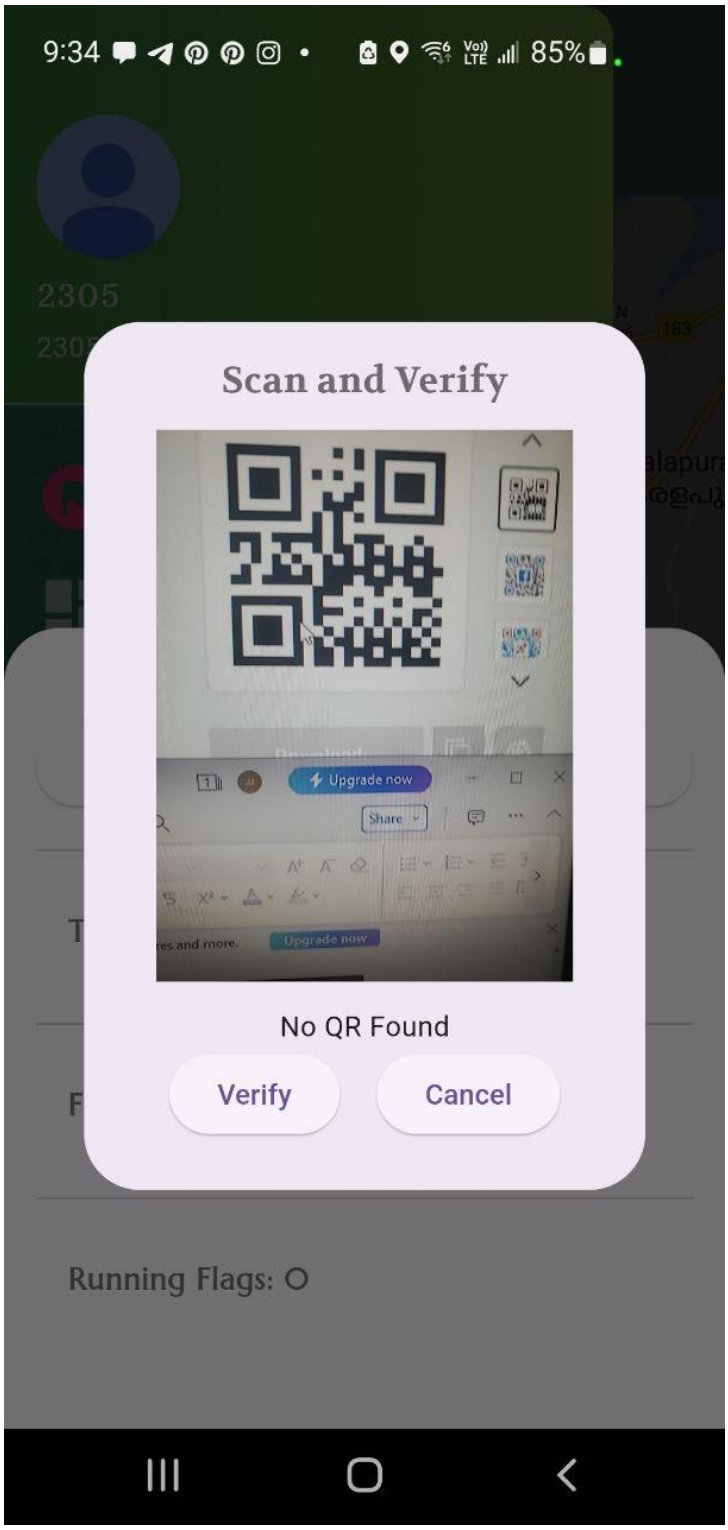


FIG 4.4.1 SCAN AND VERIFY

4.2 CAUGHT FLAG

The Caught Flag section in the Food Flag app provides users with detailed information about the flags they have claimed (or "caught") from the map. This section is designed to give users clear insights into the flags they are currently holding, and offers several actions they can take regarding the claimed flags. It is accessible to users who have caught at least one flag, and it serves as a central place to manage those flags.

When a user accesses the Caught Flag page, the following key information is displayed:

1. Flag Type: This field indicates whether the flag is a Self-Prepared or Restaurant flag. It helps users distinguish between flags they raised themselves and those raised by restaurants.

2. **Flag Cause**: This field shows the cause associated with the flag, such as a birthday or charity event, which the user provided when creating the flag or the restaurant provided when raising the flag on behalf of a user.

3. **Meal Type**: This section specifies whether the meal associated with the flag is veg, non-veg, or from a restaurant. This helps users identify the type of food they are receiving, making it easier to match with their dietary preferences.

4. **User Name of Flag Owner**: This is the name of the user who originally raised the flag, allowing the current user to know who the meal donation is coming from.

5. **Secret Code**: A **Show Secret Code** button reveals the **QR code** that serves as the unique identifier for the claimed flag. This code can be used for verification when the user visits the restaurant or presents the QR code to the restaurant staff to confirm the meal claim.

6. **Amount**: This field displays the amount associated with the flag, indicating the monetary value assigned to it, which could be the value the flag creator set or the restaurant's pricing for the meal.

Available Actions in the Caught Flag Section:

Delete Button: This option allows the user to delete the current caught flag. Deleting the flag removes it from the user's list of caught flags and signifies that the user no longer intends to claim it. Deleting a flag is useful if the user no longer wants to proceed with the meal claim or has resolved the donation.

Directions Button: This button opens Google Maps, providing the user with directions to the origin of the caught flag. It helps users navigate to the location where they can collect their meal from the flag owner or the restaurant.

Call Button: The **Call** button allows users to contact the flag owner directly via phone. This is helpful if users need to coordinate the pickup or confirm details about the meal.

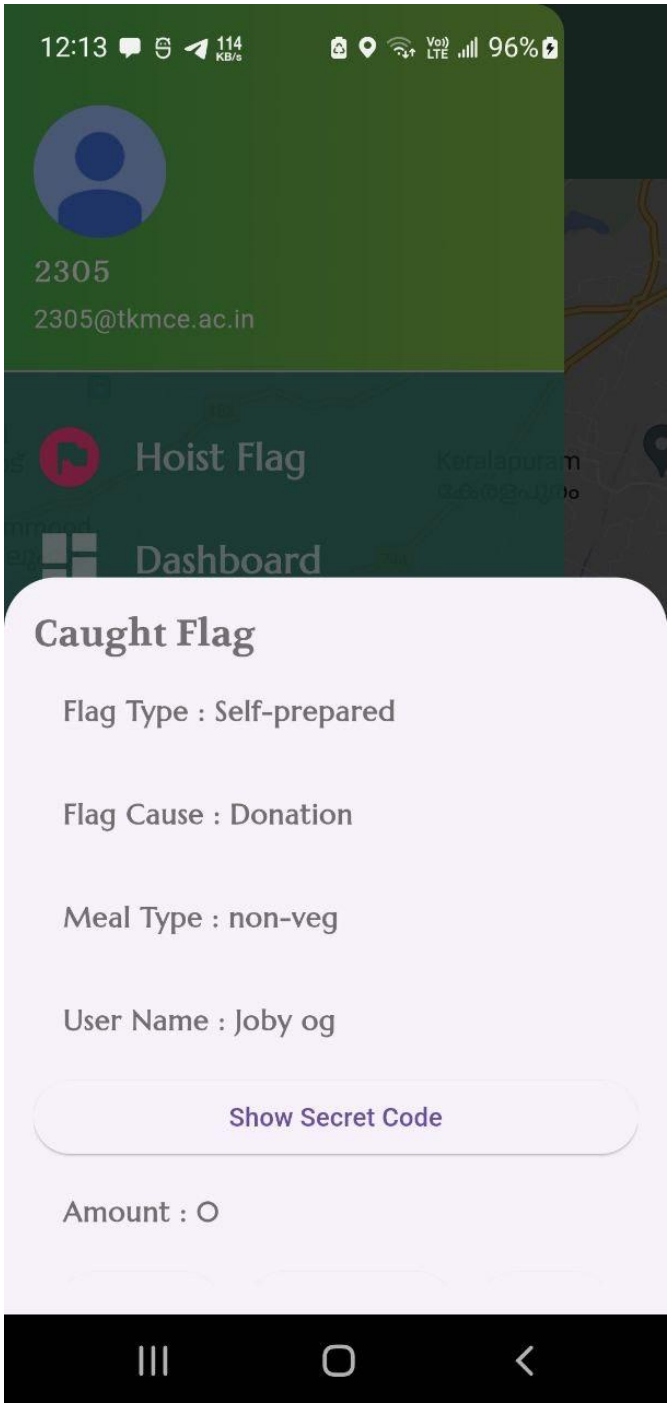


FIG 4.5 CAUGHT FLAG

4.2.1 SHOW SECRET CODE

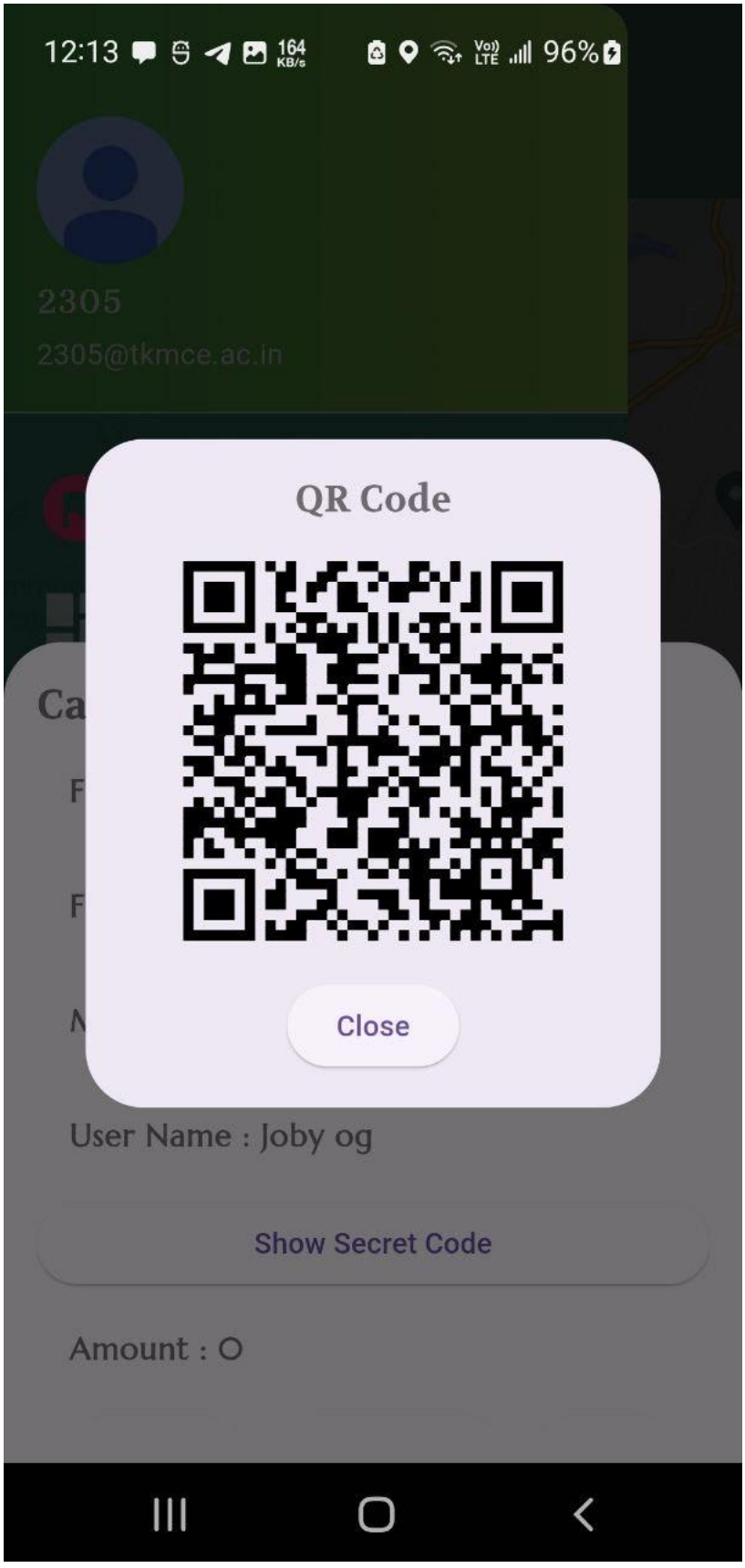

12:13
96%
2305
2305@tkmce.ac.in
QR Code
Close
User Name : Joby og
Show Secret Code
Amount : O

FIG 4.5.1

4.3 SIGN UP / LOGIN

The **Sign-up/Login Page** of the Food Flag app is an essential component for user authentication and registration. It is the entry point for both regular users and restaurant owners to access the app's features, allowing them to either create a new account or log into an existing one.

Key Features of the Sign-up/Login Page:

4.6.1. Google Sign-In Button:

This is the primary method of authentication in the app, leveraging Firebase Authentication with Google Sign-In. When the user is not signed in, this button allows them to sign in using their Google account. Once signed in, the button changes to a **Sign Out** button, allowing users to log out of the app securely.

The Google Sign-In button simplifies the login process, removing the need for users to remember and enter passwords.

4.6.2. Create User Account:

Below the Google Sign-In button, there is a **Create User Account** button. Clicking this button takes the user to a separate page where they can enter their name and phone number, which are required to create a new account.

After entering these details, the user clicks the **Sign Up** button, which will prompt them to choose a Google account for authentication. Once selected, the user is registered as a regular user and is granted access to the app's features.

This option is for users who are registering for the first time and allows them to sign up quickly by linking their phone number and Google account.

4.6.3. Restaurant Account Sign-Up:

For restaurants, there is a **Restaurant Account Sign-Up** option, which is separate from the regular user account creation. Restaurant owners must fill out three text fields: **Restaurant Name**, **FSSAI Number**, and **Phone Number**.

After entering the required information, the restaurant can click the **Sign Up** button to create a restaurant-specific account. This account allows the restaurant to manage meal donations, create restaurant flags, and interact with users who claim meals.

Once a restaurant signs up, it becomes an exclusive account type, meaning the same Google account cannot be used for both regular user and restaurant roles. This ensures that each account type is clearly separated, avoiding confusion and streamlining the user experience.

4.6.4. User Role Distinction:

The **Sign-up/Login Page** ensures that users can only register as one role at a time: either as a **regular user** (who can donate or claim meals) or **as a restaurant owner** (who can raise flags and manage meal claims).

This distinction is crucial because the app's functionalities differ significantly between users and restaurants, and it ensures that the user experience remains seamless and appropriate to their selected role.

This page provides the foundation for users and restaurant owners to access the app, ensuring secure and easy login or sign-up while setting up the appropriate permissions for each user role. With clear guidance and options to either sign in or create a new account, the page serves as a convenient starting point for users and restaurants alike to begin interacting with the Food Flag platform.

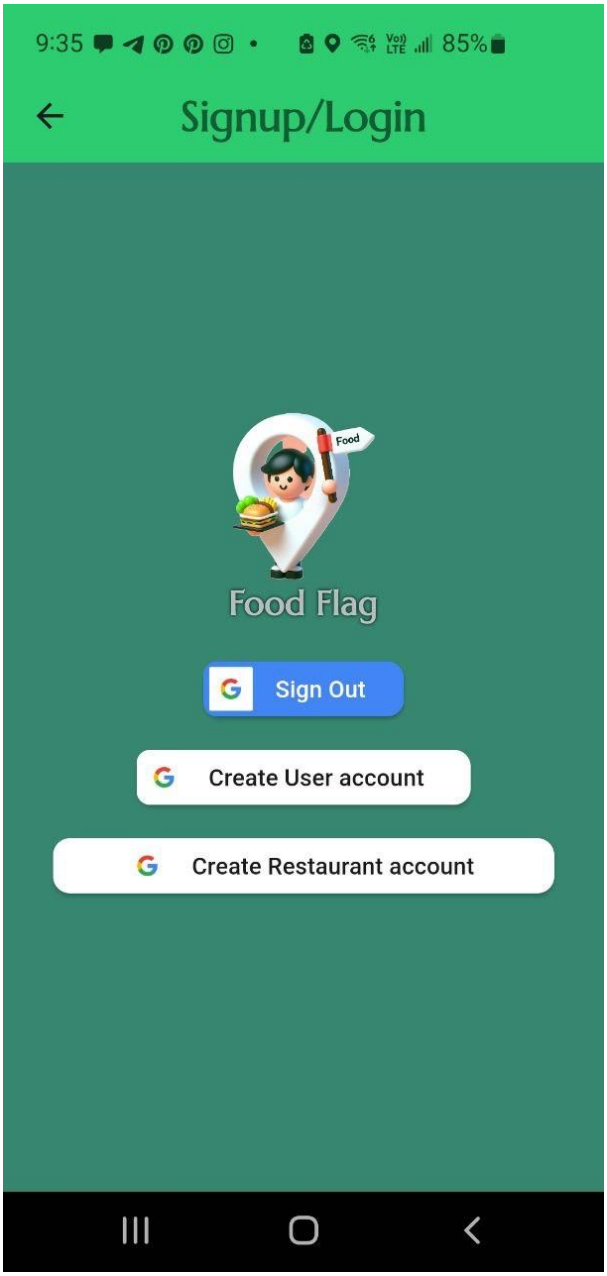


FIG 4.6 SIGNUP/LOGIN

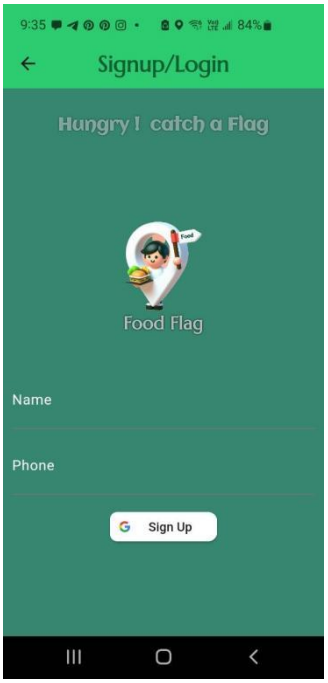


FIG 4.6.2 USER SIGNUP

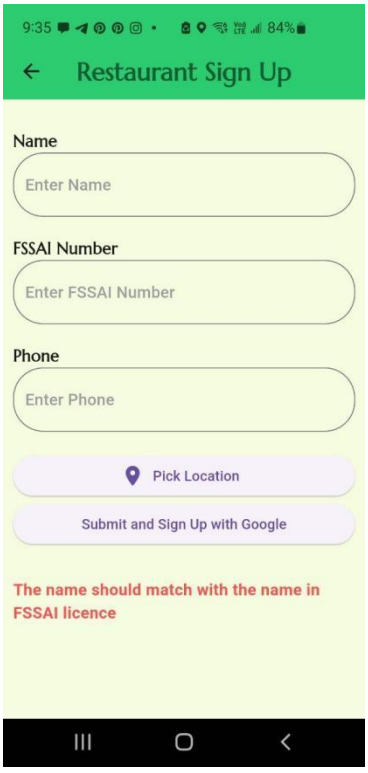


FIG 4.6.3 CREATE RESTAURANT ACCOUNT

4.4 ADD RESTAURANT FLAG

The **Add Restaurant Flag** page in the Food Flag app is designed specifically for restaurant owners to raise food flags on behalf of their establishment. This page allows restaurants to generate flags that indicate available meals for donation, which can then be claimed by registered users. The functionality on this page is exclusive to restaurant accounts, ensuring that only authorized users (restaurant owners) have the ability to create these flags.

Key Features of the Add Restaurant Flag Page:

1.QR Code Scanner:

The page starts with a **QR Code Scanner** that allows the restaurant owner to **scan a QR code** from a user who wishes to raise a restaurant flag. This QR code is created during the **Pay and Raise** process by the user and is tied to a specific cause and meal request.

Upon scanning the QR code, the system fetches the details from the user's QR code (such as the cause and other relevant information), ensuring that the flag raised corresponds correctly to the user's request.

This scanner is crucial for verifying the authenticity of the request and associating the flagged meal with the correct user.

2. Flag Details – Count and Amount:

Below the QR code scanner, there are two input fields:

Count: This field allows the restaurant to specify how many flags they want to raise. For example, if a user wants to donate meals for a group or event, the restaurant can input a higher number of flags.

Amount: This field specifies how much each flag is worth. It could indicate the cost or value of each meal associated with the flag.

These fields allow the restaurant owner to raise multiple flags at once, each with a specified value and quantity, making it flexible for various meal donations and requests.

3. **Create Flags Button:**

After entering the **Count and Amount** values, the restaurant owner clicks the **Create Flags** button to initiate the flag creation process. This action generates the specified number of flags, each linked to the restaurant's location on the map and tied to the user's cause.

The newly created flags are immediately visible on the **Home Screen Map**, allowing users to see available meals in their vicinity.

Additionally, these flags are associated with the user's account (the one who requested the flags), and their dashboard is updated with the status of the flags they have raised via the restaurant.

4. **Visibility and Restrictions:**

Restaurant flags are different from regular user flags in that they can only be claimed at the restaurant's location. They cannot be redeemed by the original user at their own location, ensuring that the process is managed and authenticated through the restaurant.

Once the restaurant owner raises these flags, they cannot be redeemed at the user who created them. Instead, the claimer must go to the restaurant to claim the meal, and the restaurant will verify the flag using the **QR code** scanner on the **Verify Flag** page.

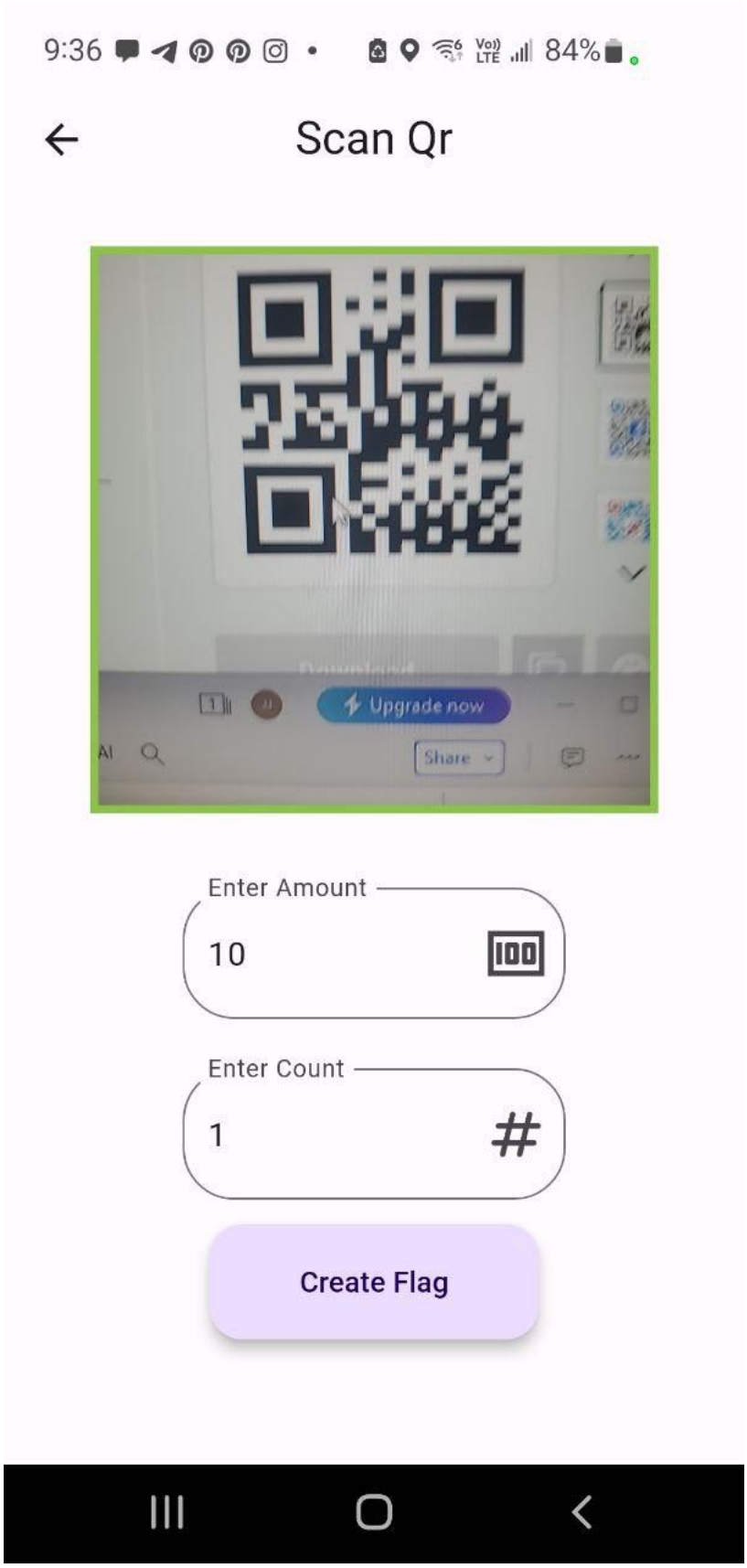

9:36
84%
Scan Qr
Upgrade now
Share
Enter Amount
10
Enter Count
1
Create Flag

FIG 4.7

4.5 VERIFY RESTAURANT FLAG

The **Verify Restaurant Flag** page in the Food Flag app is designed to allow restaurant operators to verify and authenticate flags that users bring in to claim their donated meals. This page is a key component of the system that ensures the integrity of the donation process and verifies that the flag is legitimate before a meal can be provided.

Key Features of the Verify Restaurant Flag Page:

1. QR Code Scanner:

The page includes a **QR Code Scanner** that restaurant operators can use to scan a **QR code** presented by the user. This QR code contains the unique identifier of the flag, which corresponds to a specific meal donation.

When a user arrives at the restaurant with a flag (whether it's a self-prepared or restaurant-raised flag), the restaurant operator scans the QR code to verify the authenticity of the flag.

The scanner ensures that the flag is legitimate and has been raised through the proper process, preventing fraud or misuse.

2. Flag Verification:

After scanning the QR code, the system checks the flag's validity. If the QR code is valid, the app shows the **flag details** (such as the **amount**) in an alert box, allowing the restaurant operator to verify that the meal corresponds to the correct flag and user.

If the QR code is **invalid**, the system will notify the operator with a message indicating that the flag cannot be verified, ensuring that only valid flags are processed.

The **multi-factor verification process** adds an extra layer of security, ensuring that the flag being verified is legitimate and that the meal will be provided to the right person.

3. Flag Amount Display:

When the QR code is successfully verified, the restaurant operator sees the **amount** (which corresponds to the value or cost of the meal) displayed in the alert box. This helps the restaurant know what meal or donation they are providing based on the flag details.

4. Verification Action:

Verify Button: Once the flag is confirmed to be valid, the restaurant operator can click the **Verify** button to authenticate the flag. This action will:

Increment the donation count for the user who raised the flag (indicating that the meal has been successfully donated).

Remove the flag from the map, ensuring that it can no longer be claimed by other users, and it will be marked as "redeemed."

Ensure that the transaction is properly recorded in the system, with both the user's and restaurant's records being updated accordingly.

5. Cancel Button:

If the operator chooses not to verify the flag or if there's an issue with the flag, they can click the **Cancel** button, which will close the verification alert without taking any further action.

This gives the restaurant operator the flexibility to decide whether or not to proceed with the donation based on the flag's validity.

6. **Integration with User Dashboard:**

After the flag is verified, the user's Dashboard is automatically updated, reflecting the new donation. The user can see their total number of successful donations, and the flag status is updated accordingly to indicate that it has been claimed and the donation process is complete.

This integration ensures that both the user and the restaurant have a seamless experience in managing their flag-related activities and maintaining transparency throughout the process.

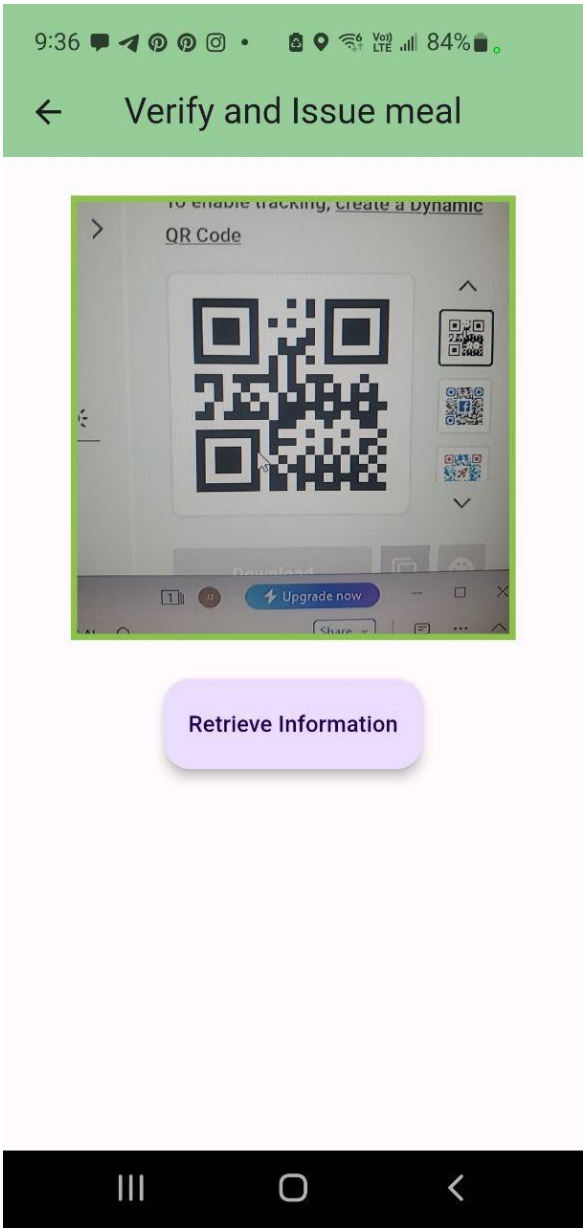


FIG 4.8

Chapter 5

Conclusion

In conclusion, the Food Flag application is a forward-thinking solution designed to revolutionize the food donation process by harnessing modern technology to create an efficient, secure, and user-friendly platform. The app's ability to connect donors, recipients,

and restaurants facilitates a seamless experience for all involved parties, ensuring that food donations reach those who need them the most. With features like real-time flag management, QR code verification, and intuitive navigation, the app simplifies the donation process while maintaining high standards of security and transparency.

The application's design emphasizes ease of use, catering to individuals with varying levels of technological expertise. Its simple interface and streamlined functionality allow both donors and restaurant operators to interact with the platform effectively, promoting active participation in the food donation network. Through its integration with Firebase Firestore and Google Maps, the app provides a robust system for tracking donations, managing markers, and verifying flag statuses.

Furthermore, the Food Flag app is built with scalability in mind, ensuring that it can accommodate future growth and handle increased user activity during peak periods. Continuous feedback loops and performance optimization strategies will ensure that the application evolves in line with user needs, improving its features and user engagement over time.

Overall, this project not only meets the goal of simplifying the food donation process but also demonstrates the power of technology in creating meaningful social impact. As the app continues to develop, it has the potential to be a model for other similar initiatives, empowering communities and fostering a culture of giving. With ongoing improvements and enhancements, the Food Flag application will remain responsive to emerging challenges and maintain its role as an essential tool in the fight against food insecurity.

5.1 Future Enhancements

While the Food Flag application provides a strong foundation for food donation and distribution, several enhancements could further improve its functionality, user engagement, and overall impact.

1. Donation Streaks and Gamification: Introducing a donation streak feature would encourage consistent contributions by rewarding users for making donations on a regular basis. A gamified approach, such as providing badges or recognition for milestone achievements (e.g., donating a certain number of meals), could further motivate users to engage with the platform. This would foster a sense of accomplishment and community among donors.

2. Achievements and Milestones: Incorporating achievement-based rewards can enhance the user experience. For example, users could earn specific rewards or unlock new features after reaching donation milestones, such as contributing a set number of flags, verifying donations,

or participating in a certain number of claims. This would not only incentivize users but also keep them engaged by offering rewards for their contributions to the food donation process.

3. 7 km Marker Notifications: To improve the user experience for both donors and recipients, implementing a feature that sends notifications when flags are raised within a 7 km radius of the user's location can increase donation opportunities. This will allow users to be promptly informed of nearby donations, helping recipients claim meals quickly and efficiently, and encouraging donors to contribute when they are nearby. The real-time notifications will ensure that both donors and recipients are always aware of the available opportunities around them.

4. Enhanced Analytics and Reporting for Users: Allowing users to access detailed analytics about their contributions (e.g., number of meals donated, total number of successful claims) would provide transparency and encourage continued participation. These insights could also help users track their impact and contribution to the community, enhancing the sense of purpose and fulfillment.

5. Location-Based Features for Restaurants: Restaurants could benefit from more advanced location-based features, such as the ability to target donation campaigns based on local areas with higher need or increased visibility. Additionally, restaurants could have an option to customize their donation parameters (e.g., offering specific meal types or flag counts) based on regional requirements.

6. Expanded Notification System: A more comprehensive notification system for both donors and recipients could be implemented, including reminders for donations, flag statuses, or meal claims. Customizable push notifications could allow users to personalize how and when they receive updates, improving overall engagement.

7. Integration of Social Media Sharing: Enabling users to share their donation activities on social media platforms could help spread awareness about the app and encourage others to

participate. This social sharing feature could include personalized messages, milestones, and achievements, amplifying the app's outreach efforts and fostering a community-driven movement.

Appendix

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