



# The University of Jordan

**School of Engineering  
Department of Computer Engineering**

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## **WellPathJo: Mobile Application for Wheelchair Accessibility to public buildings in the city of Amman**

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**May 27<sup>th</sup>, 2024**

Submitted in partial fulfillment of the requirements of B.Sc. Degree in Computer Engineering

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Eng. Saadeh Sweidan

Signature:

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## **DEDICATION**

We would like to express our deepest gratitude to Dr. Saadeh Sweidan, our esteemed supervisor, for his invaluable guidance, support, and encouragement throughout the course of our graduation project. His expertise, insights, and unwavering dedication have been instrumental in shaping the success of our endeavor. We are truly grateful for his mentorship and contributions to our academic journey.

Furthermore, we extend our sincere appreciation to the faculty and staff of the University of Jordan's Engineering Department for their continuous support and resources that have facilitated our project's development and completion. Their commitment to excellence has provided us with a conducive learning environment and invaluable opportunities for growth. We are indebted to their commitment to our academic and professional advancement that has greatly contributed to our learning and growth as aspiring engineers.

## **ABSTRACT**

This project proposes a solution to address accessibility challenges in urban environments, particularly in the city of Amman. The rapid urbanization of Amman has led to increased population growth, resulting in inadequate accessibility measures in public buildings. As highlighted by His Majesty King Abdullah II at the Global Disability Summit, "Our future lies in inclusion. We cannot move forward if we leave anyone behind." We've worked to tackle these challenges to achieve the optimized intersection of human rights and inclusion within the context of accessibility in urban environments, with a specific focus on the city of Amman. This project introduces WellPathJo, a comprehensive mobile application designed to provide real-time accessibility information about public buildings and essential services in Amman. WellPathJo aims to empower individuals with mobility impairments to navigate the city independently and participate fully in societal activities. The application features innovative functionalities, including community engagement, emergency assistance, indoor maps, screen readers compatibility, voice commands, equipment supplier recommendations, and chatbot interaction. By integrating these features, WellPathJo seeks to revolutionize accessibility, promote inclusivity, and enhance the overall urban landscape of Amman. Testing was conducted on various Android devices with different versions, ensuring compatibility and functionality. The results showed that WellPathJo successfully worked on 100% of the tested devices, allowing users to create accounts and utilize all the application features.

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# **CHAPTER 1**

## **INTRODUCTION**

The rapid urbanization of Amman over the past two decades has significantly increased its population, leading to a higher number of individuals relying on wheelchairs. This demographic shift has highlighted a critical issue: the lack of accessibility in many public buildings throughout the city. This shortfall poses considerable challenges for wheelchair users, making it difficult for them to navigate urban spaces, access essential services, and fully participate in societal activities.

Amman's urban growth has been marked by substantial planning challenges, including inadequate public infrastructure and poor accessibility for individuals with disabilities [1]. The city's fast-paced development has often outstripped the implementation of inclusive urban planning measures, resulting in significant barriers for those with mobility impairments [2].

Addressing these accessibility issues is essential to ensure equitable access to public spaces and uphold inclusivity and social justice within Amman's urban environment. Implementing comprehensive accessibility measures would not only improve the quality of life for wheelchair users but also align with broader sustainable urban development goals [3].

### **1.1. Problem Definition**

Many public buildings in Amman present significant challenges for wheelchair users, impeding their ability to perform daily activities such as visiting shops or offices. This lack of accessibility often leads to feelings of exclusion and difficulty in maintaining independence. Addressing these accessibility issues is crucial for ensuring that all residents of Amman can navigate the city easily and feel included in society.

A survey by the Amman Municipal Authority assessed 150 public buildings for accessibility and found that none offered mobile assistance services for individuals with mobility impairments. Interviews with wheelchair users revealed that 70% experienced frustration and difficulty accessing essential services and participating in community activities due to these barriers[4].

A poignant example involves a wheelchair user who struggled to renew her identification card at a government office because the building had a flight of stairs and no wheelchair ramp. This situation forced her to rely on passersby for help, compromising her dignity and autonomy. Another individual missed a job interview because the office building lacked accessible entrances, highlighting the severe impact of inadequate infrastructure on employment opportunities[5].

Plus, that the increase of new buildings has a great opportunity to make them suitable for a wheelchair user below we can see some old Hospital in Amman:



Figure 1. Photo of Iron sheet used as a ramp in a hospital in Amman.[1]

## 1.2. Proposed Solution

To address the urgent demand for enhanced accessibility information in Amman, we propose creating a comprehensive mobile application. This user-friendly platform will provide individuals with mobility impairments real-time access to information about the accessibility features of public buildings and essential services across the city. Additionally, the application will compile data on inaccessible buildings, enabling proactive measures to improve accessibility and enhance inclusivity throughout Jordan.

## 1.3. Project Deliverables

The WellPathJo application aims to revolutionize accessibility in Amman by offering a comprehensive suite of features tailored to the needs of individuals with mobility impairments. Users can easily locate wheelchair-accessible public buildings across the city, with detailed information on accessibility features such as ramps, elevators, and parking. Community engagement is fostered through feedback mechanisms, allowing users to share experiences and insights. Personalized recommendations based on user preferences enhance the overall experience, empowering individuals to navigate the city with autonomy and confidence. WellPathJo is poised to promote inclusivity and accessibility, reshaping the urban landscape of Amman for the better.

## **1.4. Project Impact**

The WellPathJo project aims to revolutionize Amman's societal, economic, and health landscapes by addressing accessibility barriers for individuals with mobility impairments. Socially, the app fosters inclusivity by enabling independent city navigation and community engagement through comprehensive accessibility information. Economically, it promotes increased patronage and economic participation by enhancing accessibility to public buildings. Health-wise, it reduces physical and mental stress by providing reliable wheelchair-friendly routes and facilities information, supporting users' physical and mental well-being and promoting frequent outings and social interactions. This, in turn, boosts confidence, independence, and overall quality of life for users.

# CHAPTER 2

## RELATED WORK

In the domain of accessibility applications, various platforms aim to enhance inclusivity and empower individuals with diverse needs. However, we spotlight three top-rated applications globally, highlighting what distinguishes the project we have developed since We have developed a new feature that will be of great benefit to users who may lack sufficient knowledge or experience into Amman community.

### 2.1 AccessibleJordan

“AccessibleJordan” [6] is a mobile application designed to assist individuals with disabilities in locating accessible establishments across Jordan, available on both iOS and Android platforms. The app features a searchable database encompassing a variety of accessible venues, including restaurants, cafes, hotels, and tourist attractions as shown in figure2, allowing users to filter their searches by place type, location, or specific accessibility features. Each venue entry provides comprehensive details such as wheelchair ramps, accessible bathrooms, along with essential information like address, contact details, and operating hours.

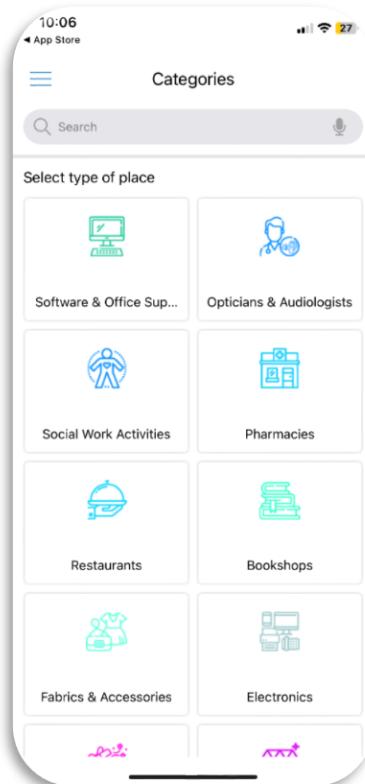


Figure 2. AccessibleJordan Main Page [6]

The AccessibleJordan app in figure2 serves as a valuable resource for individuals with disabilities, offering essential information about accessible locations. However, it does face certain limitations. For instance, the absence of color-coded features can pose challenges for users who rely on visual cues. Additionally, the database of accessible places is still in development, meaning not all such locations in Jordan are included. Furthermore, the app lacks a community feature, which could enable users to interact, share experiences, and provide mutual support.[6]

## 2.2 iAccess Life

iAccess Life in figure3 is a mobile app dedicated to enhancing accessibility and inclusivity for individuals with disabilities. It provides location-based accessibility information for venues like restaurants and hotels, along with detailed ratings and reviews covering features like ramps and restrooms. The app also offers GPS navigation tailored to users' accessibility needs, aiding in easier navigation. [7]

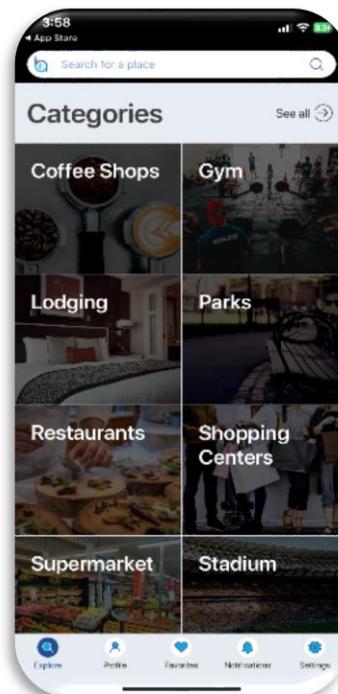


Figure 3 IAccess Life Main Page [7]

iAccess is an invaluable tool for individuals with disabilities, offering crucial details about accessible locations. Nevertheless, it does come with certain limitations. One notable drawback is the absence of color-coded features, making it difficult for users who depend on visual cues. Furthermore, the app's database of accessible places is still a work in progress, meaning not all such locations are currently included. Additionally,

iAccess lacks a community feature, which could foster interaction, experience-sharing, and mutual support among users.[7]

## 2.3 Roll Mobility

Roll Mobility in figure4 is a mobile application that provides information on the accessibility of restaurants, public spaces, businesses, trails, and parking spaces for people who use wheelchairs or have mobility issues. The app is community-driven and relies on user reviews to provide accurate data. At Roll Mobility, you can effortlessly access and share comprehensive details about essential features such as wheelchair ramps, elevators, and accessible restrooms [8]. Their platform adopts a community-led approach, ensuring that they prioritize delivering the information users require, all while raising awareness among their able-bodied allies about what it takes to make a space fully inclusive.

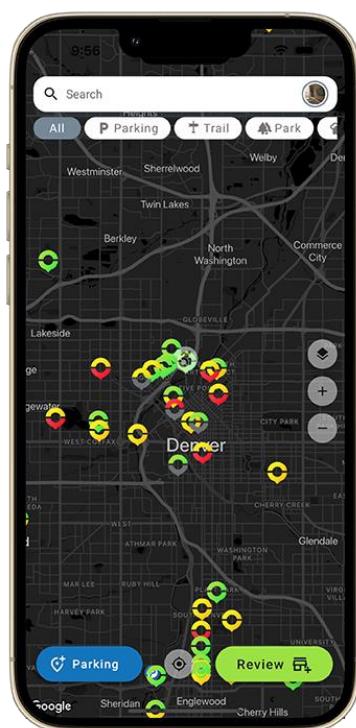


Figure 4. Roll Mobility main screen.[8]

While Roll Mobility as shown in figure4 serves as a valuable platform for accessing information on the accessibility of various locations, its reliance on user-generated content poses significant limitations. This dependence introduces the risk of incomplete, inaccurate, or inconsistently reported data, undermining the app's reliability and usefulness. Furthermore, disparities in user engagement across different regions may result in uneven coverage and accessibility information gaps.

Table 1. Feature Comparison

Features	WellPathJo	AccessibleJordan	Roll Mobility	iAccess Life
Review and Rating	✓	✓	✓	✓
Search	✓	✓	✓	✓
Filtering	✓	✓	✓	✓
Add New Place	✓	✓	✓	✗
Localization	✓	✓	✓	✗
Accessibility features stored within the application	✓	✓	✗	✗
Adding images on Buildings	✓	✗	✓	✗
Color-Coded system	✓	✗	✓	✗
Notification	✓	✓	✗	✗
Add new category	✓	✗	✗	✗
Dark mode	✓	✗	✗	✗
Report system	✓	✗	✗	✗
Navigate to Screen Reader	✓	✗	✗	✗
Voice Command	✓	✗	✗	✗
Chatbot	✓	✗	✗	✗
Community Engagement	✓	✗	✗	✗
Emergency Settings	✓	✗	✗	✗
Building owner access	✓	✗	✗	✗

In Table 1, while AccessibleJordan [6] and Roll Mobility [8] offer a subset of features similar to WellpathJo, they lack the comprehensive range provided by our application. AccessibleJordan, for instance, provides review and rating, search, filtering, and multilingual support but does not include advanced functionalities like navigation support for screen readers or voice command integration. Similarly, Roll Mobility focuses on visual accessibility aids such as image addition and color-coded systems, but lacks features like a chatbot or community engagement tools. iAccess Life [7], while fostering a community-driven approach through user-generated content, primarily focuses on review and rating, search, and filtering, omitting more advanced features present in WellpathJo. This distinction highlights the unique value proposition of WellpathJo as a comprehensive solution offering a wide array of features to address the diverse needs of users in the accessibility domain. Additionally, while AccessibleJordan includes notification functionality, WellpathJo stands out with unique offerings such as notifications, the ability to add new categories, dark mode, and a robust report system, distinguishing it as a comprehensive solution catering to diverse user needs in the accessibility domain.

# CHAPTER 3

## SOFTWARE TOOLS AND SYSTEM DESCRIPTION

In this chapter, our attention turns towards a thorough examination of the application's theme and requirements. From essential must-haves to those cool, extra features, we'll explore both the functional and non-functional aspects that lay the groundwork for our app. Moreover, we'll delve deep into the implementation details of various features and the overarching design. This discussion is aimed at offering a comprehensive insight into the application's functionality and its alignment with specified criteria and user expectations.

### 3.1.The Application Theme

We adhere to the principle of "the simpler the better" in our work, aiming to create a user experience that is intuitive and accessible for wheelchair users. Carefully considering their unique needs and challenges, we crafted our application for wheelchair users. Our process involved thorough research in the UI/UX field, which plays a crucial role in application accessibility, as well as expert consultations and surveys to inform our decisions. The result is a user-friendly interface designed to meet the diverse needs of wheelchair users. Our color palette, featuring shades of black, white, and gray, exudes sophistication and clarity, enhancing the overall user experience.



Figure 5. WellPathJo logo

### 3.2.System Overview

"WellPathJo" is a groundbreaking application designed for two types of users: building owners and wheelchair users. Building owners can add their buildings to the app and provide detailed information about their accessibility features, while wheelchair users can benefit from a tailored experience to enhance their mobility and accessibility in Amman.

With its intuitive interface, users can effortlessly navigate the city, gaining valuable insights into the accessibility features of various buildings and facilities. From ramps and elevators to accessible bathrooms and parking spaces, WellPathJo serves as a comprehensive guide, empowering users to explore their surroundings with ease and independence.

Through real-time updates and community contributions, this innovative tool fosters inclusivity, ensuring that everyone can fully participate in the vibrant life of Amman. WellPathJo keeps information current by allowing building owners to manage their building's accessibility details directly. Additionally, the app collects data on inaccessible buildings, driving efforts to make more buildings in Jordan accessible.

### **3.2.1. System Components**

In our system, we employ Android Studio and Visual Studio Code as our integrated development environments (IDEs) to ensure a seamless development experience. Our application is built using Firebase for backend services, Flutter for the UI framework, and Dart as the primary programming language. This combination allows us to create a high-performance, cross-platform application with real-time updates and rich user experience. The main components of our application are:

- Firebase: Provides the application with security services.
  - Database: We use Cloud Firestore as our NoSQL database and Firebase Storage for reliable data storage, management, and retrieval.
  - Authentication: We rely on Firebase Authentication for robust user authentication capabilities, ensuring secure access to our application's features and data.
- Flutter and Dart: The primary user interface, that allows users to interact with the system and access its features.

### **3.2.2. User Requirements**

In our application, there are three distinct user roles: admin, wheelchair user, and building owner. The admin possesses comprehensive control over all aspects of the application, ensuring the accuracy and integrity of the information provided. Building owners have the capability to add their buildings to the platform, provide accessibility details, and subsequently manage their building's information to ensure it remains current and accurate. Wheelchair users utilize the application to navigate buildings and assess whether the facilities meet their accessibility requirements.

*Table 2.shows users list of requirements specific needs, expectations, and constraints.*

Users	Users Requirements
<b>Admin, Wheelchair user and Building owner user</b>	<ul style="list-style-type: none"> <li>▪ Log in to Existing Account</li> <li>▪ Change and Reset Password</li> <li>▪ Sign Out of Application</li> <li>▪ Add New Place</li> <li>▪ Update Account Information</li> <li>▪ Switch Language to Arabic or English</li> </ul>
<b>Wheelchair user and Building owner</b>	<ul style="list-style-type: none"> <li>▪ Provide Building Feedback</li> <li>▪ Post, Comment, and Reply in Community</li> <li>▪ Add Emergency Contact</li> <li>▪ Add Places to Favorites</li> </ul>

<b>Wheelchair user only</b>	<ul style="list-style-type: none"> <li>▪ Create New Account</li> <li>▪ Verify Email Accounts</li> </ul>
<b>Admin only</b>	<ul style="list-style-type: none"> <li>▪ Delete or (Edit and Accept) New Place Additions</li> <li>▪ Edit or Delete Community Posts, Comments, and Replies</li> <li>▪ Edit or Delete Building Information</li> <li>▪ Automatically Send Emails for Inaccessible Buildings</li> <li>▪ Delete Buildings.</li> </ul>
<b>Building owner only</b>	<ul style="list-style-type: none"> <li>▪ Edit or Delete Own Building Information.</li> </ul>

### 3.2.3. Functional and Non-Functional Requirements

Functional requirements define the specific functions or features that a system must perform, outlining the actions it should take under certain conditions. Non-functional requirements, on the other hand, specify the qualities or attributes that the system must possess.

Table 3 presents the interactive features available within our application, enabling users to engage with various functionalities. These features are designed to enhance user experience and provide valuable interactions.

*Table 3.shows the functional requirements of the system for all the users.*

Functional Requirement	Description
<b>Create an account</b>	Wheelchair users can only create a new account using a unique email address, after which they will receive a verification email to ensure the validity of the provided email address. The email and password information are securely stored in Firebase for authentication purposes, while user information is stored in Firestore.
<b>Logging into the system</b>	We feature two separate login screens: one for wheelchair users and admin, and another for building owners. Successful login requires entering the correct email address and password, which must be stored in Firebase Authentication.
<b>Tailored Users Settings in Application Sidebar</b>	In the application's settings accessible from the sidebar, users can find various features tailored to their needs, such as the ability to change passwords, update account information such as editing personal details (first name, last name, gender), log out from their account, and access other relevant functionalities.

<b>Categories and Building Management</b>	The Categories Management component organizes establishments such as Banks, Universities, and Hospitals, facilitating user navigation by storing essential information. Within each category, Building Management oversees detailed establishment data, including textual descriptions, geographical coordinates, Google Maps integration, visual imagery, and accessibility features breakdown, empowering users to make informed decisions.
<b>User Feedback and Accessibility Rating System with Color Coding</b>	User Reviews and Ratings inform the Accessibility Rating System, which computes accessibility scores for buildings. These scores are then visually displayed through the Color-Coding System that shows the lower ratings are coded orange for partial accessibility or red for not accessibility while green for full accessibility, helping users quickly assess accessibility levels.
<b>Search and Filter Features</b>	Users can search for buildings using keywords or voice commands, with real-time results showing multiple matches. Alternatively, they can use the Filtering Functionality to refine searches by category and accessibility features, enhancing engagement and ease of use.
<b>Screen Reader</b>	Our app supports screen readers like "TalkBack" on Android, which users manage through their device's system settings for security. An accessible button within the app provides easy access to "TalkBack" settings, ensuring enhanced accessibility for visually impaired users.
<b>Community</b>	Users can share experiences and recommendations about wheelchair-accessible buildings, fostering a supportive community and raising awareness. They can delete or edit their posts, comments, and replies, ensuring accuracy and engagement. Users can also attach images and videos to enhance their posts. The admin can edit or delete any content to maintain quality, promoting a positive and inclusive environment.

<b>Add new place</b>	The "Add New Place" feature allows users and admin to expand the app's database with wheelchair-accessible locations, stored in Firestore. Admin ensure data accuracy through review and editing, while users can introduce new categories, promoting inclusivity and flexibility within the app.
<b>Notification</b>	In the WellPathJo app, we utilize Firestore Cloud Messaging for notifications. Scheduled notifications remind users to engage with the app, while automatic notifications alert admin of new place additions for quick review. This system encourages engagement, ensures data accuracy, and enhances the user experience.
<b>Localization</b>	In our application, we use the Localization feature to offer both English and Arabic languages. This accommodates diverse user preferences and enhances accessibility, ensuring inclusivity and user satisfaction.
<b>Chatbot feature</b>	The chatbot assists users with accessibility inquiries using predefined questions and responses about wheelchair accessibility, ramps, elevators, restrooms, parking, location details, contact information, and support services in Amman. With the matching mechanism it ensures accurate responses to user queries, even with slight variations or misspellings.
<b>Admin Report Screen</b>	The admin report screen enables users to flag issues, categorized into buildings marked as red for immediate attention and user-reported concerns, forming a comprehensive dataset of inaccessible buildings. Each section includes a "send email" button to prompt resolution via formal email templates. Admins can forward user issues to relevant parties, fostering a proactive approach to addressing building accessibility concerns.
<b>Enhancing User Safety with Emergency Settings</b>	Our feature enables users to designate one emergency contact for critical communication, prioritizing personal safety. We enhance user privacy by securely storing contact information locally, ensuring data protection within the application.
<b>Streamlining Access with Favorite Places</b>	Our feature allows users to save and access their most cherished or frequently visited locations with ease. Whether it's a restaurant, vacation spot, or business location, users can quickly add these places to their

	favorites list for future reference, staying organized and connected.
<b>Dark and Light Mode Support</b>	Our app supports both dark and light modes for user convenience. Dark mode reduces eye strain with darker colors in low light, while light mode offers comfortable viewing in brighter conditions.

Non-functional requirements define software performance standards, as shown in Table 4. System users refer to all users.

*Table 4. Non-Functional Requirements of the System.*

Non-Functional Requirement	Description
<b>Security</b>	Email and password are securely stored in Firebase authentication. System users cannot login to the mobile application if the email is not stored there
<b>Performance</b>	The mobile application uses Firebase to get real-time information and data from Firestore database and Storage.
<b>Flexibility</b>	The system must be flexible to update and change information like password, Account information buildings information.
<b>Usability</b>	The application must be user-friendly and easy to use by all authorized users.
<b>Reliability</b>	The application must be reliable

### 3.3. Firebase

Firebase is selected for its versatility, ease of integration, and reliability in managing a wide range of database requirements, from small-scale to enterprise-level applications. Unlike conventional SQL databases, we chose Firebase for its NoSQL approach, which provides flexibility in handling unstructured and semi-structured data.

Furthermore, Firebase seamlessly integrates with other Firebase services, streamlining development processes and enabling real-time updates. This aligns perfectly with our project's need for dynamic and responsive functionality. Table 5 illustrates Firebase services utilized in our application, each serving distinct purposes to enhance functionality and user experience.

Table 5. Firebase Services Used.

Firebase Services Used	functionality
<b>Firebase Authentication</b>	using authentication services supporting email/password, and verification.
<b>Cloud Firestore</b>	A NoSQL database used for storing and querying structured data using collections and subcollections such as building information, user profiles, community content, average ratings, reports, and newly added places.
<b>Firebase Storage</b>	Storage solution for user-generated content such as images and videos.
<b>Firebase Cloud Messaging (FCM)</b>	A messaging solution for sending notifications to both users and administrators.

### 3.1.1. WellPathJo Firestore

The Cloud Firestore A flexible, scalable database for mobile, web, and server development. With a suite of services at our disposal, Cloud Firestore serves as our primary database solution. Within our project, Cloud Firestore acts as the central hub for storing diverse datasets. Leveraging Cloud Firestore ensures efficient data organization, easy accessibility, and scalability to accommodate our application's demands.

#### ➤ Average Rating:

In Firestore, there exists a category titled “Average Rating” in figure6 designed to aggregate user-submitted ratings for buildings. This category calculates and stores the final average rating derived from these user inputs. The resulting average rating serves as a pivotal metric for implementing a color-coded system, facilitating intuitive visualization and comparison of building ratings.

The screenshot shows the Firebase Cloud Firestore interface for the 'wellPath-app' database. The left sidebar lists collections: (default), AddNewPlace, Average Rating, Buildings, CommunityPost, Reports, Status, User, and User Posts. The 'Average Rating' collection is selected and expanded, showing its documents. One document, 'artandeng', is expanded to show its fields: Rate (with value 5) and Rate: 5. Other documents listed include Ritzhotel, Romero, Shoman library, Shospital, aau, abdalih, abdalim, abulail, aca, admission, argriculture, and artandeng.

Figure 6. shows the Average Rating collection with the documents that present the buildings.

“Average Rating” collection have document and field as shown in figure7.

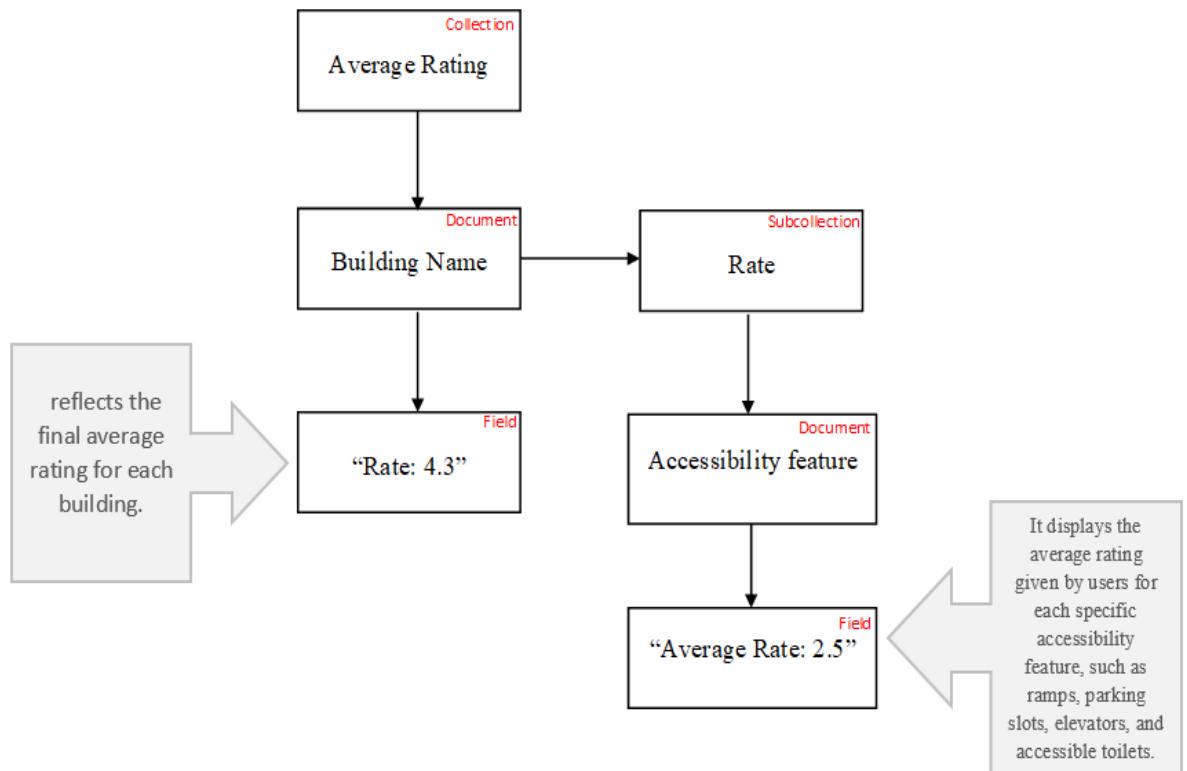
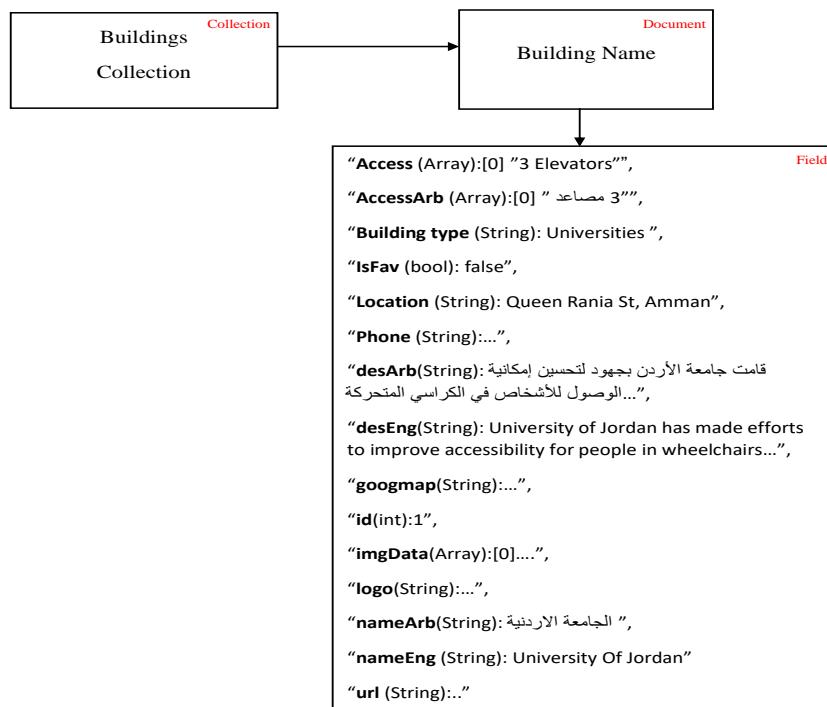


Figure 7.“Average Rating” collection.

### ➤ Buildings:

The “Buildings” collection in Firestore stores detailed information about various buildings within the application. Each document includes fields for accessibility features, building type, location, contact details, and descriptions in both English and Arabic. The “Access” and “AccessArb” arrays list accessibility amenities like elevators, ramps, and parking, while “Building type” specifies the category, such as “Universities.” Location is denoted by “Location”, and contact information is captured in the “Phone” field. Descriptions in both English “desEng” and Arabic “desArb” provide insights into the building's accessibility provisions and services. Additionally, each document contains an ID for unique identification, image data including a logo, and a website URL “url” associated with the building. As shown in figure8.

(a) *Firebase Buildings collection*



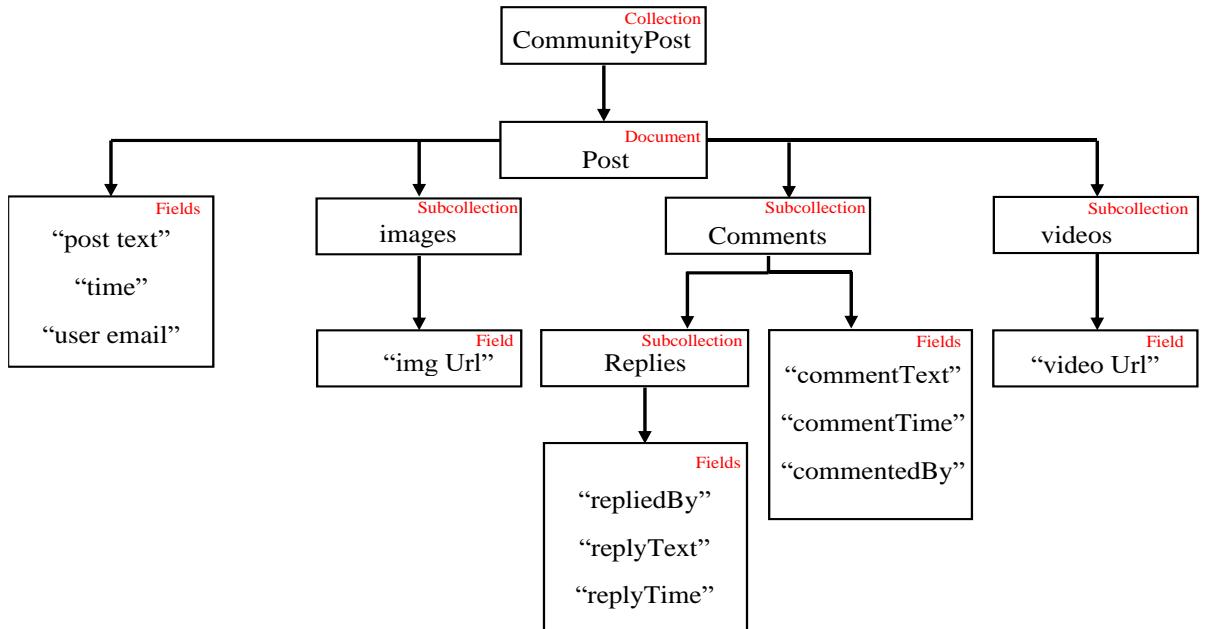
(b) "Buildings" Collection diagram.

Figure 8. "Buildings" Collection.

## ➤ Community Engagement:

The "CommunityPost" collection in Figure 9 organizes user-contributed posts in the Firestore Database, including fields for text content, publication time, and author details. Posts can have subcollections like "Images" and "Videos" for media content, and "Comments" for user feedback. Comments can also have a "Replies" subcollection for further interaction, with fields for text content, publication time, and responder details.

(a) *Firestore CommunityPost collection*



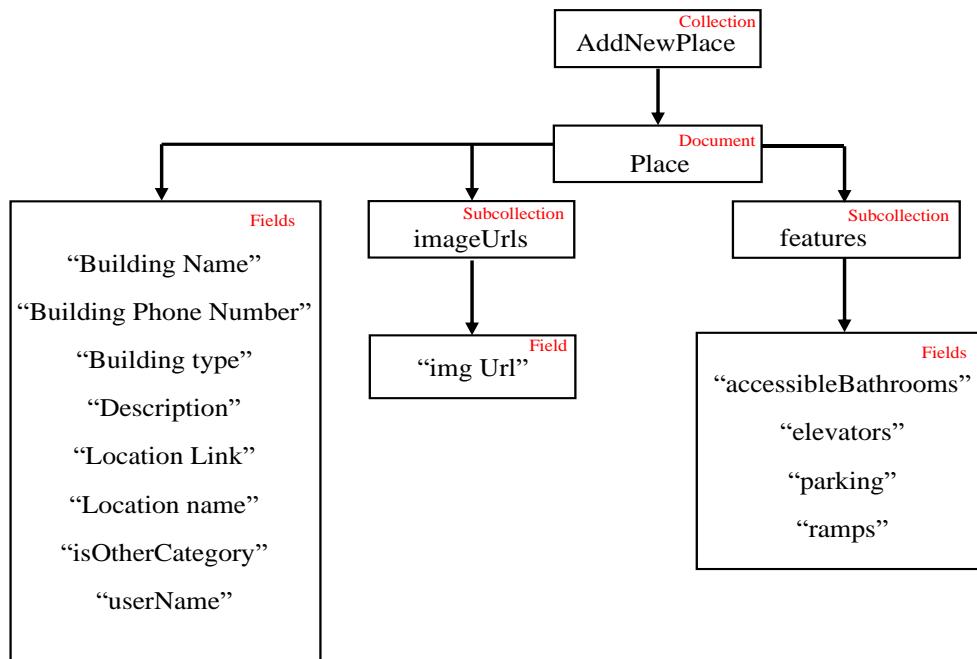
(b) *CommunityPost collection diagram*

Figure 9. shows the "CommunityPost" collection with the documents that present the Posts.

### ➤ Add New Place:

The "AddNewPlace" collection in Figure 10 streamlines user addition of new places via an admin-managed page. Each document includes essential attributes like "Building Name" and "Building Phone Number." The "Location Link" integrates with Google Maps, and "Description" provides insights. "Building Type" categorizes places, and "Username" records the user. Subcollections enhance functionality, with "Features" indicating amenities and "ImageUrls" housing image URLs.

(a) Firestore AddNewPlace collection



(b) AddNewPlace collection diagram

Figure 10. shows the "AddNewPlace" collection with the documents that present the new place.

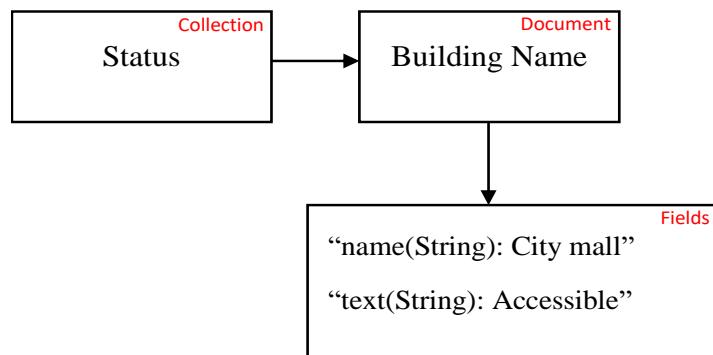
#### ➤ Status:

In the depicted figure11, there exists a category labeled "Status", wherein each document corresponds to a building within the application's framework. These documents consist of two primary fields: "name", denoting the name of the building, and "text", which reflects the current status of the respective building. The status is visually represented through color-coding within the application interface. When the color code associated with a building is green, indicating accessibility, the corresponding text field within the document stores the term "accessible." Similar

associations exist for other status colors, ensuring clarity and efficient communication of the building's current state to users of the application.

The screenshot shows the Cloud Firestore interface for the 'wellPath-app'. On the left, there is a sidebar with various icons and a list of collections: 'AddNewPlace', 'Average Rating', 'Buildings', 'CommunityPost', 'Reports', 'Status' (which is selected and expanded), 'User', and 'User Posts'. The main area displays the 'Status' collection with documents: 'Hilhotel', 'Interhotel', 'Kababji jordan', 'Khospital' (selected and expanded), 'MedicalSooq', 'PharmacyIbnArabi', 'PharmacyNijmehAbdoun', 'PharmacyTouchAngelOfMercy', 'RafidianBank', 'Ritzhotel', 'Romero', 'Shoman library', and 'Shospital'. A detailed view of the 'Khospital' document is shown on the right, containing fields: 'name: "Al-Khalidi Hospital"' and 'text: "Partially"'.

(a) *Firebase Status collection*



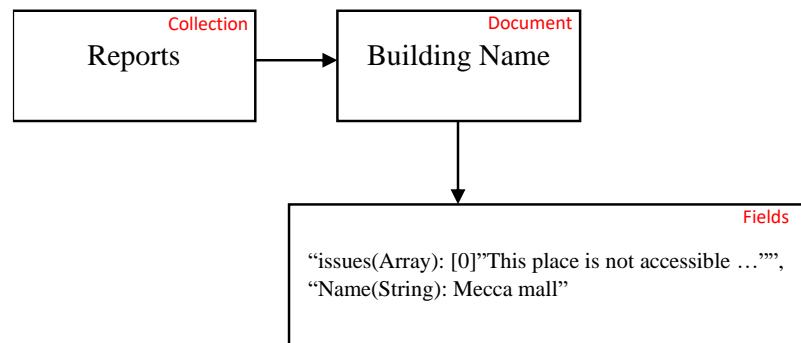
(b) *Status collection diagram*

*Figure 11. shows the "Status" collection with the documents that present the buildings within the application.*

## ➤ Reports:

Within the "Reports" category of the application as shown in figure12, each document serves as a representation of buildings reported on by users. These documents contain a crucial field named "name," designating the building's identity. Additionally, a vital array field called "issues" encapsulates all the reported problems and concerns that users have documented. This comprehensive collection of issues enables administrators to address and resolve building-related issues efficiently.

(a) *Firebase Report collection*



(b) *Report collection diagram*

*Figure 12.* shows the “Reports” collection with the documents that present the buildings has been reported within the application.

### 3.1.2. WellPathJo Firebase Storage

#### ➤ Maps Folder:

In the storage section, there is a "maps" folder in figure13 that houses subfolders named "aau", "just", and "uj". Each of these subfolders contains images showcasing the respective buildings and highlighting their accessibility features. These images serve as visual guides, providing users with a clear understanding of the accessibility amenities available at each building.

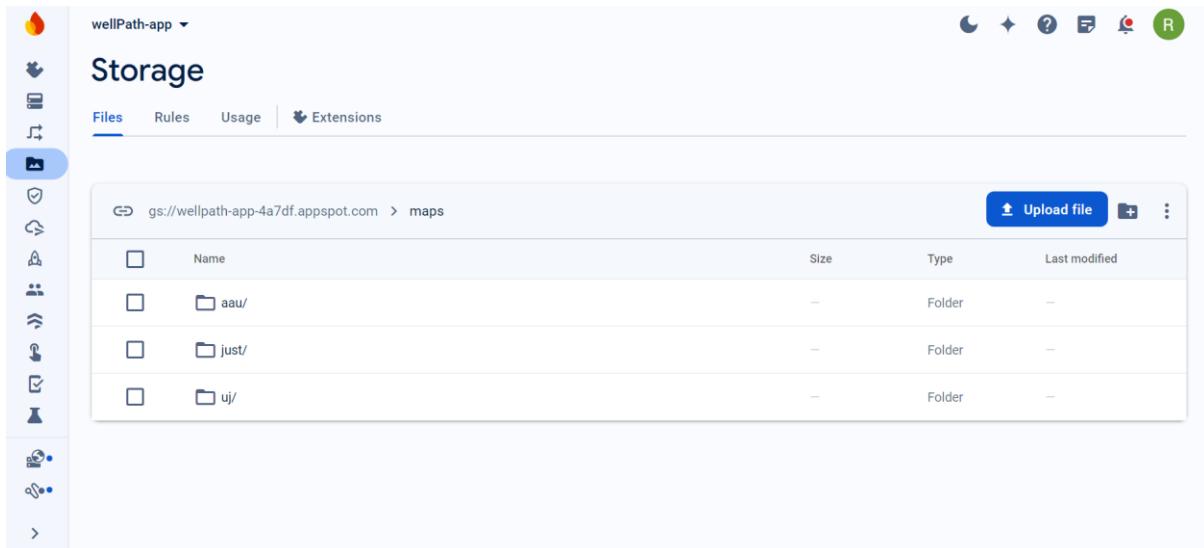


Figure 13. shows the folder where all the buildings that have accessible map.

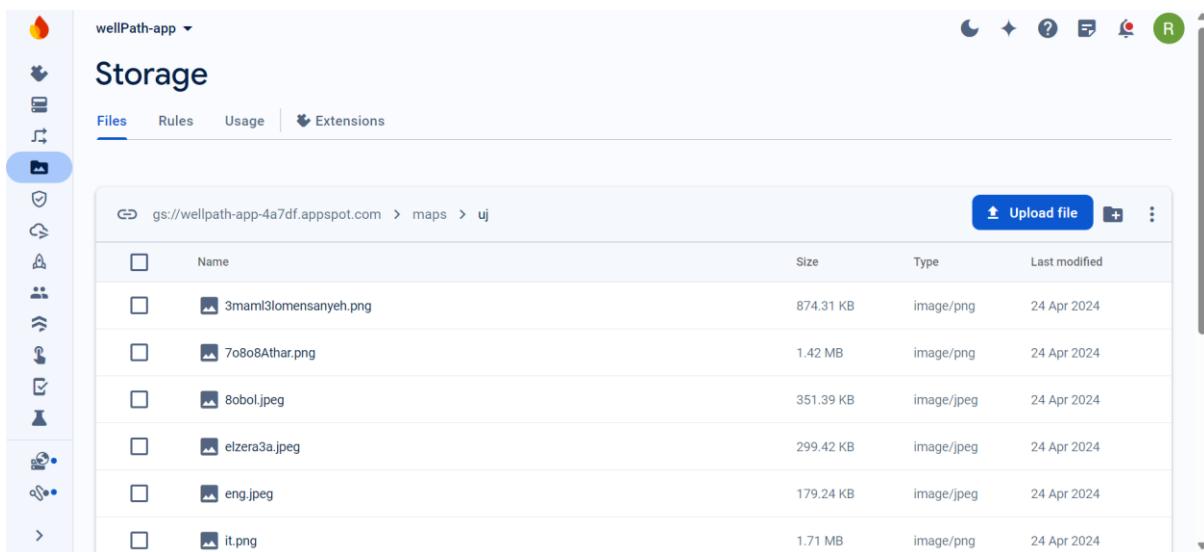
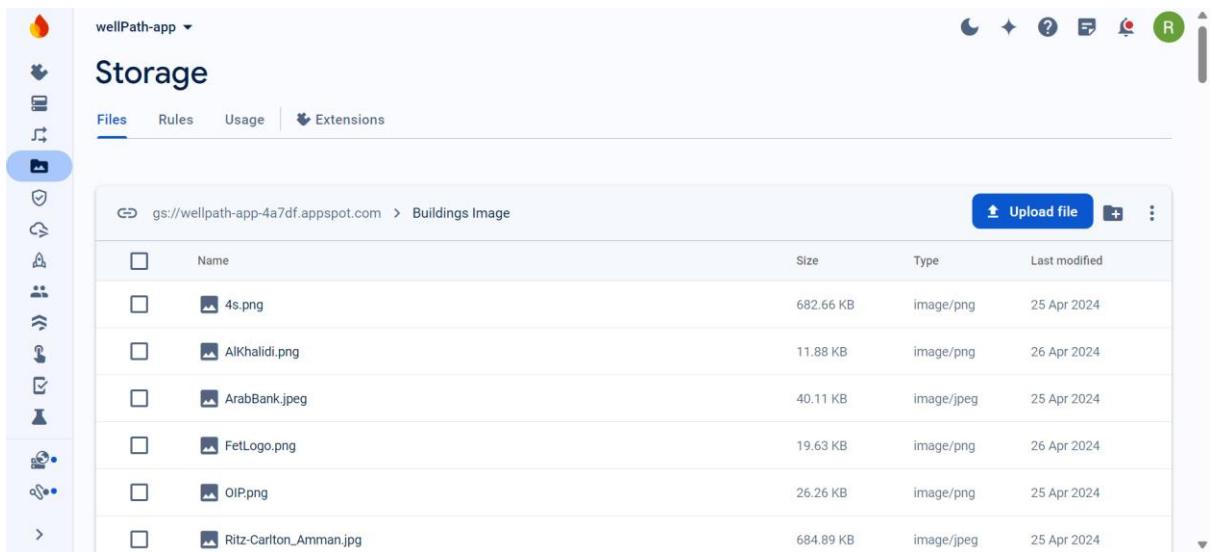


Figure 14. displays the “University of Jordan” folder.

The “University of Jordan” folder in figure14 is a repository containing accessible map images for its various departments, highlighting the availability of accessibility features throughout the university's facilities. These images offer a visual guide to the layout and amenities of each department, ensuring that individuals with diverse accessibility needs can navigate the university campus effectively. From ramps to elevators and designated parking areas, these maps provide valuable information to students, staff, and visitors, promoting inclusivity and ease of access within the university environment.

## ➤ Building images:

The Building Image Folder in figure13 within Firebase storage serves as a centralized repository containing images for all buildings within the application. This folder hosts a comprehensive collection of visual assets, including photographs and graphics, associated with each establishment. By consolidating building images in a single location, the folder streamlines access and management, facilitating efficient retrieval and utilization of visual content across the platform. This centralized approach ensures consistency in image storage and organization, optimizing the user experience by providing seamless access to building visuals throughout the application.



The screenshot shows the Firebase Storage interface for the 'wellPath-app' project. The left sidebar contains various icons for managing files, and the main area is titled 'Storage'. Below it, there are tabs for 'Files', 'Rules', 'Usage', and 'Extensions', with 'Files' being the active tab. The path 'gs://wellpath-app-4a7df.appspot.com > Buildings Image' is displayed above a table. The table lists seven files: '4s.png', 'AlKhaldi.png', 'ArabBank.jpeg', 'FetLogo.png', 'OIP.png', and 'Ritz-Carlton\_Amman.jpg'. Each entry includes a checkbox, the file name, size, type, and last modified date. A blue 'Upload file' button is located at the top right of the table area.

	Name	Size	Type	Last modified
<input type="checkbox"/>	4s.png	682.66 KB	image/png	25 Apr 2024
<input type="checkbox"/>	AlKhaldi.png	11.88 KB	image/png	26 Apr 2024
<input type="checkbox"/>	ArabBank.jpeg	40.11 KB	image/jpeg	25 Apr 2024
<input type="checkbox"/>	FetLogo.png	19.63 KB	image/png	26 Apr 2024
<input type="checkbox"/>	OIP.png	26.26 KB	image/png	25 Apr 2024
<input type="checkbox"/>	Ritz-Carlton_Amman.jpg	684.89 KB	image/jpeg	25 Apr 2024

Figure 15. displays the “Buildings images” folder.

## ➤ Videos:

The Videos folder in figure14 within Firebase serves as a repository for video content associated with user posts within the app. This folder is structured to include subfolders labeled with each user's email address, allowing for seamless organization and retrieval of user-specific video content. Within these user-specific folders, the videos uploaded by individual users are stored, ensuring clear attribution and easy access to the videos associated with each user's posts. By structuring the Videos folder in this manner, the app effectively manages and categorizes user-contributed video content, enhancing the overall user experience and facilitating the seamless integration of videos within the app's interface.

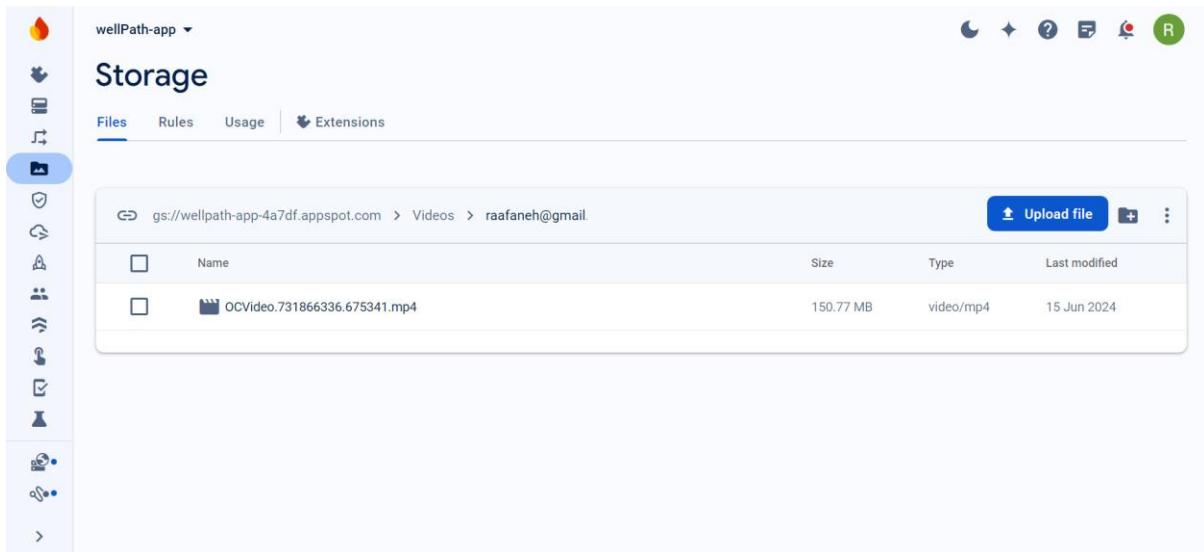


Figure 16. displays the “Videos” folder.

## ➤ Images:

The Images folder within Firebase is structured to accommodate two key functionalities: storage of images for newly added places and storage of user-specific images associated with posts. Under the “Images” directory, there exists a “New Place” subfolder dedicated to storing images of newly added locations, organized by the respective user's email address in figure15. This ensures clear attribution and organization of images for each user's contributed content. Additionally, another subfolder labeled with the user's email address directly contains images associated with their posts, facilitating easy access and retrieval of user-specific visual content within the app's interface in figure16.

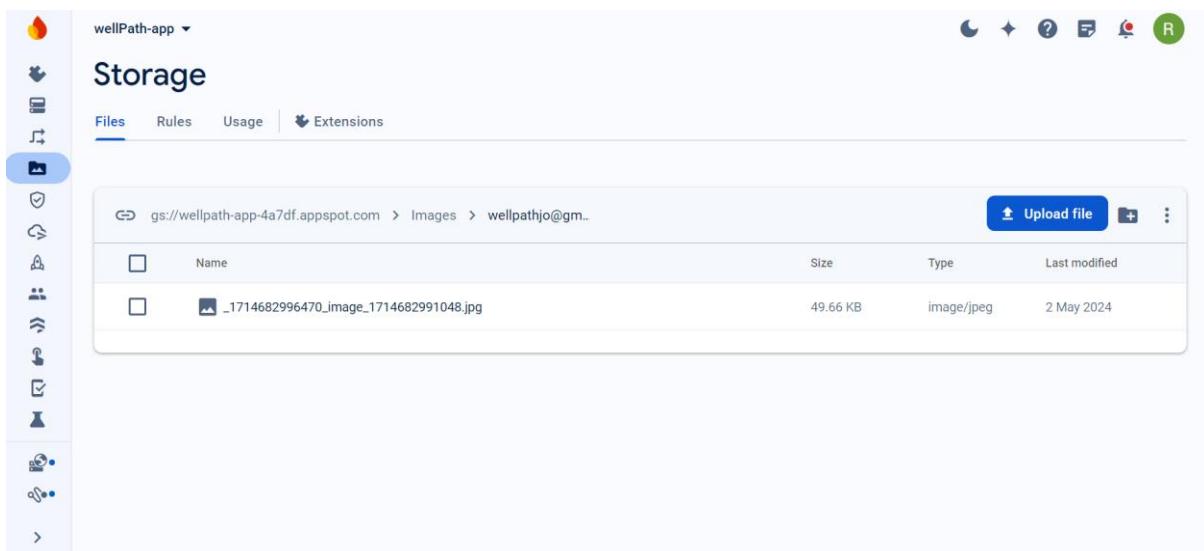


Figure 17. displays the “Images” folder.

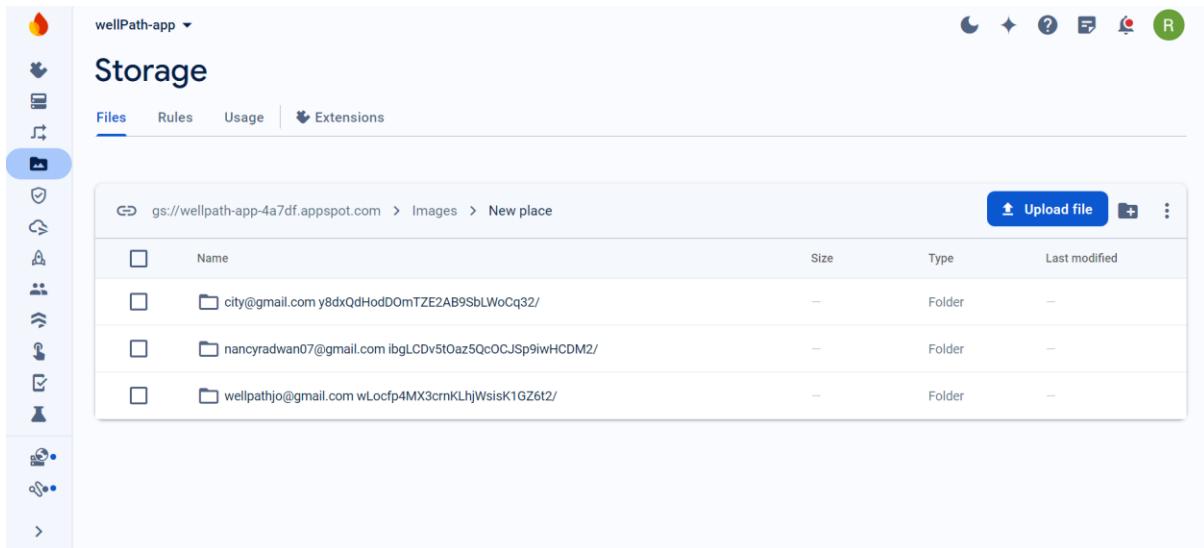


Figure 18. displays the "Images / New place" folder.

### 3.1.3. WellPathJo Firebase Cloud Messaging

In the WellPathJo app, we leverage Firebase Cloud Messaging to send notifications to all users daily at 10 am. These notifications, titled 'WellPathJo,' contain the message: 'Hello from the WellPathJo app, have a nice day. Remember, you can use the app to search places ' as in figure19. This scheduled reminder prompts users to engage with the app regularly, ensuring they stay connected and making the most out of its features.

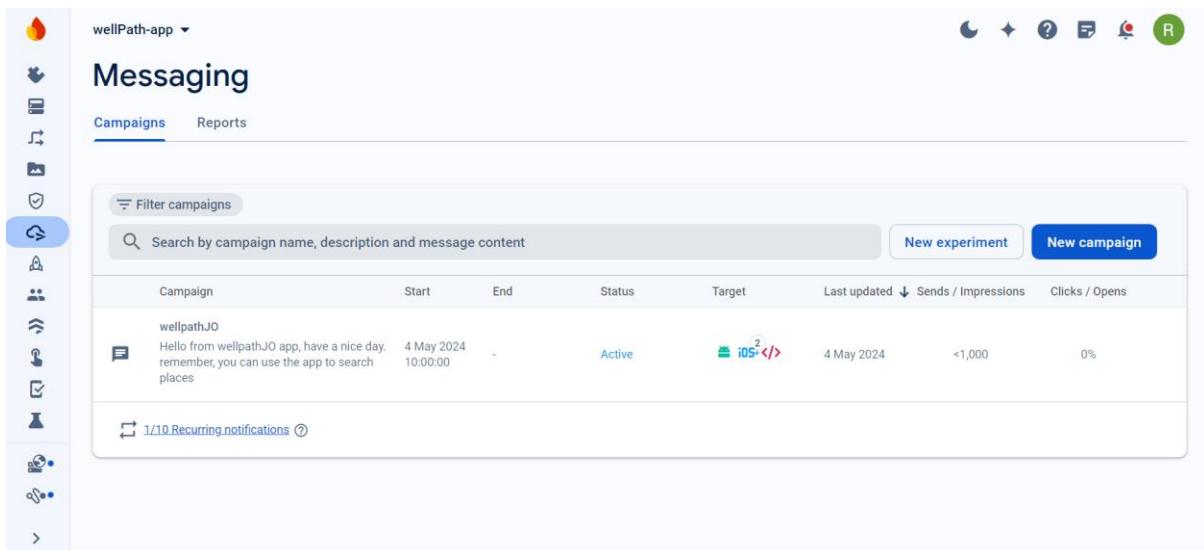


Figure 19.shows the firebase cloud messaging.

### 3.4. WellPathJo user interfaces

In this section, we explore the design and implementation details of our mobile application interfaces. We provide insights into each component, discussing the technologies utilized for their development. Additionally, visualizations are included to demonstrate the system's functionality, along with flow charts illustrating the internal operations of the dashboard screens.

#### 3.4.1. Mobile Application Components

This section outlines the primary components of the mobile application, as depicted in Figure 20. The application is developed using the Flutter framework with Dart programming language, integrated with Firebase services including Firestore, Cloud Storage, Firebase Messaging, and Authentication.

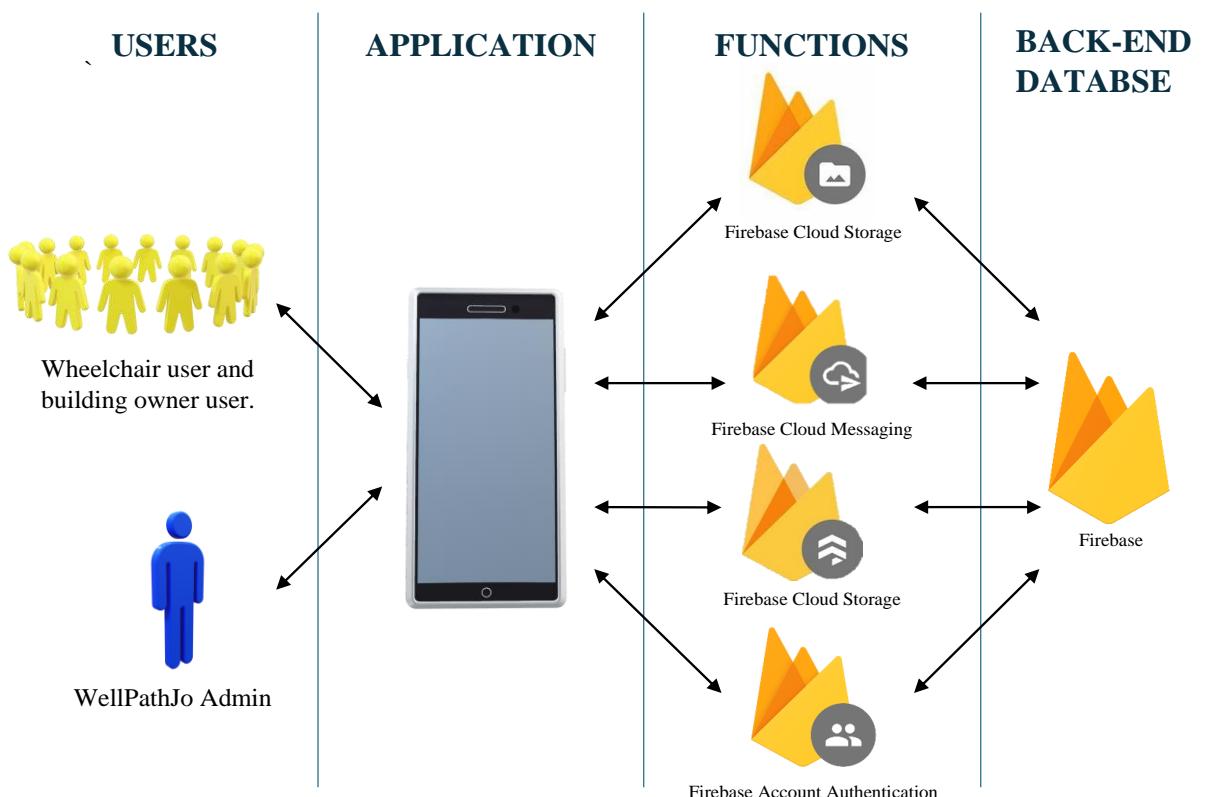
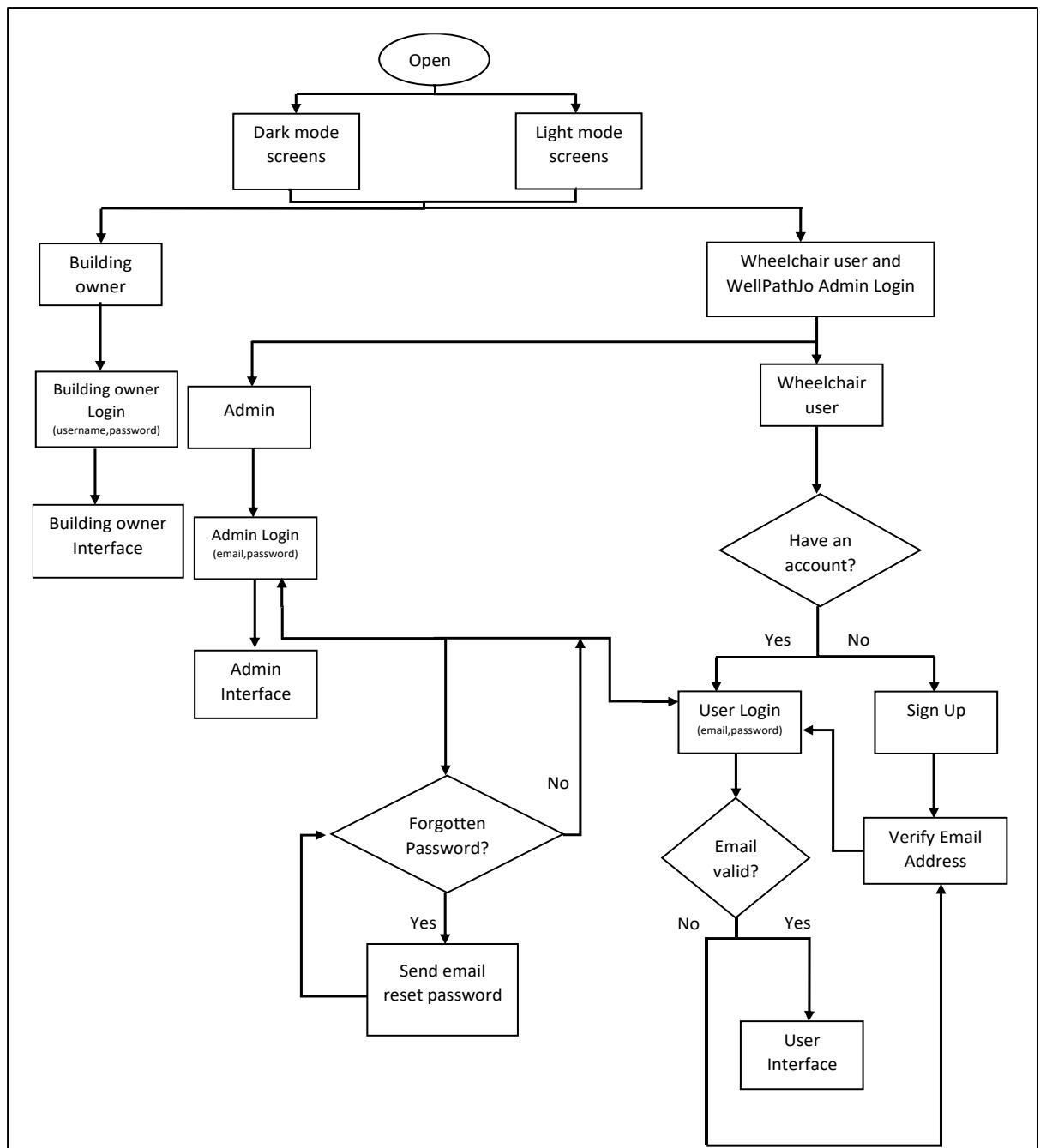


Figure 20. The application Component.

#### 3.4.2. Visualization of the Mobile Application

This section provides an in-depth overview of the mobile application interface and a comprehensive explanation of its functionality. Figure 21 illustrates the flow of the application, specifically outlining the authentication process for all users. The interface is designed to be intuitive and user-friendly, ensuring that users can easily navigate through various features and functionalities.



*Figure 21. Authentication process for all the users.*

Wheelchair users have distinct access privileges on screens compared to other user types, like WellpathJo admins and Building owners. Figure 22 illustrates all the features and capabilities available to users.

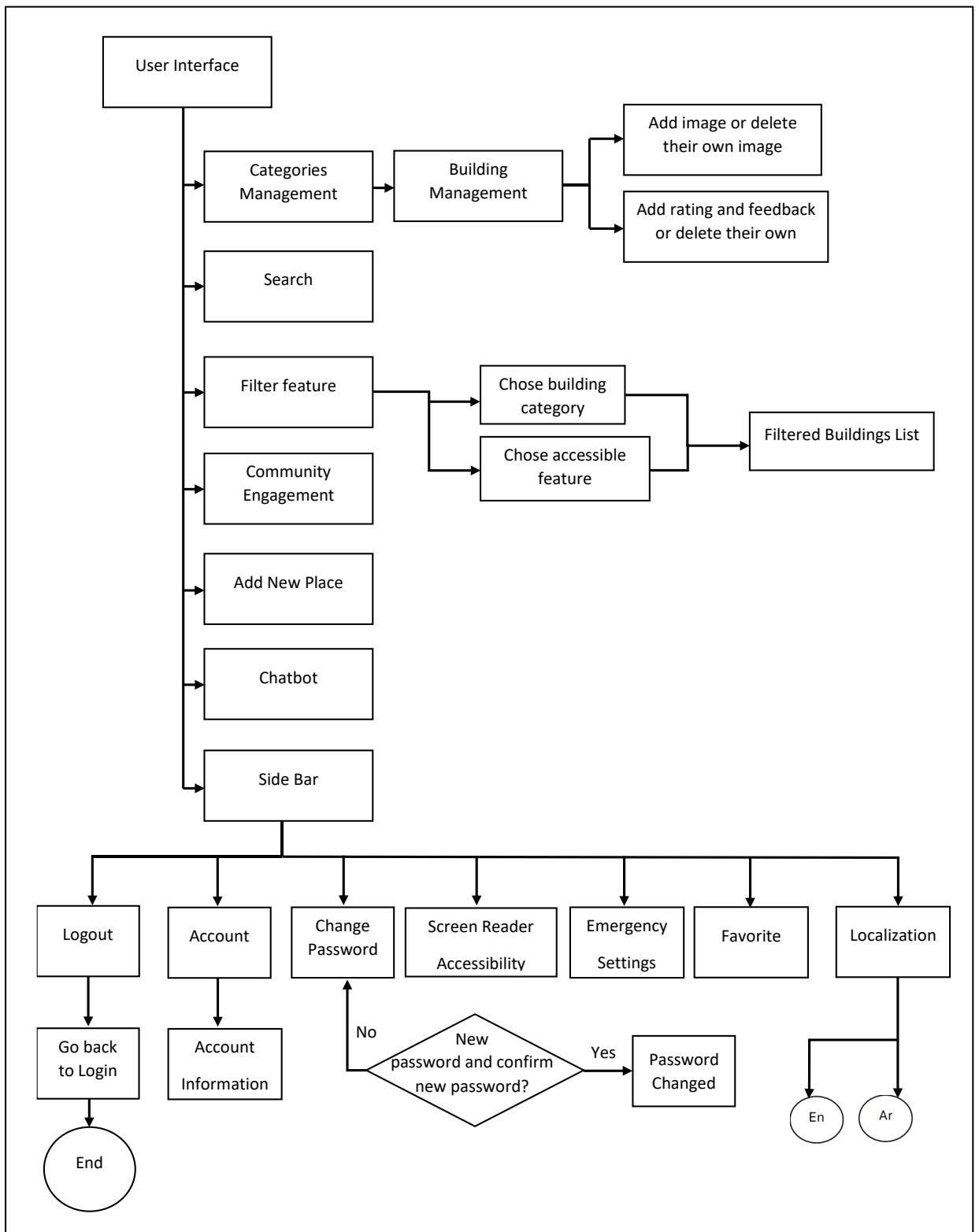


Figure 22. User interface.

The WellpathJo admin has unique screens and privileges, as shown in Figure 23.

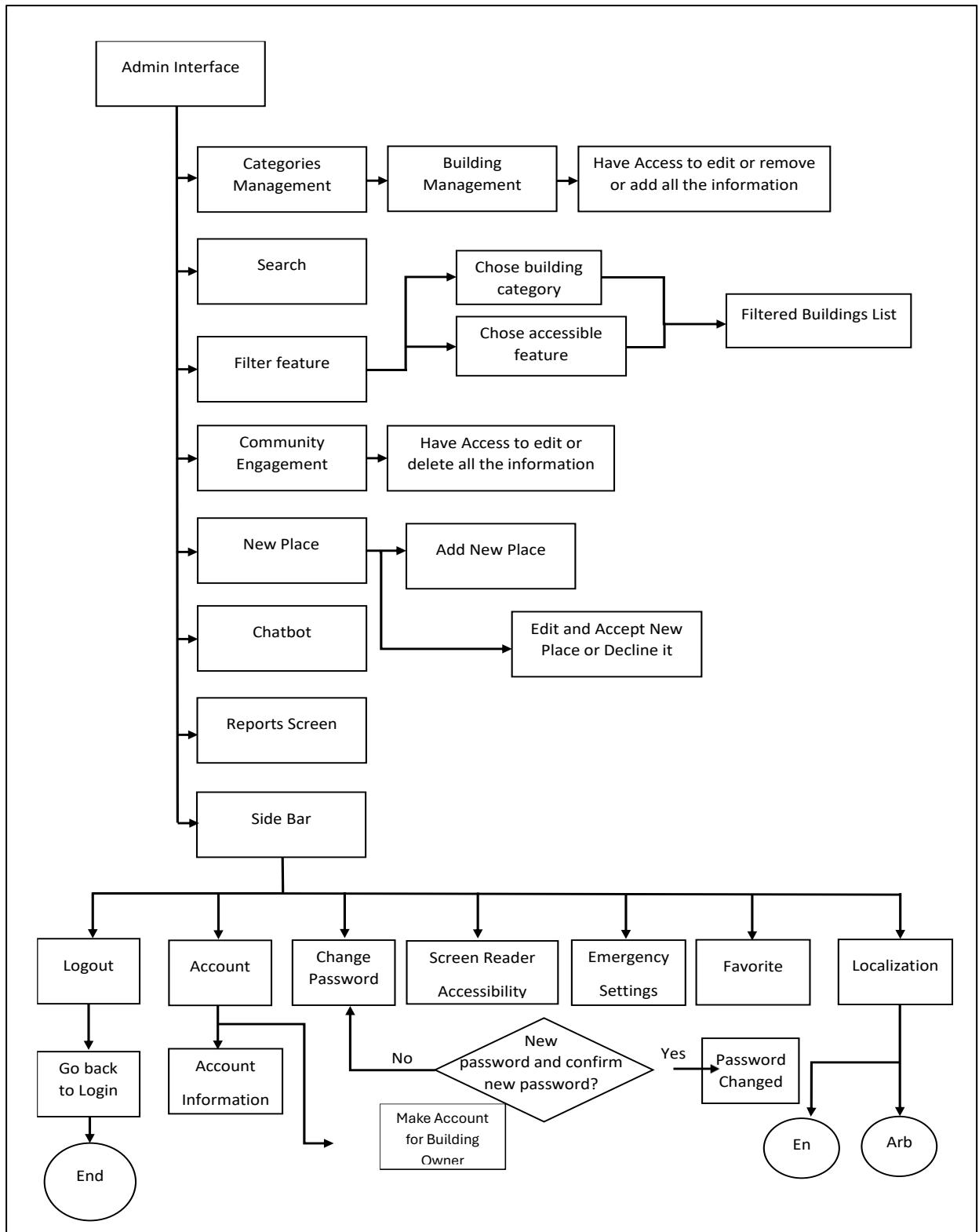


Figure 23. Admin interface.

While Building owners has also unique screens and privileges, as shown in Figure 34.

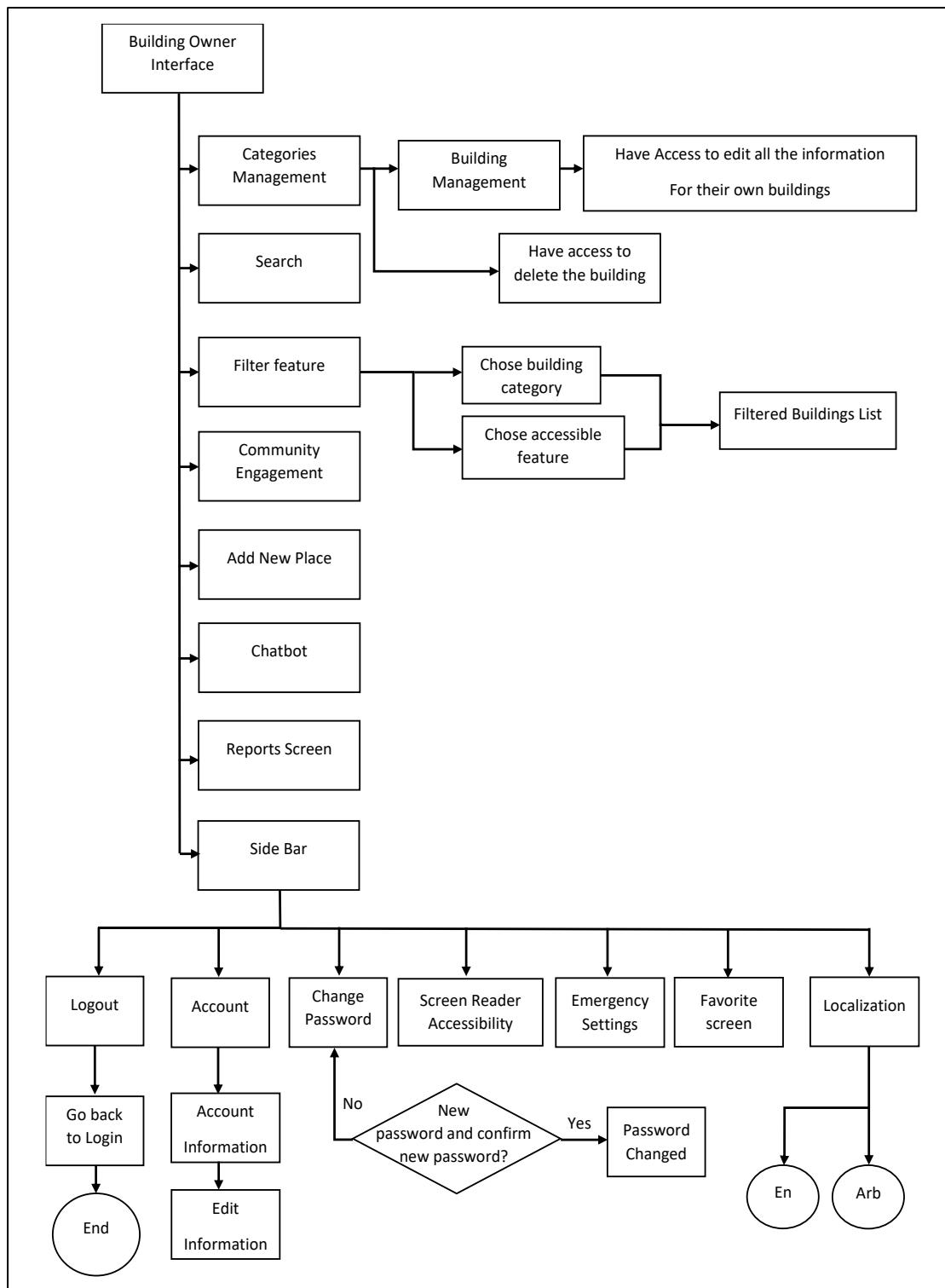


Figure 24. Building owner interface.

Here, we provide a comprehensive visualization of every feature within our application, allowing you to grasp the flow of the user experience. We aim to offer an in-depth exploration of each feature, empowering you to fully understand the functionality and capabilities of our platform.

Figure 25 displays a diagram detailing the categories and buildings management functionalities. This diagram offers a visual representation of the components and features encompassed within these management systems.

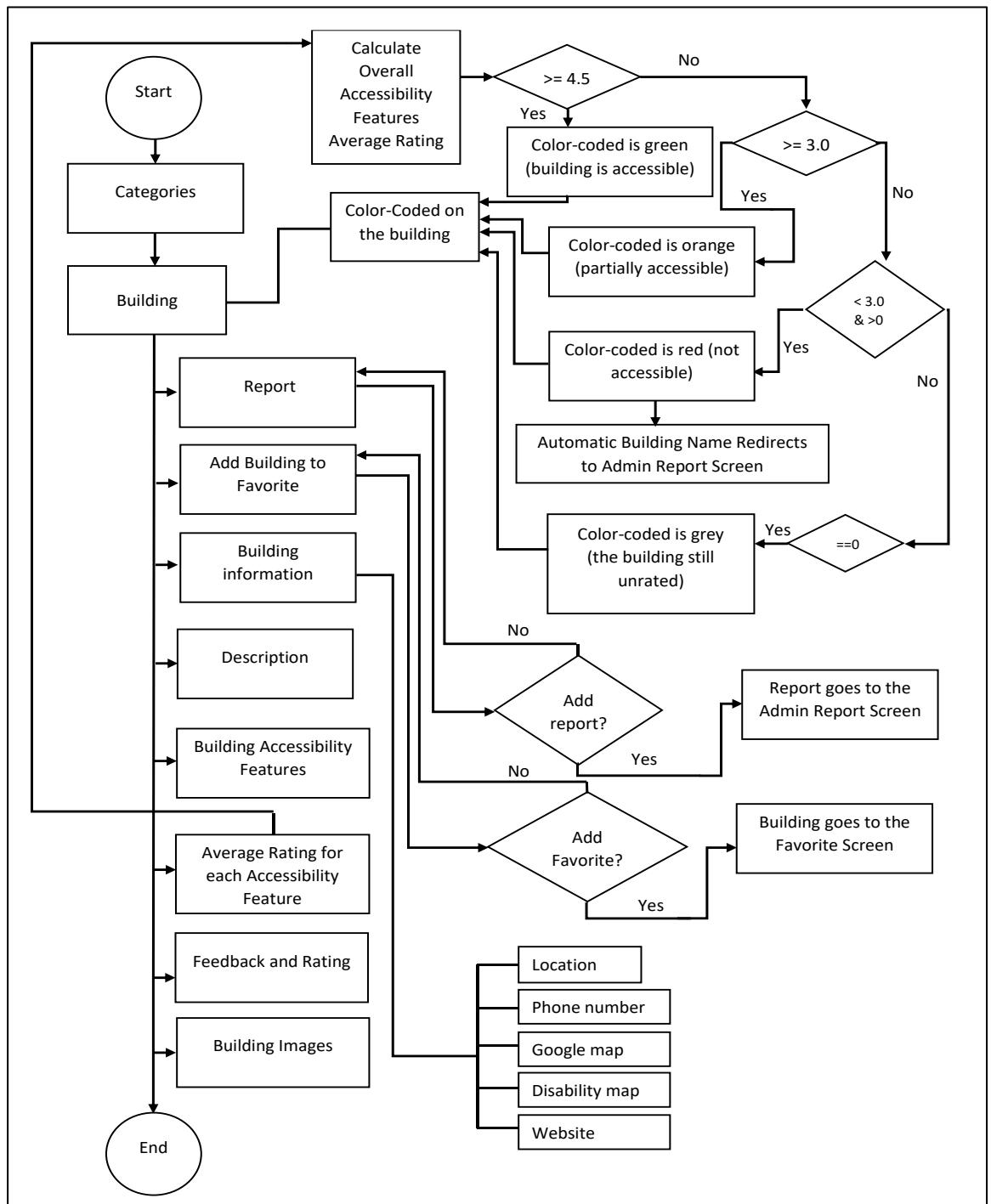


Figure 25. Category and Building management.

The search feature streamlines navigation and reduces manual exploration by enabling users to input keywords or phrases, whether through voice command or text entry. It promptly delivers real-time, relevant results, as shown in the figure26.

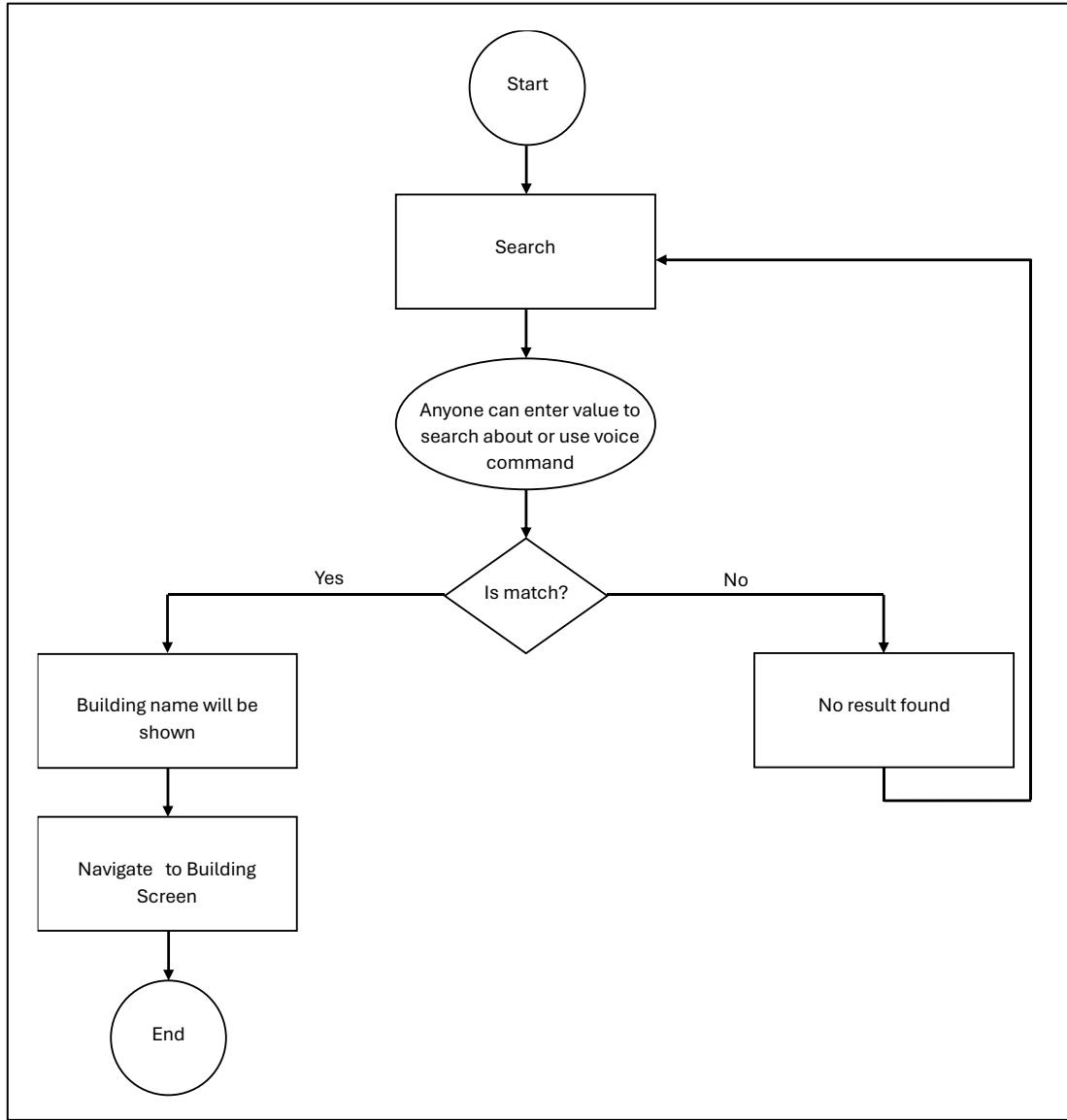


Figure 26.Diagram shows Search feature.

Users have the option to contribute to the Community page by creating new posts, initiating discussions, or seeking information with Images and Videos, as shown in the figure.

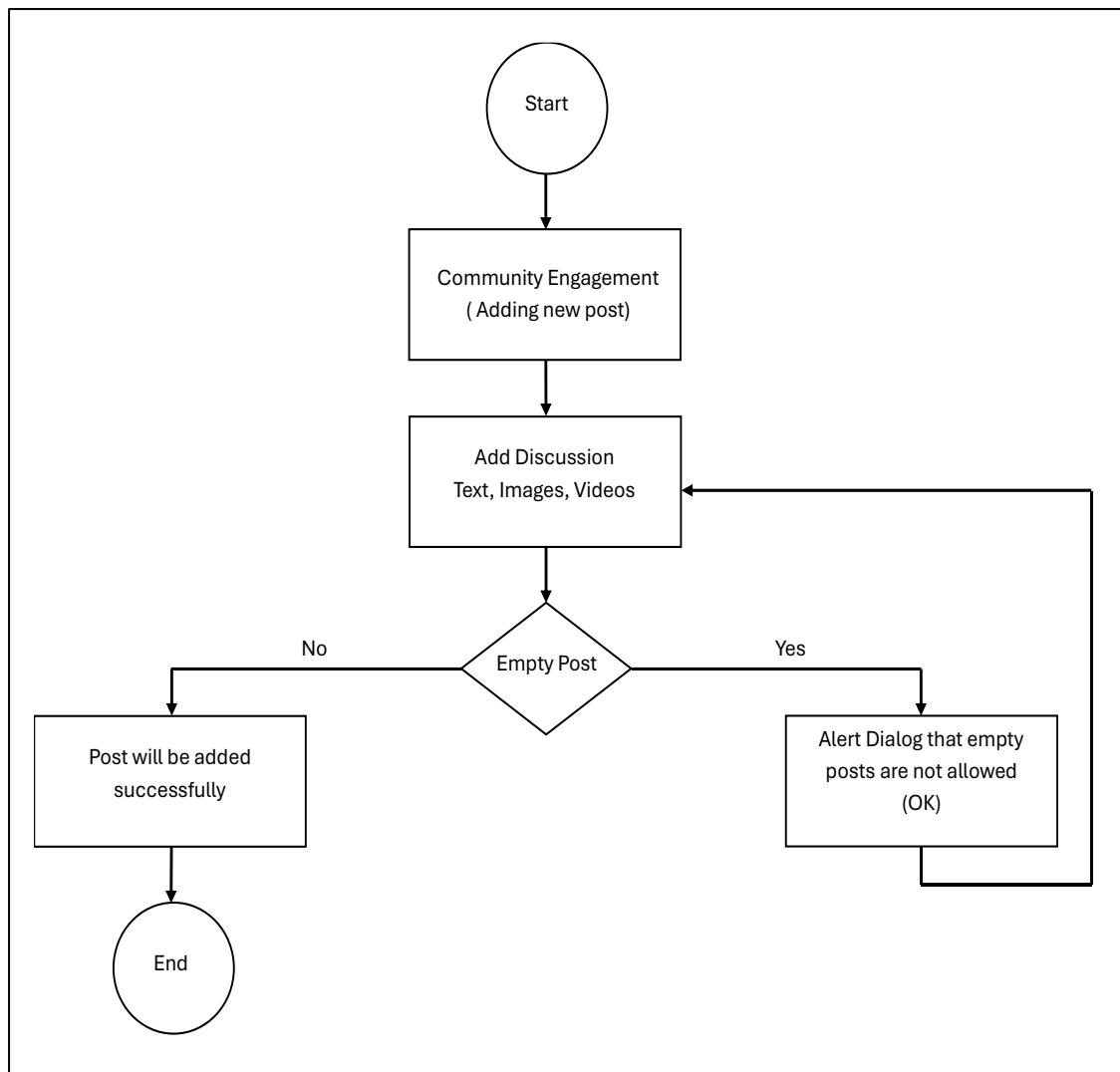


Figure 27. Diagram shows Adding Post in Community.

Users have the capability to contribute new places to our platform as in figure. When a user adds a new place, it doesn't automatically go live for public viewing. Instead, it's directed to a designated page accessible solely by administrators.

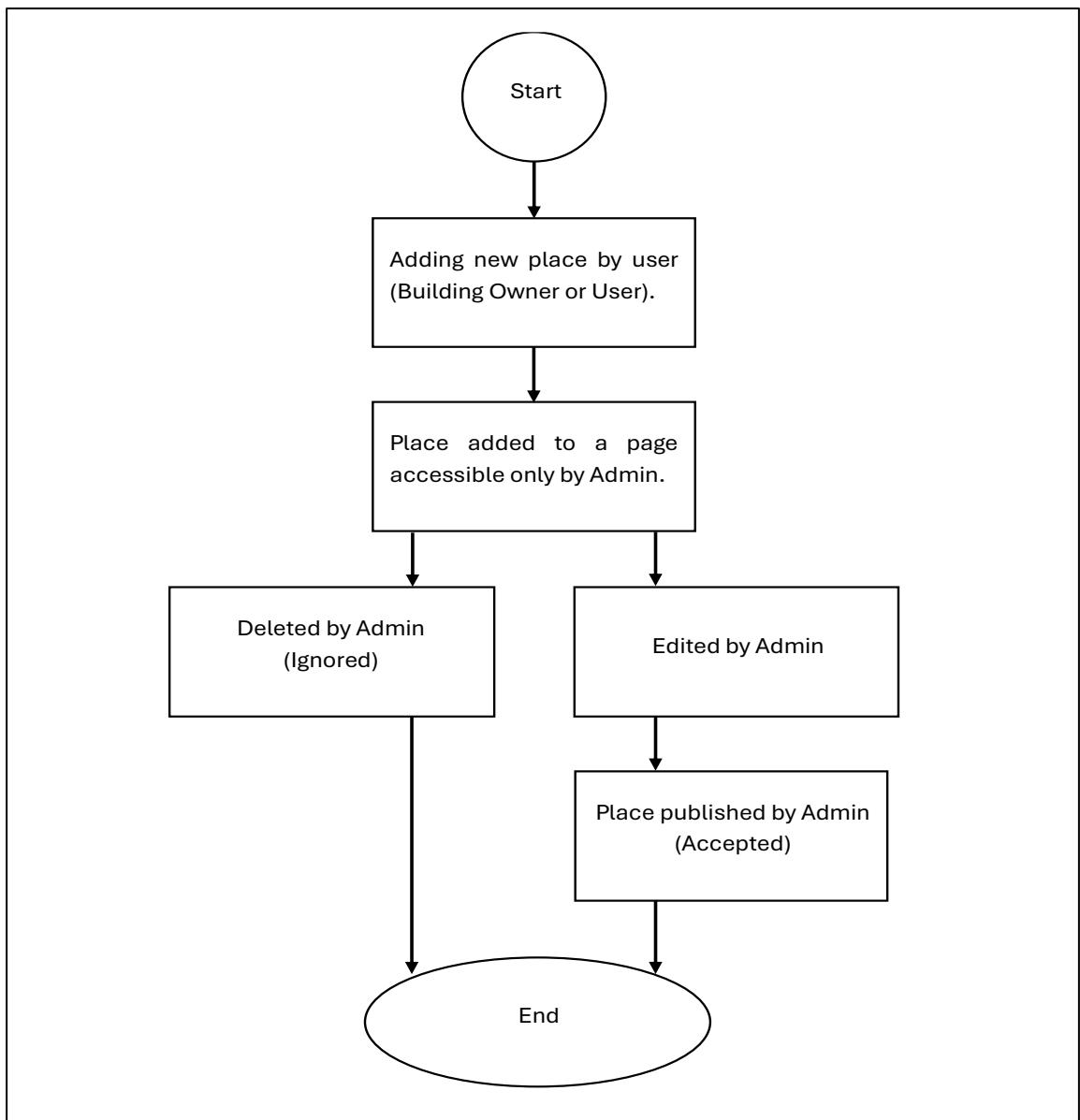


Figure 28. Diagram shows Adding new place by User or Building Owner.

The figure29 provides a detailed diagram showcasing the inner workings of the chatbot, shedding light on its mechanisms for processing and responding to user questions. It offers insight into the algorithms and processes involved in delivering accurate and relevant responses to user queries.

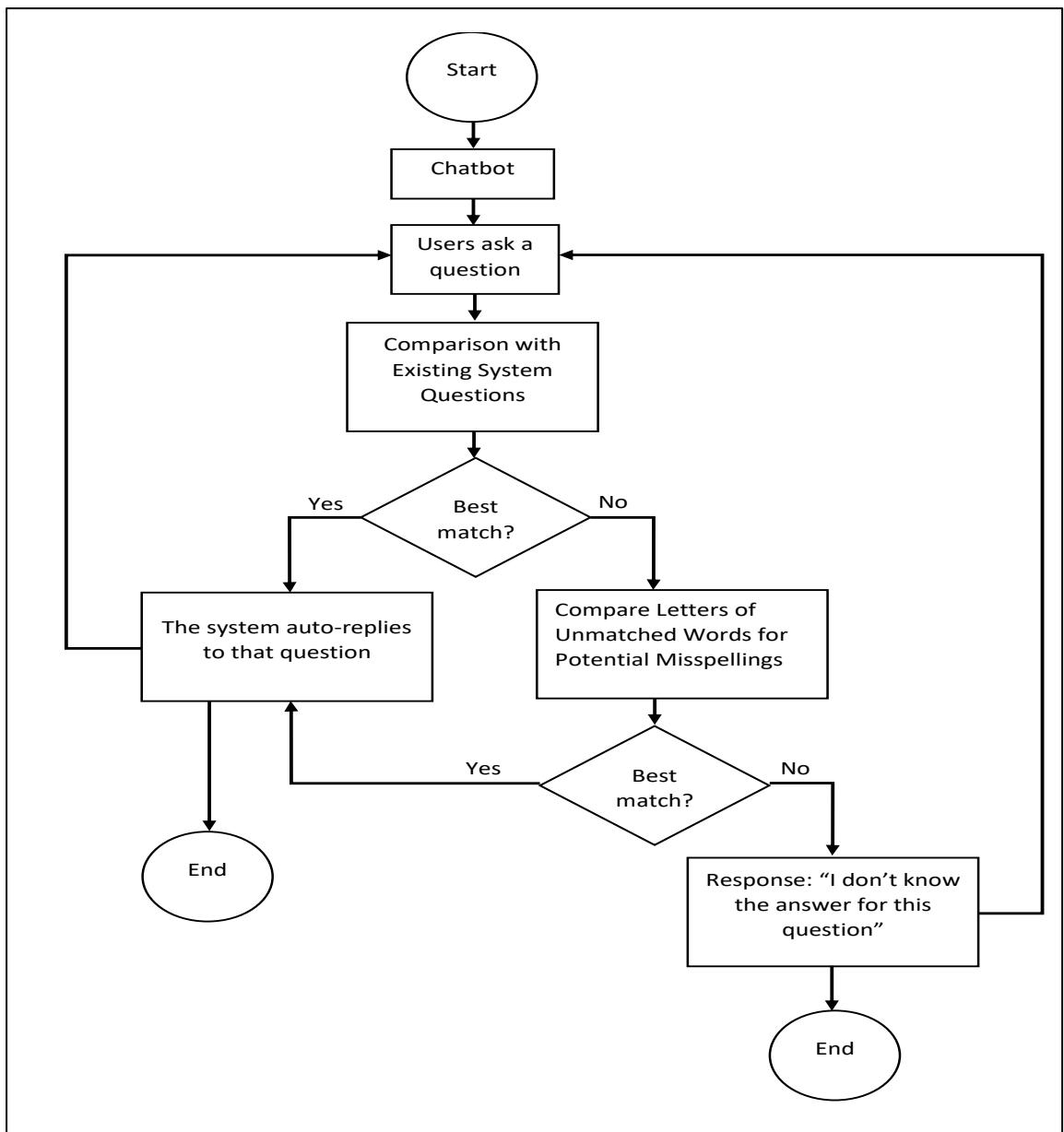


Figure 29. Chatbot diagram.

The Report Screen is just accessible to WellPathJo admins. It presents a dataset containing all buildings marked as inaccessible, along with user reports regarding these buildings. This allows admins to review the information and take appropriate actions, as shown in figure30.

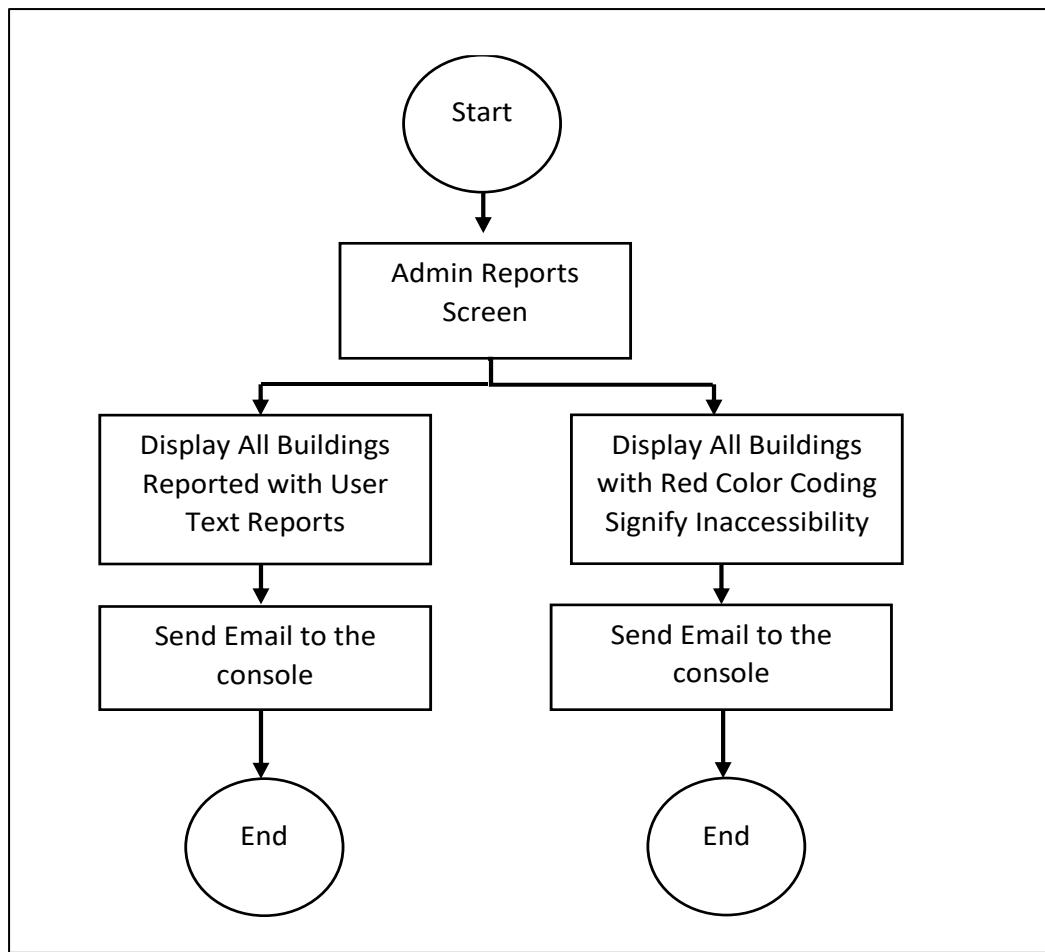


Figure 30.Admin Report Screen.

Within the application's sidebar, there's a feature called Screen Reader. This component in the Flutter app enhances security by managing access to accessibility settings such as "TalkBack" directly within the app. This approach maintains user privacy and system integrity. Users can easily navigate to Screen Reader Settings or return to the previous page, ensuring a balance between security and accessibility. This functionality is depicted in the accompanying figure31.

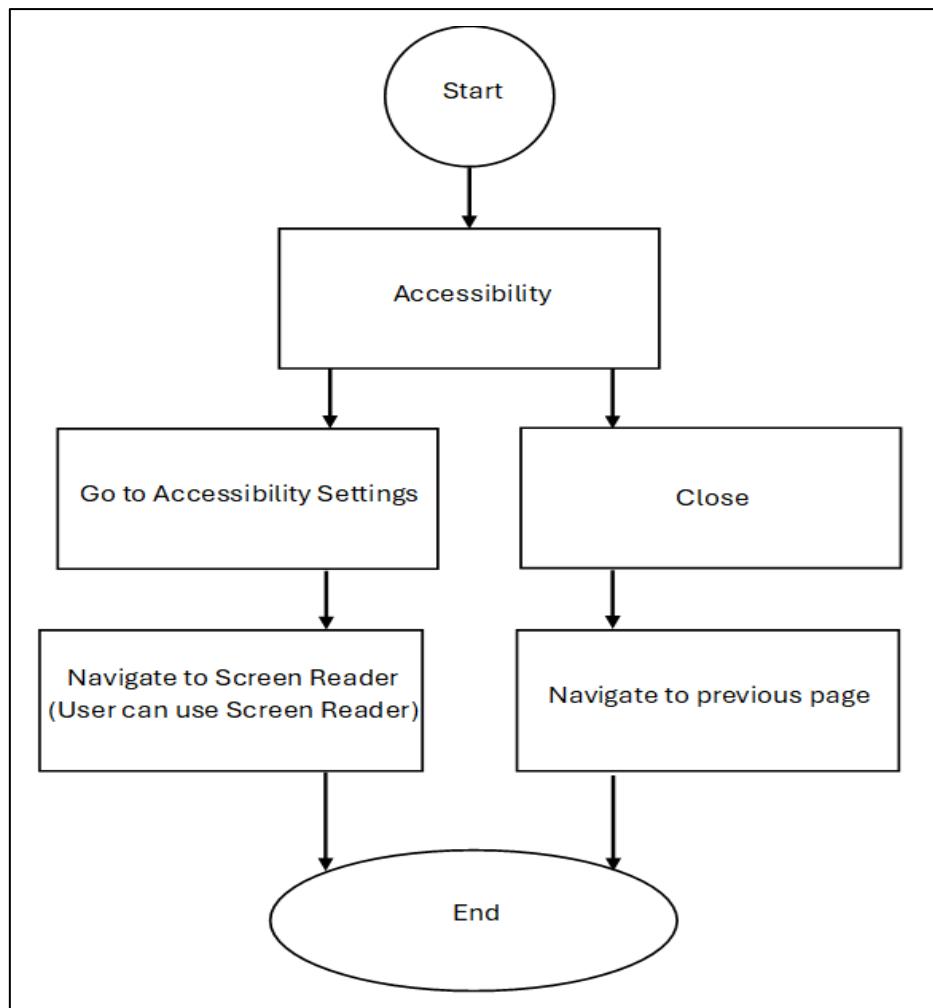
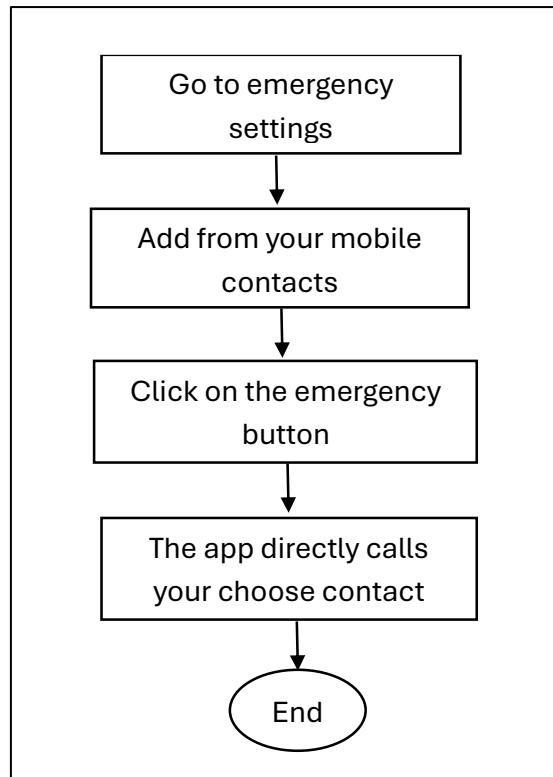


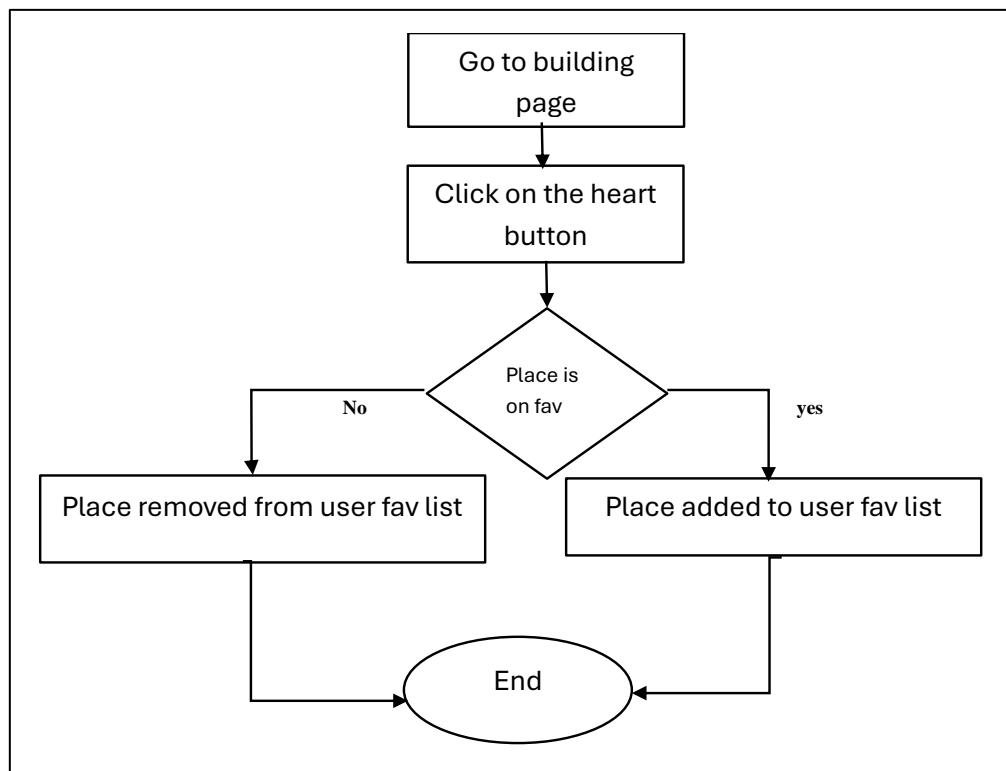
Figure 31. Diagram shows Accessibility Screen Reader feature

In the emergency settings, as shown in Figure 32, users have the option to add emergency contacts. With this feature, users can designate specific contacts to be called in case of an emergency simply by tapping a button.



*Figure 32.Emergency Settings.*

In the Favorite Screen, depicted in Figure 33, users can conveniently navigate to frequently visited places. By clicking on the small heart button within the building, the system adds the location to their favorite list on favorite screen.



*Figure 33.Favorite feature diagram.*

# CHAPTER 4

## RESULTS AND DISCUSSION

### 4.1. Scenarios

In this section, we will mention the techniques we used to test all the project features, activity and functionalities.

Rawan, a recent school graduate, is keen on continuing her education at the University of Jordan in Amman. However, as she relies on a wheelchair for mobility, it's crucial for her to ensure that the university's departments are accessible to her. To gather this vital information, Rawan takes the first step by creating a personal account within the WellPathJo Application as in figure34.a. After completing the registration process, which includes verifying her email address, Rawan gains access to the application's interface as in figure34.b.

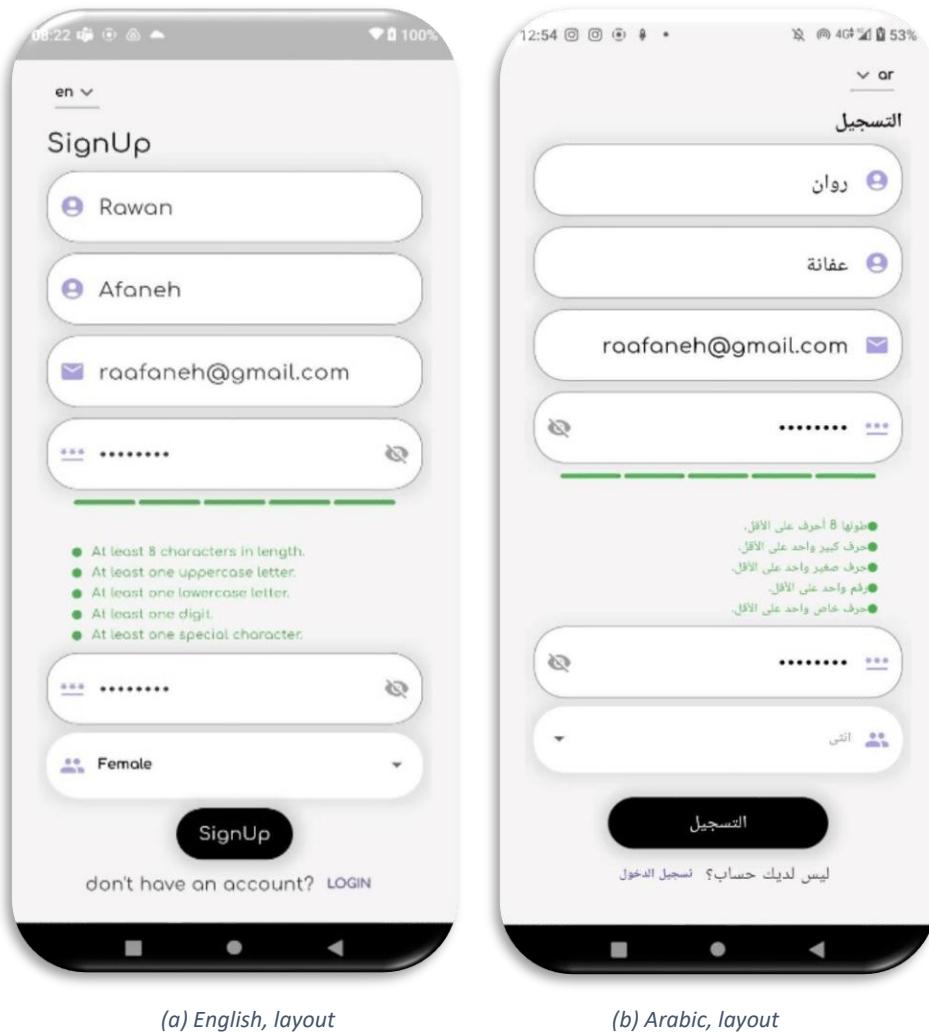


Figure 34. This series of images depicts Rawan's registration and login process.

Once logged in, Rawan finds herself on the main page where all categories are displayed as in figure35.a. Opting for further exploration, she utilizes voice commands to search for information about the University of Jordan as shown in figure35.b. Upon finding the university in the search results, Rawan clicks on it, prompting the application to direct her to the relevant category. Upon entering, she observes that each department is color-coded to indicate its accessibility status. Noticing that the engineering department is labeled as accessible as shown in figure35.c, Rawan proceeds with her exploration.

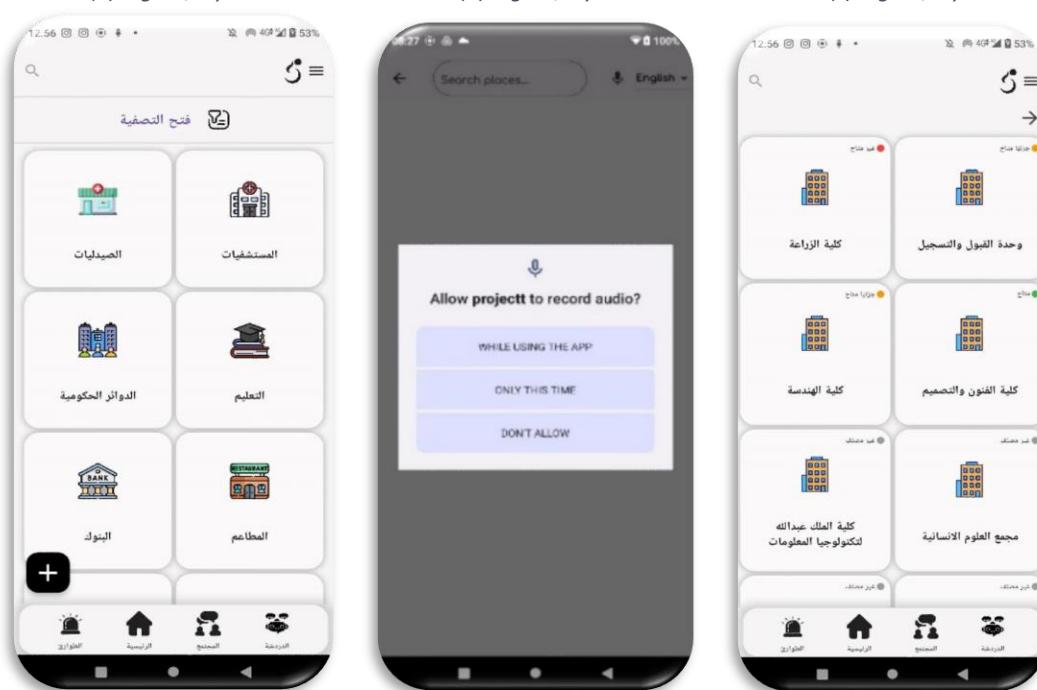
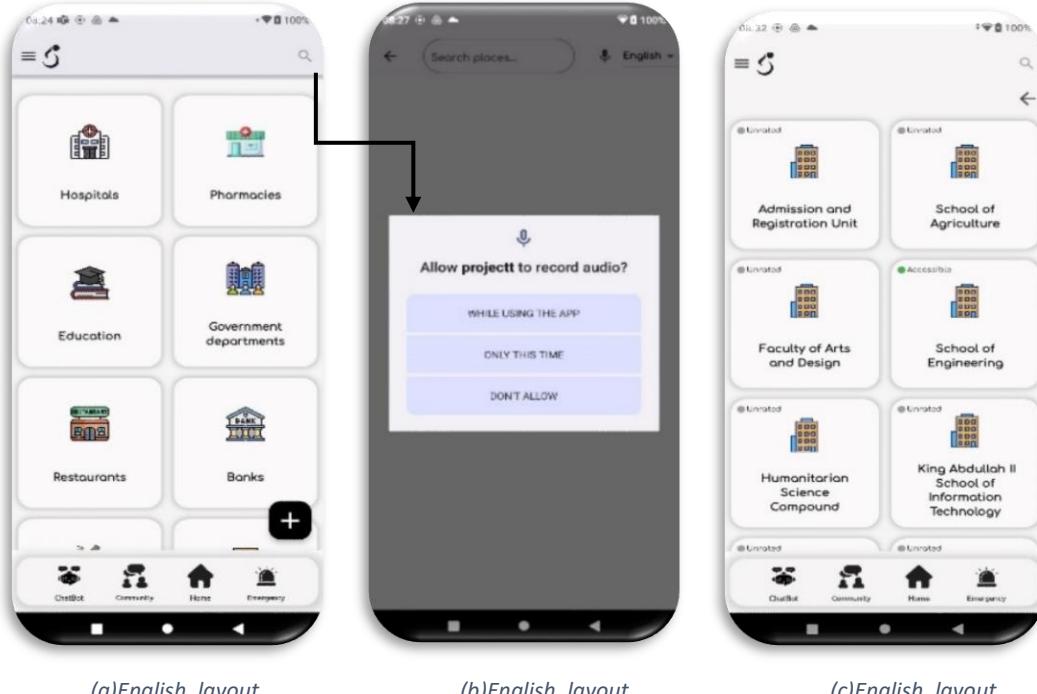


Figure 35. Searching process.

Upon entering the Engineering department as shown in figure36.a, Rawan notices images of the building displayed at the top of the page. Intrigued, she clicks on the internal map to pinpoint the locations of various accessibility features within the department as shown in figure36.b. Next, she delves into the description provided to gain a deeper understanding of the department's accessibility provisions. Subsequently, Rawan observes the different accessibility features available and their corresponding quantities, further informing her assessment of the department's suitability for her needs. Following her exploration of the Engineering department, Rawan proceeds to visit several other departments to evaluate their accessibility. This thorough examination allows her to make an informed decision regarding which department she should request admission to.

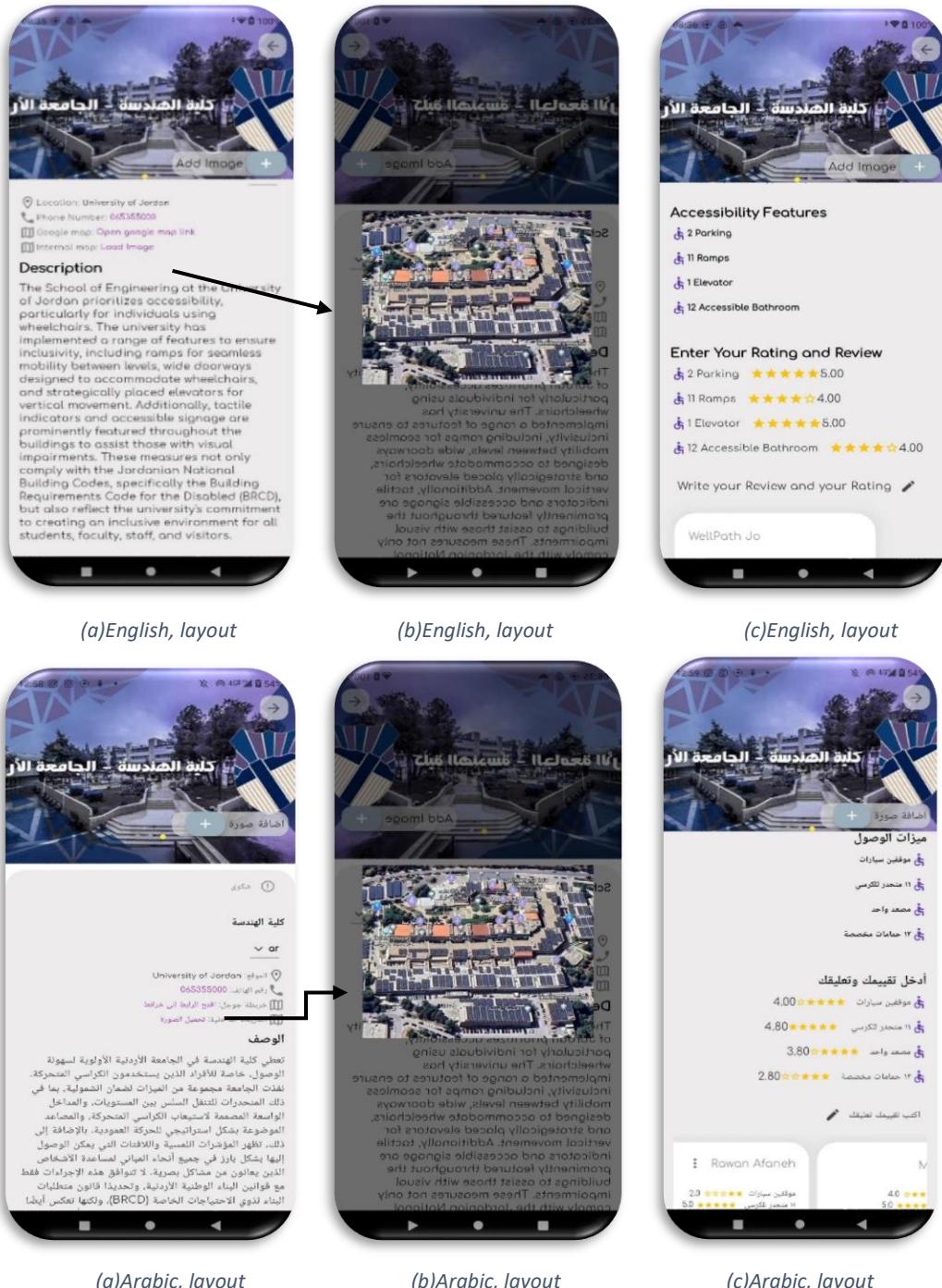


Figure 36.Rawan reviewed the building information.

After careful consideration, Rawan chooses to register for the Engineering department. As the first semester comes to a close, she reflects on her experience and realizes that the department is indeed accessible for her needs. Grateful for the application's assistance in locating accessibility features, Rawan decides to rate each feature and write a detailed review about her experience, aiming to provide valuable feedback for others. This is shown in figures37.

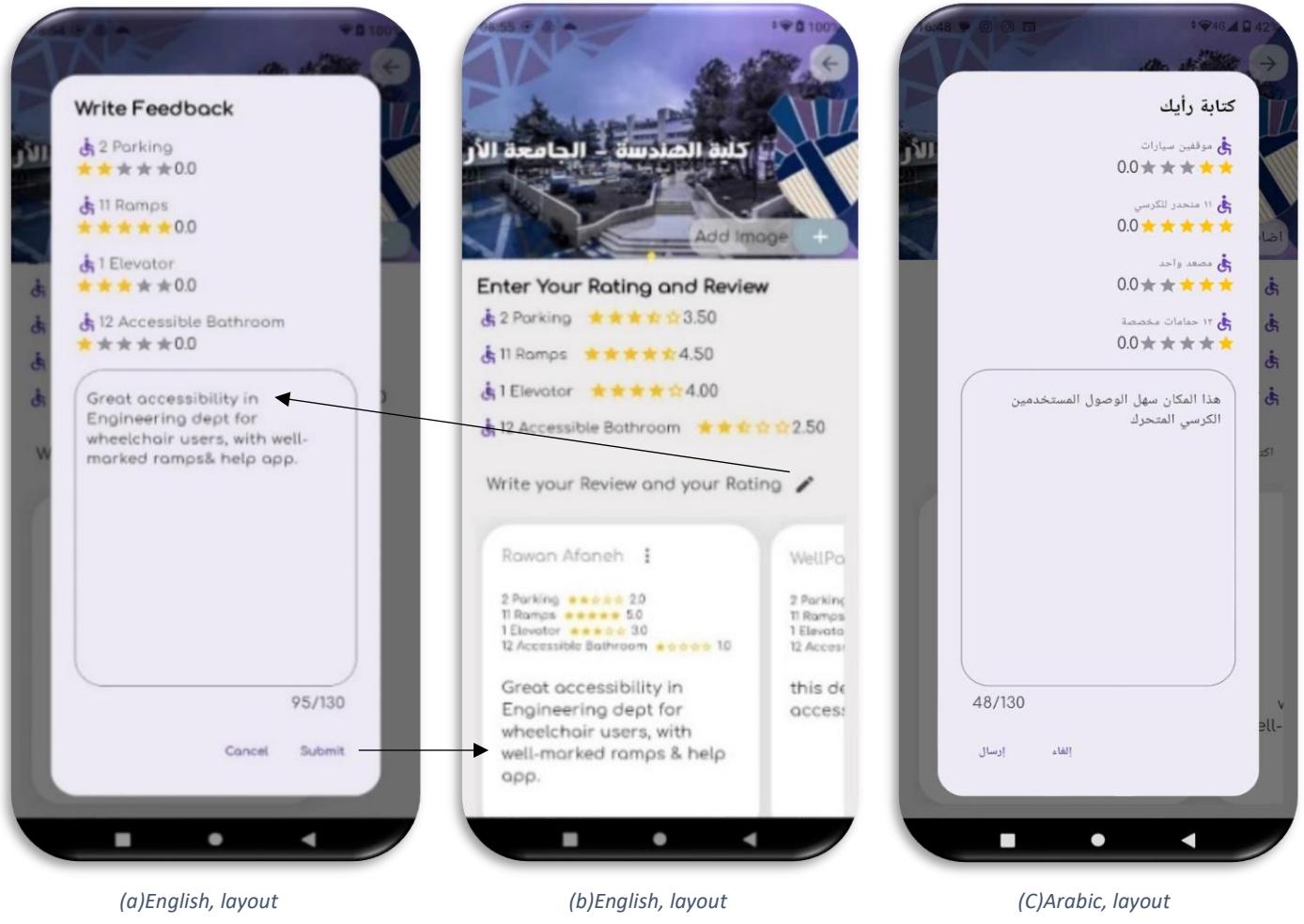
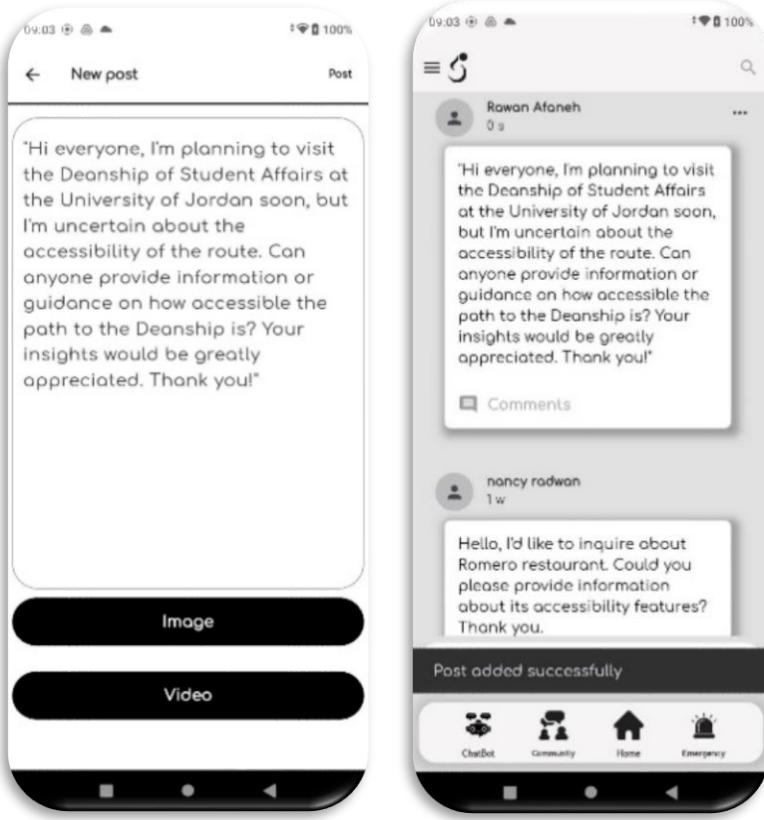


Figure 37. Rawan's review and ratings

After some time, Rawan encounters a situation where she needs to visit the Deanship of Student Affairs at the University of Jordan. Unsure about the accessibility of the route, she decides to seek guidance. Heading to the community engagement section as shown In figure38, Rawan crafts a post inquiring about the accessibility of the path to the Deanship of Student Affairs.



(a)English, layout

(b)English, layout



(c)Arabic, layout

(d)Arabic, layout

Figure 38. Rawan's post on the community engagement.

While using the application, Rawan noticed the emergency setting prompting her to designate a contact for emergencies. Without hesitation, she selected a contact from her list as shown in figure39.a. Later, while at the university, Rawan found herself in an urgent situation that required immediate action. Without delay, she pressed the emergency button on the application, initiating a call to the contact she had previously chosen as shown in figure39.b.

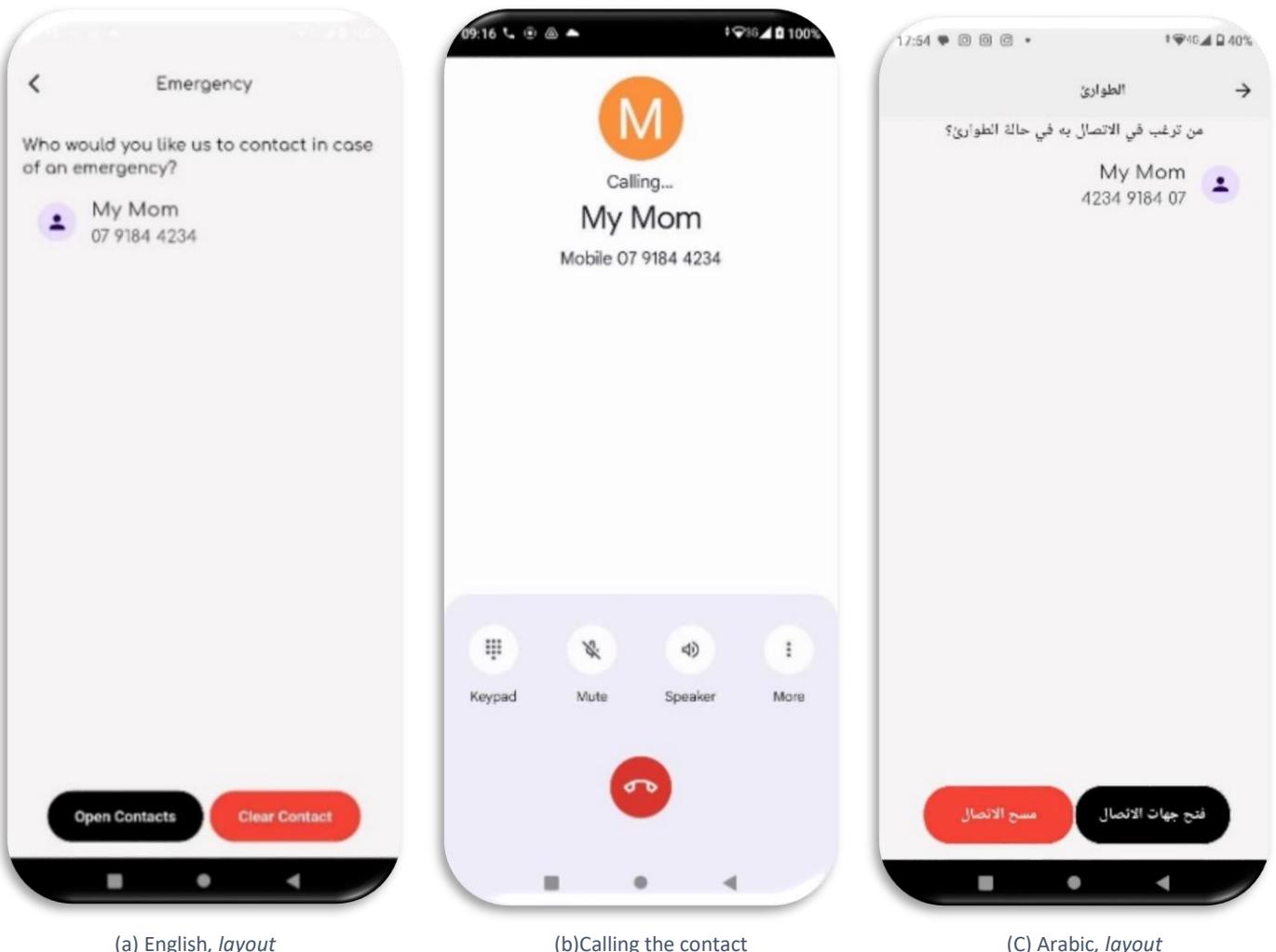
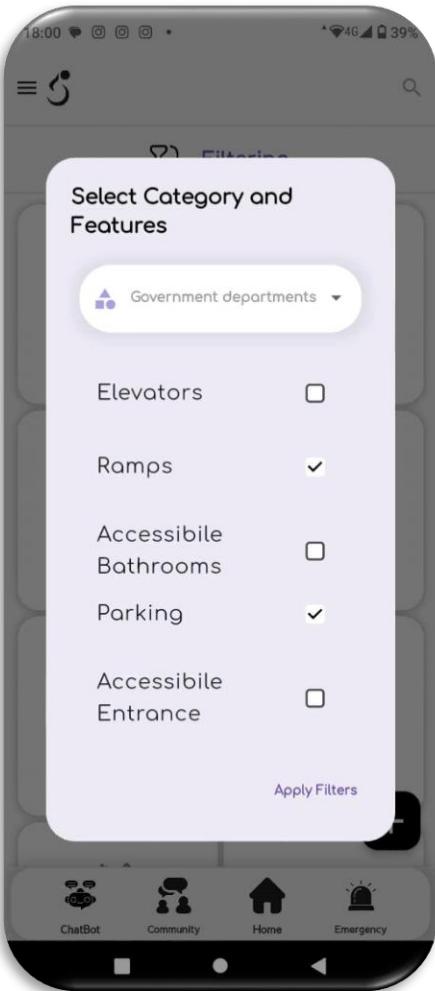


Figure 39. Rawan's Emergency feature process.

Nancy, a young woman reliant on a wheelchair, embarks on the task of renewing her passport, determined to ensure accessibility throughout her journey. Armed with the WellpathJo application, she efficiently filters government departments as shown in figure31.b, focusing on crucial features like ramps and accessible parking. Her meticulous search leads her to the Civil Status and Passports Department in Tabarbour, Amman as shown in figure40.c. With a determined click, she delves deeper, and she confirms that the department meets her needs.



(a) English, layout



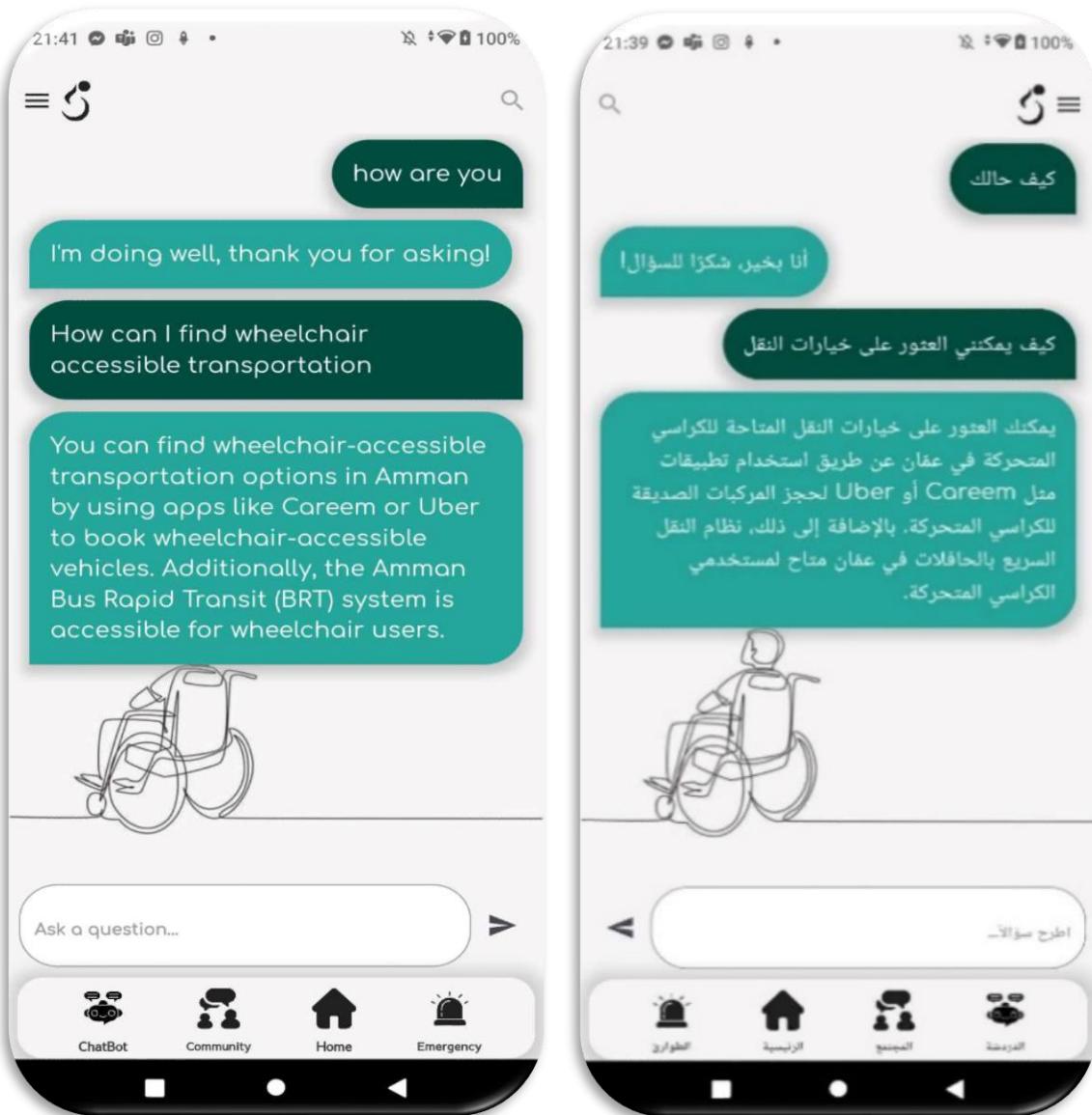
(b) Arabic, layout



(c) Arabic, layout

Figure 40. Filtering process.

After confirming that the Civil Status and Passports Department meets her accessibility needs, Nancy decides to head to the building. However, unsure of the transportation options available to her in Amman, she turns to the chatbot within the WellPathJo application for guidance. Promptly, the chatbot responds, providing a comprehensive list of wheelchair-accessible transportation options in Amman, including accessible taxis and public transportation. With this information in hand, Nancy confidently plans her journey to the department, grateful for the inclusive support offered by the application as shown figure41.



(a)English, layout

(b)Arabic, layout

Figure 41. chatbot.

Nancy decides to visit “Rafidain Bank” for some banking transactions. However, upon arriving at the bank, she encounters a significant obstacle: there are no ramps or elevators to facilitate her entry into the building. Frustrated by the lack of accessibility, Nancy opens the application she frequently uses to rate and review establishments. She leaves a detailed rating and report, highlighting the accessibility issue she faced at “Rafidain Bank”. In her report, she emphasizes the importance of making public spaces accessible to all individuals, regardless of their physical abilities as shown in figure42. The report is automatically sent to the application's admin.

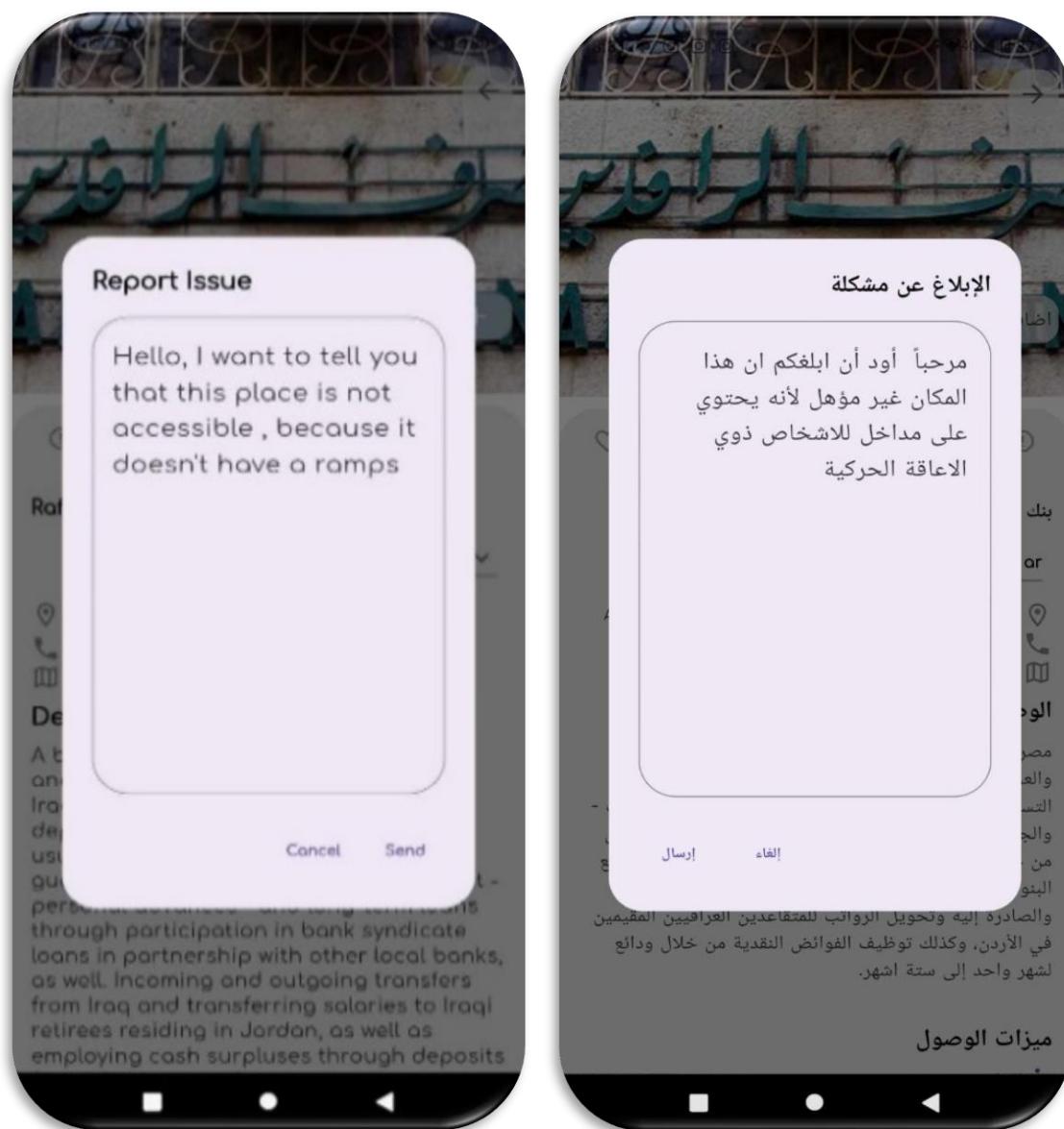


Figure 42.Nancy's report.

After a certain time spent browsing community engagement within the WellPathJo application, Nancy comes across a post from a user named Rawan seeking guidance on the accessibility of the route to the Deanship of Student Affairs at the University of Jordan. Nancy empathizes with Rawan's uncertainty, knowing firsthand the importance of accessible pathways. With a sense of camaraderie, she decides to comment on Rawan's post (From First Scenario), offering her insights and support as shown in figure43.

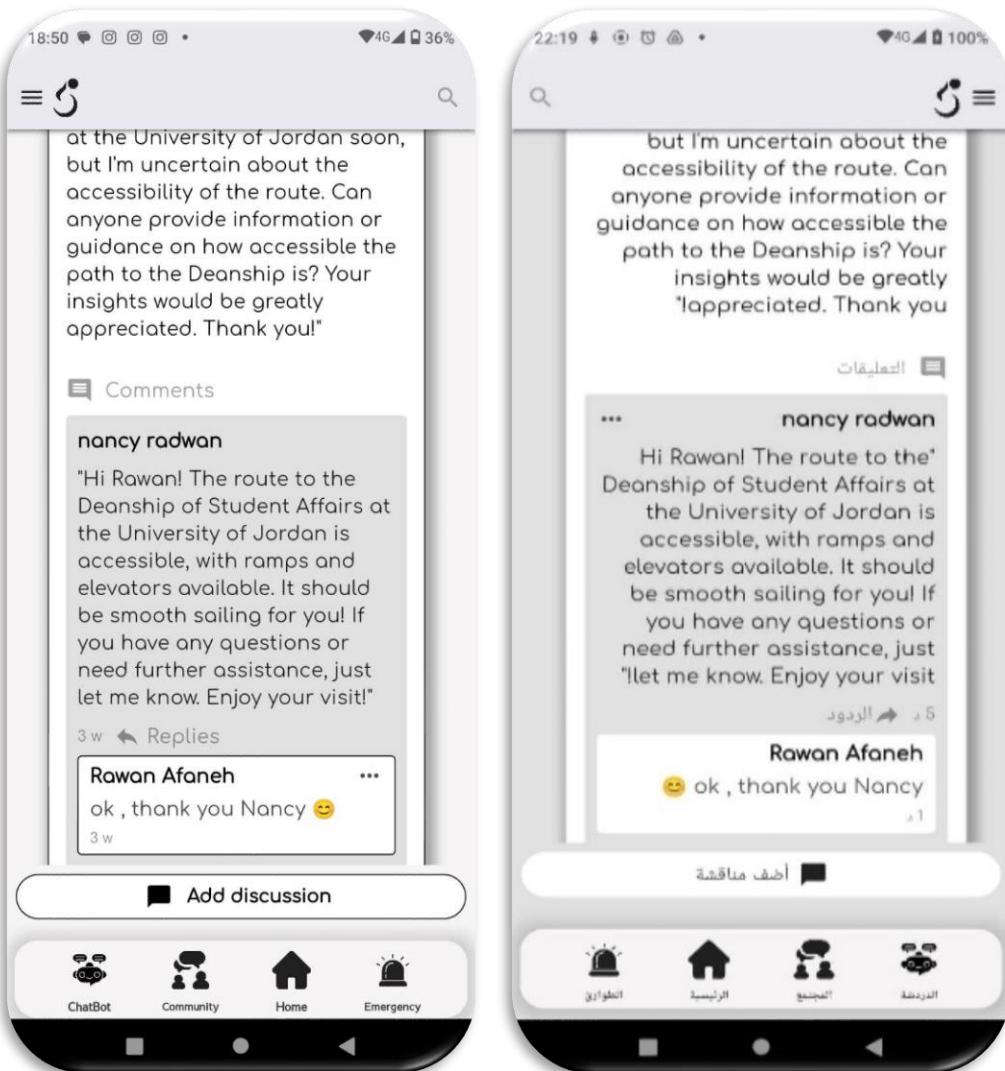


Figure 43. Community Engagement.

Understanding her aunt Martha's difficulties with reading because of a visual impairment, Nancy takes the initiative to set up a customized account within the WellPathJo application, aptly named "Martha." With this thoughtful gesture, Nancy ensures that Martha can navigate the app effortlessly. She configures the account settings to accommodate Martha's needs, including features such as screen readers tailored to assist her in reading text. Additionally, Nancy enables dark mode to enhance Martha's comfort while using the application, as depicted in Figure 44.

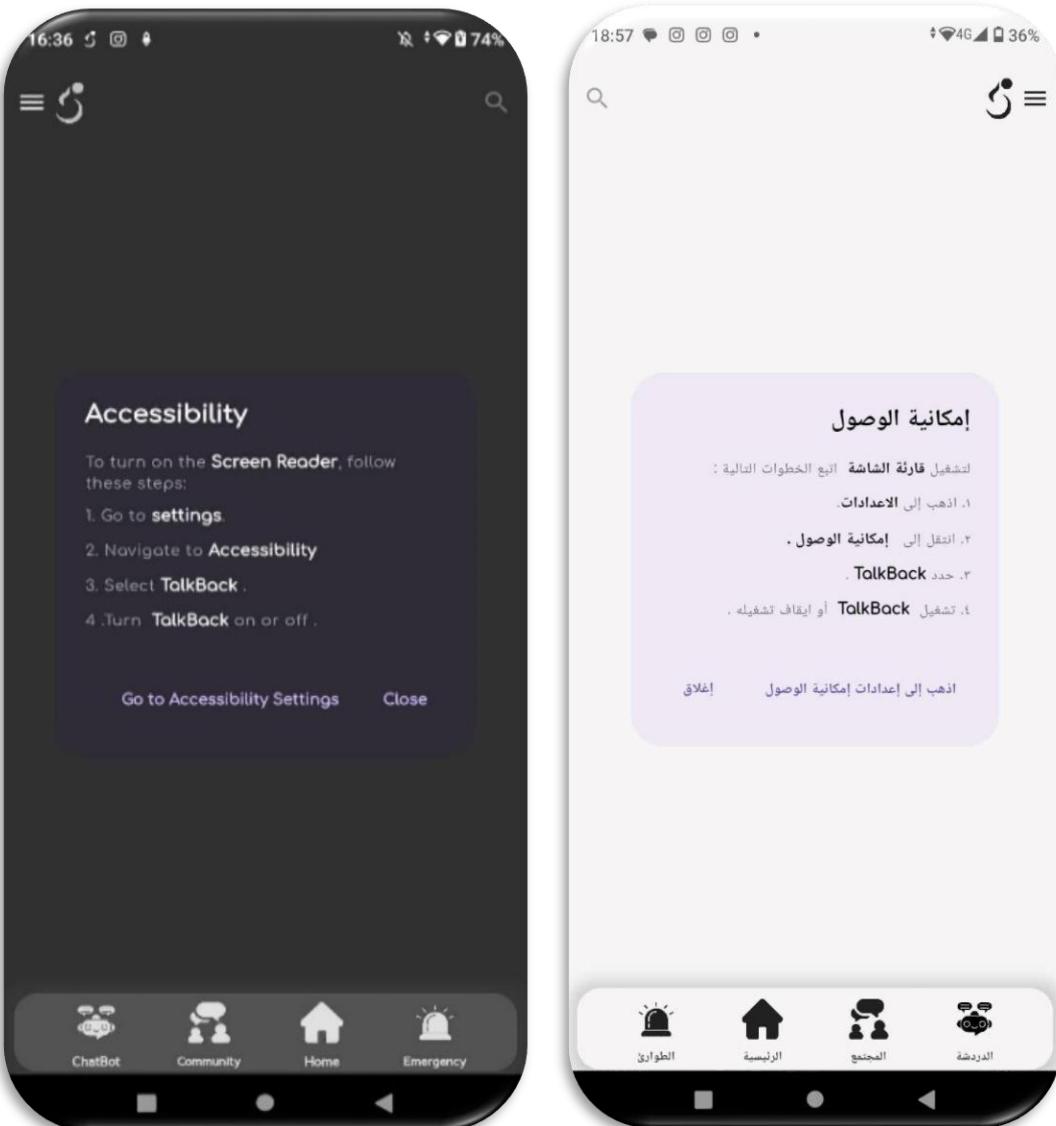


Figure 44.Guid to Screen Reader Feature screen using dark mode and light mode .

As the bustling city of Amman awakens to another vibrant day, the owner of the esteemed restaurant "Ward" contemplates expanding their reach through modern means. With the rise of mobile applications facilitating access to local businesses, the owner decides to integrate Ward into one such platform, WellPathJo. They navigate to the WellPathJo interface and locate the "Add Building" button, eager to introduce their establishment to a broader audience. With meticulous care, they fill out all the necessary information about Ward, from its delectable menu offerings to its cozy ambiance, and upload captivating images that showcase the restaurant's charm. Not forgetting inclusivity, the owner ensures to mark the accessibility feature for wheelchair users, enabling everyone to enjoy the culinary delights of Ward. With a satisfied click of the "Submit" button, the owner entrusts their submission to the digital realm, where it awaits the discerning eye of the application's admin as shown in figure 45.

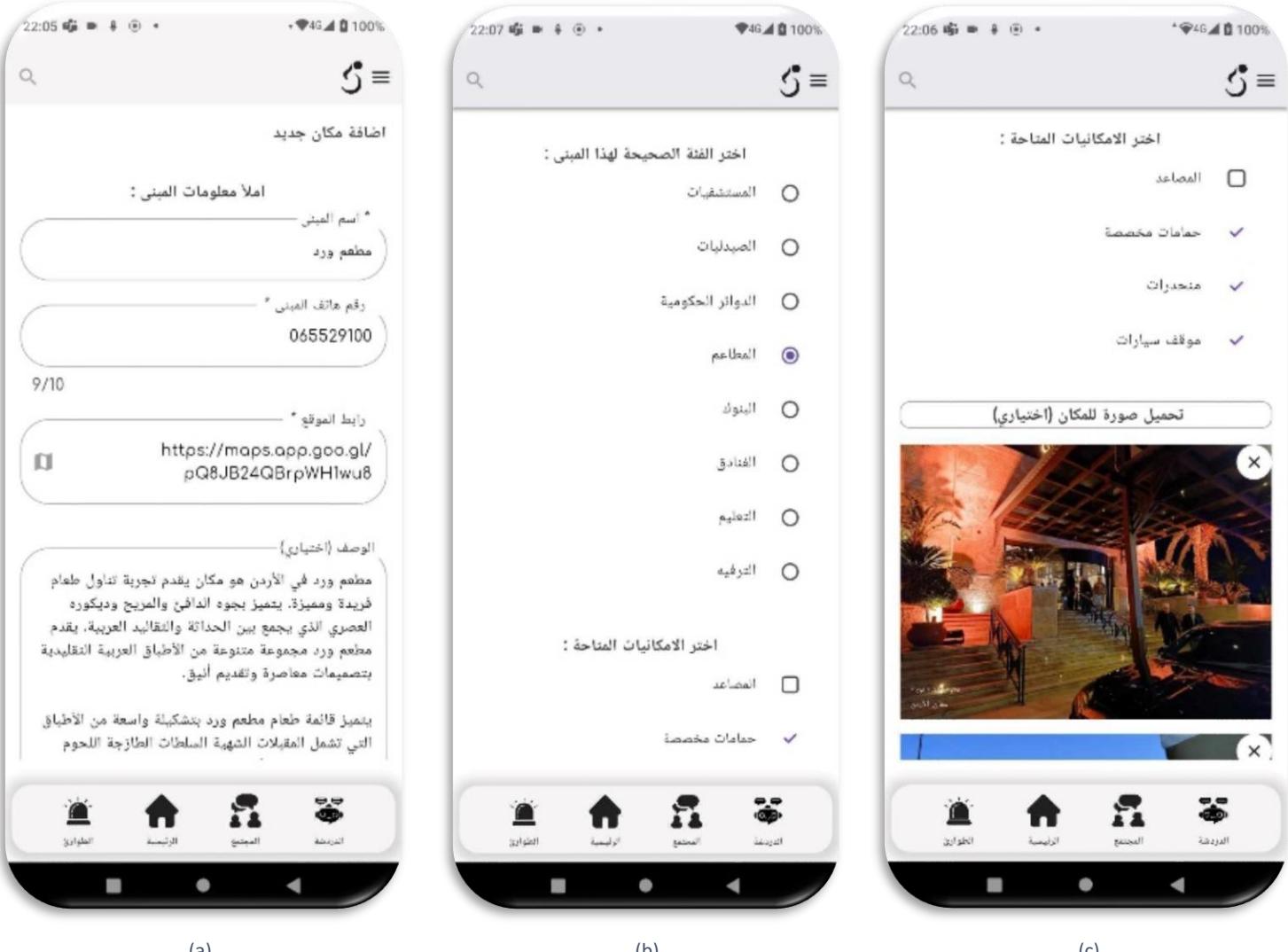


Figure 45. Add new place process in Arabic .

As the owner of a new building decides to join the application used by Shoman Library as shown in figure 46, they click on "Add New Place" to begin the process. Excitedly, they start filling in the required information about their property. However, when they reach the category section, they realize that "Library" isn't listed. Undeterred, they select the "Others" option and manually type in "Library" to create this new category. With the category issue resolved, they diligently continue inputting the remaining details before hitting the submit button. A notification then appears, informing them that their submission has been sent to the admin for review and will soon be published for all to see.

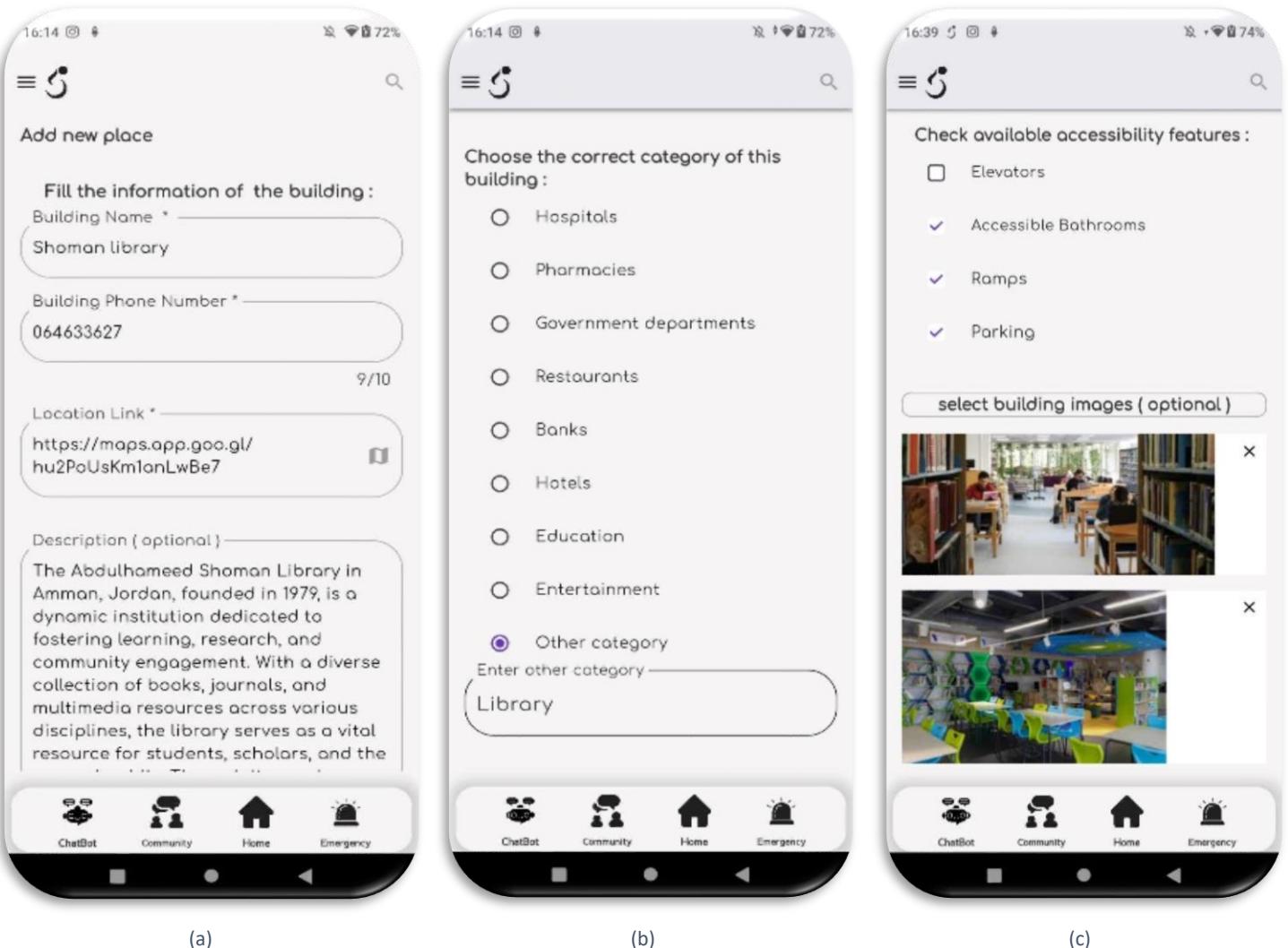


Figure 46. Shoman add their building within new category in English.

In the digital realm, the admin receives notifications indicating new building submissions. Acting, they delve into the submissions, embarking on the crucial task of review. With meticulous attention to detail, they evaluate the details provided by Ward figure38.b and Shoman figure38.c, ensuring alignment with WellPathJo's standards and criteria for inclusion. After thorough consideration, the admin makes a pivotal decision whether to accept or decline the addition of these buildings to WellPathJo. This decision has the potential to shape the culinary landscape of Amman, enhancing the city's dining experience for both locals and visitors alike, as depicted in Figure 47.

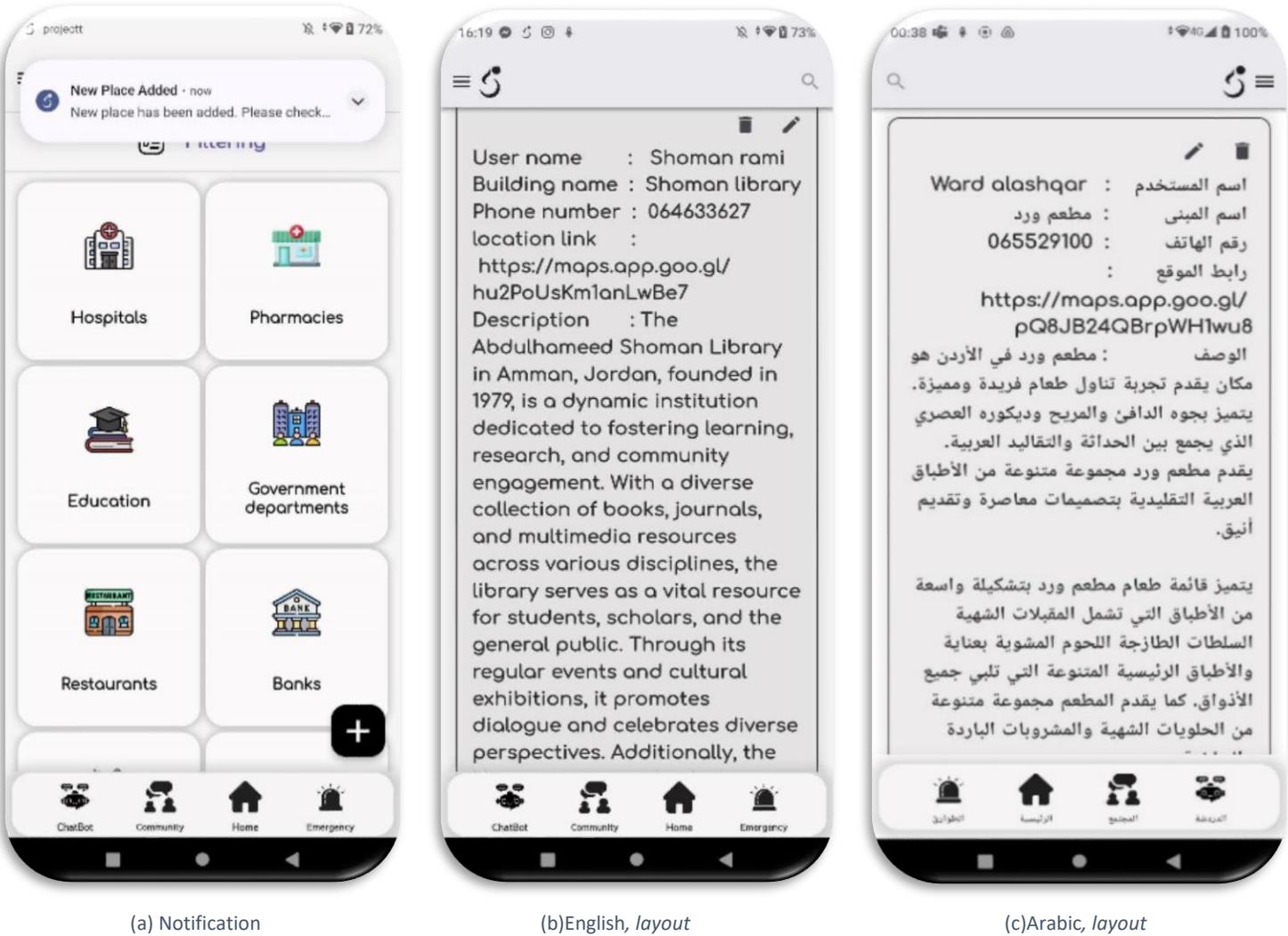


Figure 47. Evaluate Ward's and Shoman details.

After the bustling city of Amman has embraced Ward's inclusion on WellPathJo, the owner eagerly delves into managing their restaurant's digital presence. Upon discovering the "About Us" section within the application, the owner finds the designated email address and promptly sends their proof of ownership documents. With a polite request, they seek access to their building listing on WellPathJo, intending to make necessary updates and enhancements to ensure accurate representation. As the email traverses the digital channels, it reaches the application's support team, who promptly acknowledge receipt and initiate the necessary verification process. Recognizing the importance of empowering business owners to manage their listings, the support team swiftly grants the owner access to their building on WellPathJo, fostering a collaborative environment where establishments can thrive with up-to-date information as shown figure48.

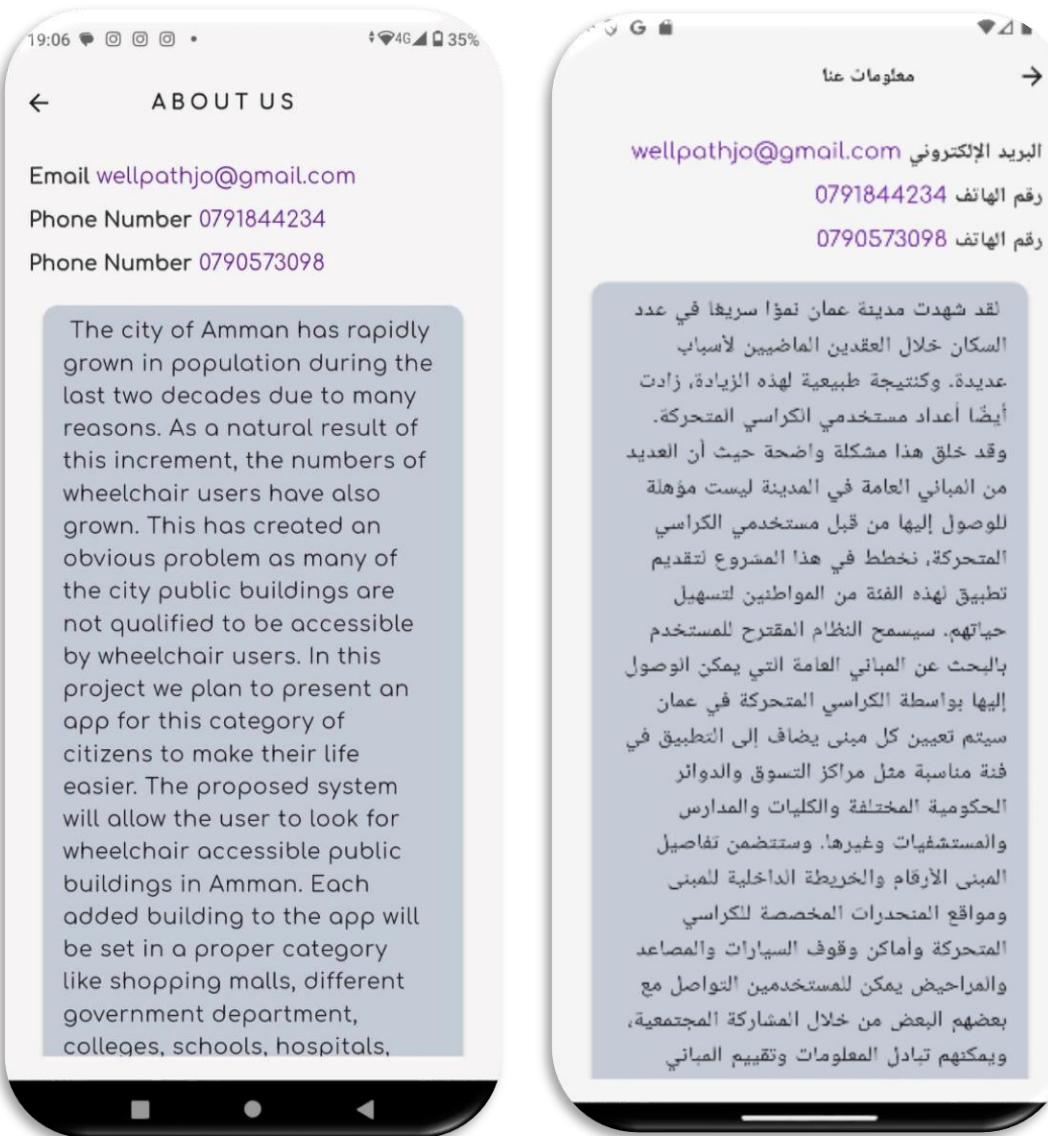
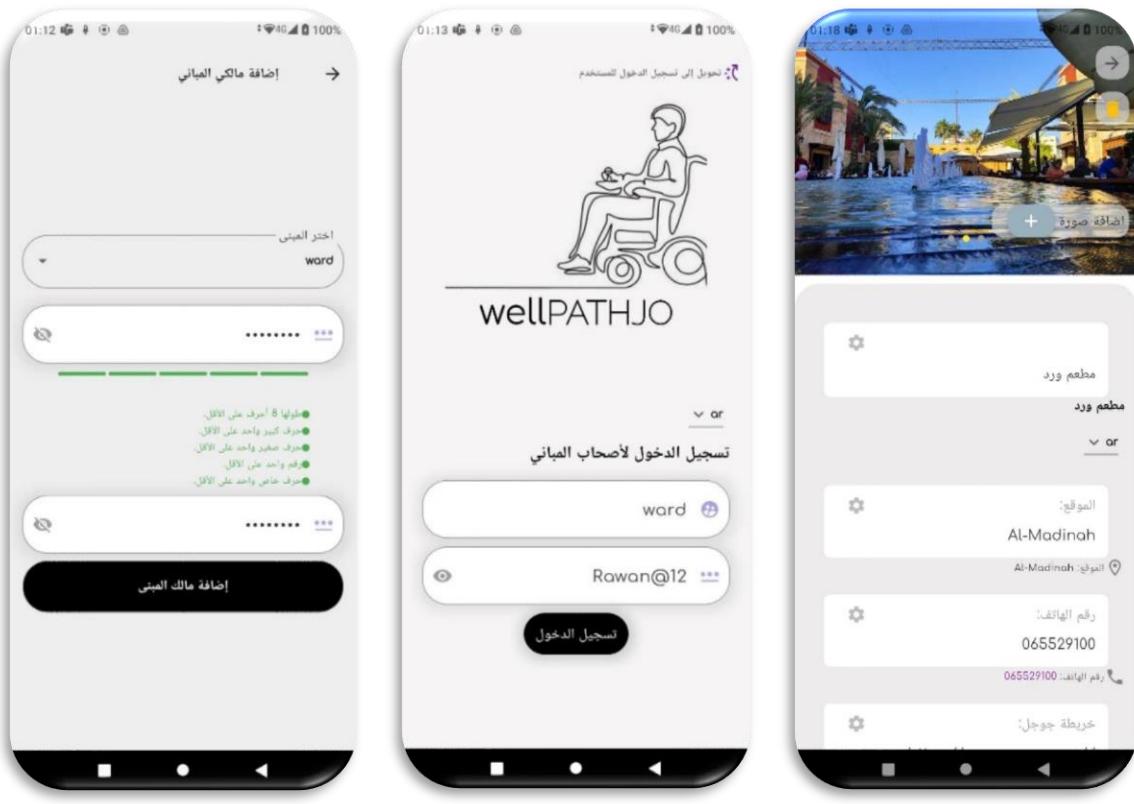


Figure 48. About Us screen.

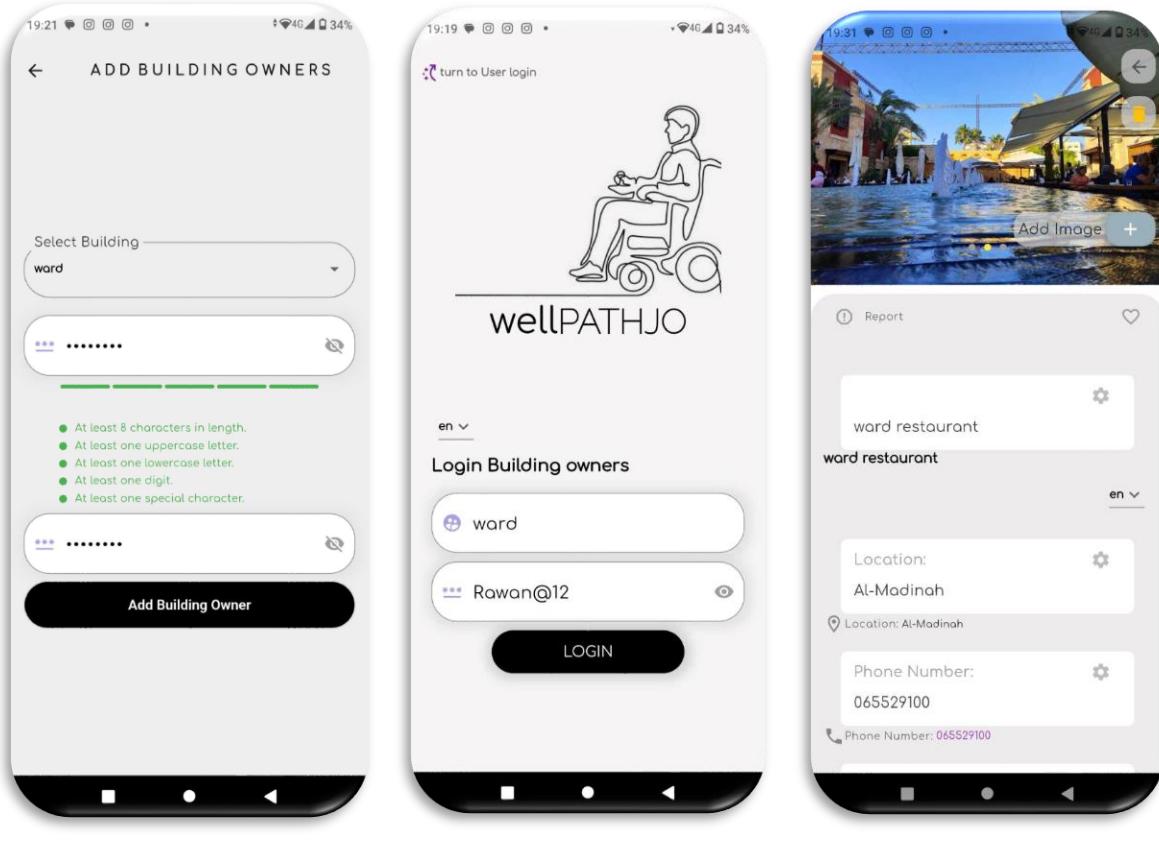
Following the approval of Ward's inclusion on WellPathJo, the admin moves swiftly to facilitate seamless management for the restaurant owner. Recognizing the owner's need for autonomy in managing their building listing, the admin takes proactive steps. With meticulous care, they create a personalized username and password as shown in figure49.a, tailored specifically for the Ward establishment. In a bid to ensure secure and efficient communication, the admin employs a secure method to deliver these credentials to the restaurant owner, enabling them to access their building listing with ease. With the digital keys in hand, the restaurant owner gains entry into their domain on WellPathJo, poised to wield their newfound control in shaping the online narrative of Ward and fostering enhanced engagement with patrons as shown in figure40.b and figure49.c.



(a)Arabic, layout

(b)Arabic, layout

(c)Arabic, layout



(a) English, layout

(b)English, layout

(c) English, layout

Figure 49. Building owner getting access process.

As the admin navigates to the reports section of the application, they notice several entries under the "Building not accessible" category, with "Rafidain Bank" prominently listed among them as shown in figure50. Upon reviewing the reports associated with the bank, they encounter numerous accounts detailing the challenges faced by individuals attempting to access the premises. These reports highlight issues such as the absence of ramps and elevators, creating significant barriers for people with disabilities. Recognizing the urgency of the situation, the admin decides to act. With a decisive click, they initiate the process of sending an email to the appropriate authority, urging them to address the accessibility shortcomings at "Rafidain Bank" and implement necessary measures to ensure inclusivity for all patrons.

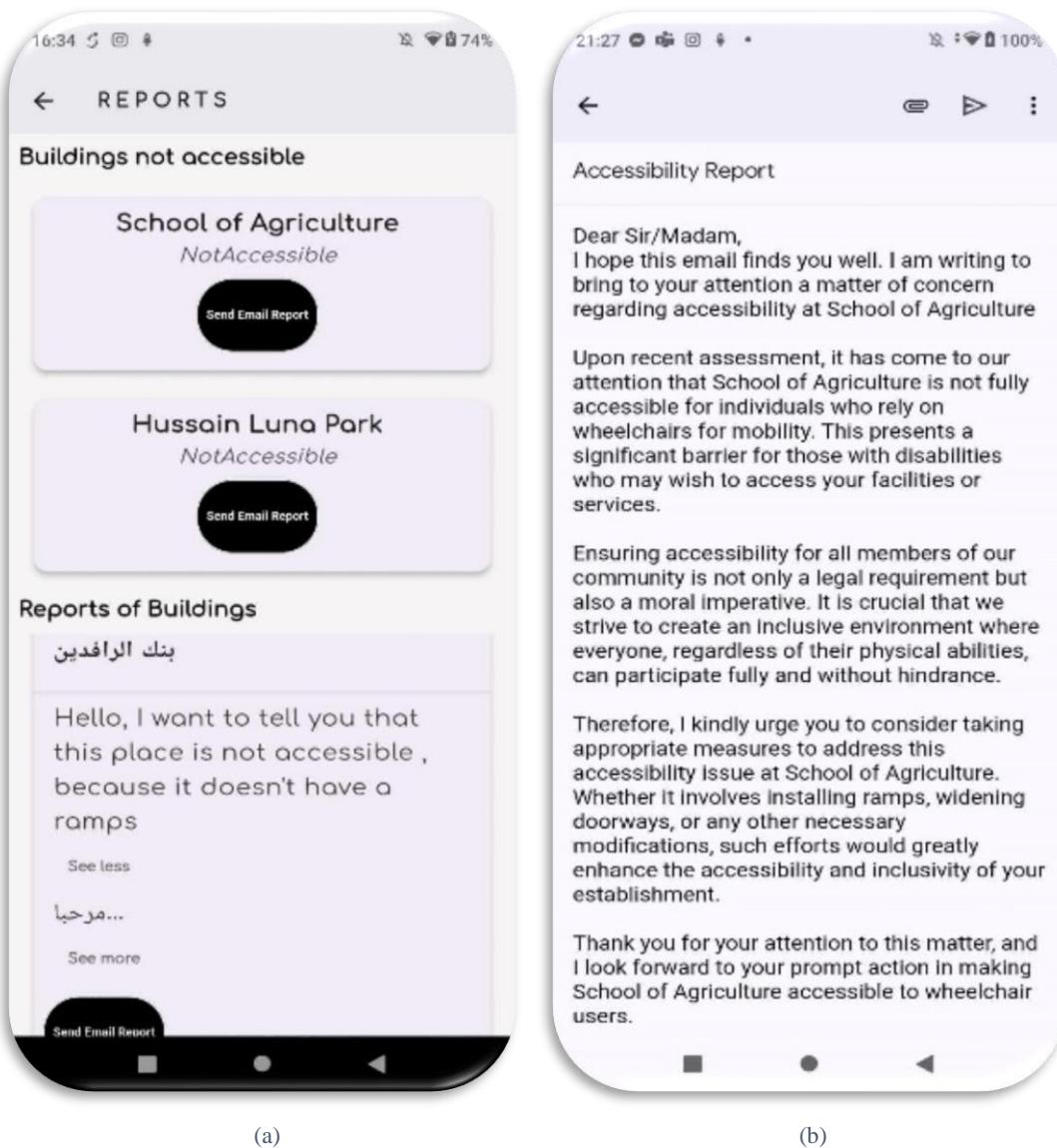


Figure 50. Reports screen on admin account and send email process.

Ali is a senior student at Al-Ahliyya Amman University, preparing for his final year. He often needs to visit various parts of the campus for classes, meetings, and study sessions. To streamline his routine, Ali decides to add Al-Ahliyya Amman University to his favorites that would Utilize Favorites for Quick Access as shown in figure51.

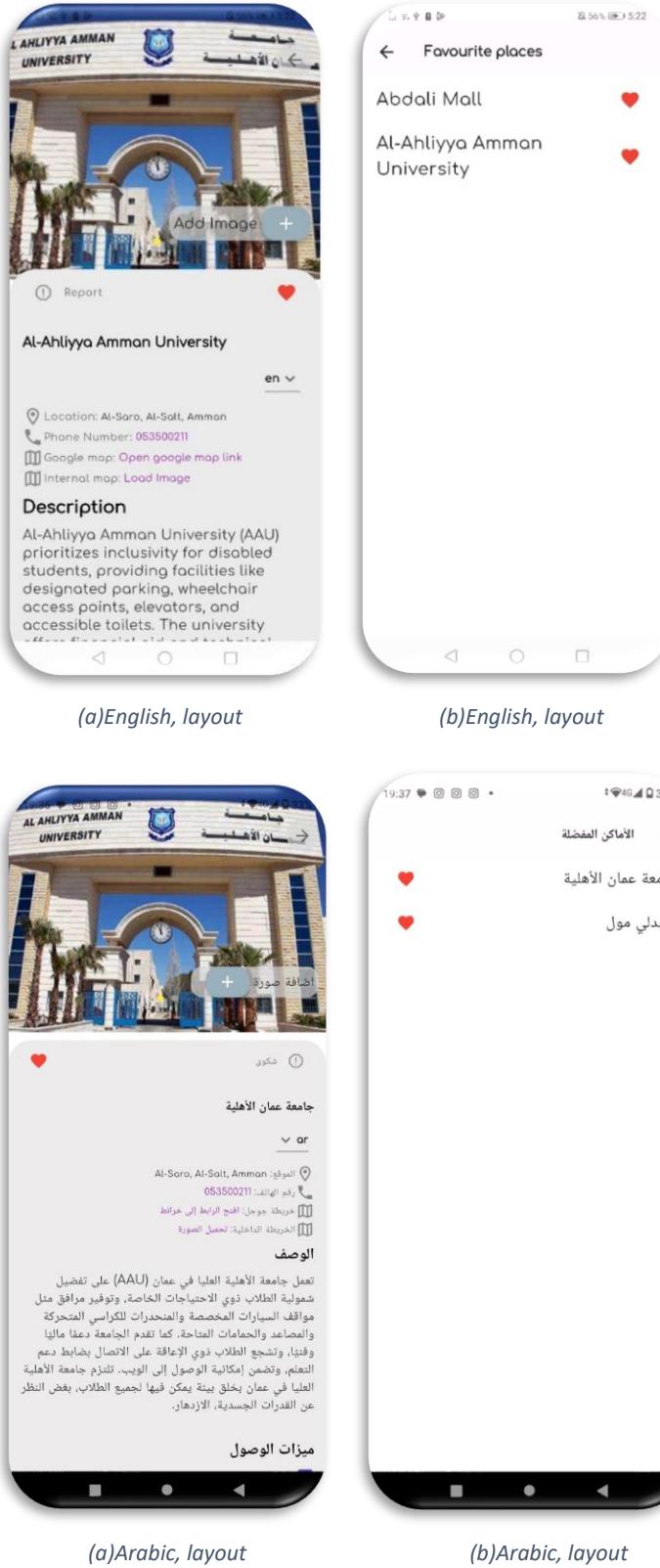


Figure 51.Add place to favorite.

## 4.2. Testing

Test cases are used to verify a feature or functionality of any software application. To verify WellPathJo functionalities, we must test Android availability on the devices and other functionalities that are implemented in the system.

As a result, our application is expected to work on 100% of android devices. We tested WellPathJo on different devices with different android versions to see if the user can create an account and if the features of our application work properly. The results are shown in Table 6.

*Table 6. Testing WellPathJo on Different Devices*

Device name	Can Create account	WellPathJo features work properly?
Android Huawei Y9	Yes	Yes
Android Hero 20 PLUS	Yes	Yes
Samsung 10	Yes	Yes

## 4.3. Survey

We conducted a survey to gather feedback on the WellPathJO application, and we received responses from 110 participants. The results provide valuable insights into the user experience and effectiveness of the application. Below is a summary of the data collected and what it implies:

Our survey, which included 110 participants, revealed a diverse range of feedback on the WellPathJO application. The demographic breakdown showed that 42% of respondents were wheelchair users, while 58% were not. When asked about prior use of similar applications, 33% had used them before, whereas 67% had not.

In terms of the chatbot's effectiveness, responses were mixed but leaned positively with 75% rating it between 3 and 5. Satisfaction with the chatbot's responses followed a similar trend. Participants felt moderately positive about interacting with other users within the community, with 80% rating it 3 or higher. A significant majority, 70%, expressed confidence in using the emergency features.

The internal map feature for navigation was well-received, with 85% rating it 3 or above. Similarly, the accuracy of the Arabic version of the application was rated positively by 85% of participants. Interest in participating in a volunteer-driven initiative to update accessibility information was moderate, with 55% showing interest.

The user interface (UI) of the chatbot received favorable ratings from 75% of respondents. The accuracy of search results for accessible locations was also rated positively by 85% of

participants. Overall, 75% rated the application positively, and 60% indicated they would likely provide feedback or reviews.

Finally, comfort with the app's interface for extended use without causing eye strain was rated positively by 78%, though a small percentage, 3%, found it uncomfortable.

These results in Table 7 indicate that while the WellPathJO application has been generally well-received, there are areas for improvement, particularly in enhancing user comfort and engagement features. The positive reception of the internal map and Arabic language accuracy highlights key strengths, while user interaction and feedback mechanisms suggest areas for further development and community involvement.

*Table 7. Survey and statistical results*

<b>1. Are you a wheelchair user?</b>				
• Yes		• No		
42%		58%		
<b>2. Have you used a similar application for wheelchair users and accessibility features before?</b>				
• Yes		• No		
33%		67%		
<b>3. How effective do you think the chatbot shown in the demo would be in assisting users?</b>				
• 1	• 2	• 3	• 4	• 5
10%	15%	25%	30%	20%
<b>4. How satisfied are you with the responses provided by the chatbot in the demo?</b>				
• 1	• 2	• 3	• 4	• 5
5%	15%	25%	30%	15%
<b>5. Do you think it would be easy to interact with other users within the community based on the demo?</b>				
• 1	• 2	• 3	• 4	• 5
5%	10%	20%	40%	20%
<b>6. Would you feel confident in using the emergency features based on the demo?</b>				
• Yes		• No		
70%		30%		
<b>7. How would you rate the internal map feature for navigation based on the demo?</b>				
• 1	• 2	• 3	• 4	• 5
7%	3%	25%	30%	35%
<b>8. How would you rate the accuracy of the Arabic version of the application?</b>				
• 1	• 2	• 3	• 4	• 5
5%	10%	25%	35%	25%
<b>9. Would you be interested in participating in a volunteer-driven initiative to update and verify the application?</b>				
• Yes		• No		
55%		45%		

<b>10. How would you rate the user interface (UI) of the chatbot?</b>				
• 1	• 2	• 3	• 4	• 5
10%	15%	25%	30%	20%
<b>11. When searching for accessible locations, how accurate are the results provided by WellPathJO?</b>				
• 1	• 2	• 3	• 4	• 5
5%	10%	35%	35%	15%
<b>12. What is your overall rating?</b>				
• 1	• 2	• 3	• 4	• 5
10%	15%	25%	30%	20%
<b>13. Would you be likely to provide feedback or reviews for different aspects of the application based on the demo?</b>				
• Yes			• No	
60%			40%	
<b>14. On a scale of 1 to 5, how comfortable do you find the app's interface for extended use without causing eye strain?</b>				
• 1	• 2	• 3	• 4	• 5
7%	15%	25%	50%	3%

# CHAPTER 5

## CONCLUSIONS AND FUTURE WORK

### 5.1 Conclusions

In conclusion, the imminent evolution of our application represents a significant milestone in our project, poised to revolutionize its capabilities and profoundly impact both our community and its users. Through a sophisticated array of features including 'Community Engagement,' 'Emergency Assistance and Alerts,' 'Indoor Maps,' 'Screen Readers,' 'Voice Commands,' 'Equipment Supplier Recommendations,' and 'Chatbot Interaction,' we demonstrate our engineering prowess and unwavering commitment to creating a more inclusive and accessible digital environment.

This comprehensive approach, meticulously crafted through our engineering expertise and fueled by our dedication to innovation, sets our project apart as a cutting-edge and socially impactful endeavor. By seamlessly integrating advanced technology with user-centric design principles, we aim to not only provide essential resources but also foster genuine community connections and prioritize user safety.

Our project's core values of inclusivity and empowerment drive us forward, serving as the guiding principles of our engineering journey. As we navigate through this transformative process, we are deeply committed to realizing our vision of a more inclusive digital landscape, one where every individual, regardless of their background or abilities, can thrive and participate fully in the digital world.

### 5.2 Future Work

In our vision for the future of our application, AI technology stands as a pivotal force driving accessibility and inclusivity to new heights. One crucial avenue lies in the refinement and expansion of existing features through AI integration. This entails enhancing functionalities like screen readers, voice commands, and indoor maps through iterative learning algorithms, ensuring they remain finely tuned to evolving user needs. Additionally, AI-powered mapping technologies hold promise in accelerating the process of mapping various buildings, from public facilities to commercial spaces and educational institutions. By leveraging AI, we aim to provide comprehensive accessibility information for a broader range of environments, enabling users to navigate with confidence and independence.

Furthermore, AI is poised to revolutionize community engagement within our application. By analyzing user interactions and feedback, AI algorithms can facilitate proactive engagement and personalized support for users with diverse accessibility needs. From deploying AI-driven chatbots capable of delivering tailored assistance to refining safety and emergency assistance through predictive analytics, our goal is to enhance user safety and empower individuals to thrive in their communities. Through continuous improvement driven by AI-driven data analysis and machine learning, we are committed to ensuring that our application remains at the forefront of accessibility innovation, continuously evolving to meet the dynamic needs of our users and foster a truly inclusive digital environment.

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# APPENDIX A

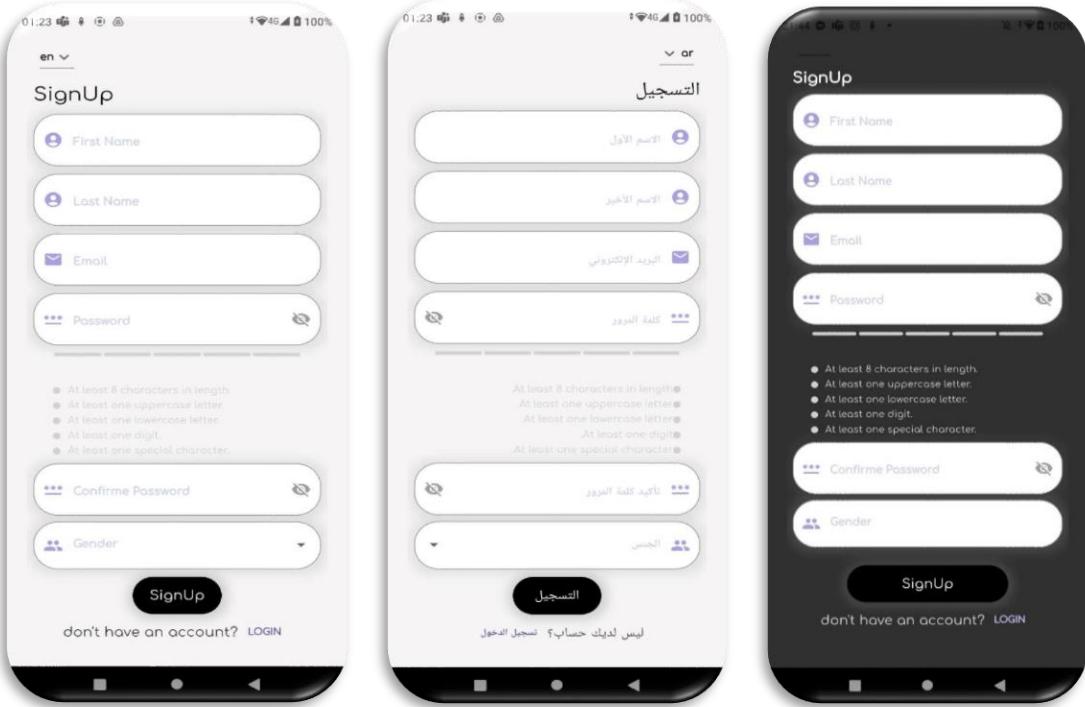


Figure 52.Signup screens.

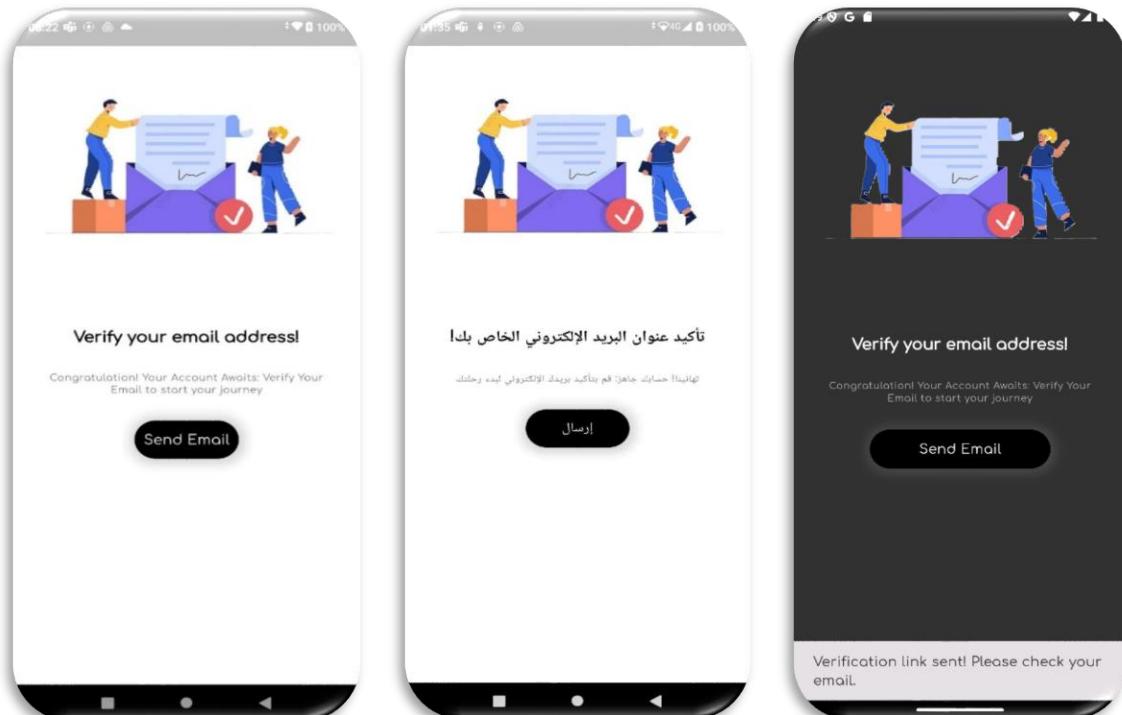


Figure 53. verifying signup screens.

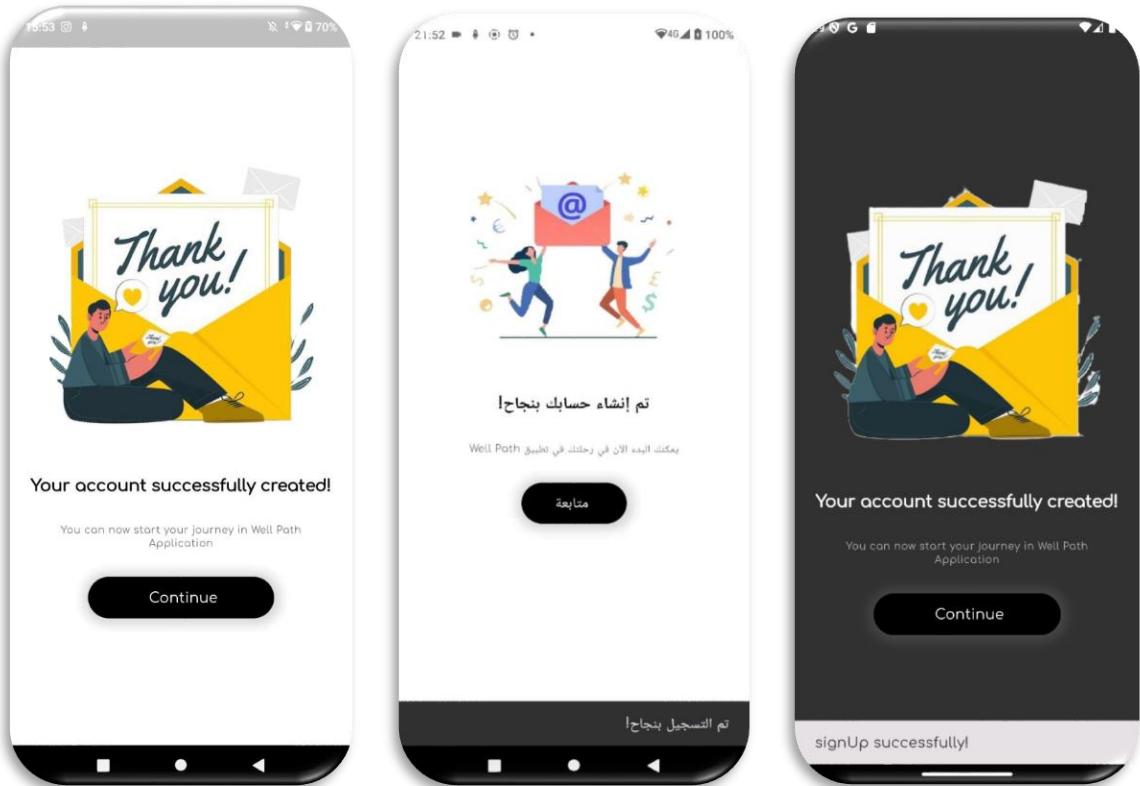


Figure 54.verify successfully screen.

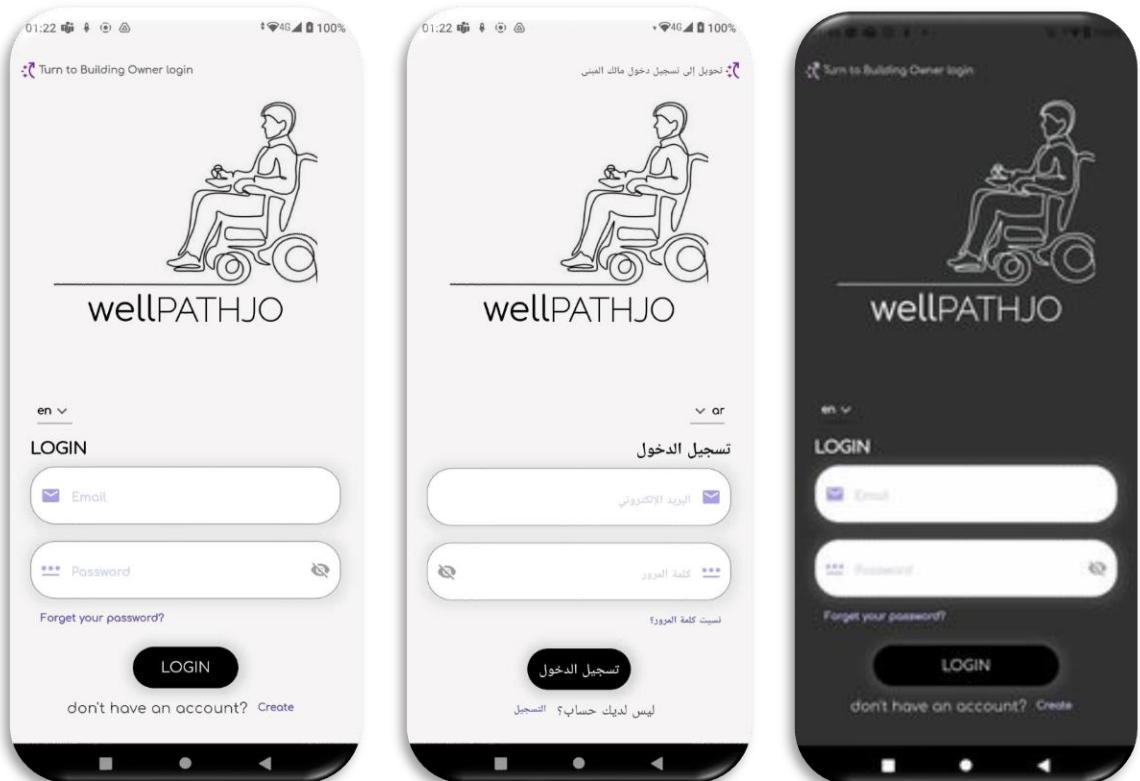


Figure 55.Login screen.

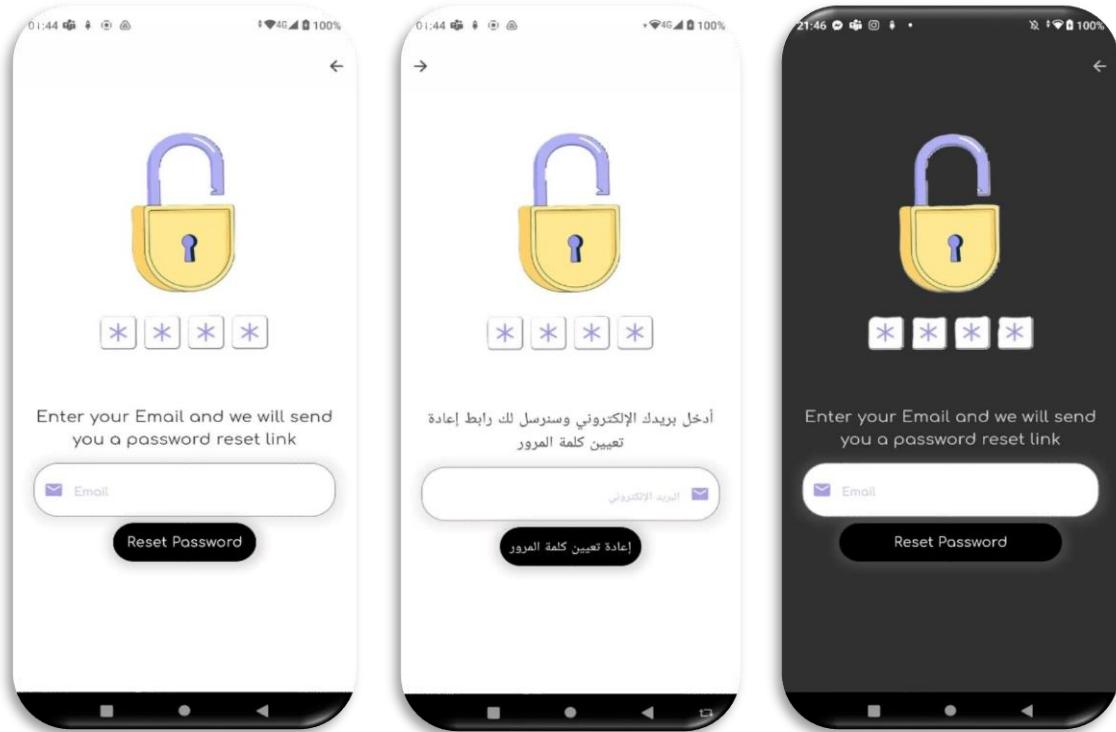


Figure 56. forget password screen.



Figure 57. building owner login screen.

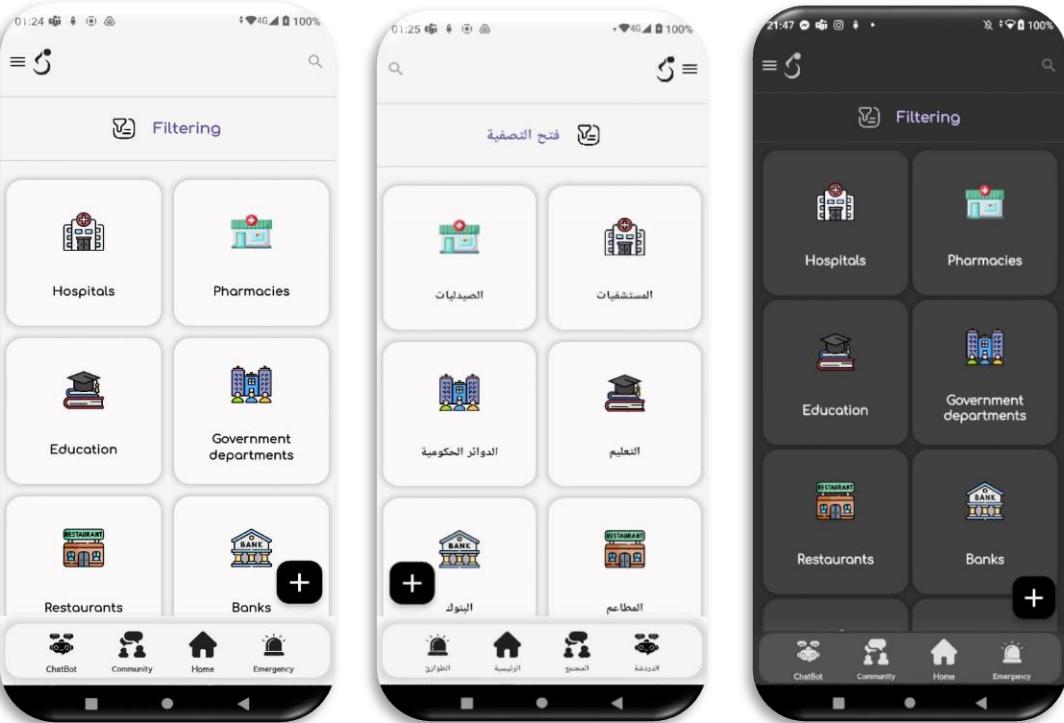


Figure 58. Main Screen.

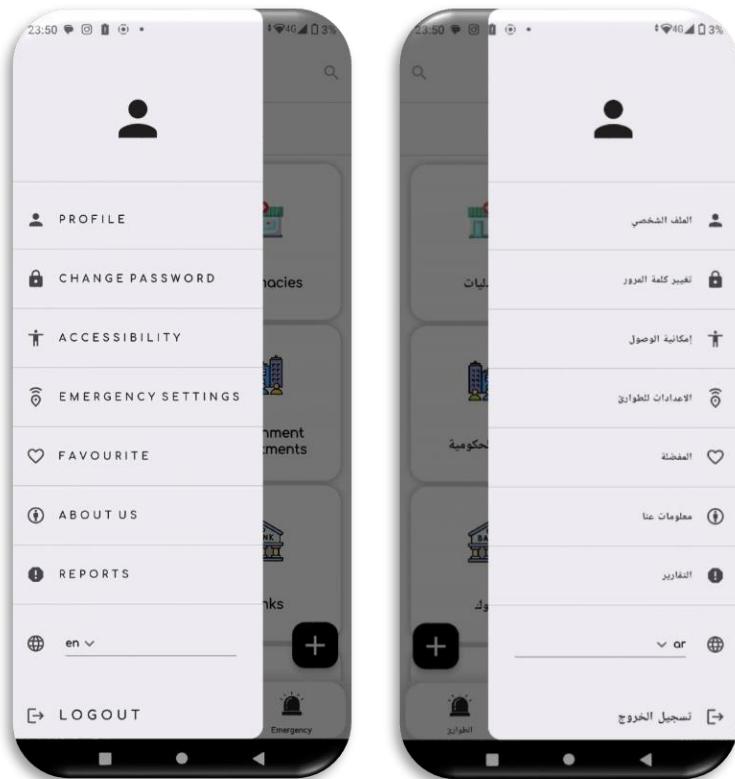


Figure 59. Sidebar screen.

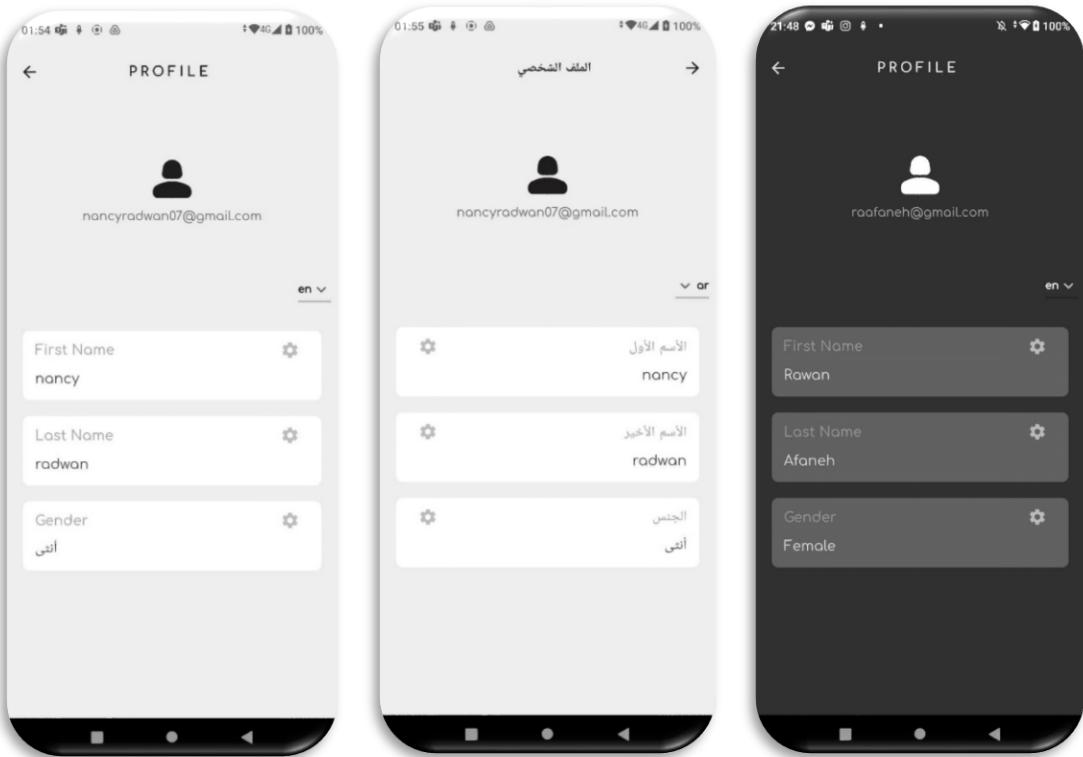


Figure 60. Account screen.

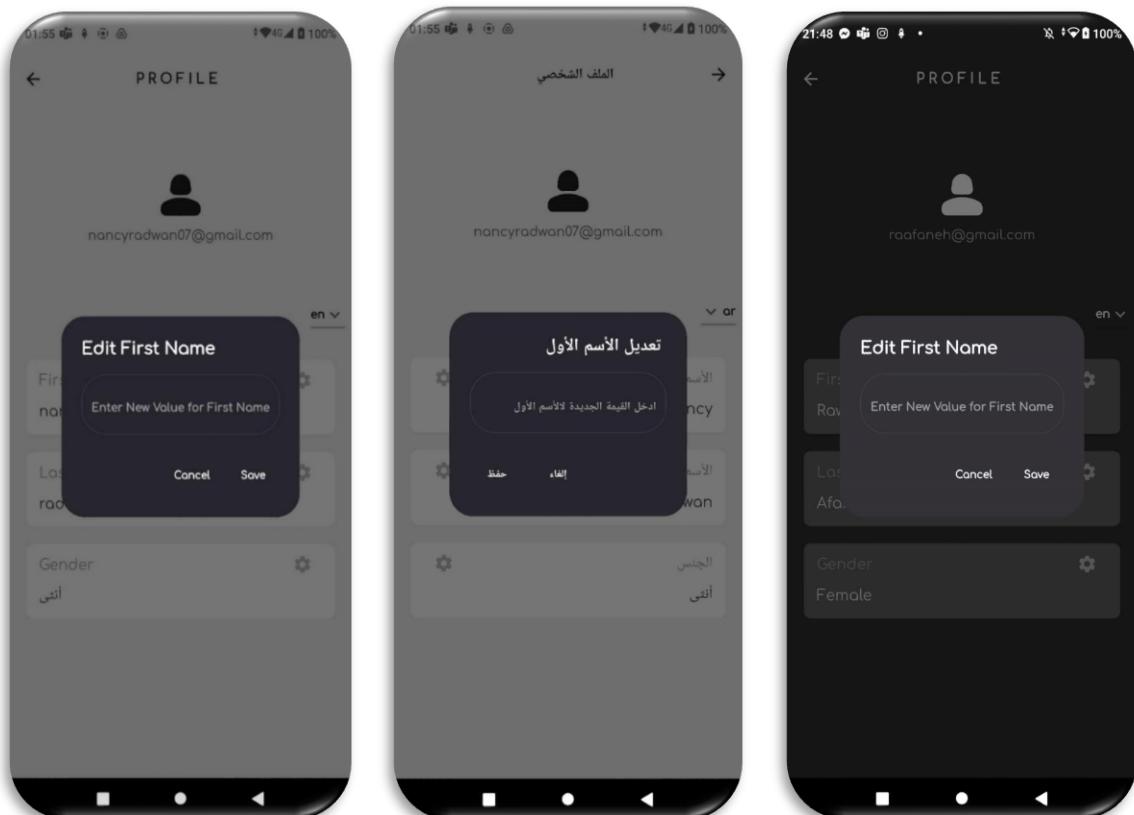


Figure 61. Editing fields dialog.

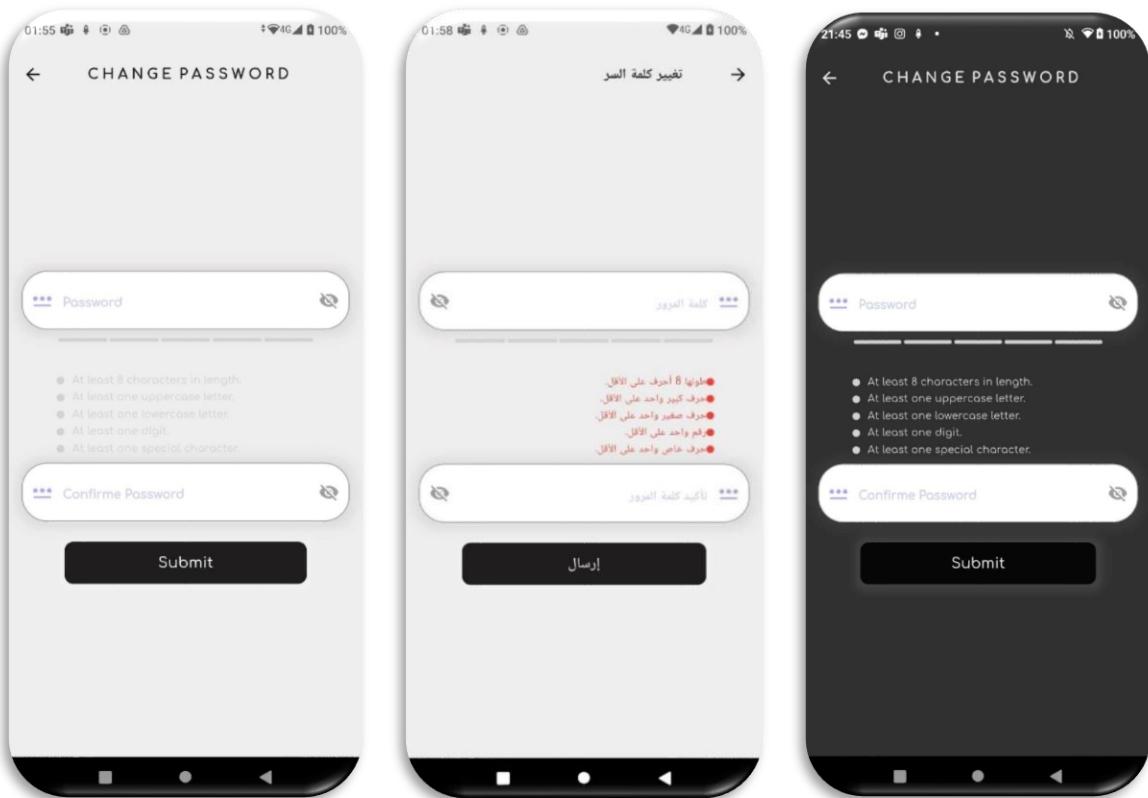


Figure 62. Change password screen.

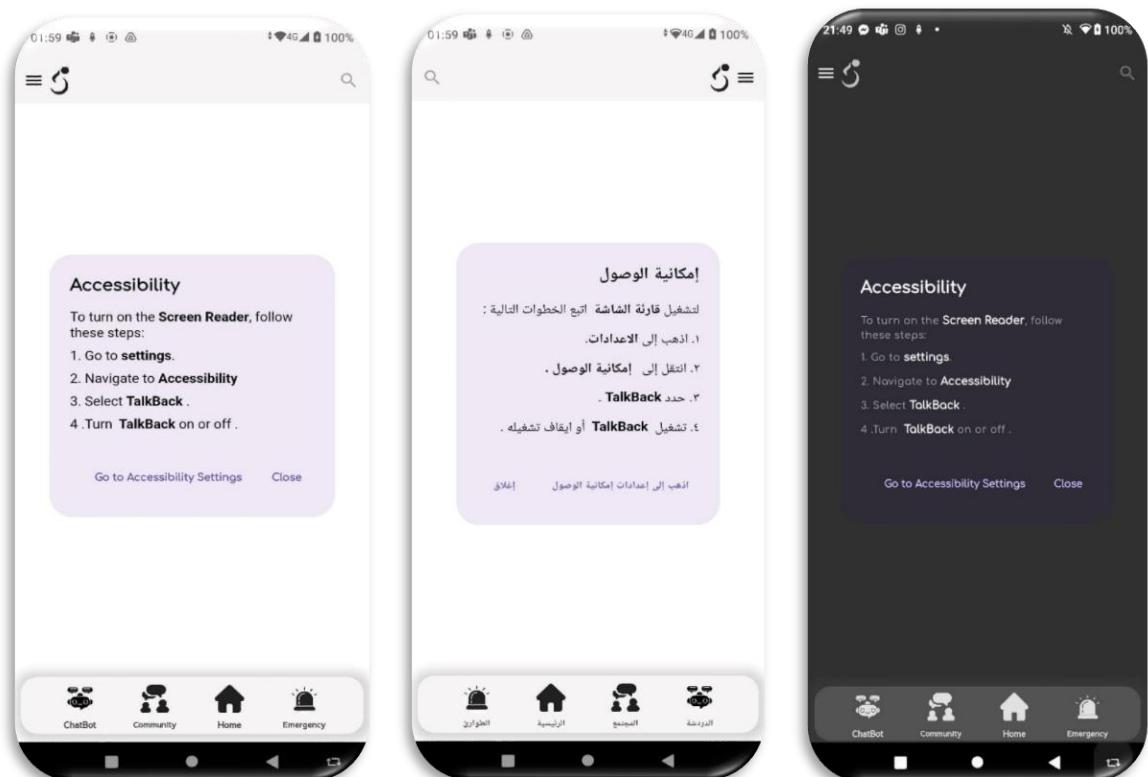


Figure 63. Screen Reader guide.

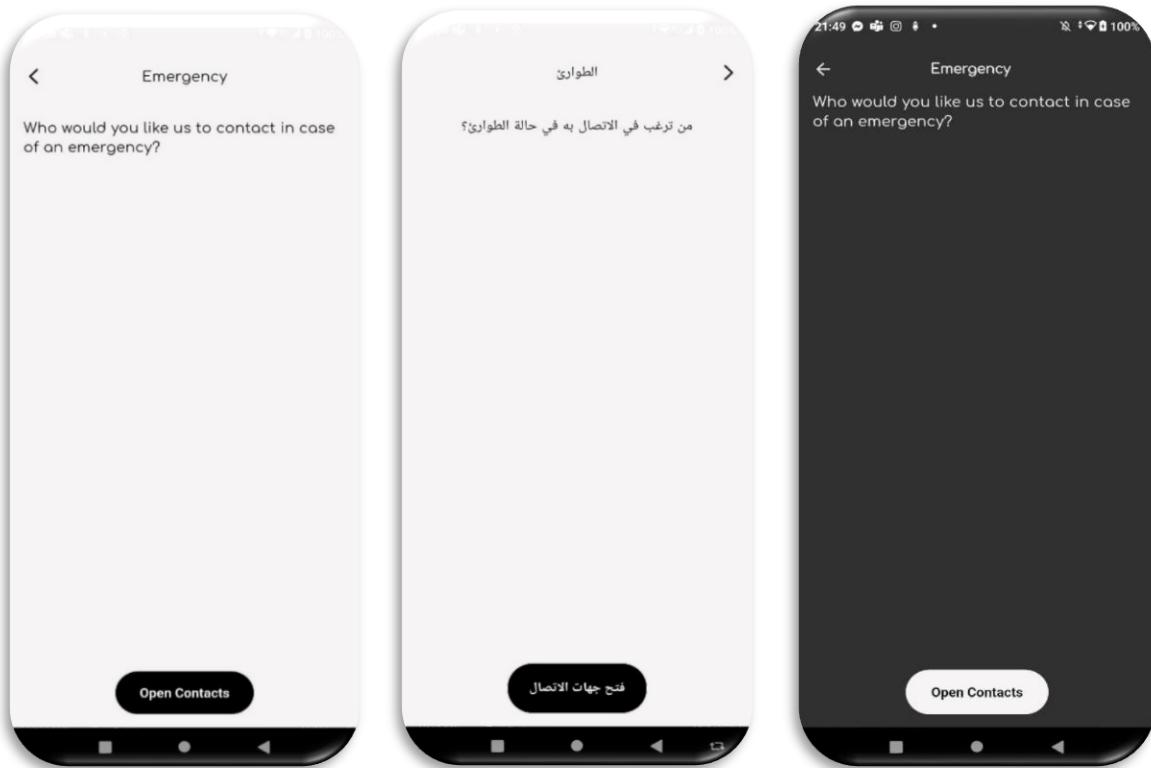


Figure 64.Emergency Settings Screen.

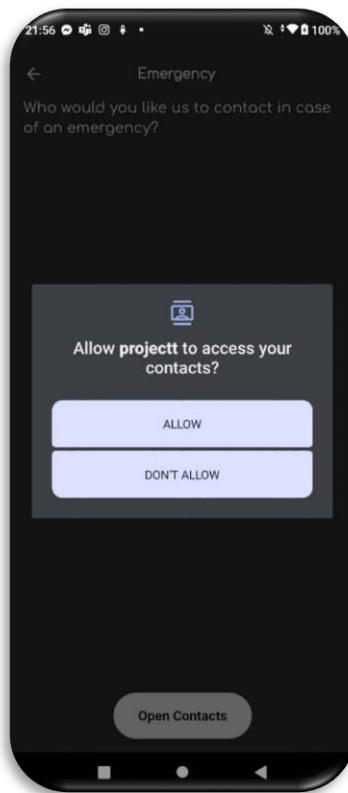


Figure 65.contact permission.

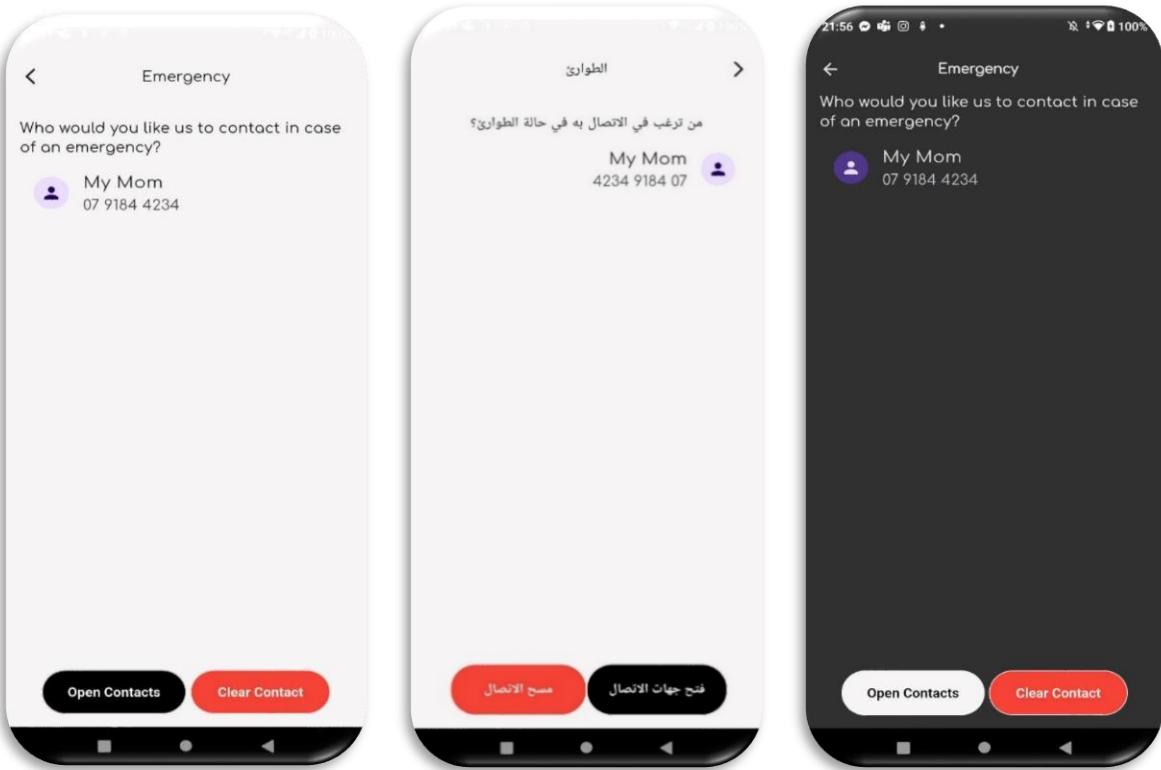


Figure 66. Adding contact screen.

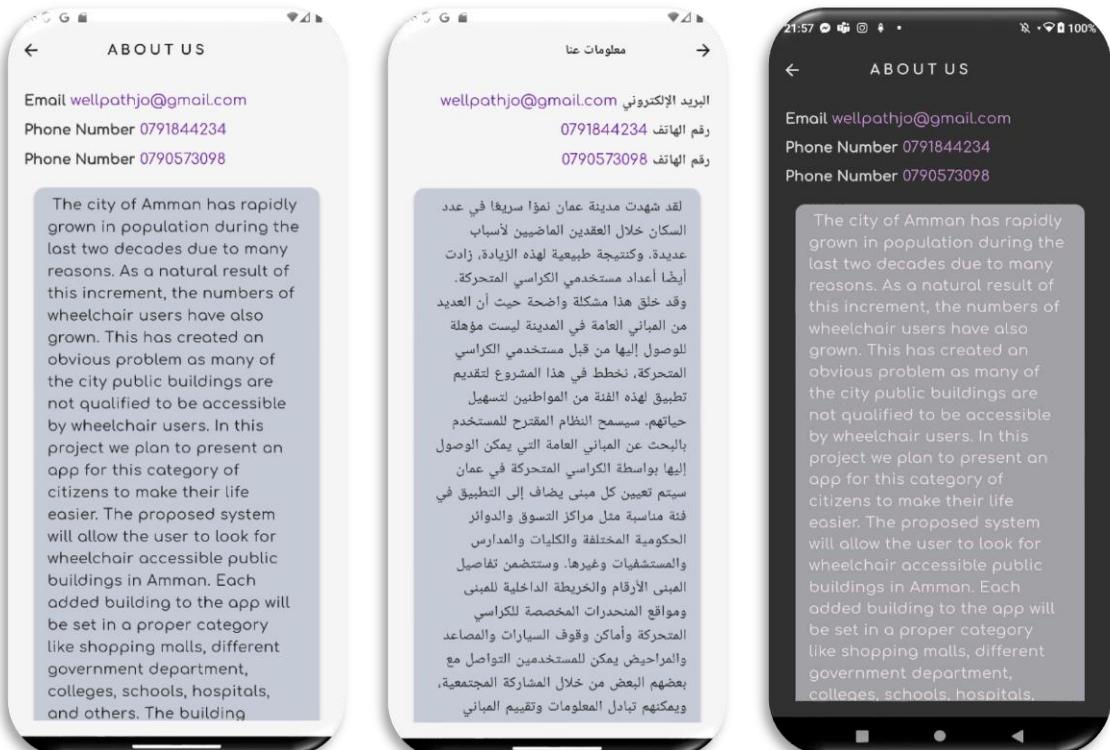


Figure 67. About us screen.



Figure 68.Chatbot Screen.

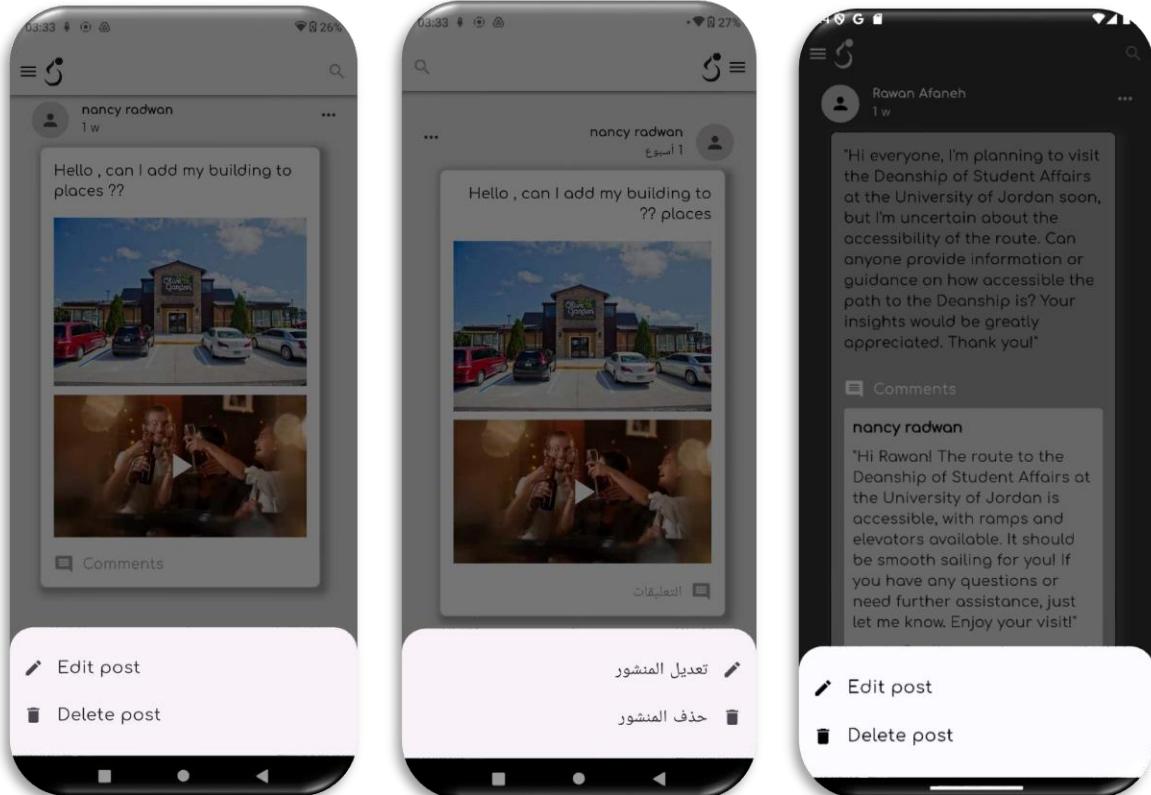


Figure 69.community engagement post option.

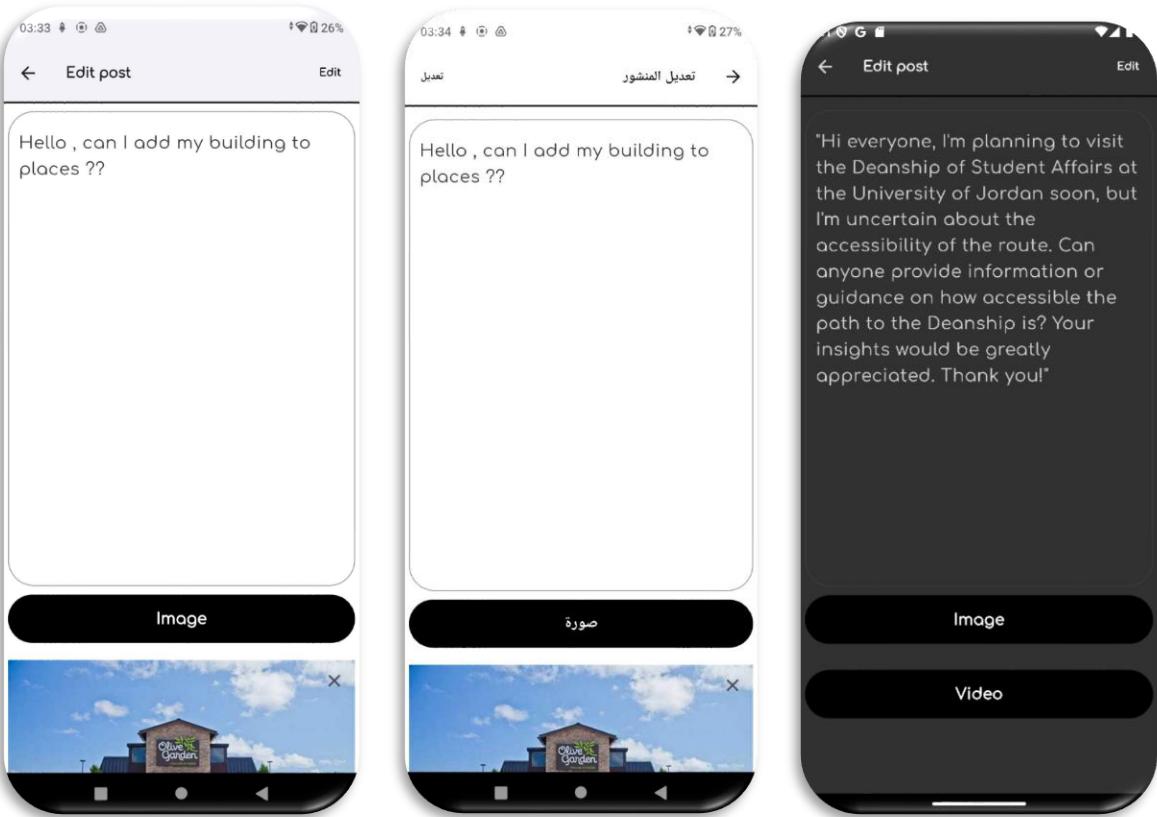


Figure 70.Editing post screen.

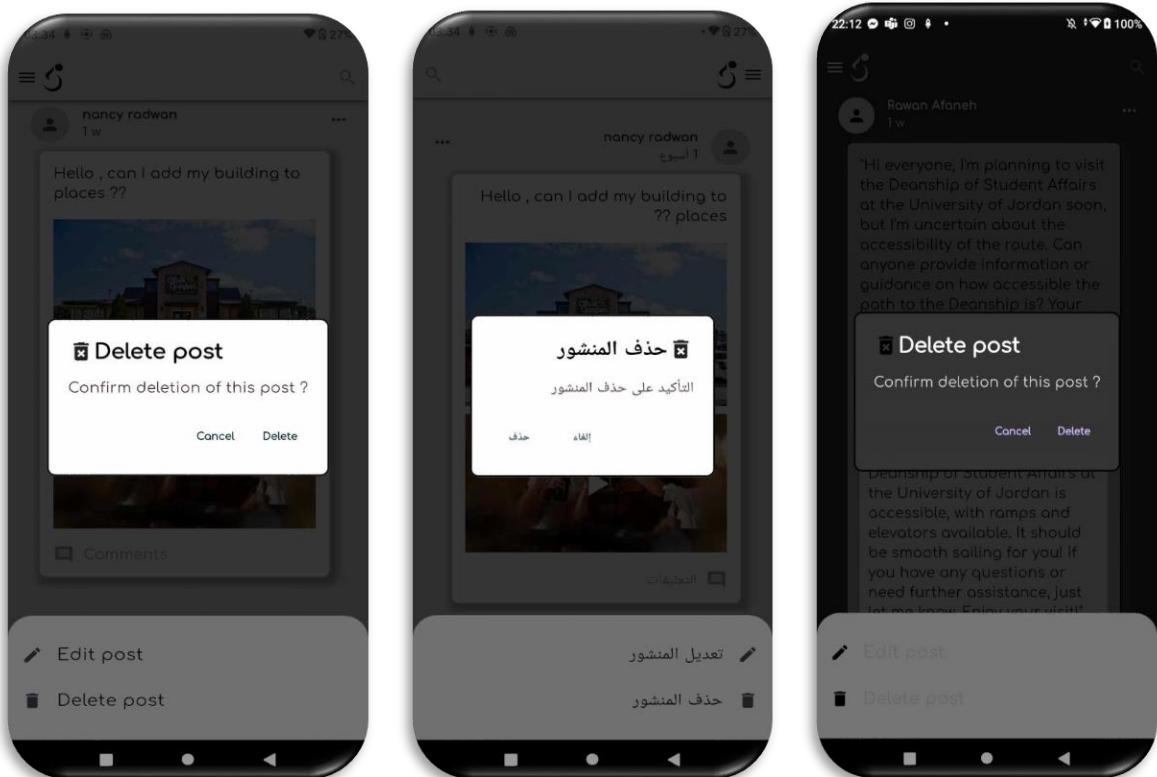


Figure 71.Delete post option dialog.

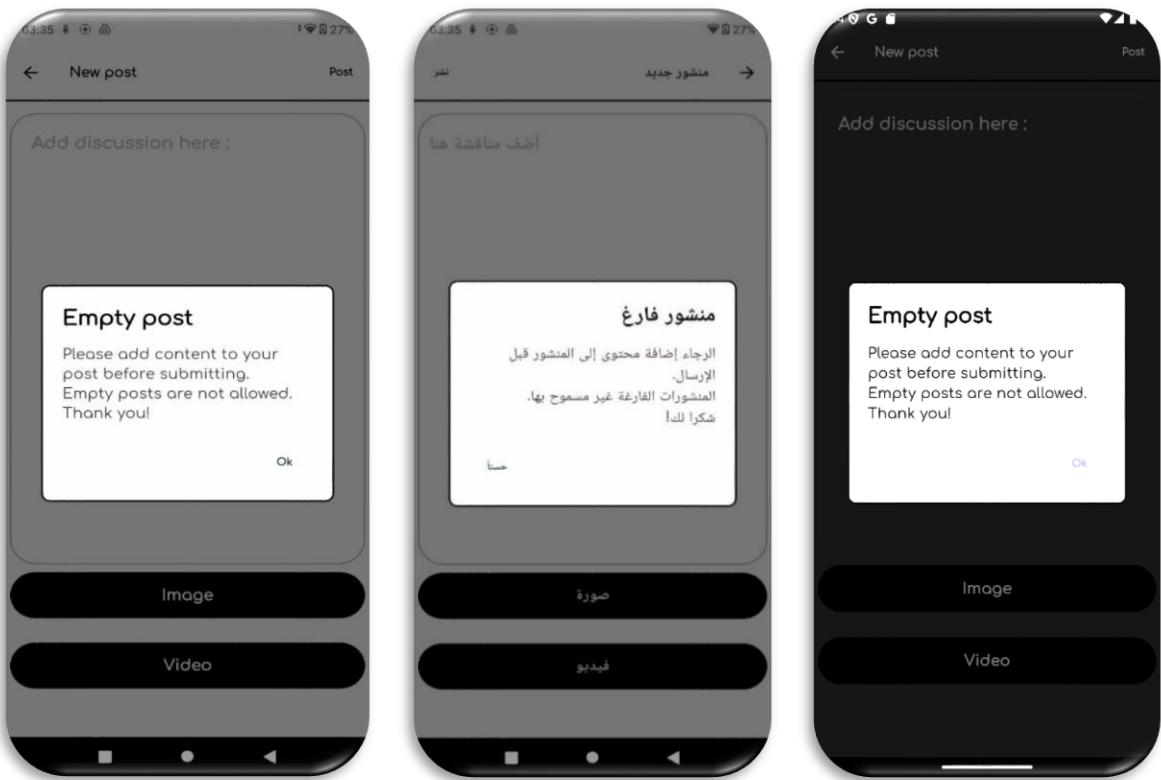


Figure 72.If the user submits an empty post.

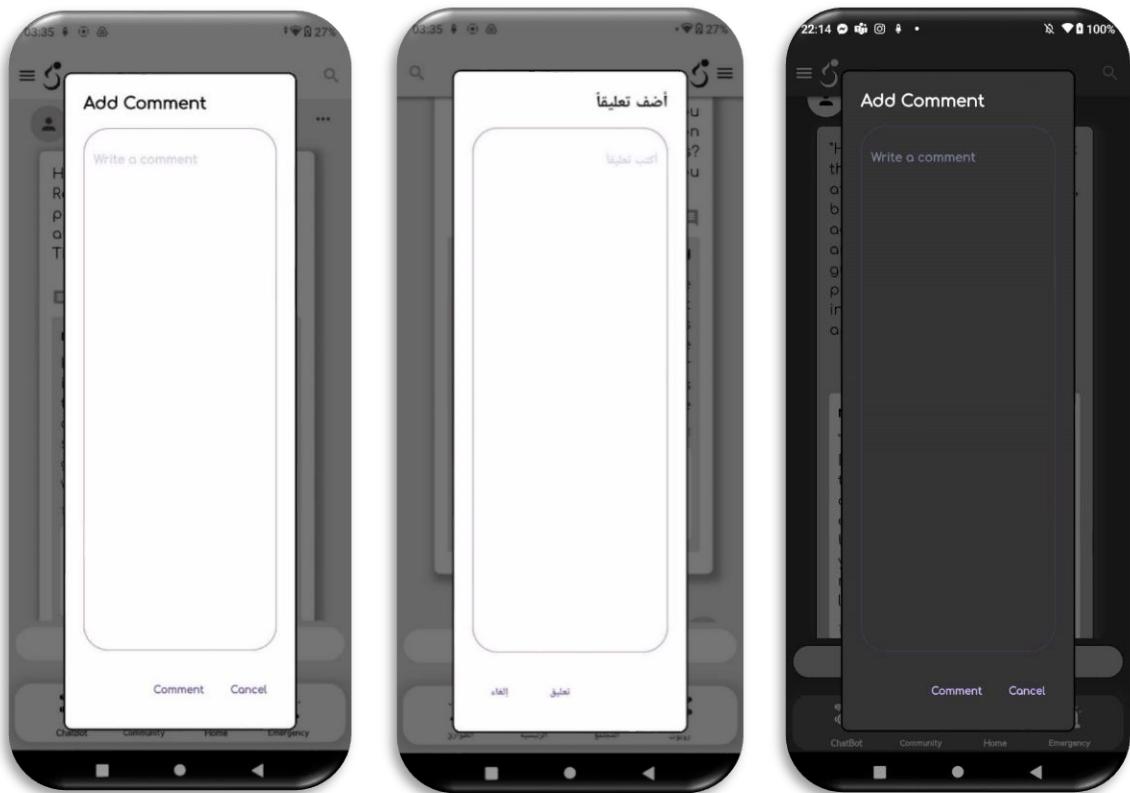


Figure 73.Adding comment dialog.

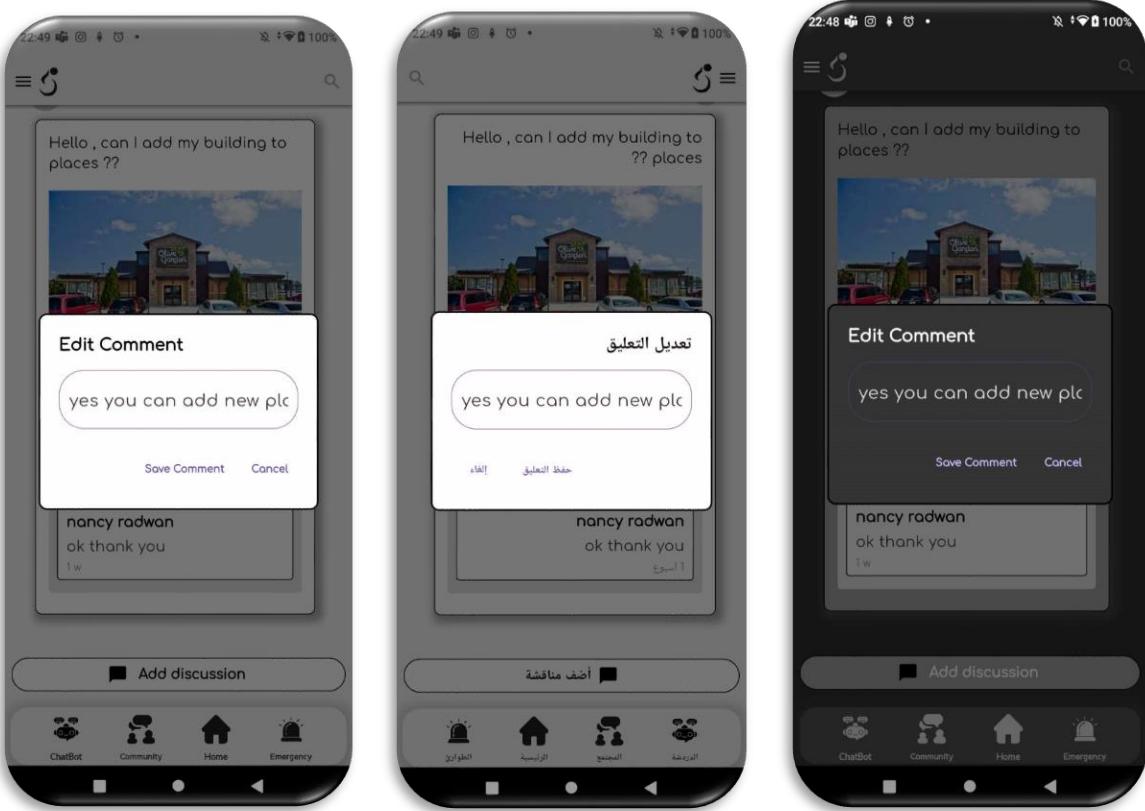


Figure 74.Edit comment.

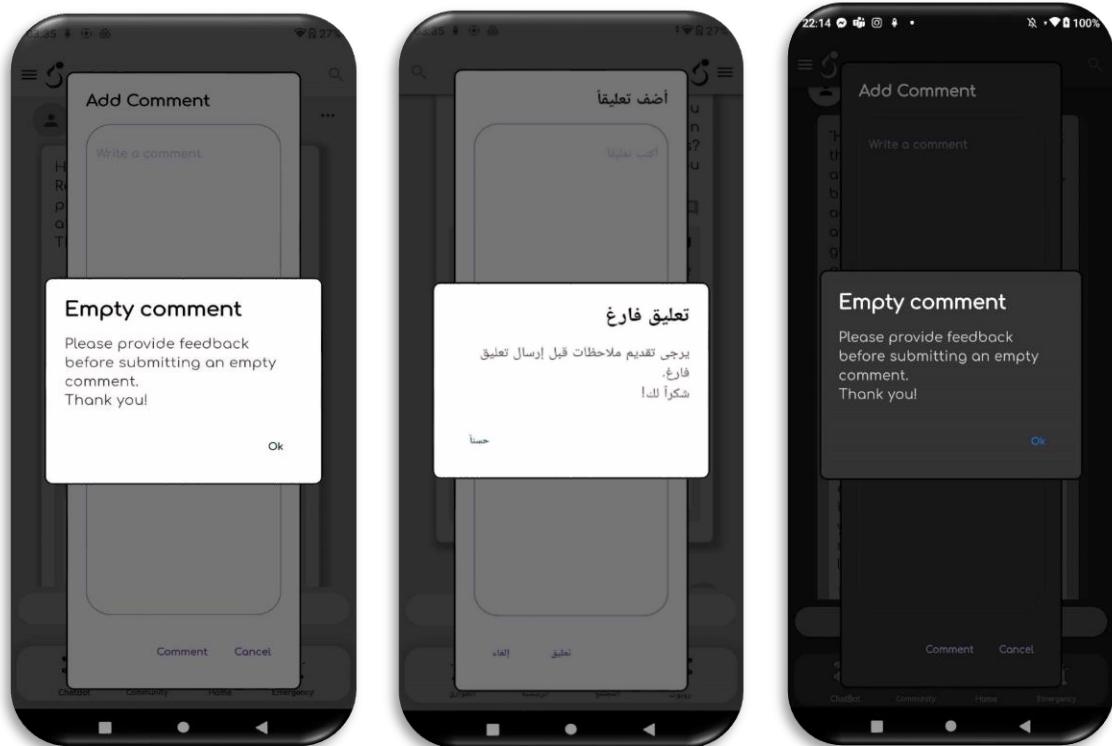


Figure 75.If adding an empty comment.

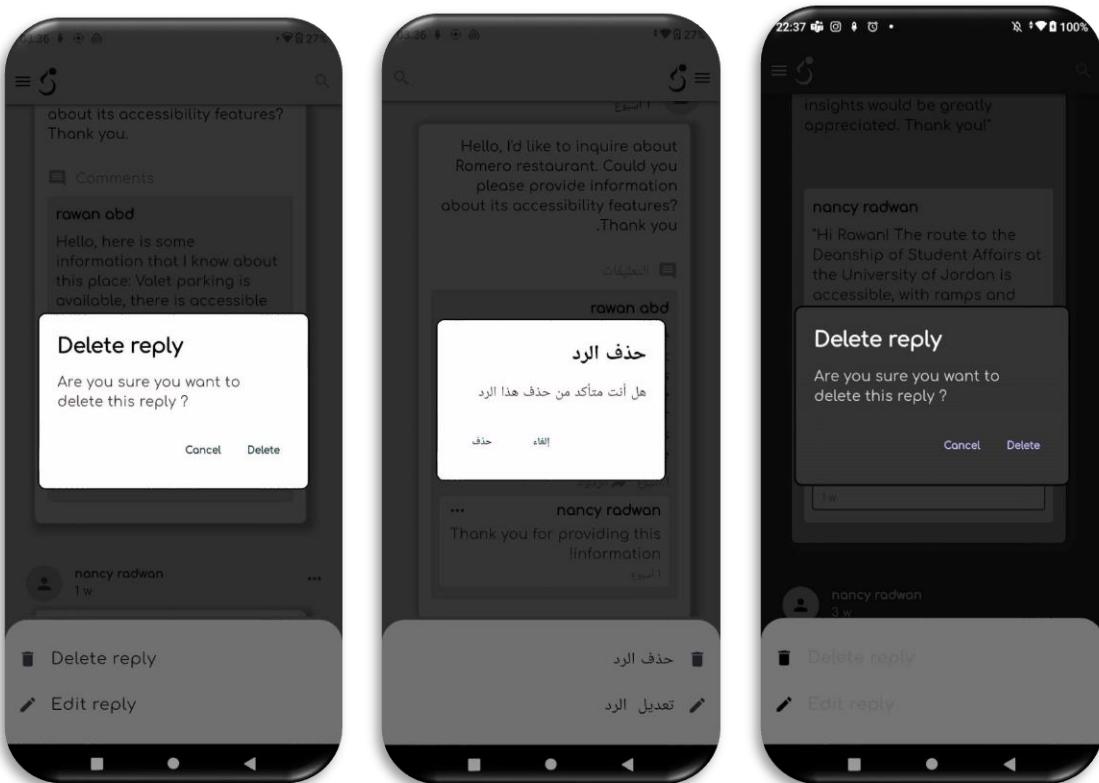


Figure 76.delete reply dialog.

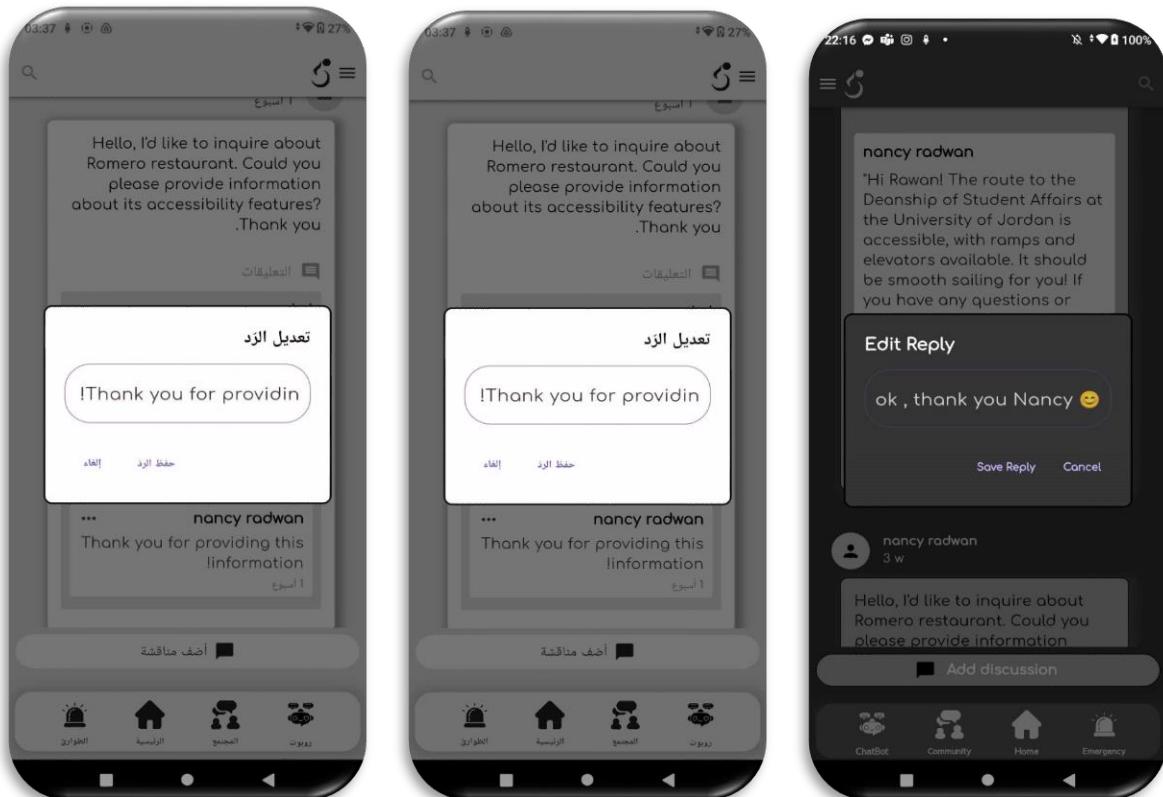


Figure 77.Edit reply dialog.

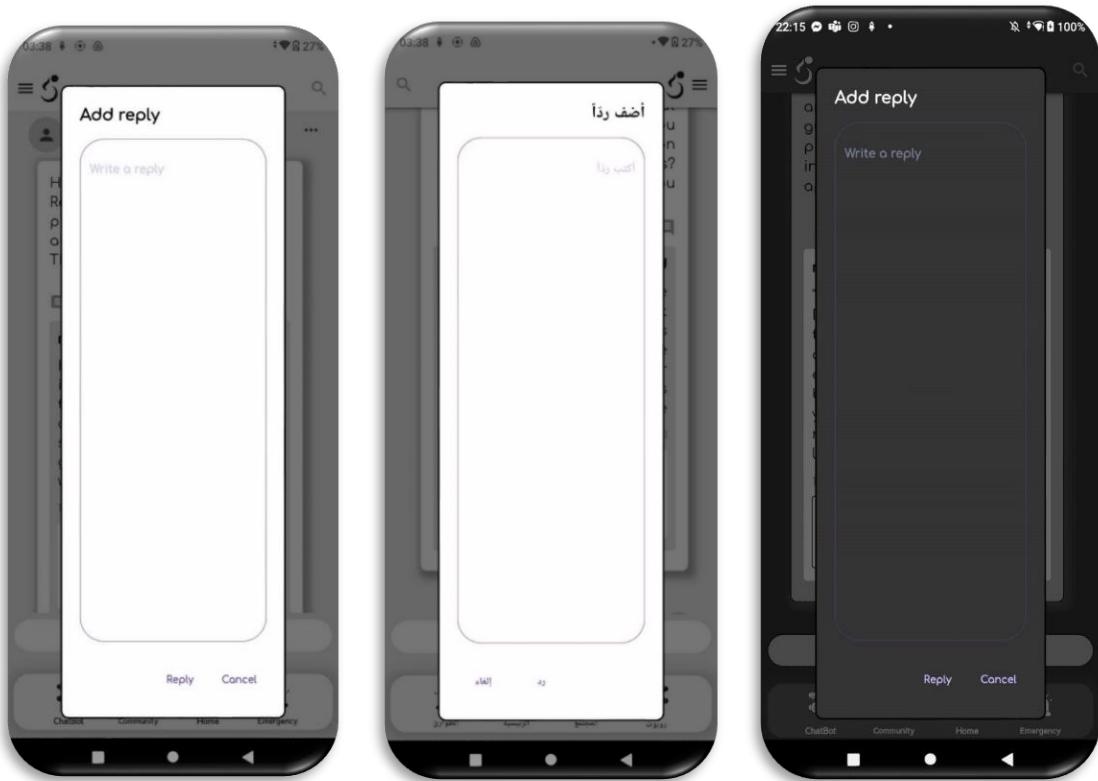


Figure 78. Write reply dialog.

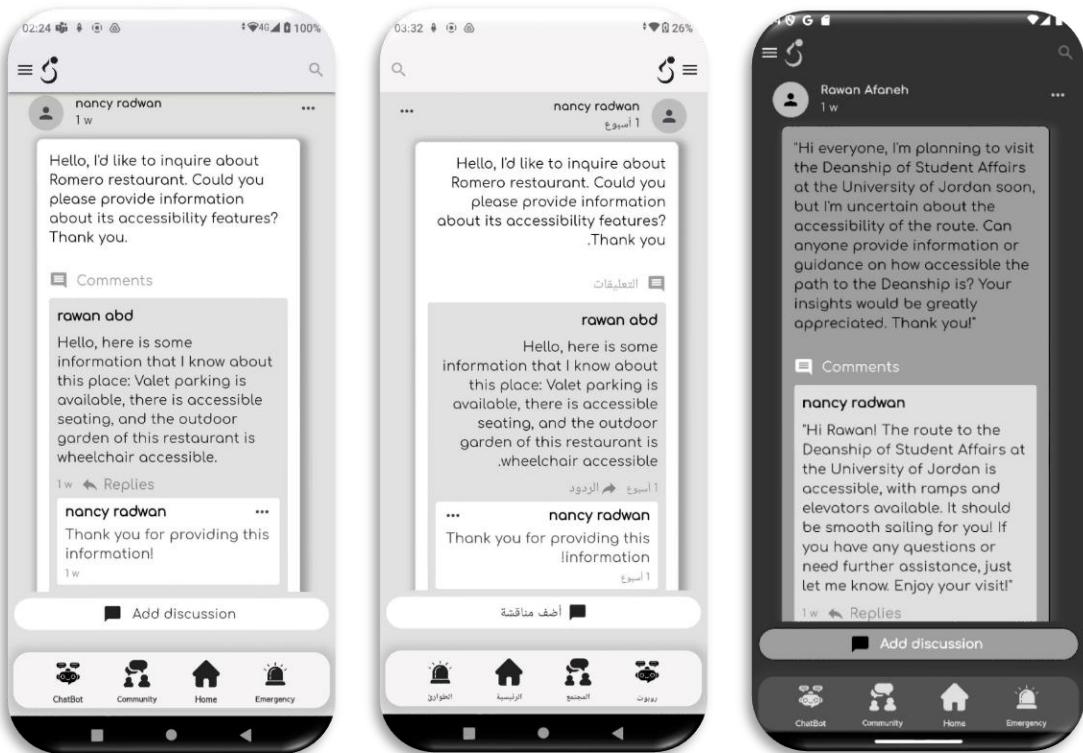


Figure 79. Community Engagement screen.



Figure 80. Search Screen.

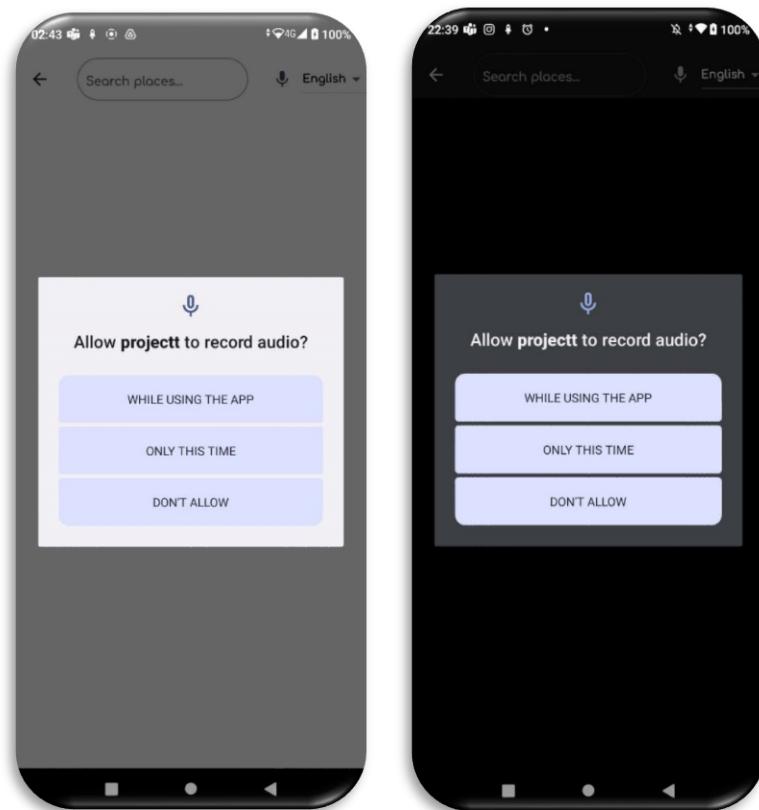


Figure 81. Voice Command permission dialog.

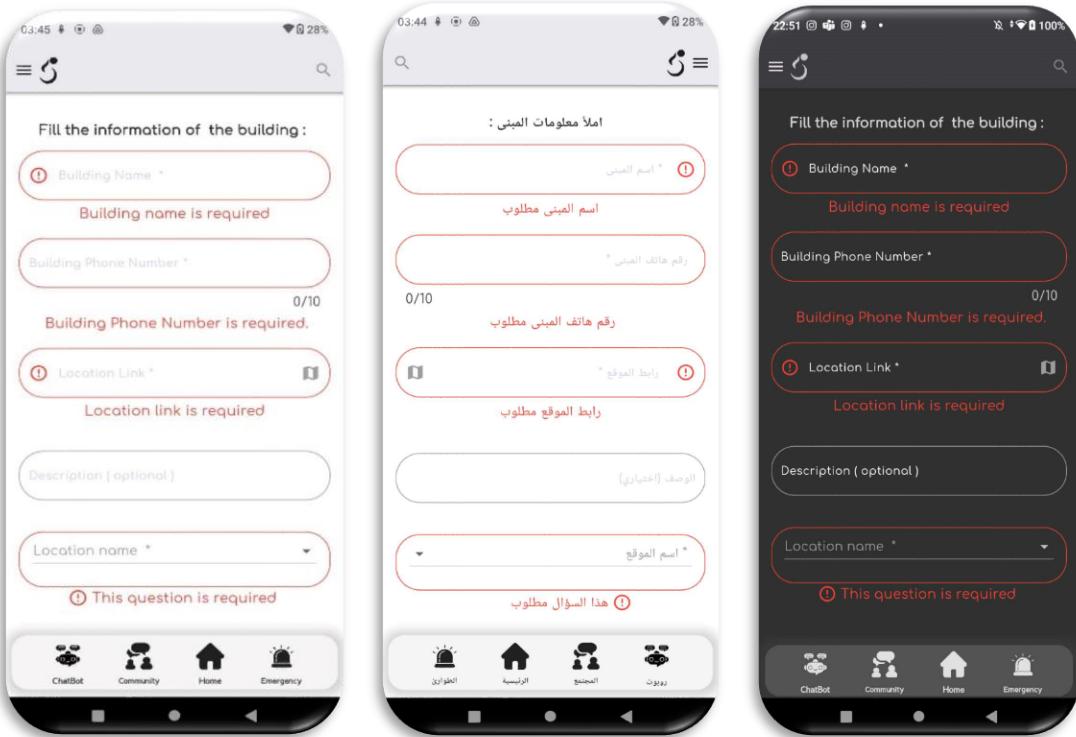


Figure 82.Adding new building information.

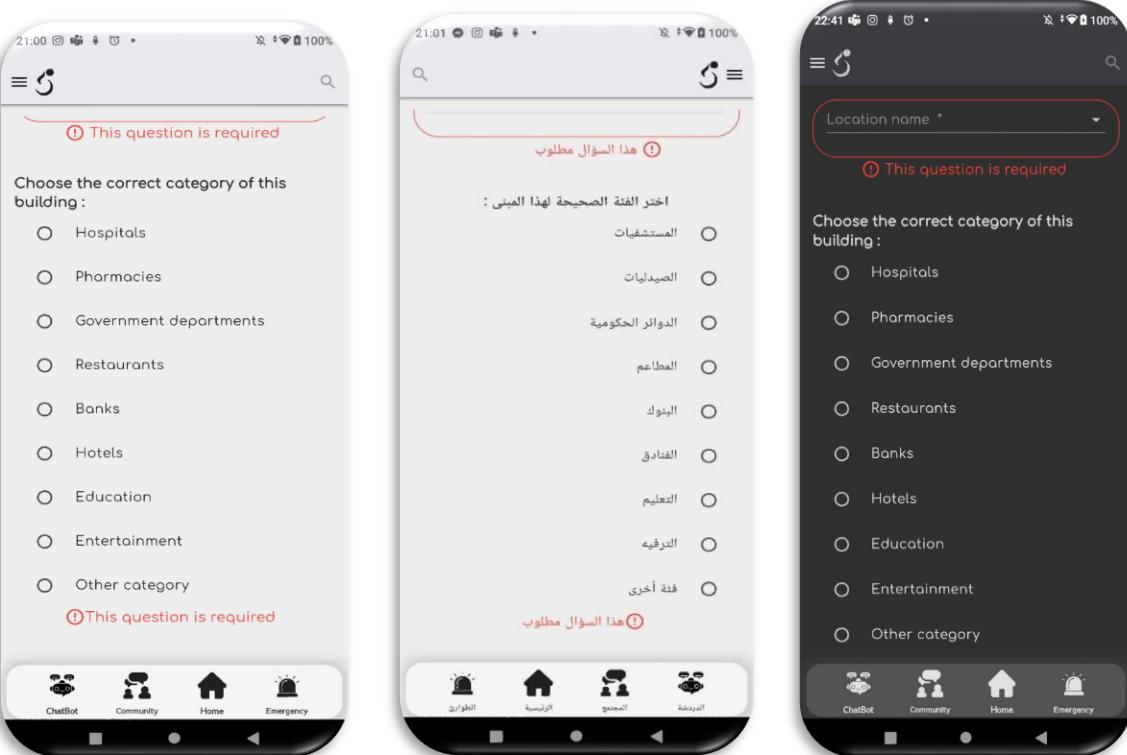


Figure 83.Adding new building information.

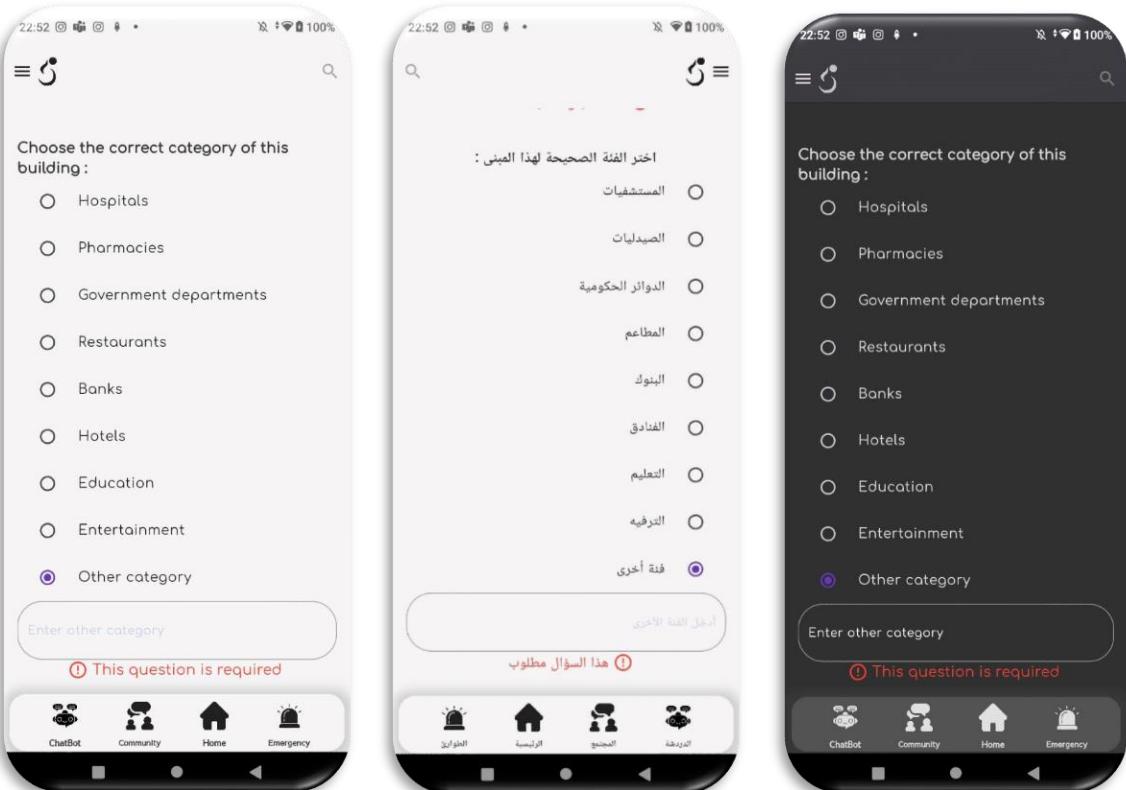


Figure 84.Add new category.

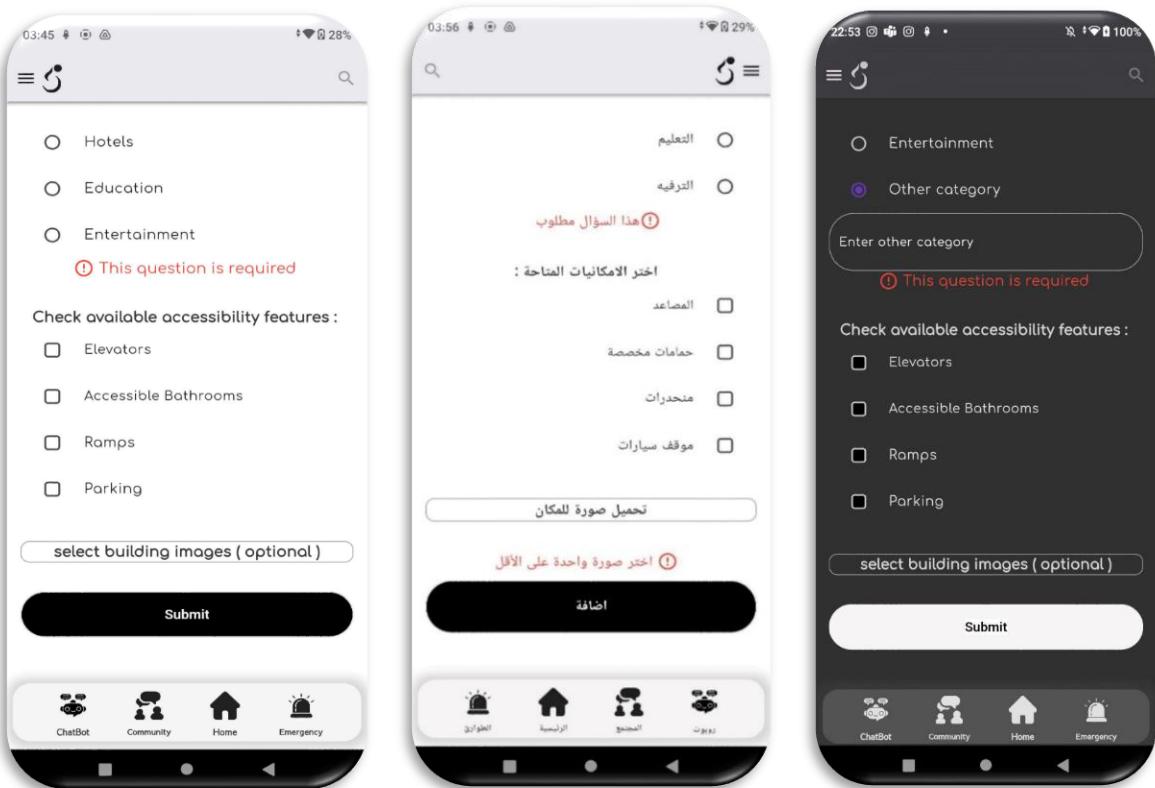


Figure 85.Adding new building information.

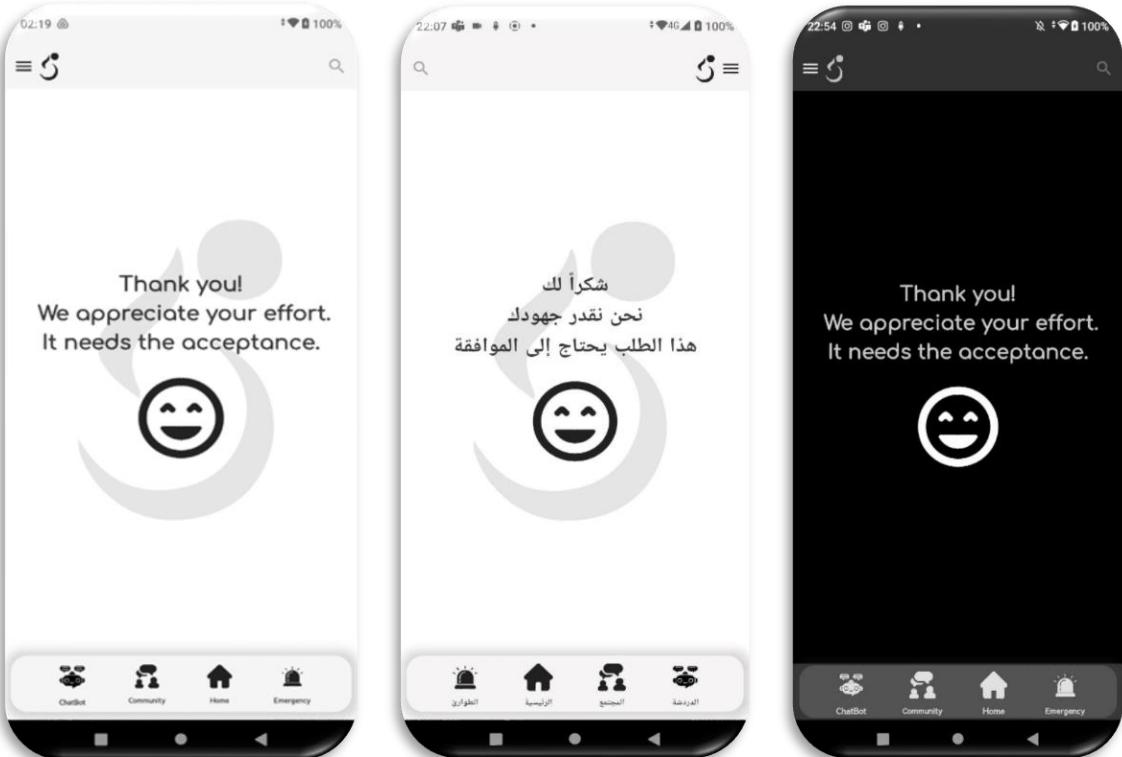


Figure 86. Thank you screen after adding new building and waiting for acceptance.

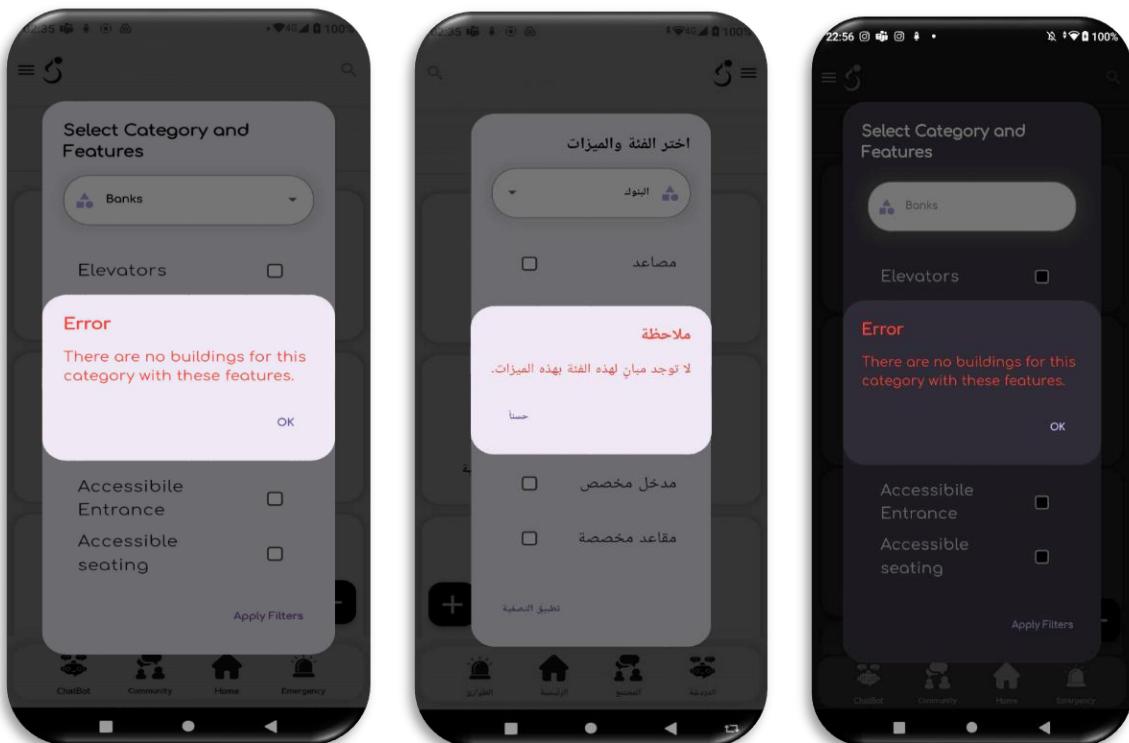


Figure 87. Filtering if apply filters without entering any buildings or features dialog.

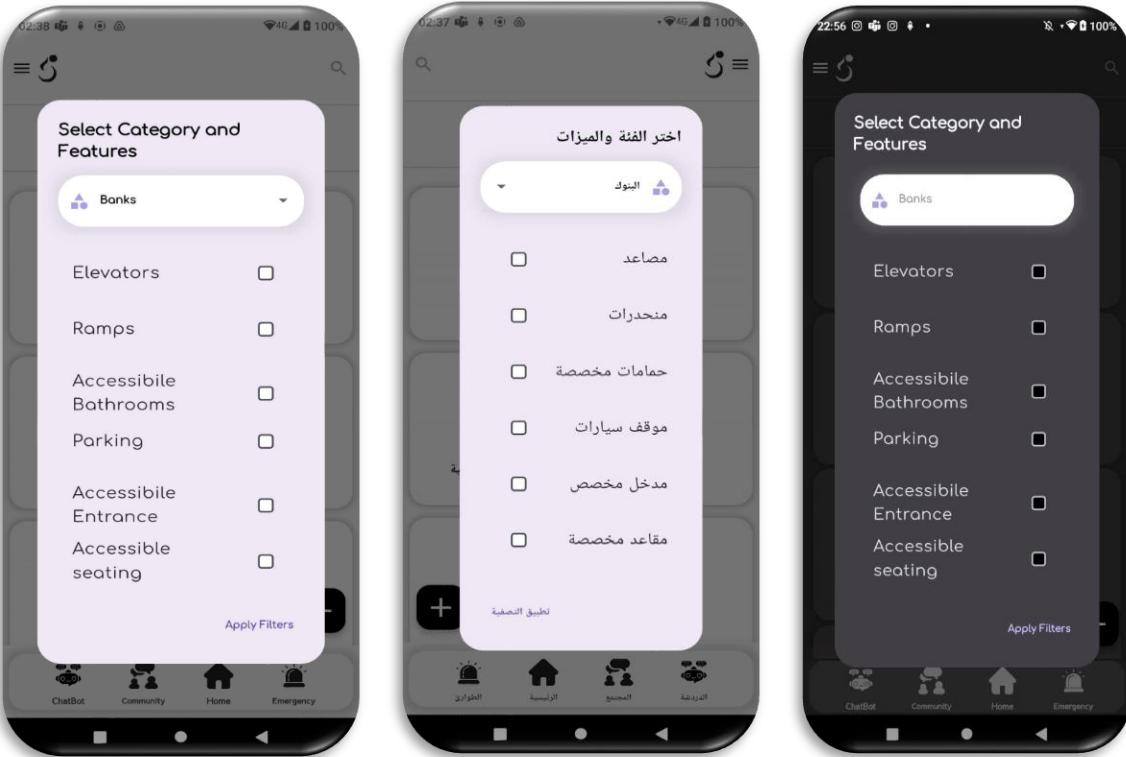


Figure 88.filtering screen.

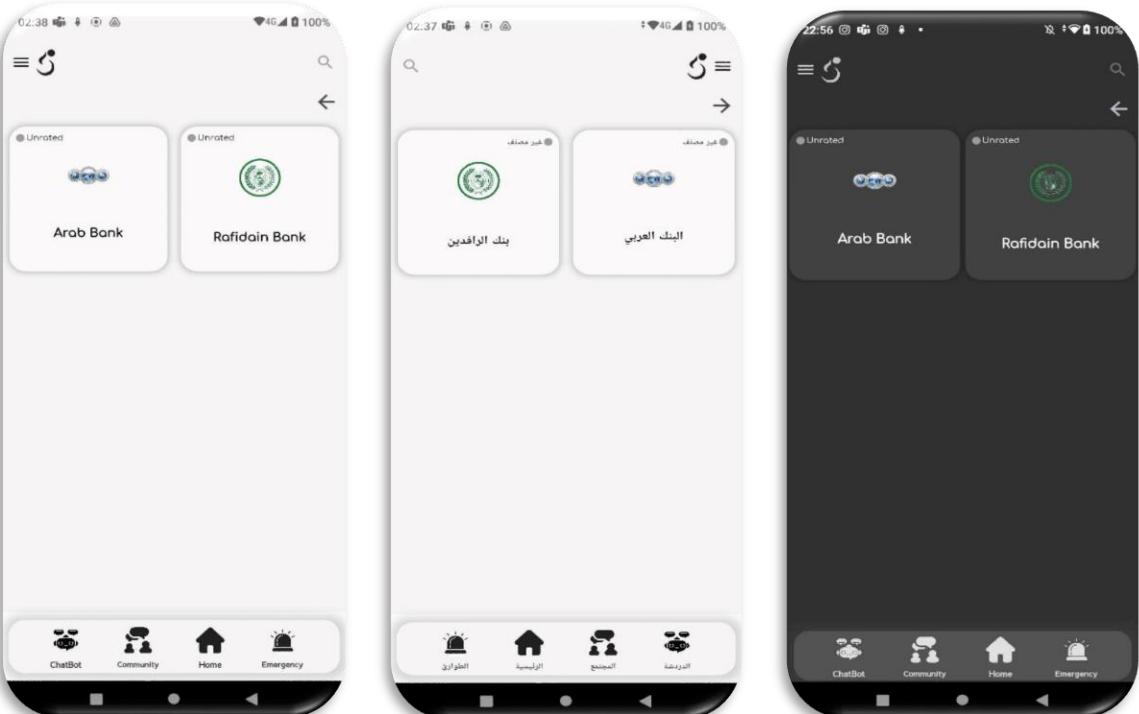


Figure 89.After filtering without check any feature.

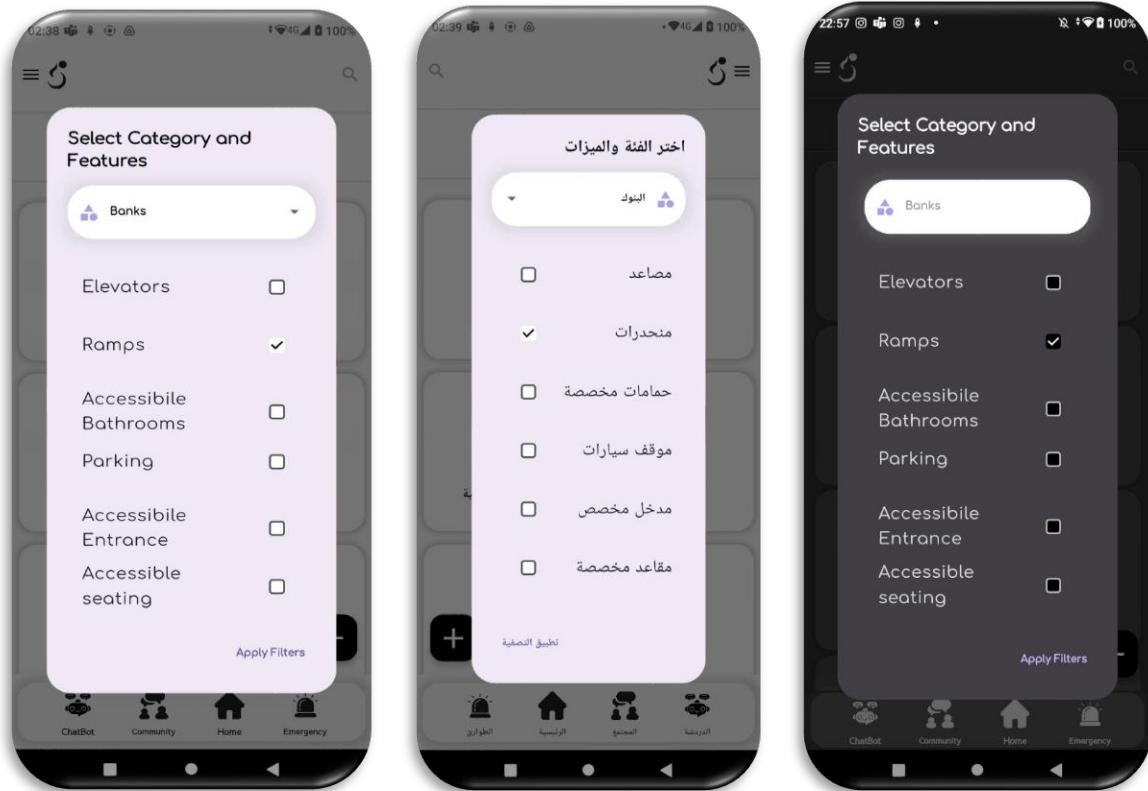


Figure 90. Filtering with check feature.

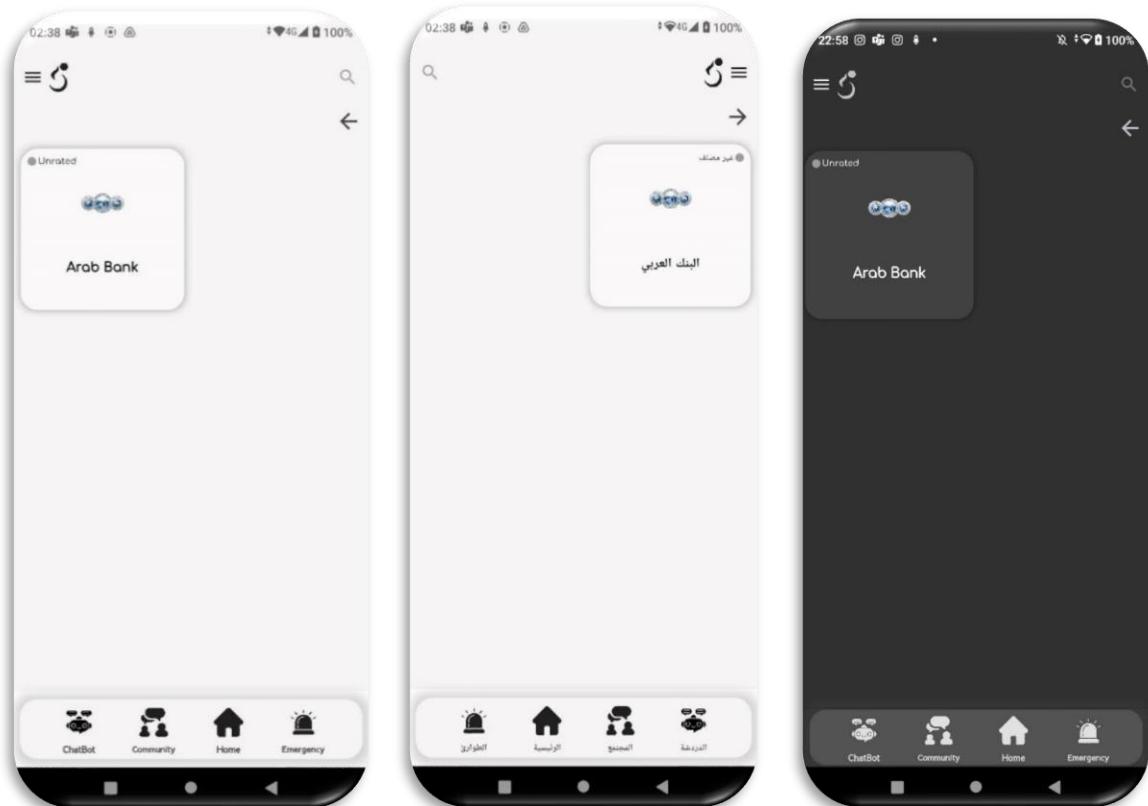


Figure 91. After applying the filtering with checking some features.

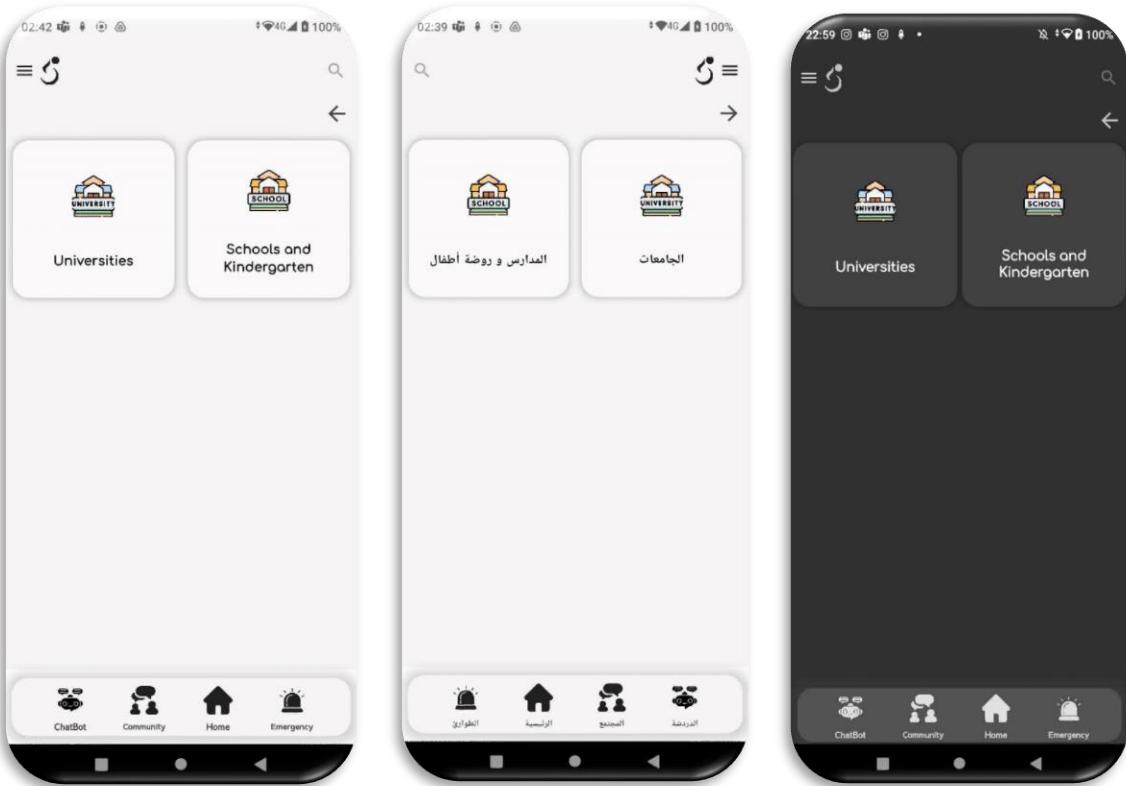


Figure 92. Education category screen.

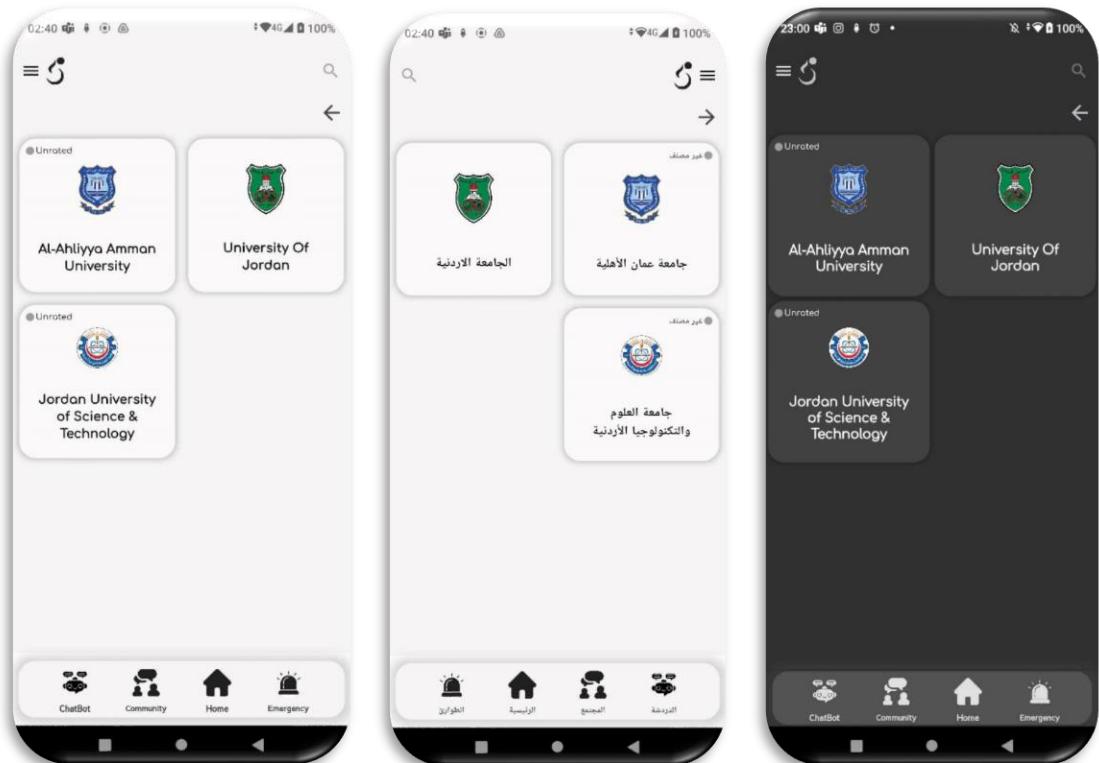


Figure 93. Universities category.

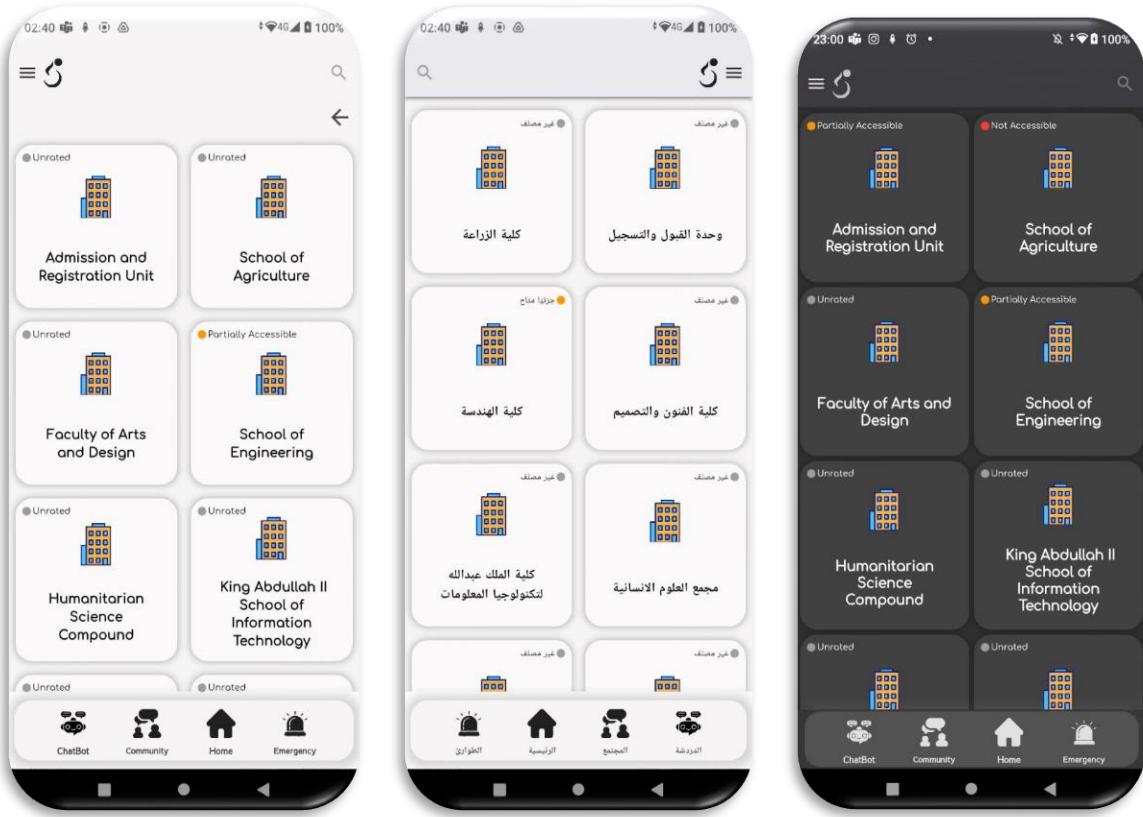


Figure 94. Departments for University of Jordan.

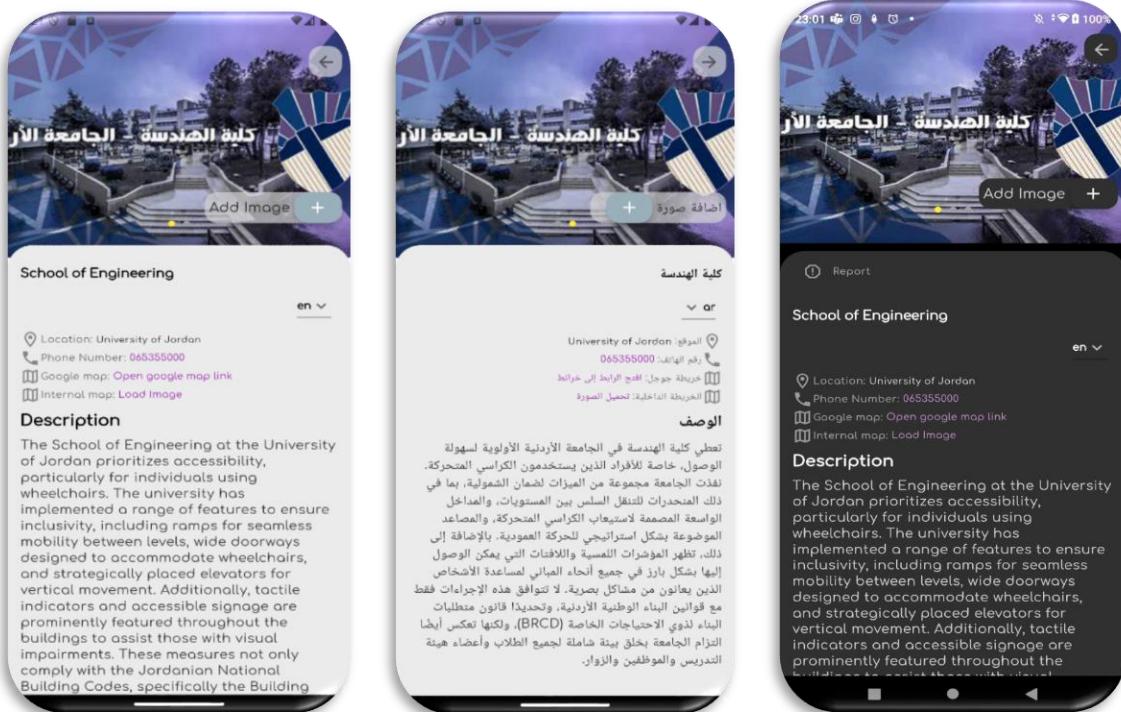


Figure 95. Engineering department on University of Jordan Screen.

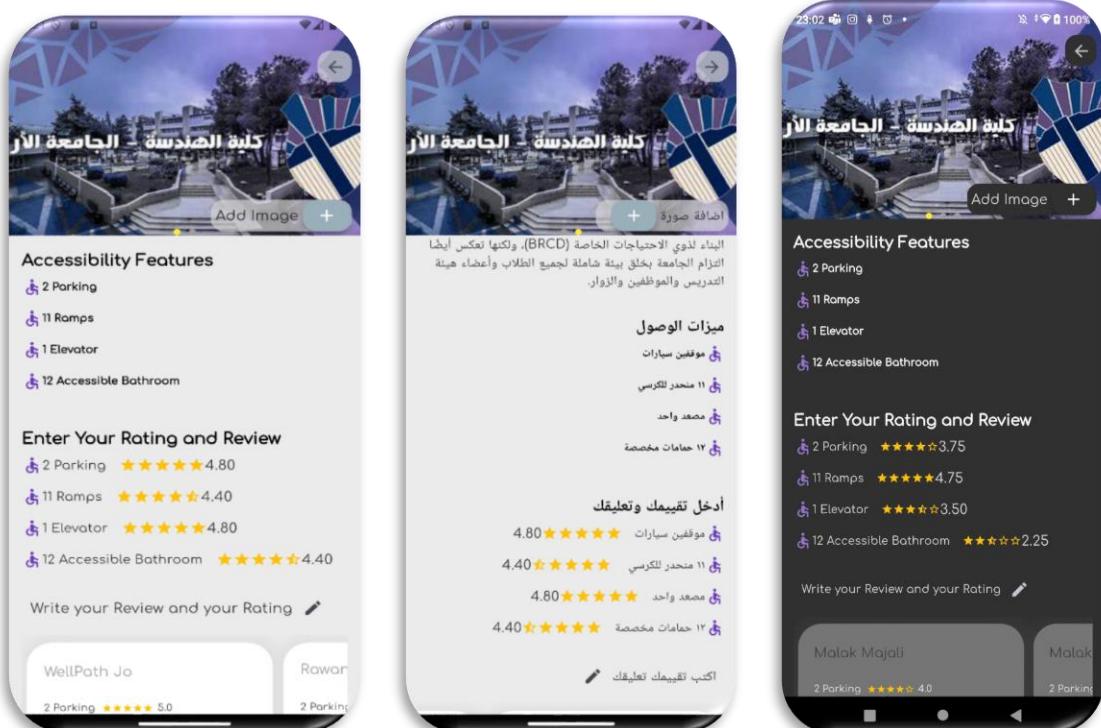


Figure 96.Engineering department on University of Jordan Screen.

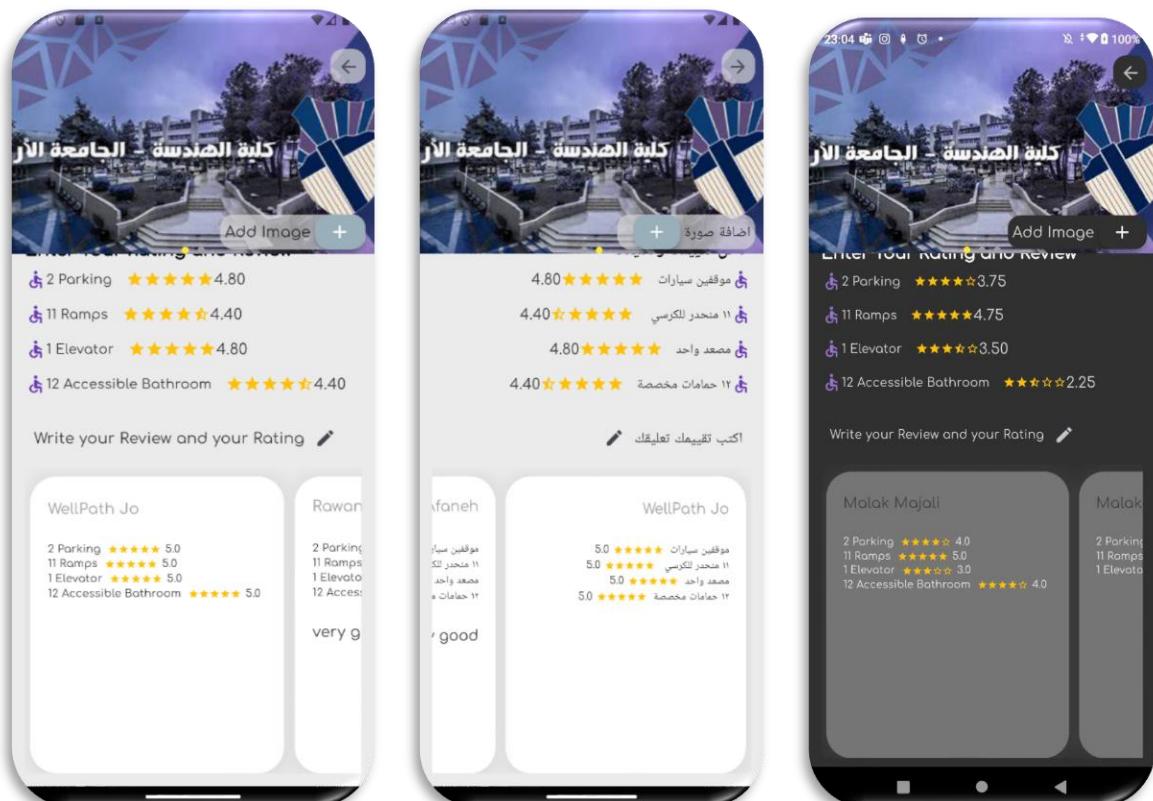


Figure 97.Engineering department on University of Jordan Screen.

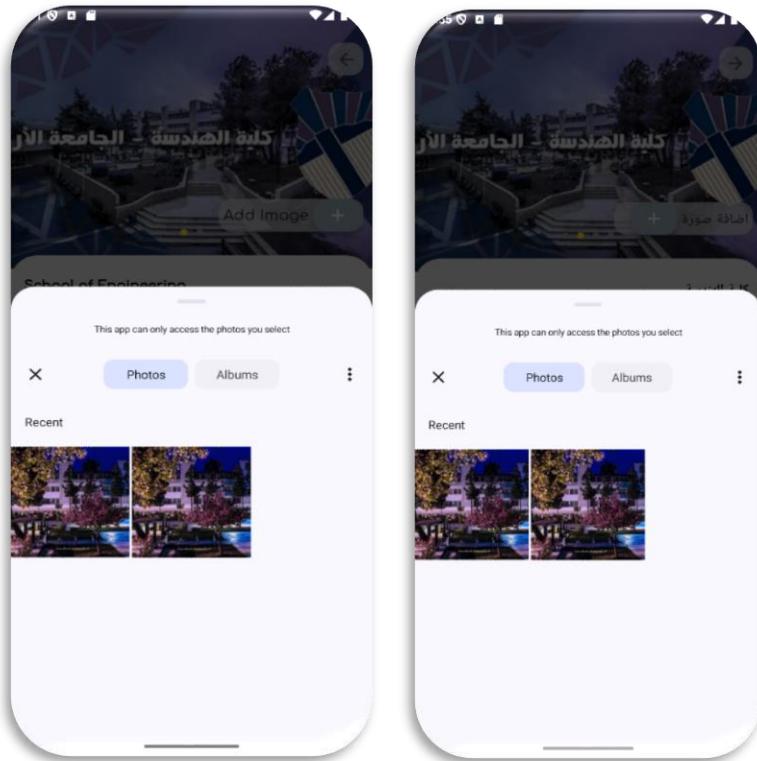


Figure 98.Adding new image for the department.

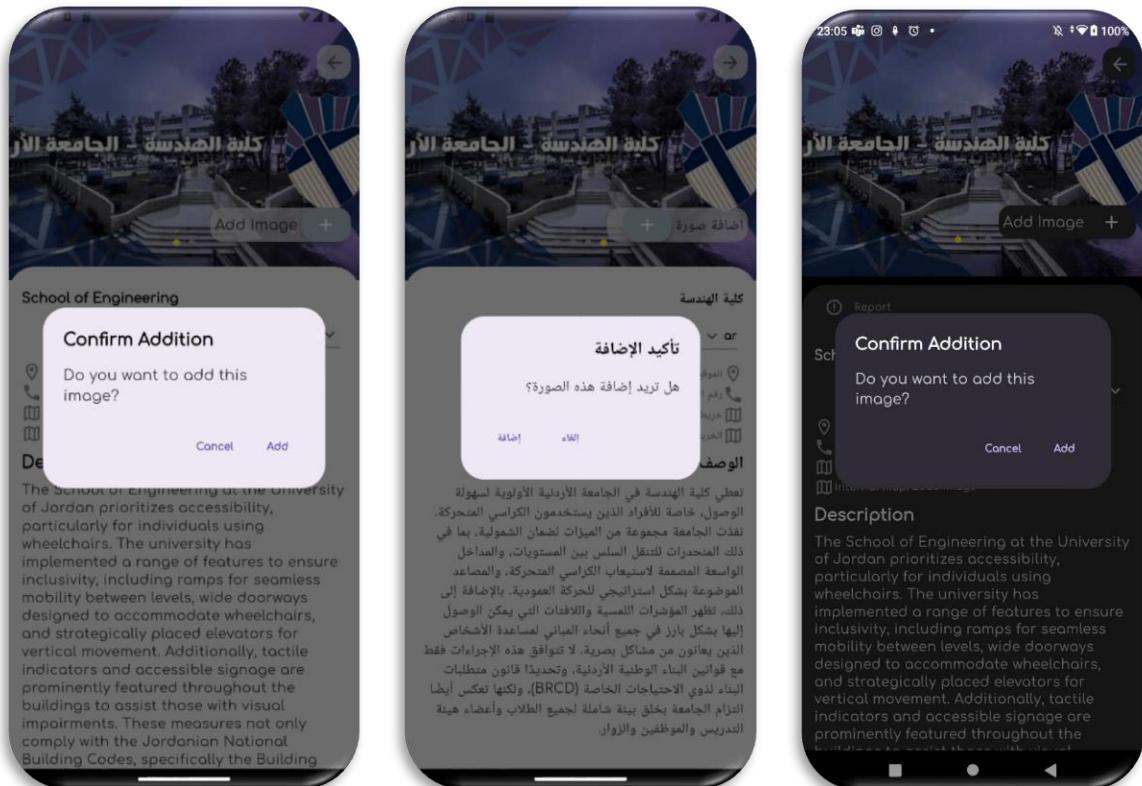


Figure 99.Confirm addition dialog.



Figure 100. clicking on the internal map to review the image.

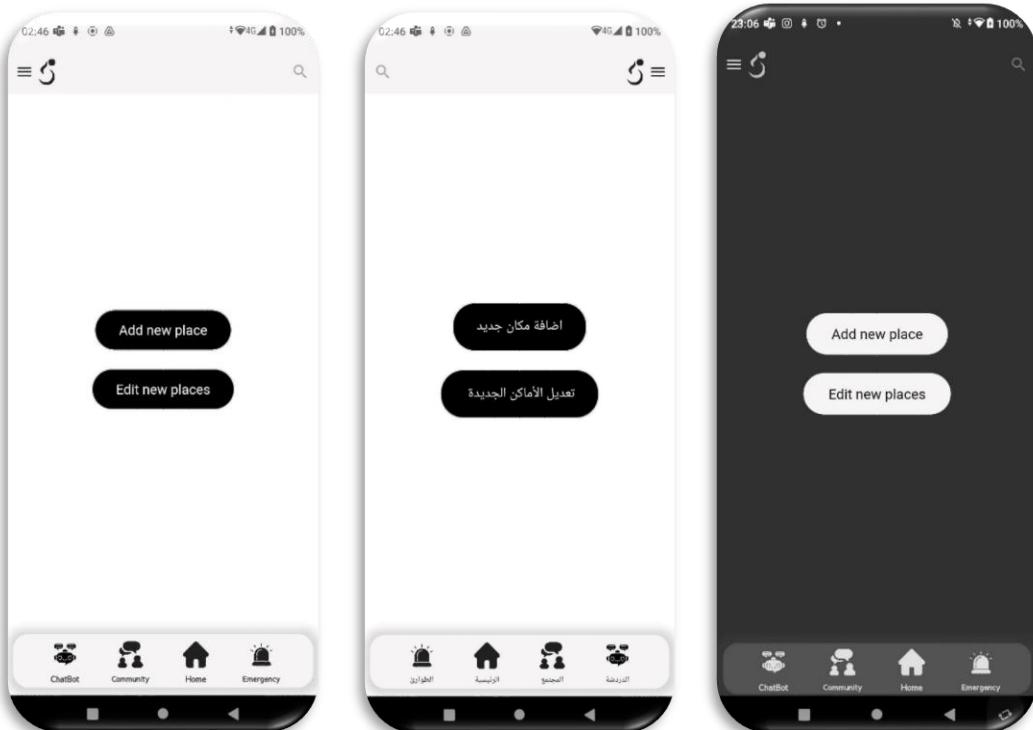


Figure 101. Admin adding new place or edit new place to accept or decline the adding places by user.



Figure 102. the admin can edit or delete the new places that have been send from the user.



Figure 103. Delete the new places that are sent by the user dialog.

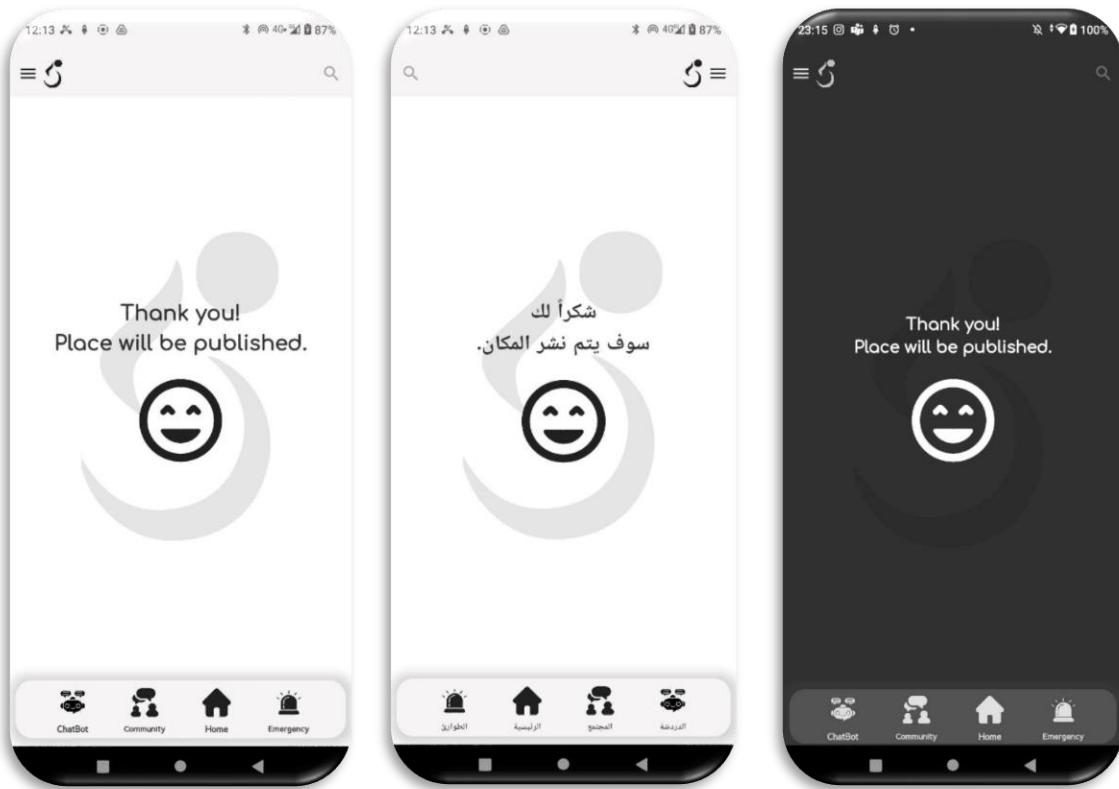


Figure 104. Thank you screen after adding the new place.

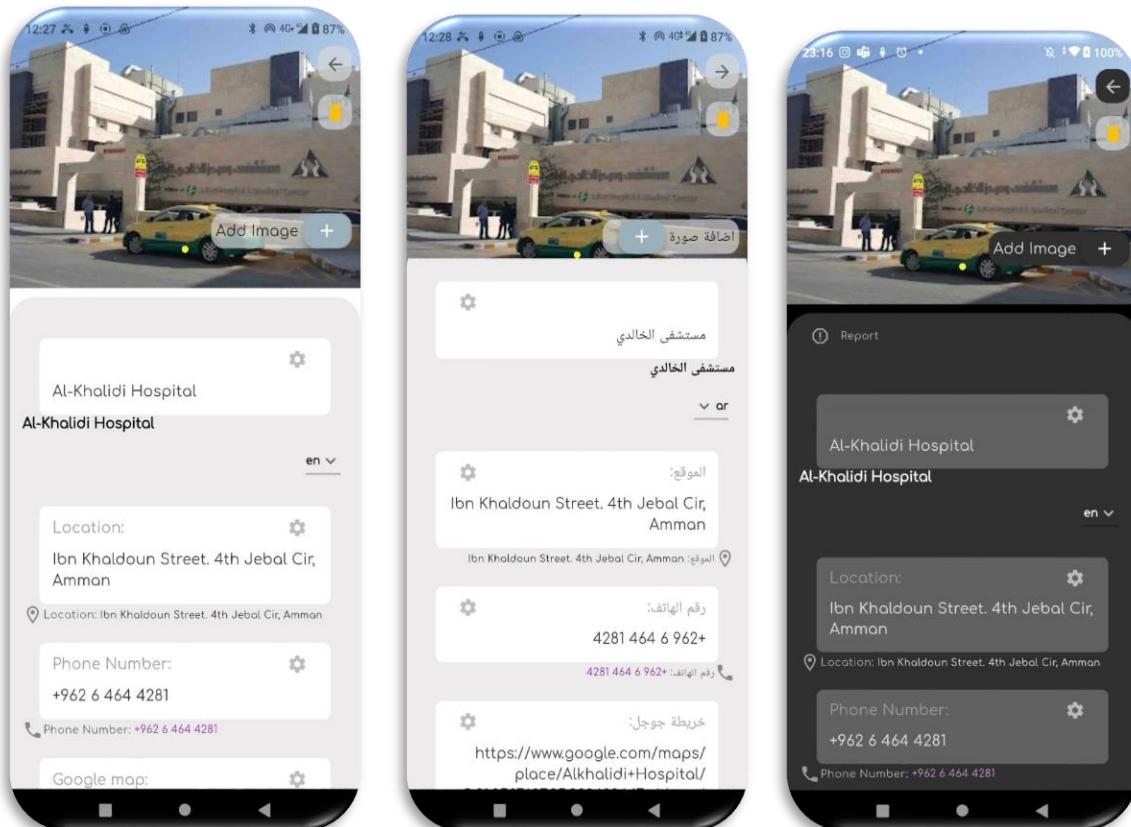


Figure 105. The admin and the owner building can edit on everything on the building information.

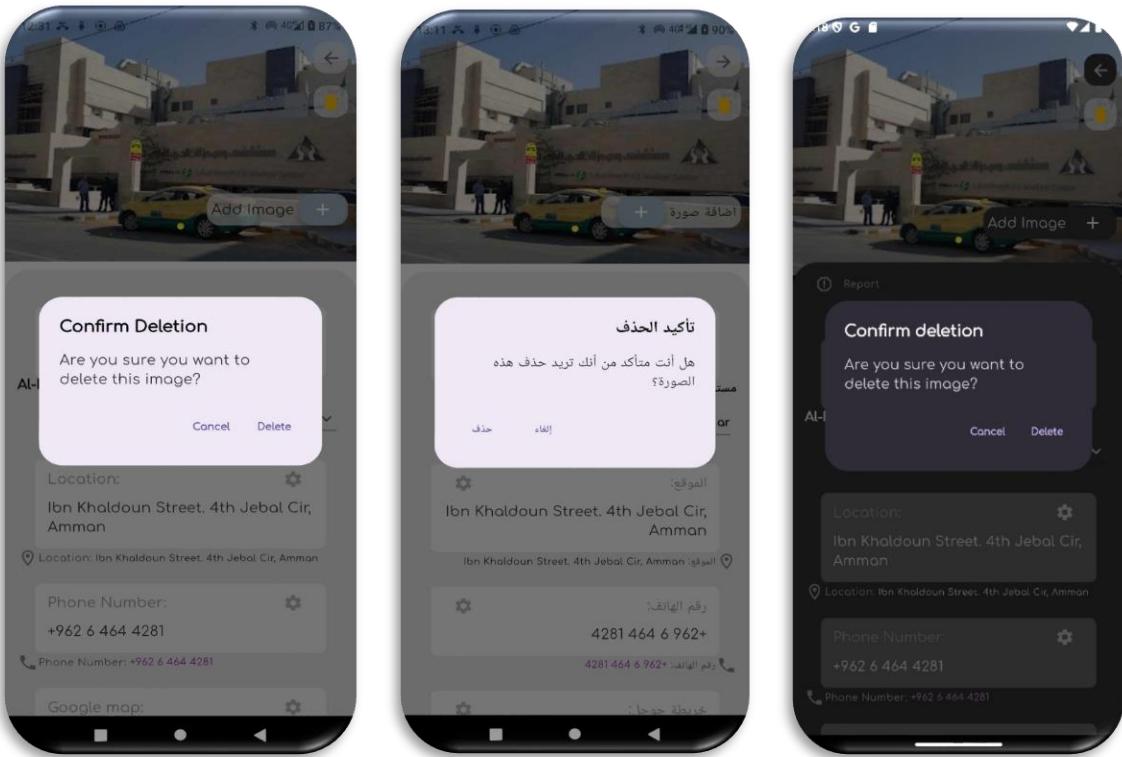


Figure 106. The admin and the owner building can delete all the images.

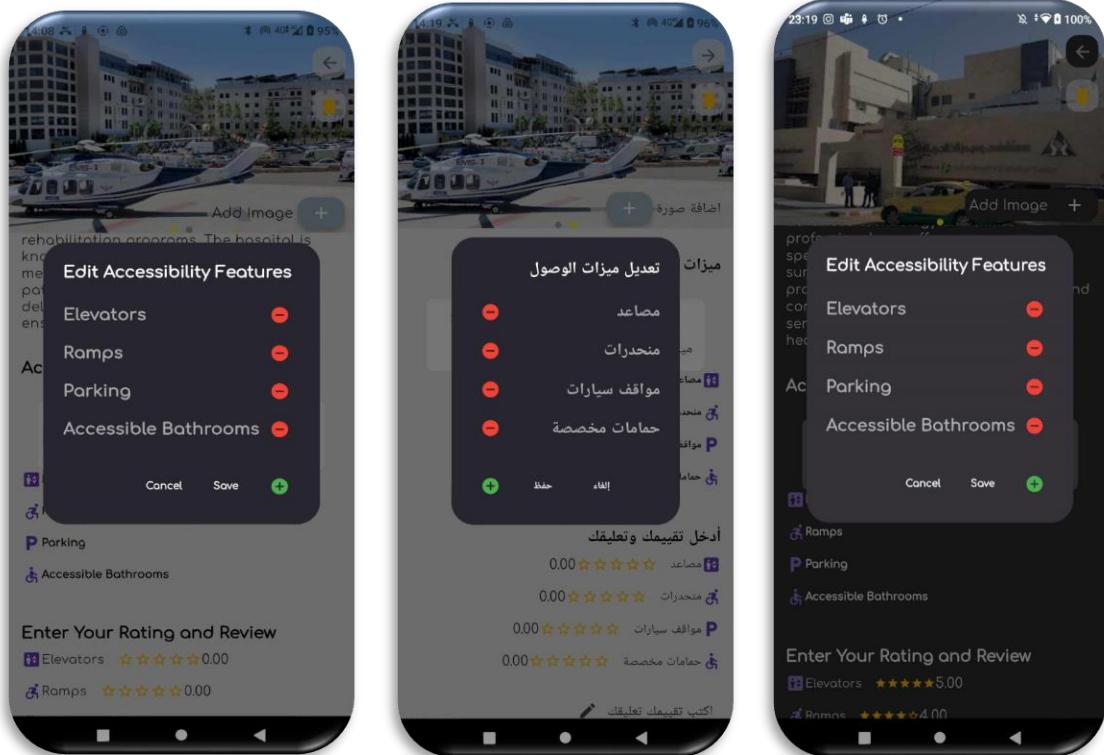


Figure 107. The admin and the owner building can edit accessibility features by deleting or adding new ones.

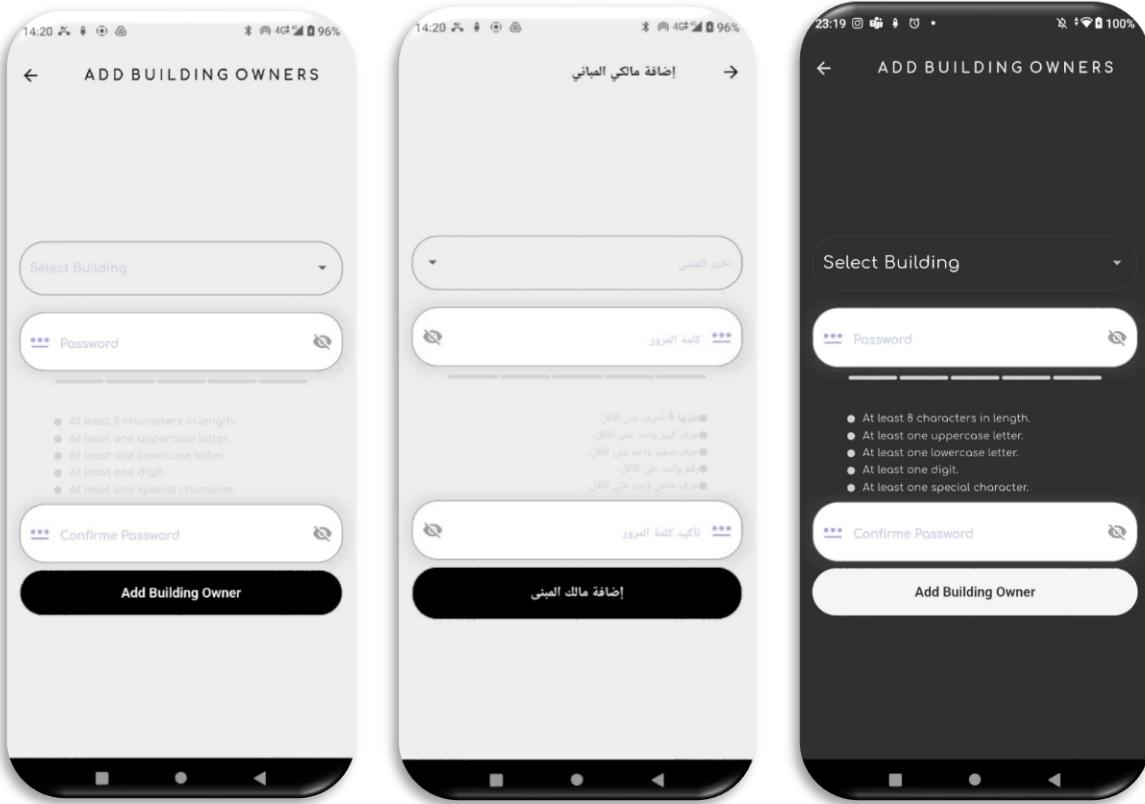


Figure 108.Adding building owners to the system by create account to them so they can take the access to their building.

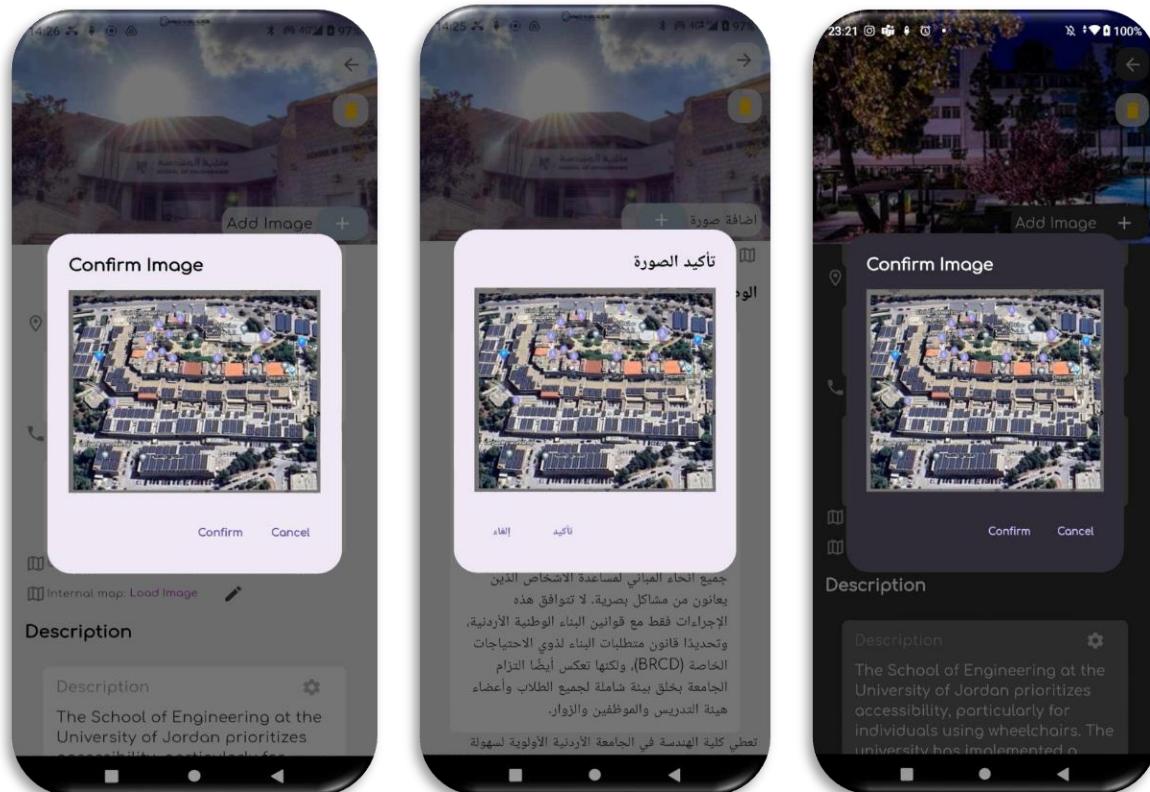


Figure 109.The admin or the building owner can edit the internal map image.

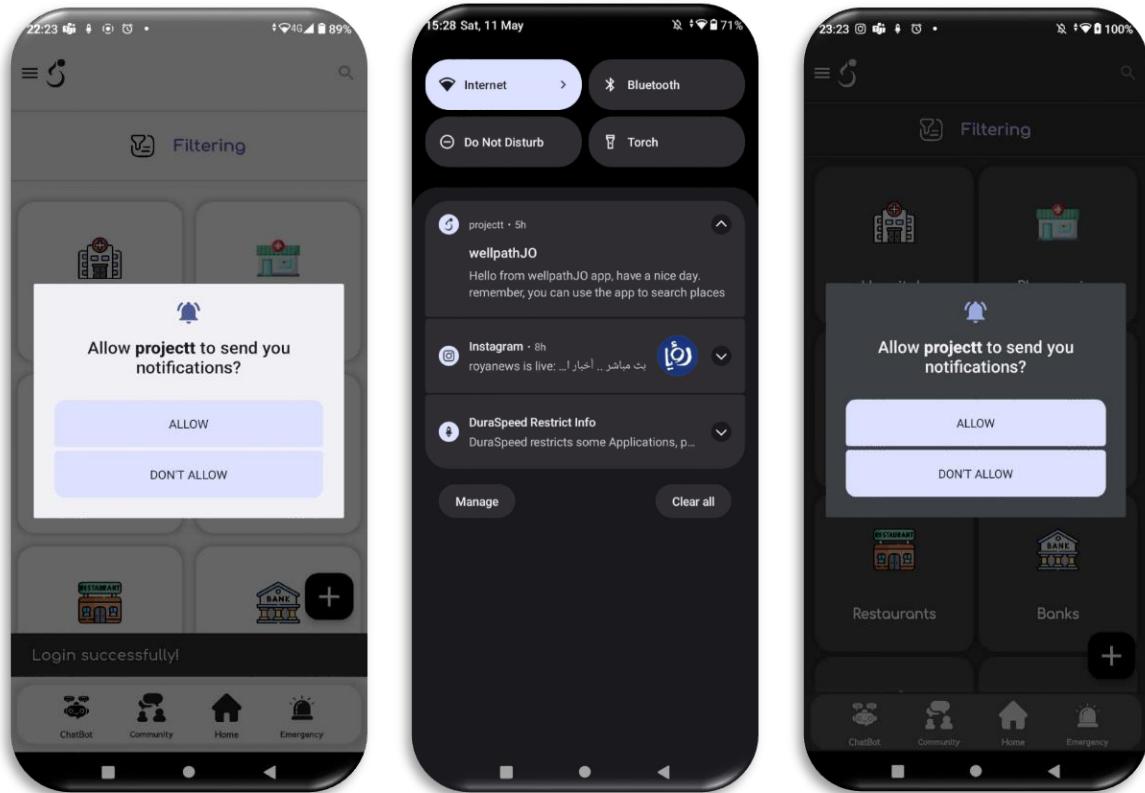


Figure 110.Notification process.

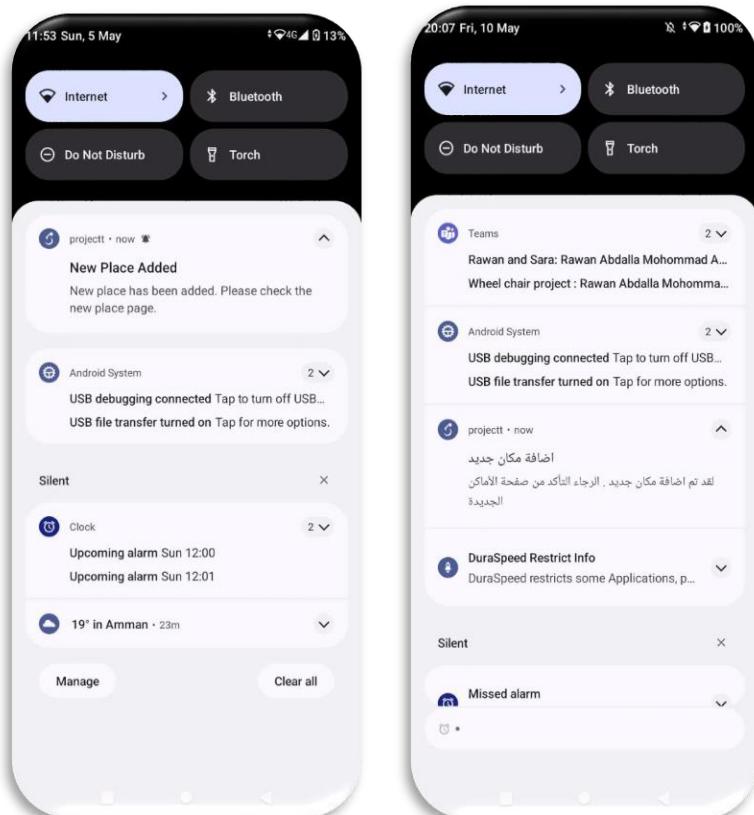


Figure 111.Notification.

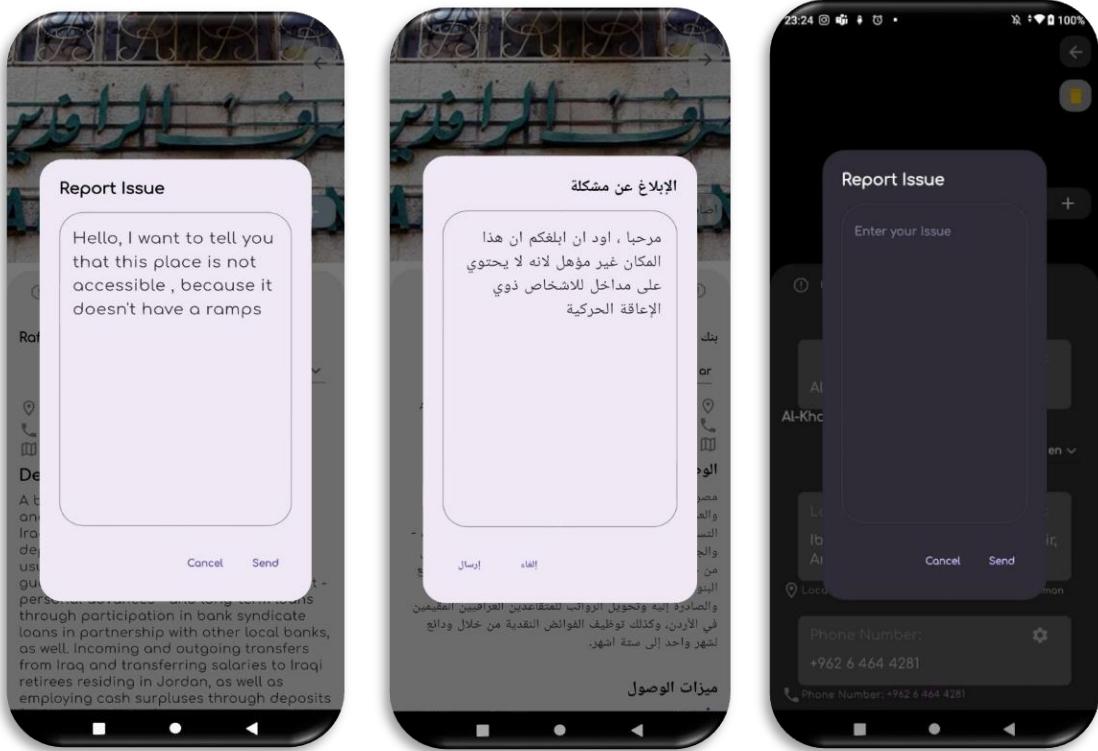


Figure 112. User report on building.

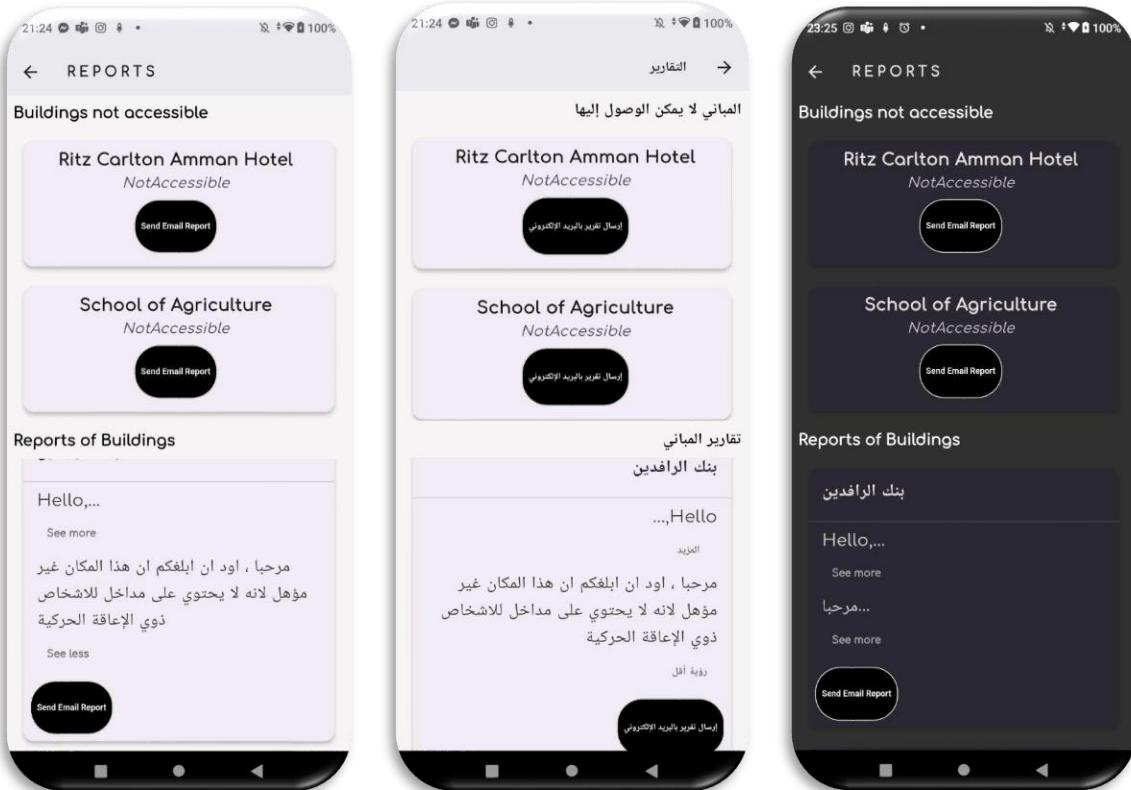


Figure 113. Report screen on admin account.

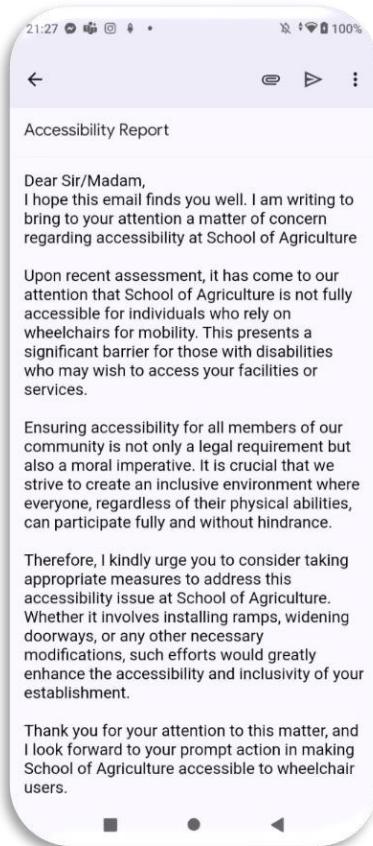


Figure 114.Email notifying that this location is currently inaccessible.

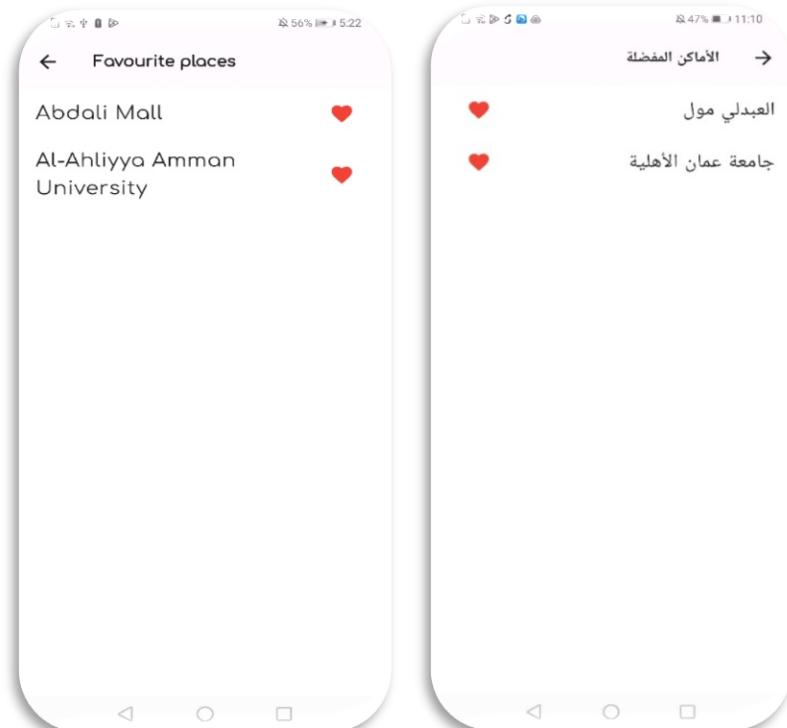


Figure 115 Favorite feature

