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Faculty of Engineering & Information Technology
Department of Computer Engineering

Graduation Project I



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Acknowledgement

In the name of Allah, the Most Gracious, the Most Merciful.

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Disclaimer

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Table of Contents

- Acknowledgement I

- Disclaimer II

- Table of Contents III

- List of Figures V

- Abstract VIII

- 1 Introduction 1**

- 2 Constraints & Earlier coursework 3**
 - 2.1 Limitations & Constraints 3
 - 2.1.1 Limited Time 3
 - 2.1.2 Limited Resources 3
 - 2.2 Earlier coursework 3

- 3 Literature Review 4**

- 4 Methodology 5**
 - 4.1 Development Tools and Technologies 5
 - 4.1.1 Tools 5
 - 4.1.2 Programming Languages and Frameworks 5
 - 4.1.3 Database Design and Management 6
 - 4.2 Mobile App System Features 7
 - 4.2.1 Sign-Up Process 8
 - 4.2.2 Login Process 9
 - 4.2.3 Service Provider Side 11
 - 4.2.4 Homeowner Side 16

4.2.5	Task Implementation For Homeowner and Service Provider	25
4.2.6	Construction Tasks Workflow - HO Side	30
4.2.7	Construction Tasks Workflow - SP Side	34
4.2.8	Admin Side	37
4.3	Website System Features	41
5	Results and Analysis	42
5.1	Results Overview	42
5.2	Analysis	42
6	Conclusion and Future Work	43
6.1	Future Work	43
	References	45
	Appendix	46
A	Website Screenshots	46

List of Figures

- 4.1 Main Screen 7
- 4.2 Sign Up 8
- 4.3 Continue Sign Up 9
- 4.4 Login Process 9
- 4.5 Forgot Password Process 10
- 4.6 SP Tutorial Guide 11
- 4.7 Catalog - Service Provider 12
- 4.8 Work Exp. - Service Provider 12
- 4.9 Catalog Item 13
- 4.10 Work Exp. Item 14
- 4.11 Profile - SP 15
- 4.12 Service Provider Profile 15
- 4.13 HO Tutorial Guide 1 16
- 4.14 HO Tutorial Guide 2 -For Search Screen- 17
- 4.15 Search Bar 18
- 4.16 Drop-down Search Functionality 18
- 4.17 Demonstrating the Fuzzy Search Capability with Fuse.js 19
- 4.18 Services List-Insulation Category- 20
- 4.19 Discover Search 20
- 4.20 Filter Process 21
- 4.21 Access Service Provider Profile from Search Screen 21
- 4.22 Adding New Construction Details 22
- 4.23 Choosing Entry Point 22
- 4.24 Home Screen After Add Const. 22
- 4.25 Construction Tutorial Guide 23
- 4.26 Construction Details 23
- 4.27 Tasks Screen 24

4.28 Homeowner Assign Service Provider	25
4.29 Service Provider Accept or decline Request -In this case he accept it-	26
4.30 Service Provider Complete Task	27
4.31 Homeowner Tracks Task Completion	28
4.32 Homeowner add a review	29
4.33 Homeowner submit a review	29
4.34 Sequential Task Dependency	30
4.35 Task 4 Details - HO	30
4.36 Task 6 Details - HO	31
4.37 Project Progress At This Point	31
4.38 Parallel Tasks	32
4.39 Static Task	32
4.40 Homeowner Customization Options: Selecting Materials and Designs for Construction	33
4.41 Material Providers	33
4.42 Task No. 2 Workflow - SP	34
4.43 Task No. 4 Workflow 1 - SP	34
4.44 Task No. 4 Workflow 2 - SP	35
4.45 Task No. 6-8 Workflow - SP	35
4.46 Task No. 12 Workflow - SP	36
4.47 Construction Analytics Overview	37
4.48 User Analytics Overview	38
4.49 Tasks Analytics Overview	39
4.50 Admin Adds Material Provider	40
A.1 Welcome Page	46
A.2 Register Page	47
A.3 Login Page	47
A.4 Tutorial Guide - HO	48
A.5 Home Page - HO	48
A.6 Tasks Page 1 - From Scratch - HO	49
A.7 Tasks Page 2 - HO	49
A.8 Task Details Page - HO	50
A.9 Tasks Page - From Middle - HO	50
A.10 Search Page - HO	51

A.11 Search by service type - HO	51
A.12 Search for Tareq - HO	52
A.13 Search Nav Bar - HO	52
A.14 Filter Search - HO	53
A.15 Edit Homeowner Details - HO	53
A.16 Inbox Page - HO	54
A.17 Chat Page - HO	54
A.18 Notifications Page - HO	55
A.19 Add Construction - HO	55
A.20 Home Page - SP	56
A.21 Tasks Details Page - SP	56
A.22 Tasks Details Page - See Item Details - SP	57
A.23 Catalog Page - SP	57
A.24 Add New Catalog Item - SP	58
A.25 Catalog Item Details - SP	58
A.26 Edit Catalog Item Info - SP	59
A.27 Work Experiences Page - SP	59
A.28 Edit Service Provider Details - SP	60
A.29 Login In Arabic	60
A.30 Task Page 1 - Arabic - HO	61
A.31 Task Page 2 - Arabic - HO	61
A.32 Material Providers - Arabic - HO	62
A.33 Service Provider Profile 1 - Arabic - HO	62
A.34 Service Provider Profile 2 - Arabic - HO	63
A.35 Request Assign - Arabic - HO	63
A.36 Construction Analytics Page - Admin	64
A.37 User Analytics - Admin	64
A.38 Tasks Analytics - Admin	65
A.39 Admin Adds Material Provider	65

Abstract

The house-building industry faces significant challenges, primarily due to poor communication between property owners and construction workers and a lack of accessible information on workers' skills and reliability. Addressing these issues, "BuildNex" emerges as a cutting-edge web and mobile platform, utilizing technologies like Flutter, Node.js, and MySQL to revolutionize construction management. It enhances communication and transparency, making it easier to find and hire skilled workers.

BuildNex provides a comprehensive pipeline of services tailored to meet the specific needs of homeowners, whether starting new projects or completing existing structures, providing flexibility and efficiency at different stages of construction. The platform facilitates easy connections between homeowners and service providers, allowing homeowners to choose providers based on location, service cost, and ratings. It also benefits service providers by offering job opportunities, thereby creating a dynamic marketplace.

The platform is designed to cater to a diverse audience, offering interfaces in both Arabic and English, thereby making it accessible and user-friendly for people from various backgrounds. Given the current needs of the country, there is a clear and pressing demand for more projects of this nature, which contribute to national development and technological progress.

In summary, BuildNex stands as an innovative solution in the construction industry, improving efficiency, transparency, and accessibility, and significantly impacting how construction projects are managed and executed.

Chapter 1

Introduction

Amidst the growing sustainability demands in the construction industry, the journey from conceptualizing to completing a house is fraught with challenges. "BuildNex" emerges as a transformative web and mobile platform ingeniously designed to simplify this journey. By harnessing the power of advanced technologies like Flutter, Node.js, and MySQL, BuildNex redefines construction management, offering a seamless and efficient pathway for homeowners and a robust support system for service providers.

BuildNex shines in its adaptability, catering to homeowners at every construction stage. Whether starting on an empty land where he needs to start the construction from zero or progressing from a structural phase requiring specialized work such as aluminium fitting, carpentry, and tiling, BuildNex ensures flexibility and efficiency. This adaptability is crucial in facilitating smooth progress and completion of construction.

The platform meticulously guides homeowners through each construction phase, from property surveys and permit acquisitions to the final installation of fixtures. Homeowners can effortlessly track their project's progress with a colour-coded system: green for completed tasks, orange for ongoing ones, and red for those yet to start. This level of transparency and the ability to follow the construction progress at every step empower homeowners with informed decision-making capabilities, ensuring efficient and effective construction management.

Simultaneously, BuildNex significantly benefits service providers. It operates like a dynamic marketplace where professionals can register, showcase their skills, and secure job opportunities. This feature creates a mutually beneficial ecosystem, enhancing visibility and business prospects for service providers and ensuring a steady workflow.

BuildNex's commitment to inclusivity is evident in its dual-language interface, offering both Arabic and English options. This design choice not only makes the platform highly accessible and user-friendly but also aligns with the linguistic diversity of its audience. In a region like Palestine, where technological innovation is integral to national development, BuildNex's approach is both strategic and impactful.

BuildNex innovates the construction industry. It enhances efficiency, transparency, and cost-effectiveness while emphasizing improved housing accessibility, sustainability, and overall efficiency in the homebuilding sector. BuildNex is revolutionizing construction management by offering homeowners a comprehensive service pipeline and creating job opportunities for service providers. BuildNex is not just a tool but a catalyst for elevating

the industry, poised to reshape the future of construction in Palestine and beyond.

The project begins with Introduction (Chapter 1), then moves on to addressing constraints, challenges, and relevant coursework that shaped the project (Chapter 2). A literature review (Chapter 3) delves into existing research, establishing a foundation for the project's context. The methodology (Chapter 4) details the systematic approach, development processes, and tools used. Results and analysis (Chapter 5) are then presented, offering data interpretation and comparisons to benchmarks. The project wraps up with a summary of key findings and potential avenues for future work (Chapter 6).

Chapter 2

Constraints & Earlier coursework

2.1 Limitations & Constraints

2.1.1 Limited Time

The development of BuildNex, presented a significant challenge in terms of time management, primarily due to the project's expansive scope and intricate details. Each task within BuildNex was layered with complexities and required meticulous attention to detail. Balancing the extensive nature of the project with the constraint of limited time necessitated a strategic approach to prioritize and focus on essential functionalities. This time limitation compelled us to streamline our processes, ensuring that we efficiently developed the core aspects of BuildNex without compromising on its innovative features and comprehensive capabilities.

2.1.2 Limited Resources

With limited resources and no similar apps on show, developing BuildNex became a novel undertaking. The lack of existing models required an inventive strategy for every aspect of the project. Our team, motivated by the distinctive challenge, systematically allocated resources to prioritize the key aspects that distinguish BuildNex. This scarcity fueled our commitment to innovation, driving us to develop a web and mobile application that not only met particular user needs but also introduced entirely new features to the industry. Despite the limitations, our focus on creativity and efficacy allowed us to navigate uncharted territory, which led to a ground-breaking application that appears as an illustration of our capacity to thrive under limited resources.

2.2 Earlier coursework

Our university coursework guided us through our learning journey, and provided us with a solid knowledge foundation, crucial in the development of BuildNex. Courses in software engineering, web design and development, and database management were valuable. They provided us with a comprehensive understanding of user interface creation, system design, and data management. This was vital in learning various technologies like Flutter for front-end development and Node.js for back-end development. Our studies in these areas equipped us with the skills to effectively handle the diverse aspects of our project

Chapter 3

Literature Review

The integration of technology into various aspects of life has led to innovative solutions addressing longstanding challenges. The home maintenance and construction services field, characterized by difficulties such as the scarcity of skilled technicians, unreliable service fulfilment, and uncertainties regarding professionals' competencies, significantly impacts homeowners. This literature review explores technological advancements in this sector, focusing on applications that streamline the interaction between users and service providers, thereby mitigating prevalent issues.

A notable example in the maintenance domain is the "FANI" application, developed by Fana Abdul Rahim Yamk and Shahd Bilal Hamza in 2023. "FANI" represents a leap forward in simplifying the communication process between homeowners and technicians, showcasing the potential of digital platforms to revolutionize the maintenance service landscape.

"AllBetter" connects homeowners with skilled contractors [1]. It provides a comprehensive network of professionals. The platform offers detailed service descriptions, supported by an interface for easy project management and scheduling. This commitment to transparency and customer support enhances the user experience, making "AllBetter" a stand-out choice for homeowners seeking reliable home service providers.

However, BuildNex carves out its niche by addressing specifically the construction industry's unique challenges. Unlike platforms with a broader home service focus, "BuildNex" hones in on the intricacies of construction management, from project planning and worker skill assessment to the sequential nature of construction tasks. It facilitates direct connections between homeowners and construction professionals, streamlining the hiring process and introducing flexibility and efficiency previously unseen in construction project management.

In conclusion, while "FANI" and "AllBetter" have significantly improved interactions between homeowners and service providers across various home services, "BuildNex" innovates within the construction space. It tailors its approach to meet the industry's specific demands, signalling a transformative phase in construction project management and emphasizing the critical role of technology in facilitating efficient, reliable, and user-friendly construction experiences.

Chapter 4

Methodology

4.1 Development Tools and Technologies

4.1.1 Tools

- Visual Studio Code. It was used for writing and executing back-end Node.js codes, It provided essential features and tools for code editing, project management, and debugging.
- IntelliJ was used to implement, test, and debug front-end Flutter codes. It provided a lightweight and fast emulator, that we employed to test the mobile application design and interactive-ness, and push changes to the GitHub repository.
- Android Studio was employ as an emulator to test the mobile application on various virtual devices, guaranteeing compatibility and smooth functionality.
- We utilized GitHub for collaborative development, keeping track of changes, and code management.
- ARC Advanced REST client employed as our API testing tool, permitting us to test and validate our APIs. With its user-friendly interface, we could send HTTP requests and receive responses.
- Cloudinary enables users to upload, store, manage, manipulate, and deliver images and video for websites and apps.

4.1.2 Programming Languages and Frameworks

In the development process of BuildNex, we chose Flutter mainly for its outstanding cross-platform development capabilities. Flutter allows us to write the application code once and deploy it seamlessly across IOS and Android, as well as web and desktop platforms. This versatility is valuable in saving significant amounts of time and resources, allowing us to maintain a consistent and high-quality user experience on different devices and and operating systems.

Node.js was chosen as the back-end programming language. It is a popular runtime environment that enables server-side development and provides efficient handling of asynchronous operations, making it suitable for building robust and scalable web applications.

4.1.3 Database Design and Management

We chose MySQL Database for BuildNex due to its excellent support for relational data. Its ability to efficiently manage relationships between multiple tables made it ideal for our needs. With MySQL, we could create and interlink various tables to handle different data aspects of our application, such as user information and service provider details, ensuring data integrity and facilitating complex queries essential for BuildNex's functionality.

In developing BuildNex, we designed a series of tables within our MySQL database, each designed to tailor to specific functions and features of the application. We also made the decision to build certain functionalities from scratch, such as notification and messaging, instead of using external services like Firebase.

Database Tables

- **User Table:** This table defines the foundation of user management within BuildNex. It stores comprehensive profile details including usernames, emails, profile information, pictures, and contact details. It's crucial for matching service providers with homeowners, encompassing data like user types, service types, ratings, and pricing.
- **Task Table:** The Task table is important for tracking individual tasks within each project. It includes task descriptions, status, and links to specific projects and service providers, playing an essential role in updating construction activities progress, and monitoring them.
- **Project Table:** This table handles all information connected to construction projects, from project names and status to locations and homeowner associations. It's vital for tracking the overall progress, and managing each construction venture.
- **Project's Information Table:** precise and detailed records of construction specifics, such as room counts, building areas, and numerous documentations are kept here. This table is essential for maintaining comprehensive records of project details and legal documentation.
- **Request Table:** Facilitating service requests between homeowners and service providers, this table records the status of requests, involved parties, and task details. It's pivotal for communication and service transactions within BuildNex.
- **Review Table:** In this table, users provide reviews and ratings for service providers, which composes of review content, and links the reviews to both service providers and homeowners. This encourages trust and quality within the BuildNex community.
- **Work Experience and Catalog Tables:** In addition to these, we also created specific tables like Work Experience and Catalog for service providers. The Work Experience table stores details of the providers' previous projects, enriching their profile credibility, while the Catalog table includes listings of items or services offered by them, complete with images, descriptions, and pricing.
- **Message and Notification Tables:** We designed our own messaging and notification systems, managed through these tables. They handle direct user-to-user messaging and app-generated notifications, tailored to our app's needs for seamless communication and user engagement.

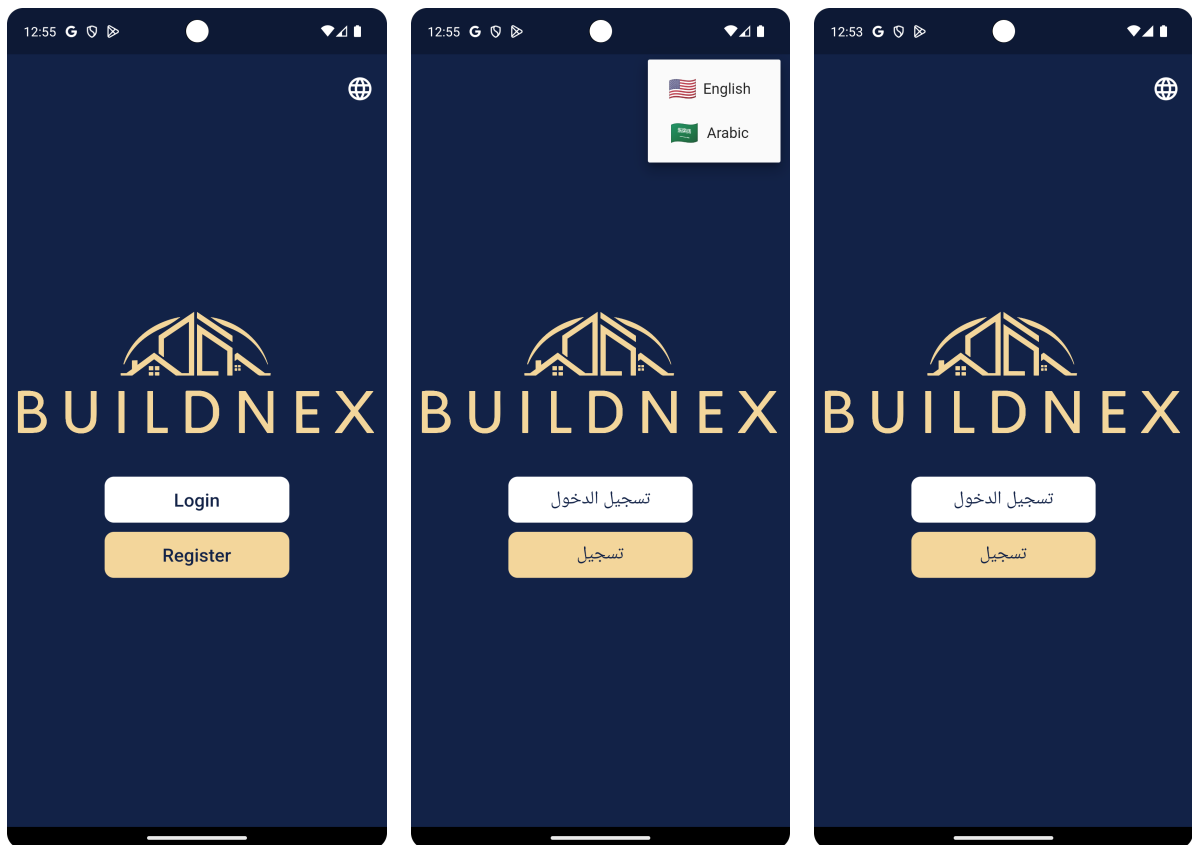
By choosing to build messaging and notification systems, we gained greater control over their functionalities, ensuring they were perfectly aligned with the rest of BuildNex's architecture. This approach contributed significantly to providing a cohesive and user-centric experience.

In addition to these main tables, our database composes of other tables that play supporting roles, each contributing to the overall functionality of BuildNex. By integrating these tables, we created a comprehensive data structure that supports the diverse functionalities of our platform, ensuring a cohesive and user-centric experience.

4.2 Mobile App System Features

The mobile application, named "BuildNex", was developed to facilitate interaction between homeowners and service providers, ensuring ease of communication and clarity in their interactions.

The main screen of the application offers a language selection option for Arabic or English, indicating a bilingual interface. Additionally, users have the choice to either log in to an existing account or register for a new one through two clearly marked buttons.



((a)) Main App Screen-English

((b)) Choose Language

((c)) Main App Screen-Arabic

Figure 4.1: Main Screen

4.2.1 Sign-Up Process

The sign-up screen for the application is designed to cater to two types of users: homeowners and service providers. During the registration process, the user must fill in the necessary information and select their role—either as a homeowner or a service provider. The screen is structured to ensure that all information is entered correctly and is visually consistent with the app’s design theme.

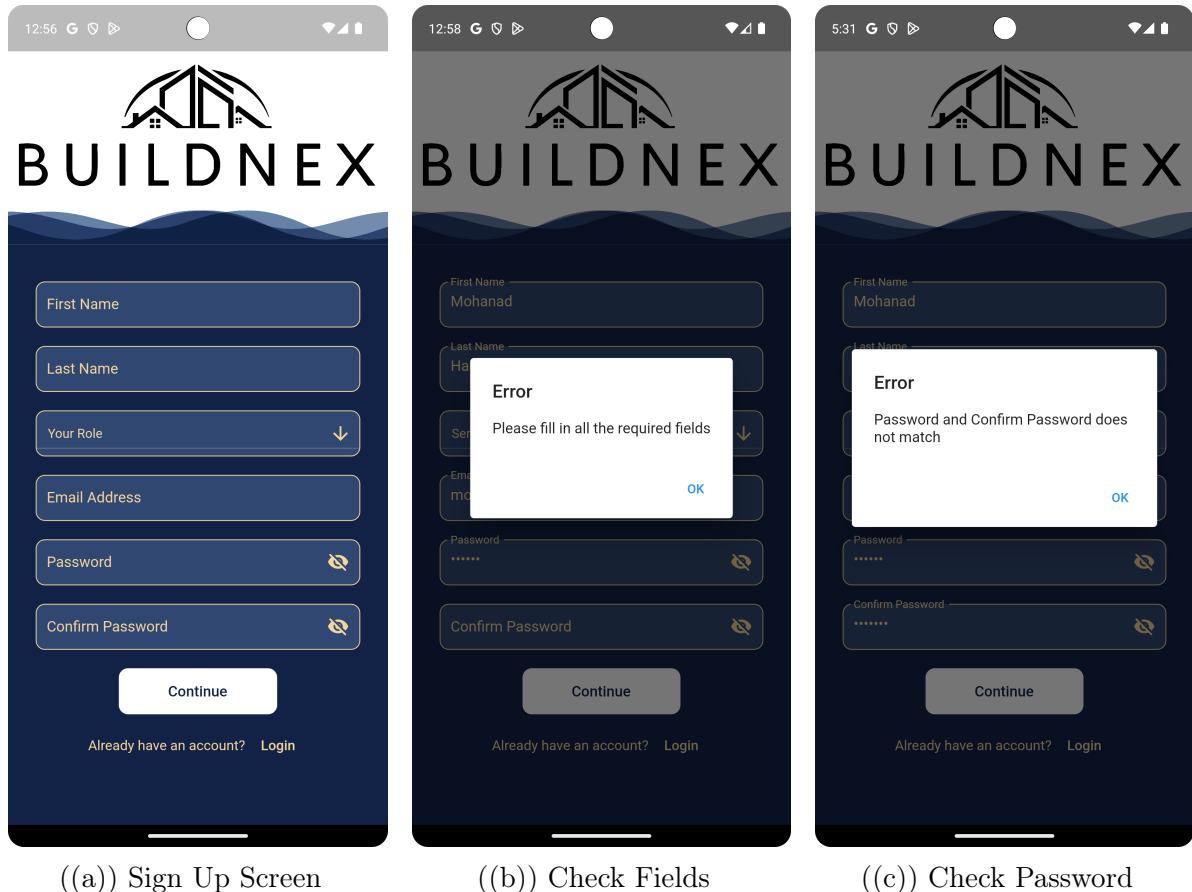
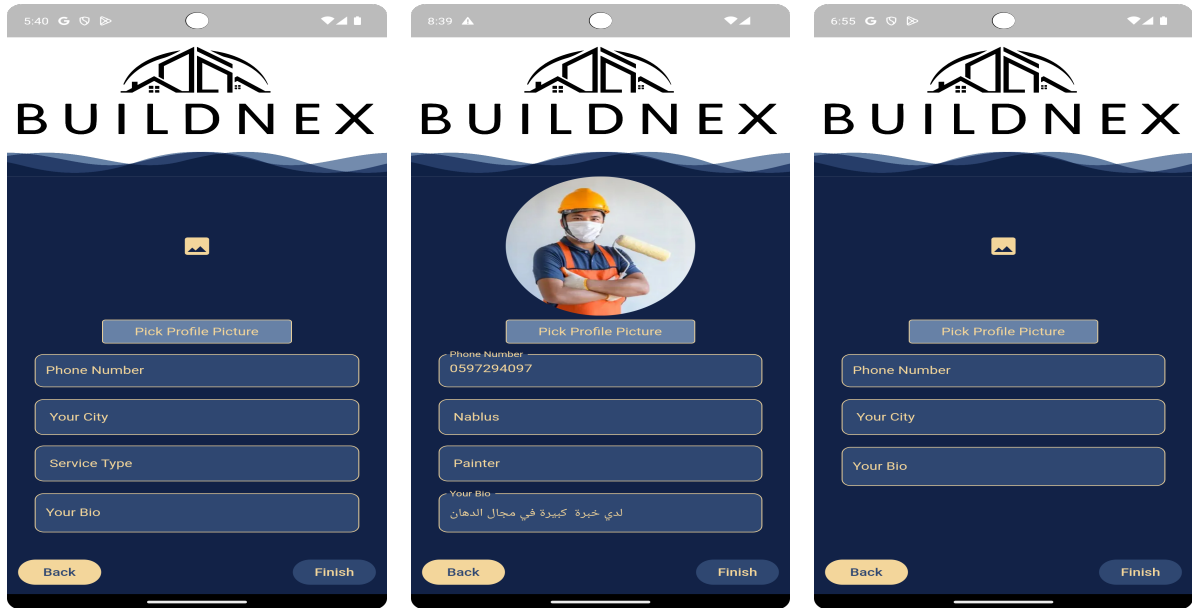


Figure 4.2: Sign Up

For enhanced usability, the sign-up screen includes error handling features to manage common mistakes, such as incomplete field entries and ensuring the uniqueness of email addresses. This approach aims to prevent errors during the sign-up process and streamline user on boarding.

For those registering as a service provider, upon reaching the registration completion screen, they are asked to select the type of service they offer from a drop-down menu. They also provide additional details such as their contact number, city and a profile photo to complete their profile setup.

Similarly, homeowners go through their own registration completion process where they enter their phone number and city.



((a)) Sign Up as Service Provider

((b)) Fill Data

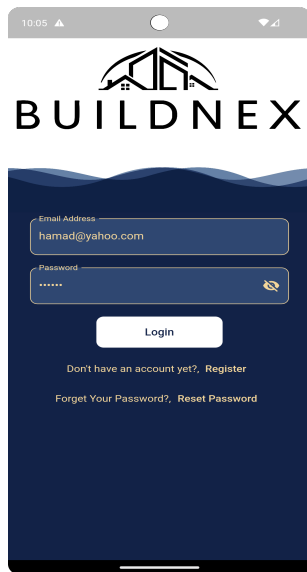
((c)) Sign Up as Homeowner

Figure 4.3: Continue Sign Up

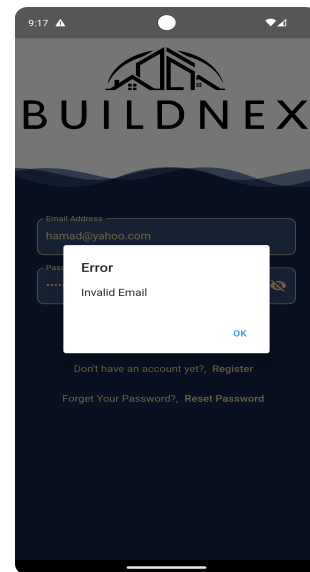
4.2.2 Login Process

The login process is designed for users who have already created an account. It ensures secure access to their accounts with the credentials established during registration.

Forgot Password Functionality: For users who forget their passwords, BuildNex offers a 'Forgot Your Password?' option. This feature enables users to reset their password by receiving a time-sensitive verification code via email, valid for 10 minutes. If the code expires, the user should request a new one.

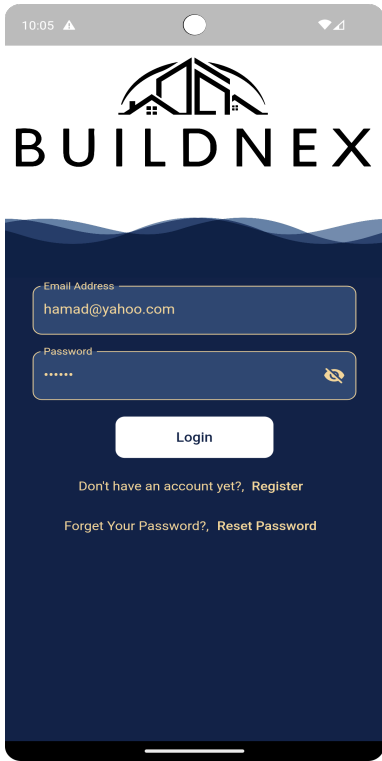


((a)) Login Screen

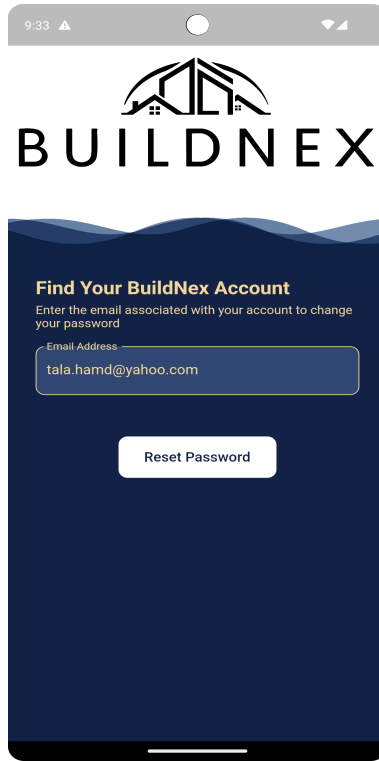


((b)) Invalid Email

Figure 4.4: Login Process



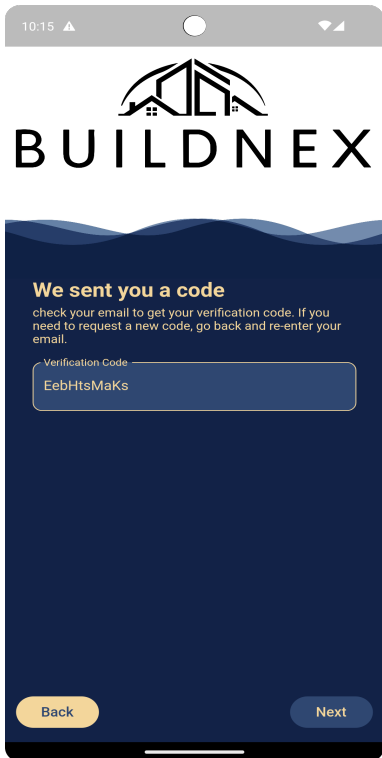
((a)) Select 'Reset Password'



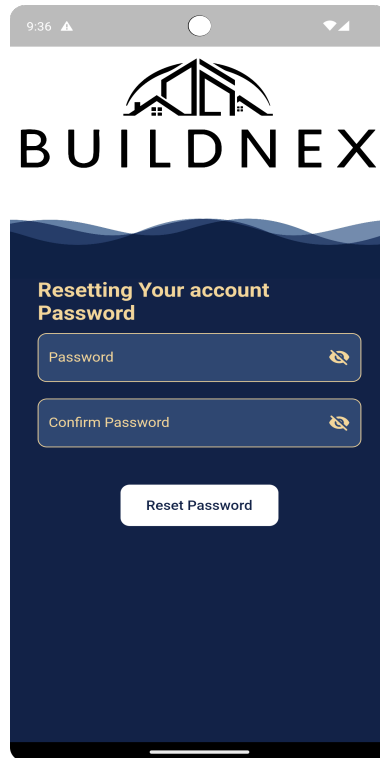
((b)) Enter Email



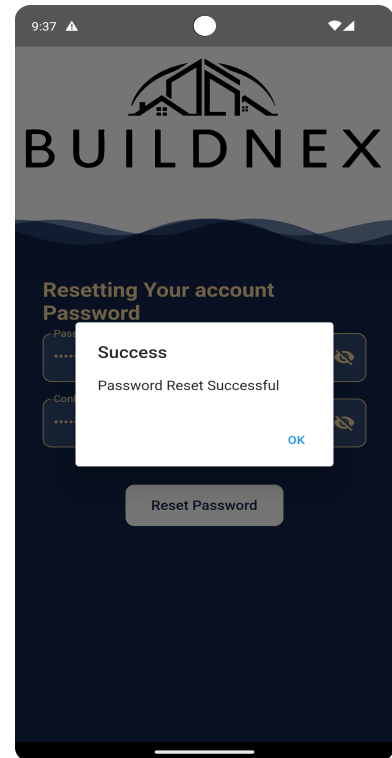
((c)) Get Verification Code



((d)) Enter Verification Code



((e)) Enter New Password



((f)) Confirmation

Figure 4.5: Forgot Password Process

4.2.3 Service Provider Side

When a service provider first logs into BuildNex, they are greeted with an interactive tutorial guide. This tutorial is designed to acquaint them with the application's functionality, showcasing the various screens and features available at their account.

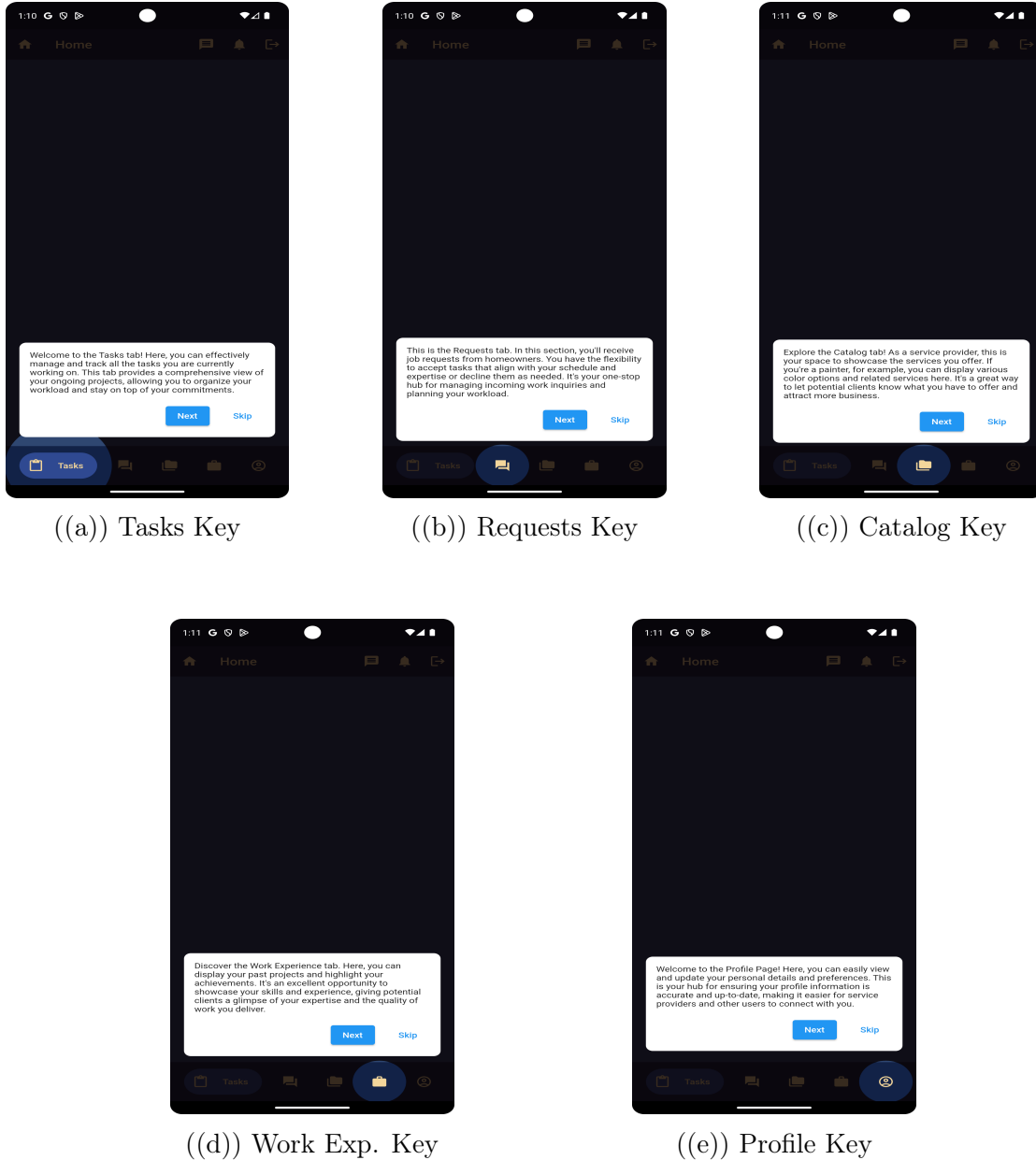


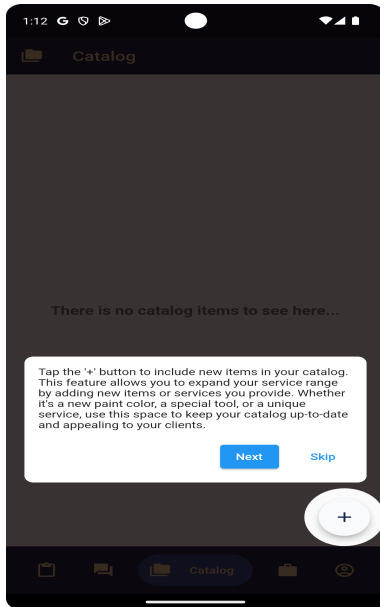
Figure 4.6: SP Tutorial Guide

Home Screen: The Home screen presents an overview of tasks under the provider's supervision, along with quick access to messages and notifications. This design ensures that service providers can efficiently manage their workload and stay updated on important communications.

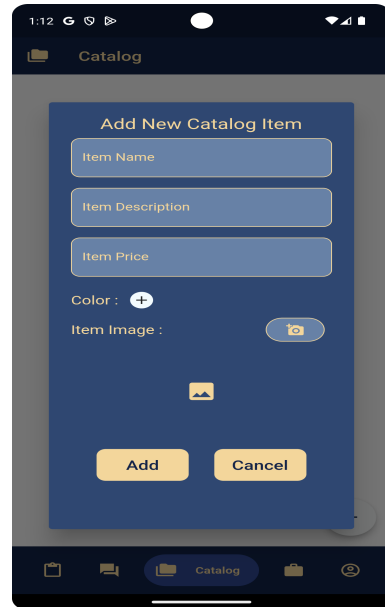
Request Management: The requests screen is where providers receive job requests from homeowners. Here, they have the flexibility to accept or decline requests based on their availability and preferences, allowing for better time management and planning.

Catalog: For providers offering specific items, the catalog screen is a space to showcase their products. A painter, for example, can list different paint types, colors, and images. This feature not only enhances their service offering but also provides homeowners with more information to make informed choices.

Work Experience: The work experience screen is dedicated to highlighting the provider's previous projects and accomplishments. By showcasing their past work, service providers can enhance their profile, building trust and credibility with potential clients.

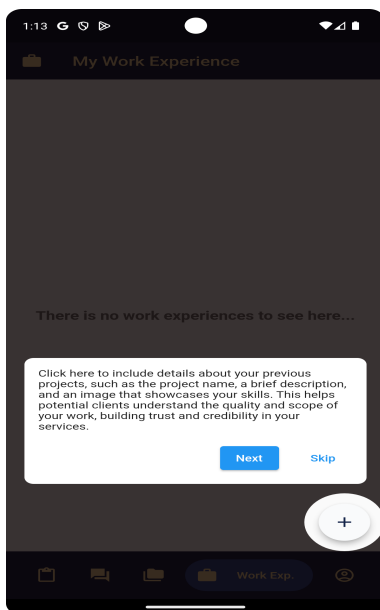


((a)) Catalog Screen

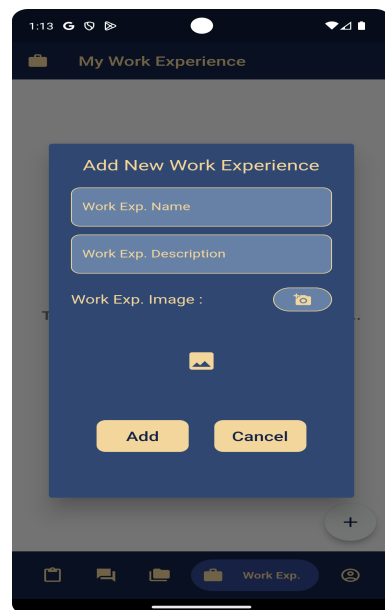


((b)) Add Item to Catalog

Figure 4.7: Catalog - Service Provider



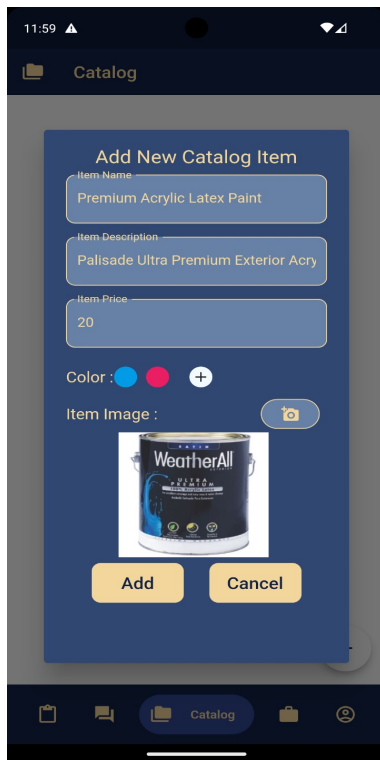
((a)) Work Exp. Screen



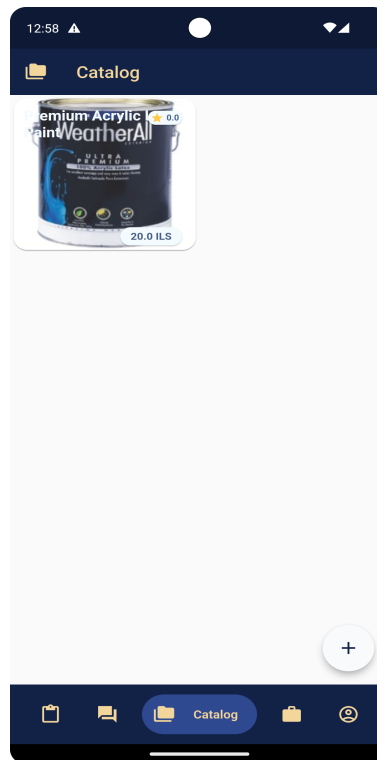
((b)) Add Item to Work Exp.

Figure 4.8: Work Exp. - Service Provider

Adding and Updating New Catalog Items



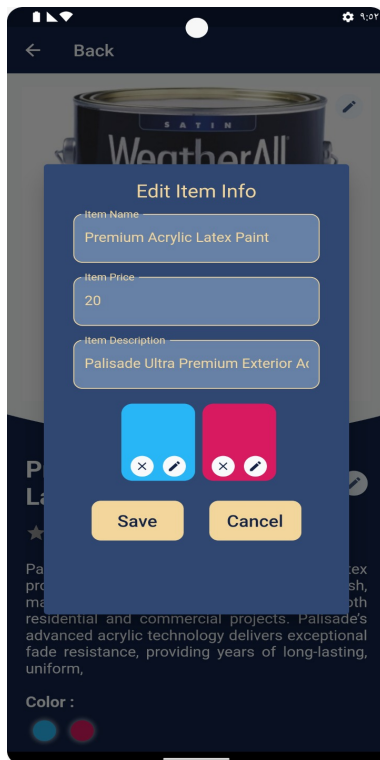
((a)) Add Item to Catalog



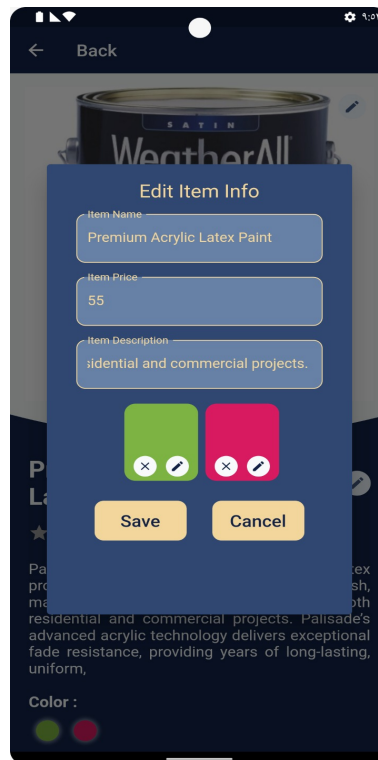
((b)) Catalog List



((c)) Item Details



((d)) Edit Item Info.



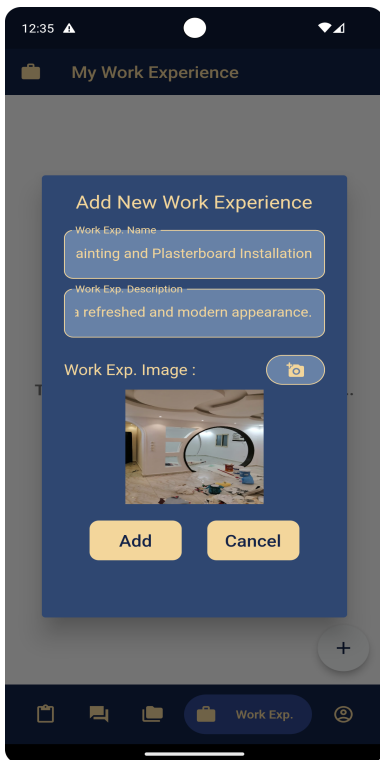
((e)) Edit Item Colors



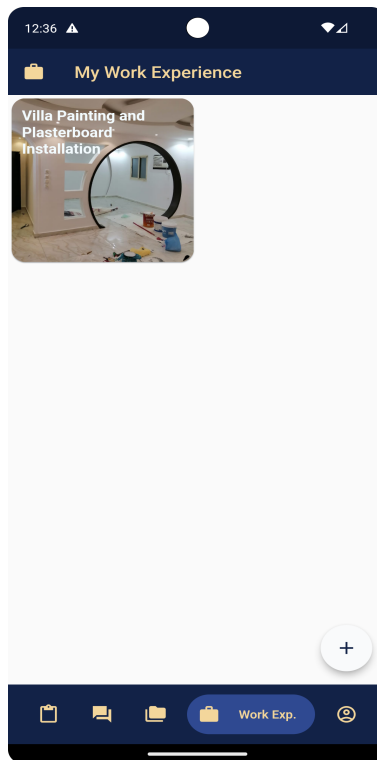
((f)) Item After Edit

Figure 4.9: Catalog Item

Adding and Updating New Work Experience



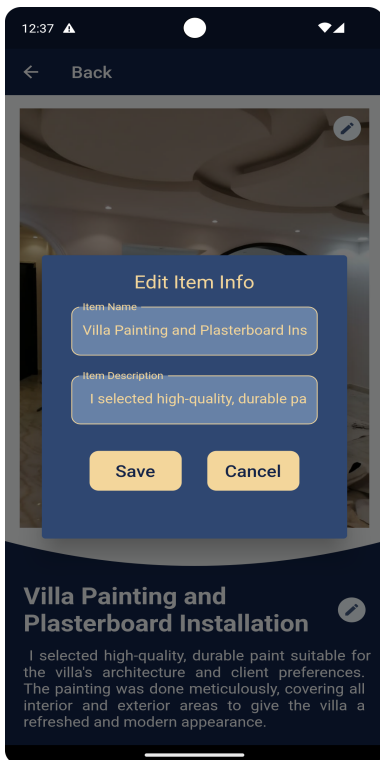
((a)) Add Work Exp.



((b)) Work Exp. List



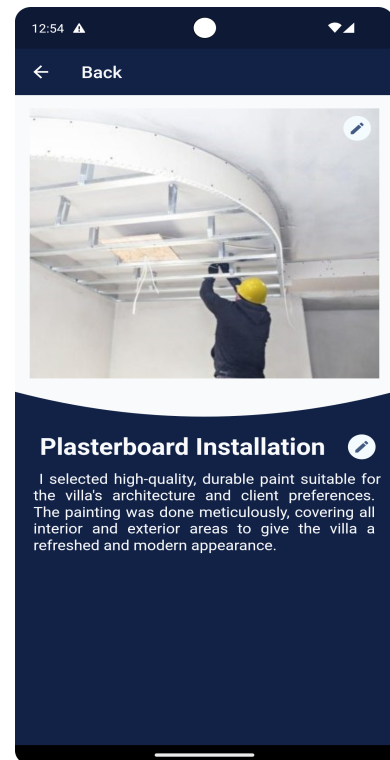
((c)) Work Exp. Details



((d)) Edit Work Exp.



((e)) Edit Work Exp. Image



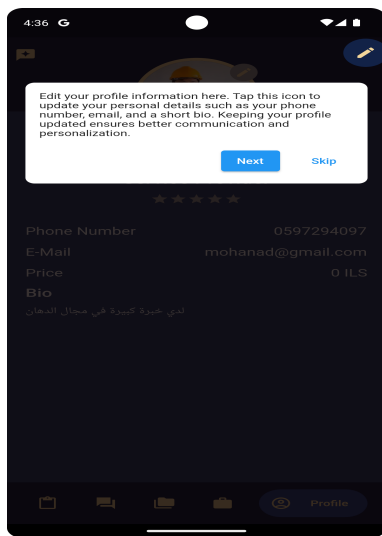
((f)) Work Exp. After Edit

Figure 4.10: Work Exp. Item

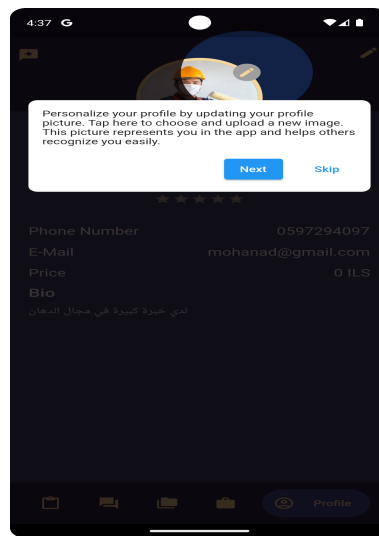
Profile Screen: This screen is displaying their private information and the reviews from homeowners. Service providers can easily view these reviews by tapping the icon located at the top left of the screen. This feature provides convenient access to valuable feedback. The ability to quickly and easily view reviews helps service providers stay informed about their performance and make necessary adjustments to enhance their service quality. Additionally, service providers have the ability to edit their information directly from the app, using the designated edit icons.



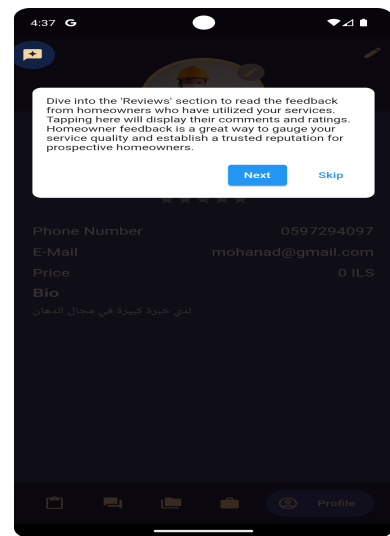
Figure 4.11: Profile - SP



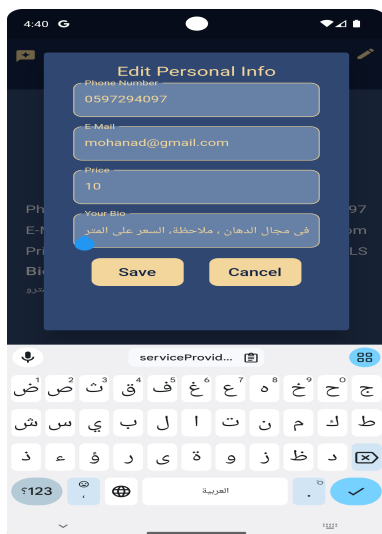
((a)) Edit Profile Key



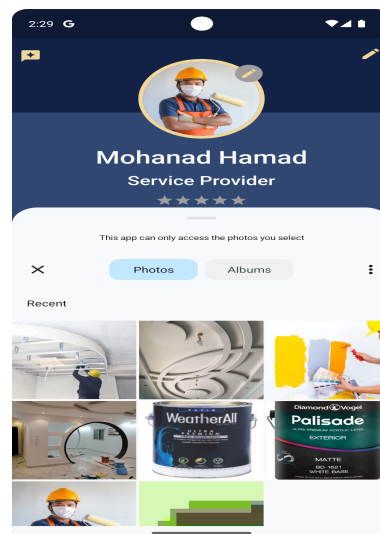
((b)) Edit Profile Pic. Key



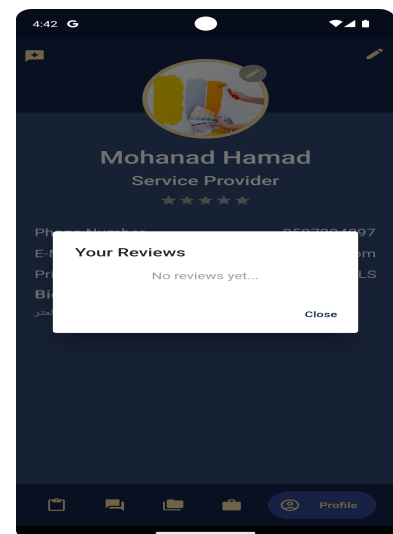
((c)) Show Reviews Key



((d)) Edit Profile Info



((e)) Upload New Image

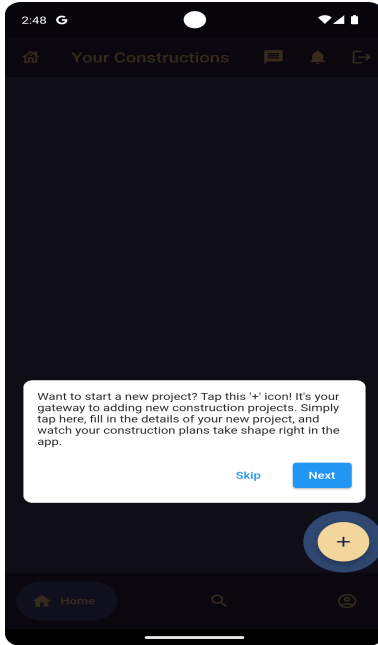


((f)) Reviews Dialog

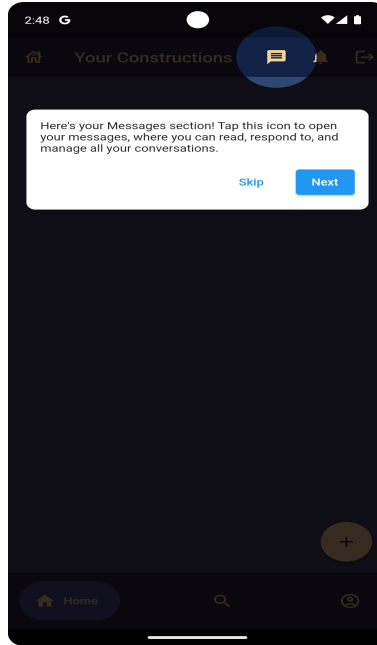
Figure 4.12: Service Provider Profile

4.2.4 Homeowner Side

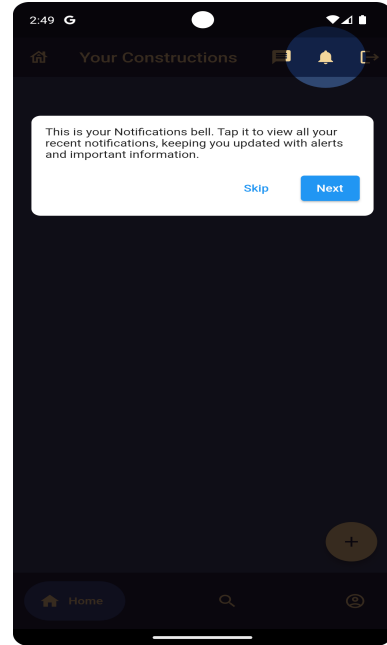
When a homeowner first logs into BuildNex, they are immediately introduced to an interactive tutorial guide. This guide is designed to familiarize them with the application's functionality, ensuring they can navigate through the app with ease and efficiency.



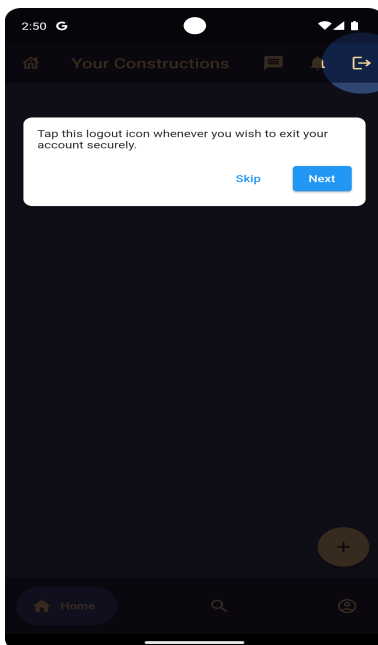
((a)) Add Construction Key



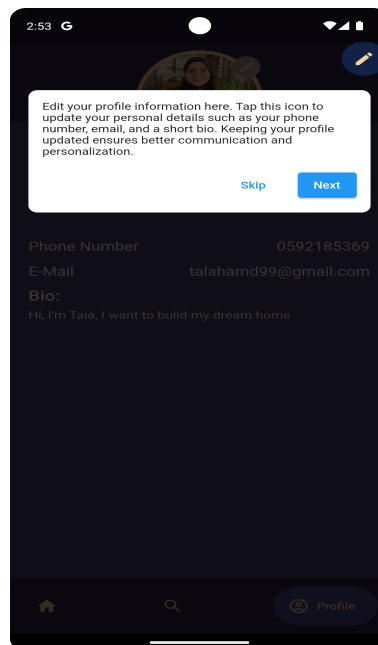
((b)) Messages Key



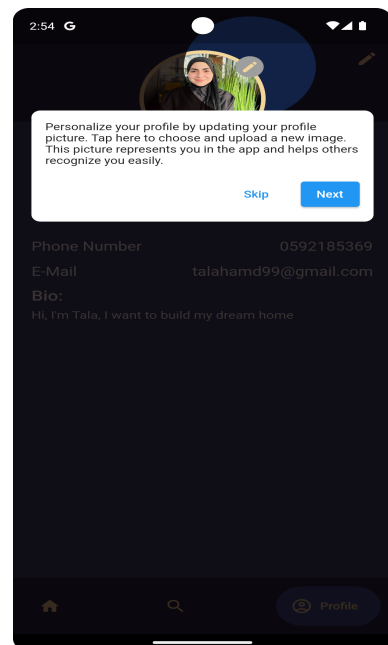
((c)) Notifications Key



((d)) logout Key

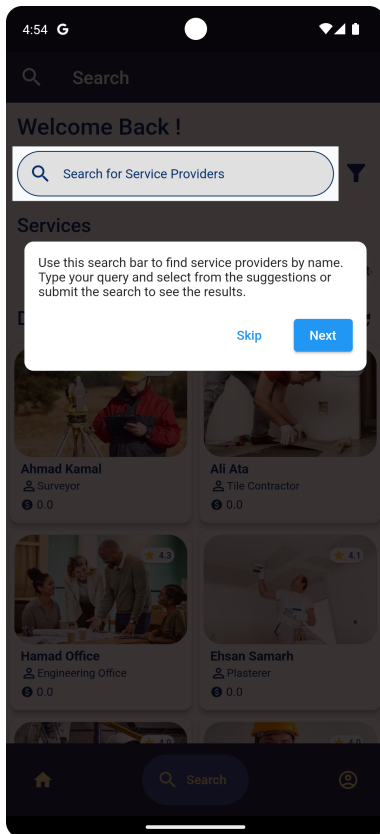


((e)) Edit Profile Info. Key

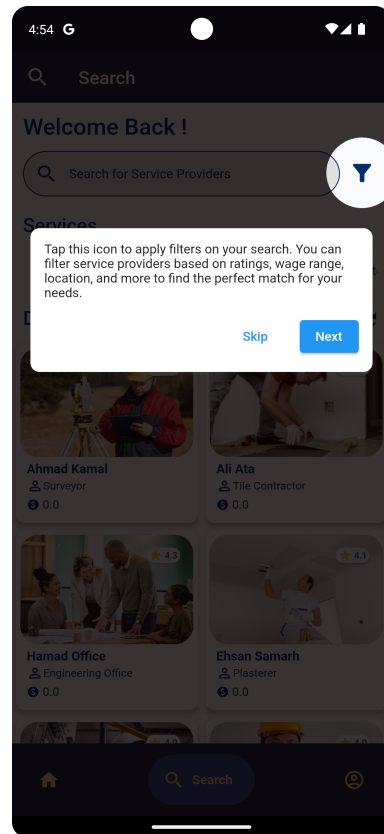


((f)) Edit Profile Pic. Key

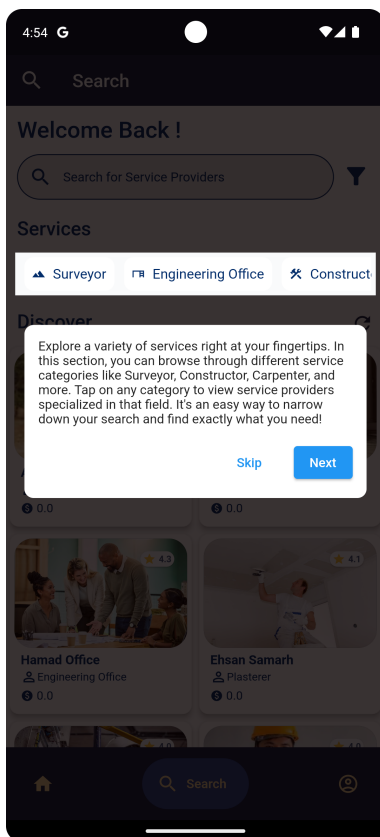
Figure 4.13: HO Tutorial Guide 1



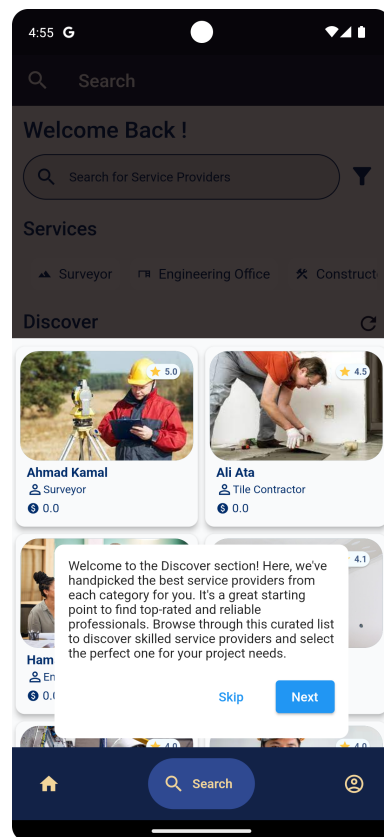
((a)) Search by Names Key



((b)) Search Filter Key



((c)) Search by Service Type Key



((d)) Discover Key

Figure 4.14: HO Tutorial Guide 2 -For Search Screen-

Search Screen

The search interface within our BuildNex application has been designed to cater to the specific requirements of homeowners in search of particular service providers. The search bar serves as the primary access point to an extensive array of available service providers. Upon activation, the search bar engenders a drop-down menu, presenting a selection of service provider names. These names are selected at random from the service providers registered within the application. This feature has been strategically implemented to expedite the process of discovery and selection.

A good aspect of our search functionality is its proactive approach in catering to user preferences. Specifically, when the homeowner interacted with the search function to find a service provider, they are presented with a drop-down menu filled with suggested names. This feature is particularly useful as it often eliminates the need for the homeowner to type in a specific query. For example, when searching a service provider like 'Hamad Office', the homeowner might find the desired option directly in the suggestions provided. This design is highly beneficial in scenarios where homeowners might not have complete or precise information about a service provider's name. The drop-down menu's suggested names enhance the probability of homeowners quickly finding what they need, potentially without having to type anything at all.

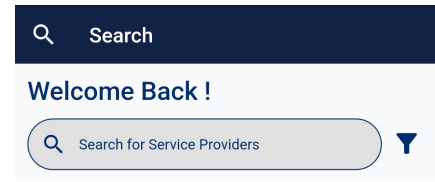
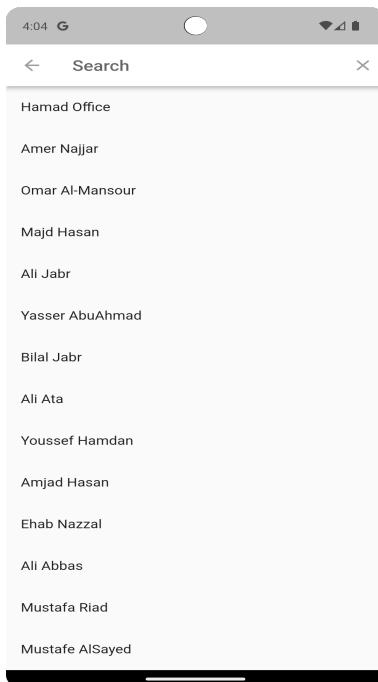
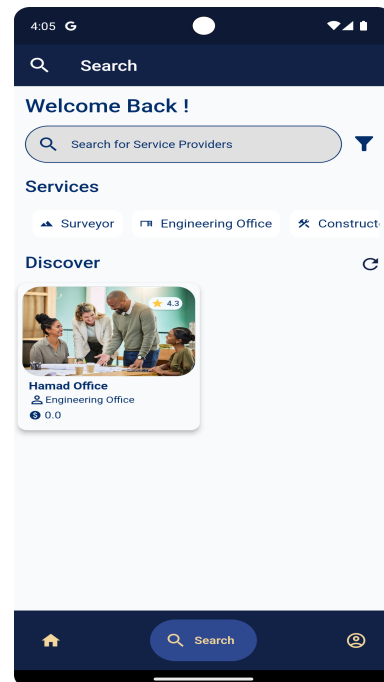


Figure 4.15: Search Bar



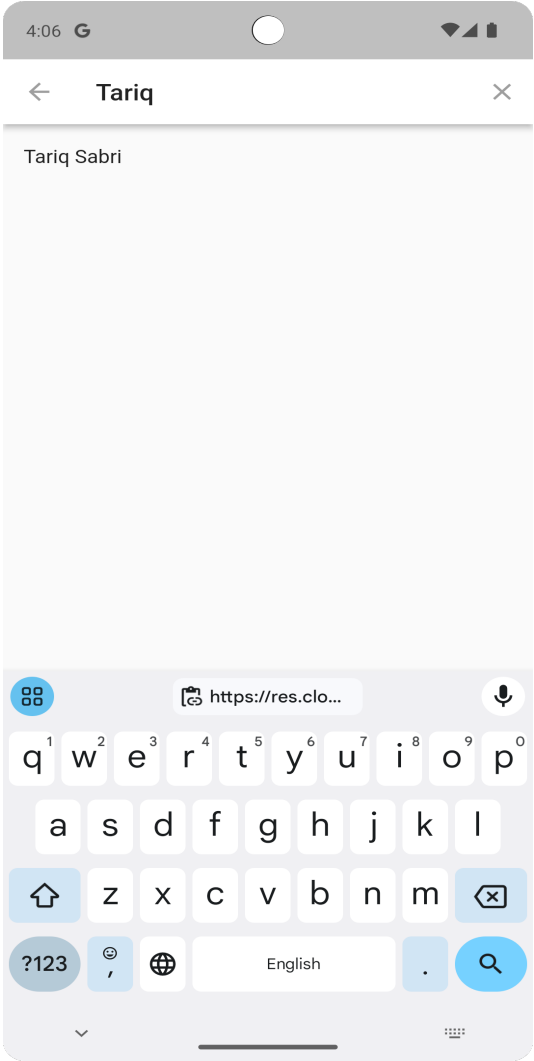
((a)) Display of Suggested Names in the Search Bar Drop-down



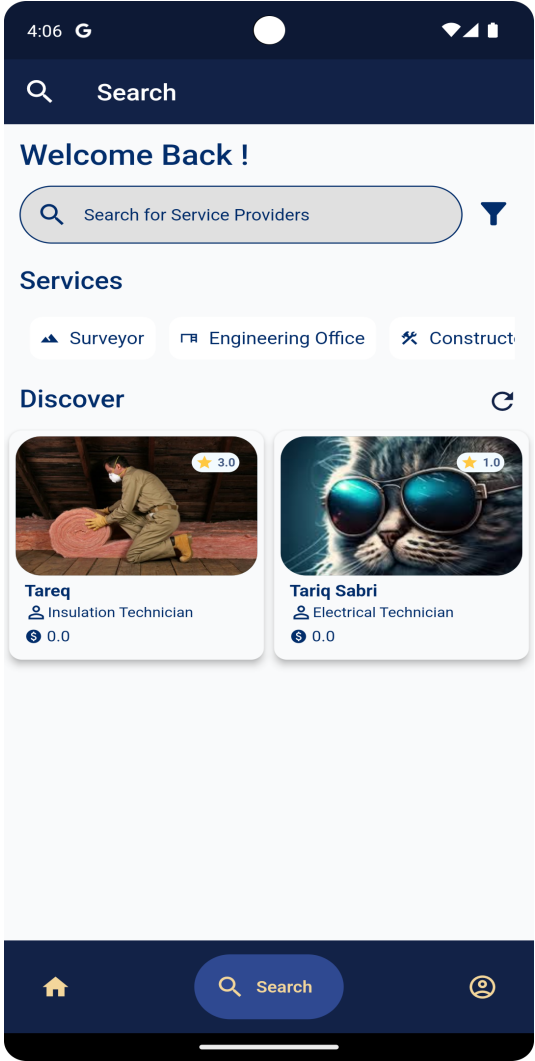
((b)) Selection Process from Suggested Names in the Search Bar

Figure 4.16: Drop-down Search Functionality

Our search system uses Fuse.js, a well-known library that's part of Node.js, which is great at fuzzy searching or finding close matches to what you type. This is really useful when homeowners accidentally type in a service provider's name wrong. For example, if someone types 'Tariq' instead of 'Tareq', our search engine is smart enough to show results for both names. This helpful feature means that even if you spell a name slightly wrong, you can still find the service provider you're looking for. This helps avoid the frustration of getting no results from your search.



((a)) Fuzzy Search Example: Typing 'Tariq' in the Search Bar



((b)) Results Display for Both 'Tariq' and 'Tareq', Showcasing Fuzzy Matching

Figure 4.17: Demonstrating the Fuzzy Search Capability with Fuse.js

Adding this smart search feature really improves the overall experience for users. It makes finding the right service provider much easier and more forgiving, especially if you're not sure about the spelling. It shows how well we use advanced technology to make things easier and simpler for homeowners looking for important services. The main goal is to lessen stress and make the whole process more convenient.

In this section, the homeowner has the ability of searching for service providers by service type. When the homeowner selects a specific category from the category list, such as 'Insulation', the app dynamically updates to display only those service providers who offer insulation services. This focused search allows for a more targeted and simplified navigation, ensuring that homeowners can easily find specialists tailored to their specific project needs. If the homeowner decides to deselect the chosen category, perhaps after a change of mind or to explore other options, the activated category will immediately be disabled. This action restores the 'Discover' section to its default state, which showcases service providers with the highest ratings across various categories, enabling homeowners to browse through them in each service domain. This intuitive toggle between a specialized view and a broad overview ensures that homeowners have full control over their search experience.

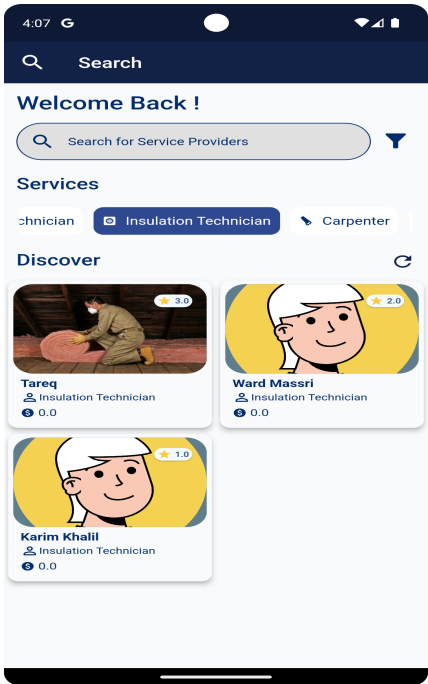
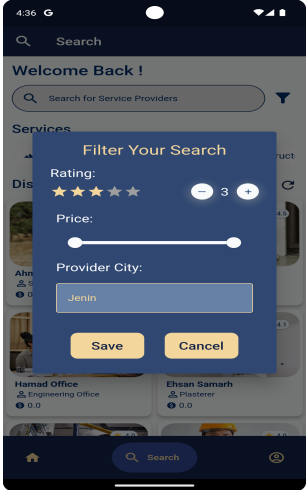


Figure 4.18: Services List-Insulation Category-

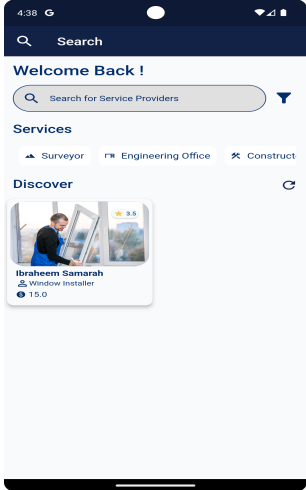


Figure 4.19: Discover Search

The final button on the search screen is the filter button. When a homeowner clicks on it, they have the option to select filters based on rating, price, and city. This allows them to refine their search across all service providers or focus on a specific type of service by using the services list which I mentioned previously. This feature helps in customizing the search to match specific requirements.



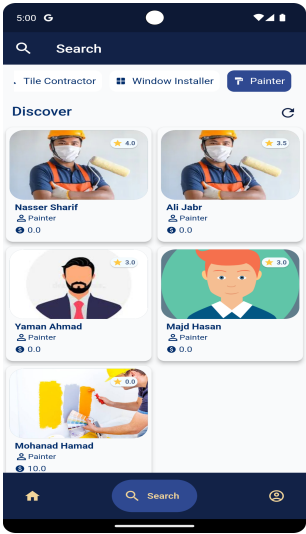
((a)) Filter Requirements



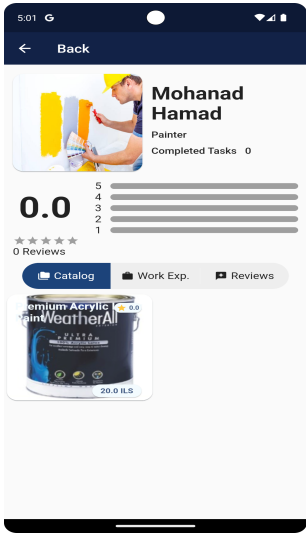
((b)) Filter Result

Figure 4.20: Filter Process

Suppose you're clicking on the painting service. When you scroll down, you'll see 'Mohanad Hamad' as a service provider. Upon clicking on his profile, you'll gain access to various details such as his ratings, the number of people who have rated him with scores ranging from 1 to 5, his completed tasks, catalog, work experiences, and a section for reviews. It's important to note that since 'Mohanad' is a new service provider, he hasn't had any jobs yet, and consequently, there are no reviews or ratings to display. In the upcoming pages of this report, I will outline the process of how this system functions.



((a)) Services List-Painting Category-



((b)) Service Provider Profile

Figure 4.21: Access Service Provider Profile from Search Screen

Home Screen:

Lets move to the home screen, there's a '+' button located at the bottom right corner.

Tapping this button brings up a form for adding a new construction project. This form is straightforward, requesting essential information like the construction name, city, address, plot, and basin numbers. Once you fill in these details and hit save, the new construction is added to your list, ready for management and tracking within the app.

The "From Scratch" button is designed for those embarking on a new construction project from the ground up. It's for projects that begin at the very first step, involving tasks like property surveying, obtaining permits, and extensive planning before the actual construction begins.

On the other hand, the "From Middle" button suits projects that are partially underway. It's ideal for those looking to continue construction work that's already past the initial stages, such as projects where foundational work is complete and the focus is on interior installations, finishing, and detailed work.

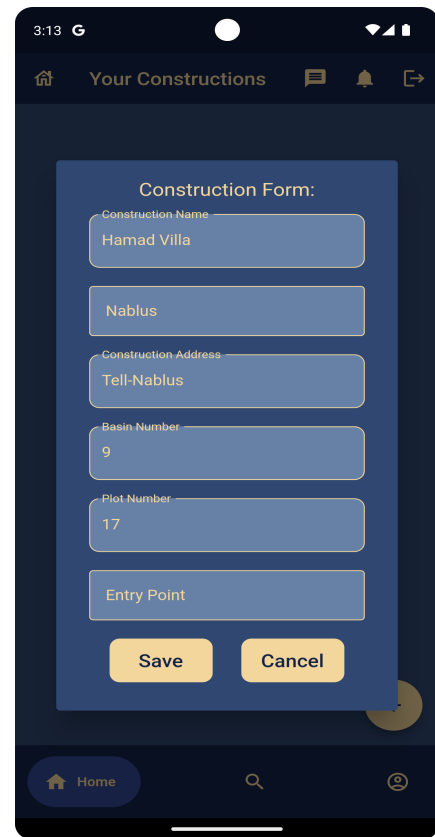


Figure 4.22: Adding New Construction Details

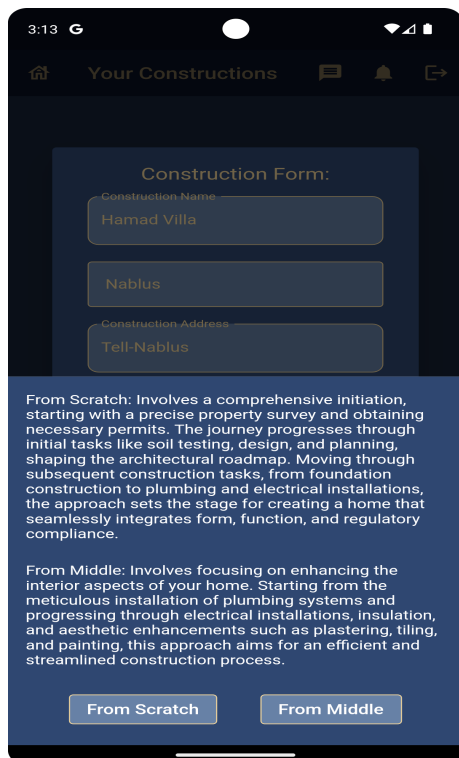


Figure 4.23: Choosing Entry Point

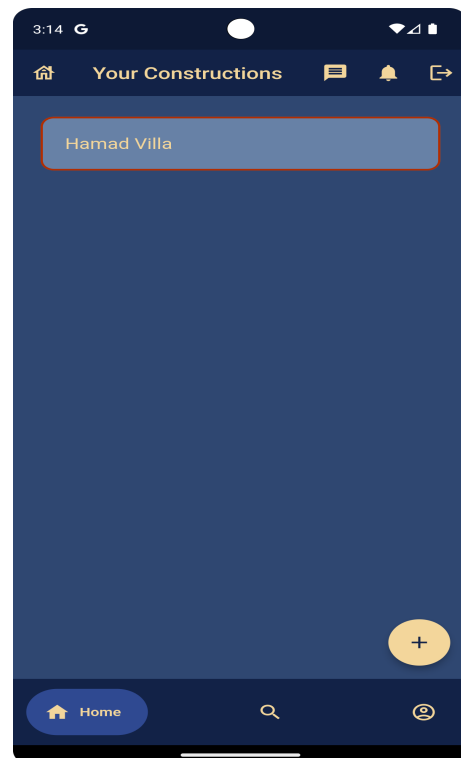
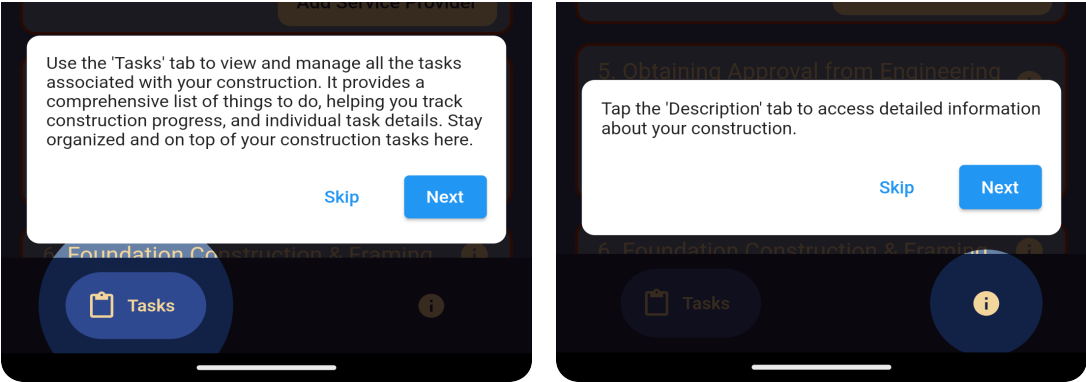


Figure 4.24: Home Screen After Add Const.

When the homeowner clicks on the construction for the first time, there will be a tutorial guide to tell him about tasks and construction description.



((a)) Tasks Key

((b)) Construction Description Key

Figure 4.25: Construction Tutorial Guide

When the homeowner clicks on 'description', the basic information related to the construction will display, like progress, address, city, plot, and basin numbers. Additionally, a drop-down list which contains building area, rooms and floors numbers, and design drawing's, these data in drop-down list will be filled by the homeowner later in the tasks that will need this information.

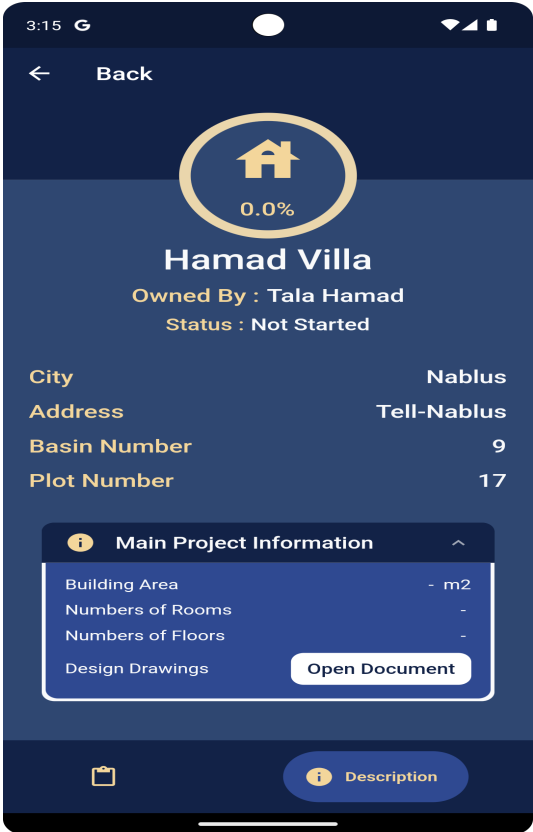


Figure 4.26: Construction Details

Let's move to the Tasks screen. When the homeowner starts from the beginning, there are 16 tasks, numbered from 1 to 16, and if the homeowner decides to start from the middle, the tasks will be from Task No. 10 to Task No. 16.

1. Property Survey.
2. Obtaining Permits & Regulatory Information.
3. Soil Investigation.
4. Design and Planning.
5. Obtaining Approval from Engineering Association & Licensing Authority.
6. Foundation Construction & Framing.
7. Rough Mechanical Work.
8. Rough Electrical Work.
9. Insulation Work.
10. Door Frame Installation.
11. Plastering Work.
12. Tile Work.
13. Aluminum Work.
14. Carpentry Work.
15. Painting Work.
16. Installing Fixtures and Finishing Up.

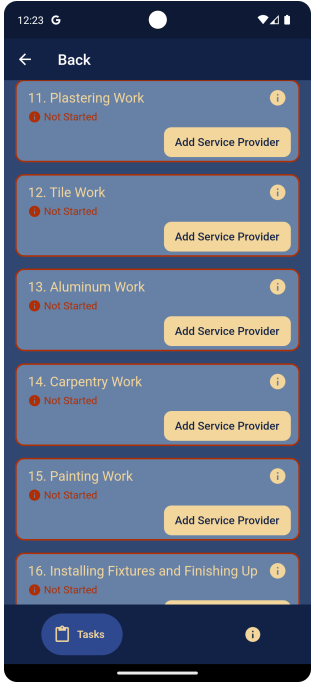
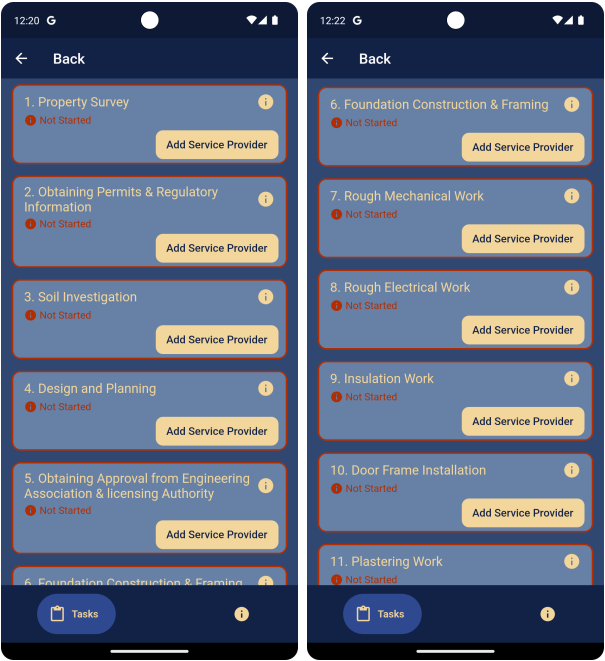


Figure 4.27: Tasks Screen

4.2.5 Task Implementation For Homeowner and Service Provider

When a homeowner decides to start with the first task related to property surveying, he will select the 'Add Service Provider' button. This action leads them to a list of surveyors specialized in this task. The homeowner can then choose a service provider based on their preferences for ratings, and other criteria. Upon selecting a service provider, the homeowner sends a request specifying the expected start date for the task. The system ensures that the date is entered and restricts the homeowner from sending multiple requests to the same service provider simultaneously or to another service provider. The homeowner must receive a response from the current request before sending another.

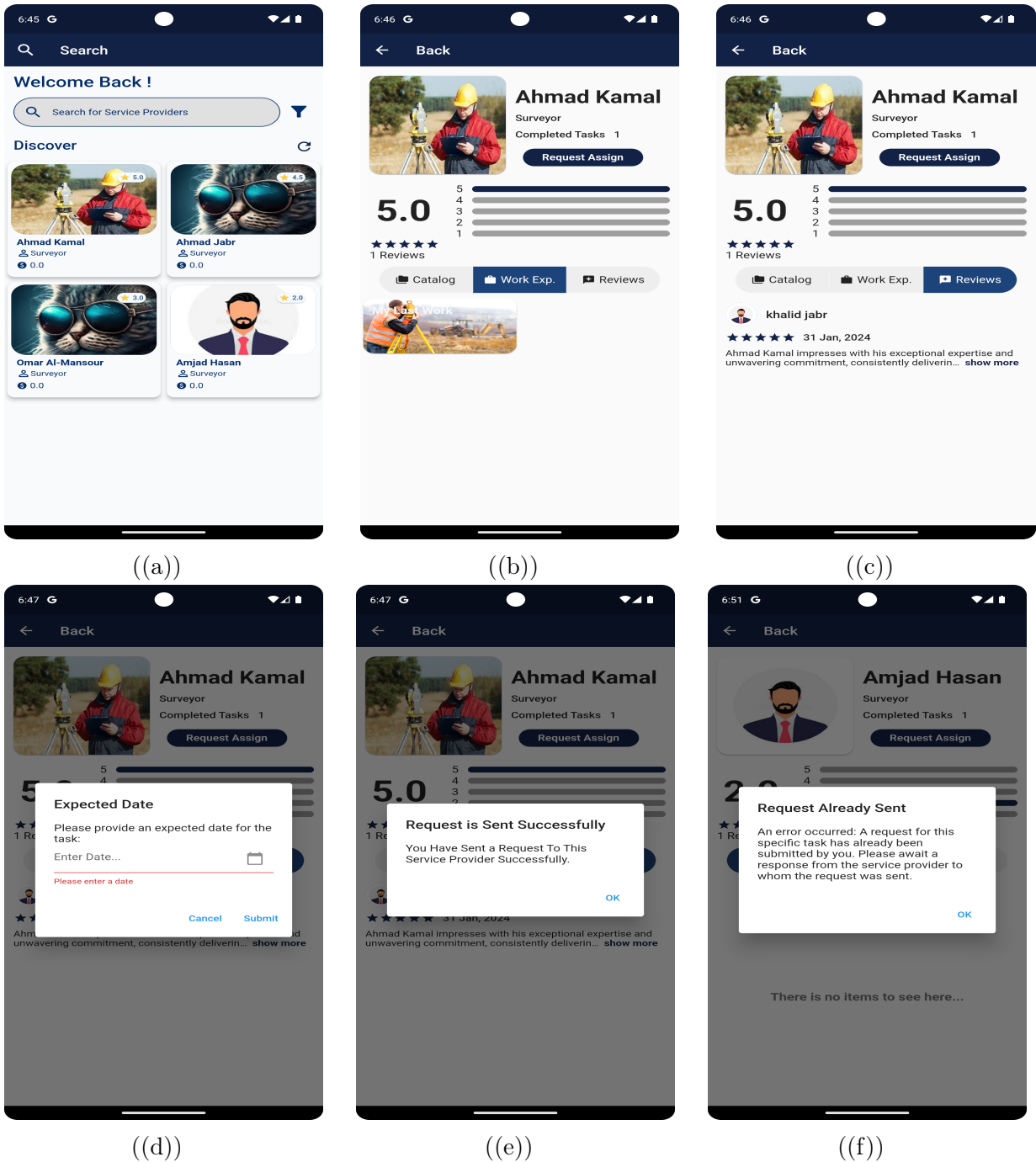
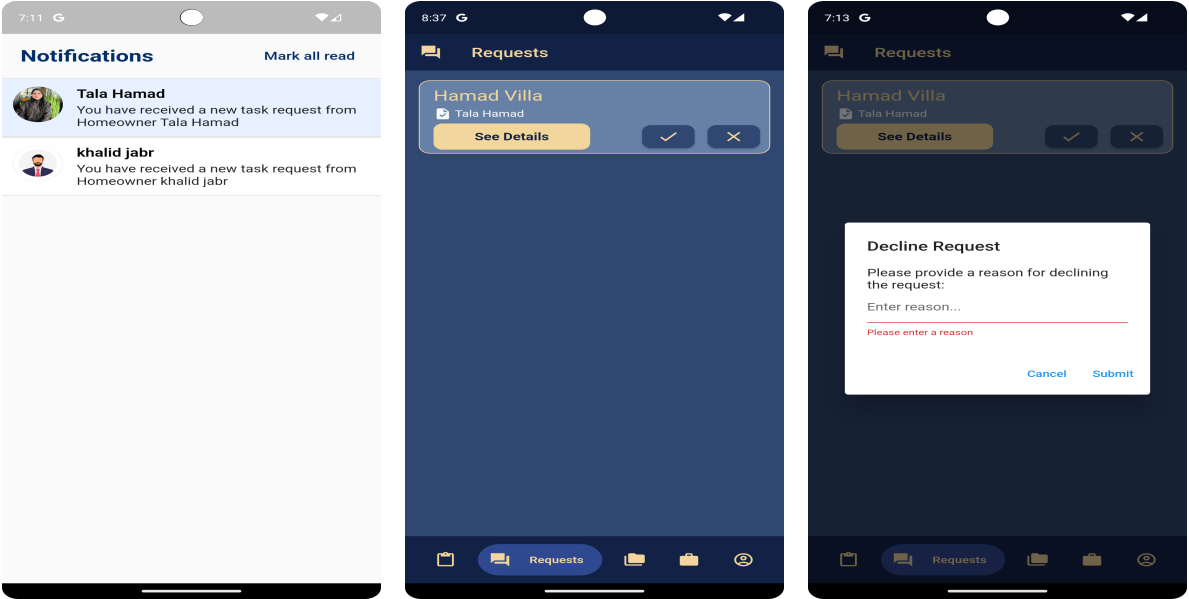


Figure 4.28: Homeowner Assign Service Provider

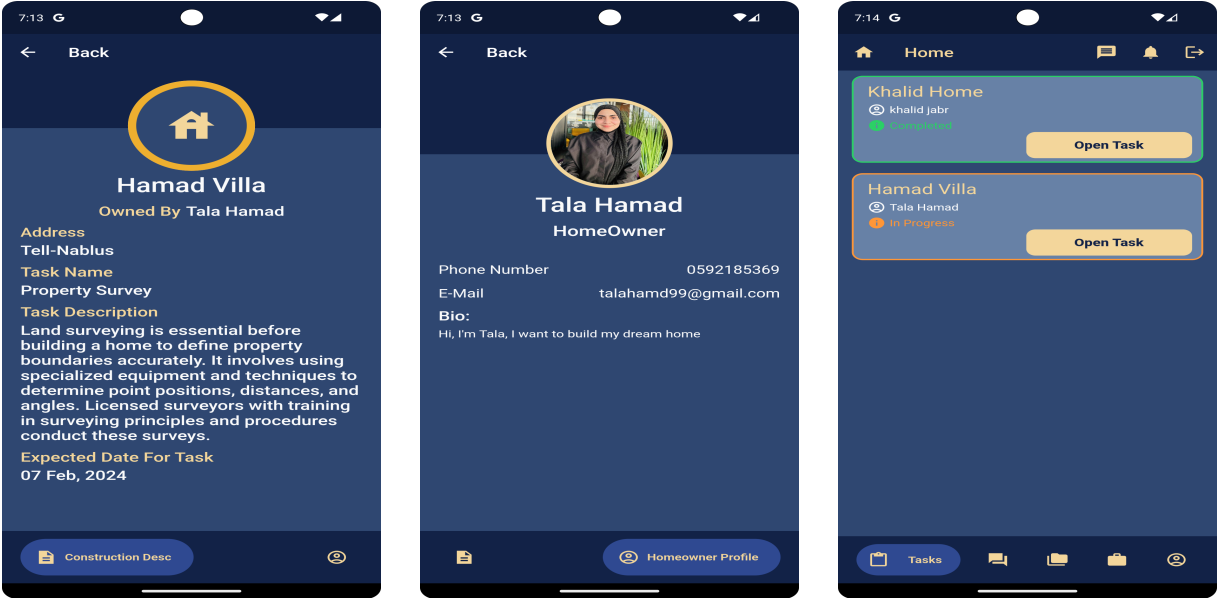
Once the request reaches the service provider, it includes detailed information about the task. It encompasses the building details, address, description of the required work, the chosen start date, and basic homeowner information like their name and contact number. It enables the service provider to make an informed decision. If he has additional queries, he can directly contact the homeowner. At this stage, the service provider can approve or decline the request based on their availability, the construction location, or other factors. If they choose to decline, they must provide a reason sent to the homeowner. Accepted requests are moved from the pending requests to the service provider's active tasks list. The task status changes from (Not Started) to (In Progress), indicated by a color change from red to orange.



((a))

((b))

((c))



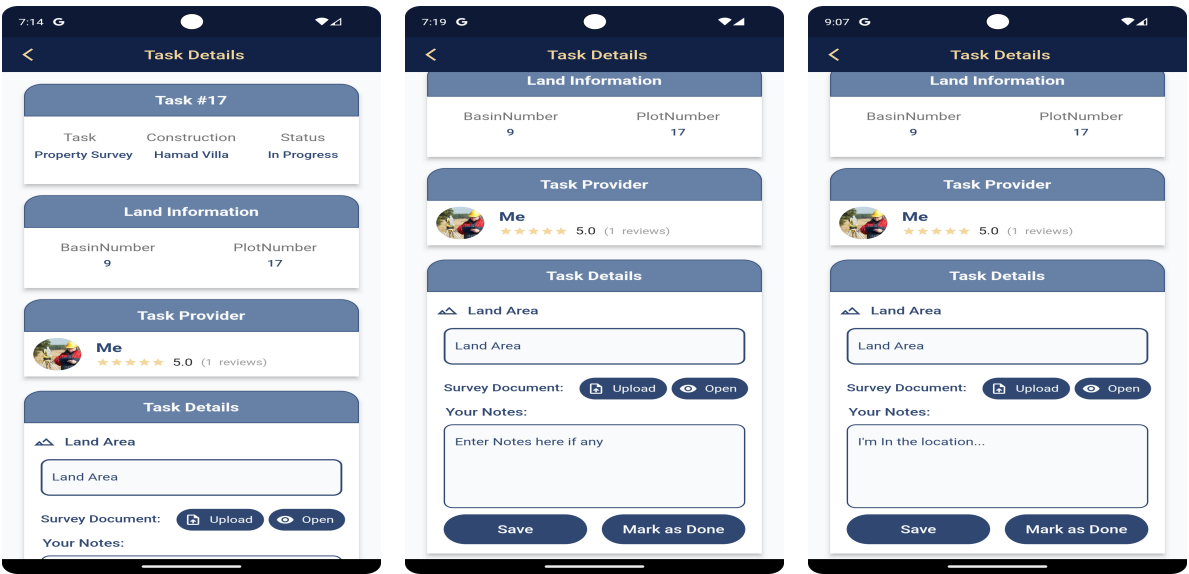
((d))

((e))

((f))

Figure 4.29: Service Provider Accept or decline Request -In this case he accept it-

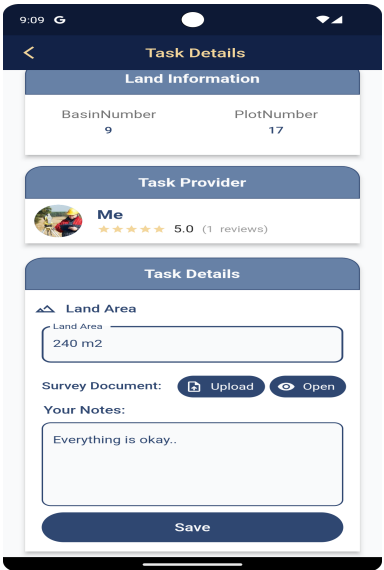
Whatever the service owner's response to the homeowner's request -accept or decline-, the homeowner is promptly notified, which is an ideal outcome. In cases where the request is declined, the homeowner is also informed of the decline reason, after this, the system will allow them to request another service provider. After the Service Provider approves the request, he accesses the task screen to find essential details like the basin and plot numbers entered by the homeowner before, which are crucial for completing their work. On the task screen, there are two notable buttons: one for saving progress and another to mark the task as done. This setup allows the Service Provider to add notes or updates for the homeowner, enhancing transparency and allowing the homeowner to track progress. For instance, on the first day, the Service Provider might note the initial steps taken, continuing to update until the task's completion, including entering the land area and uploading the survey document. Clicking 'Mark as Done' then changes the task status from 'In Progress' to 'Completed,' promptly notifying the homeowner of the completion.



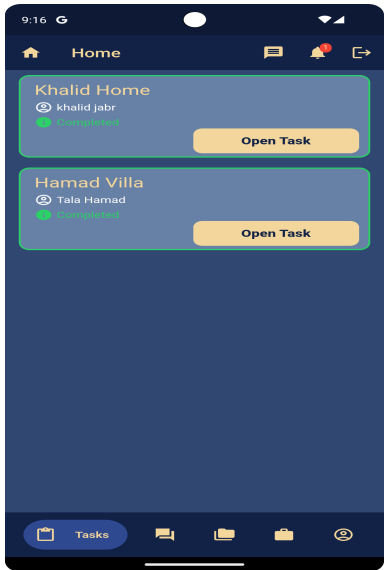
((a))

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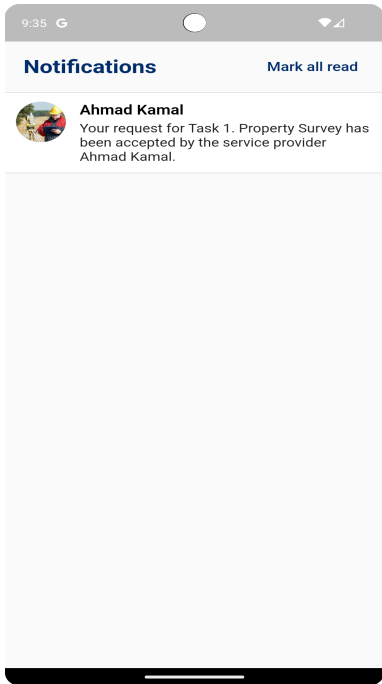
((d))



((e))

Figure 4.30: Service Provider Complete Task

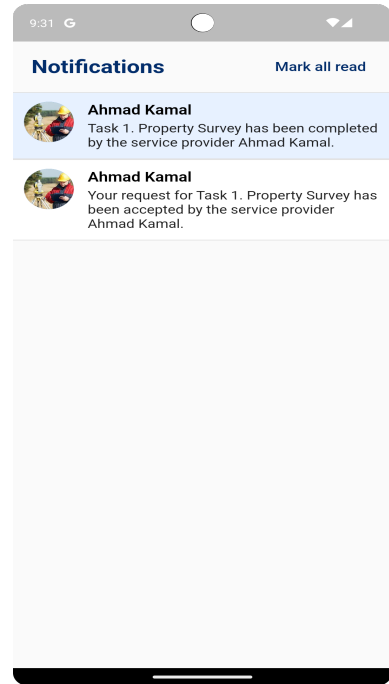
The homeowner actively monitors the task's progress, staying informed through notifications from the service provider and maintaining communication via messages. Once the task's status switches to 'Complete', indicated by green colour, the homeowner can view the details by clicking the 'Open Task' button. In this section, the homeowner has access to task details such as land area, service provider notes and survey document, there are two options regarding the survey document: the homeowner can download it to their device or view it by PDF viewer.



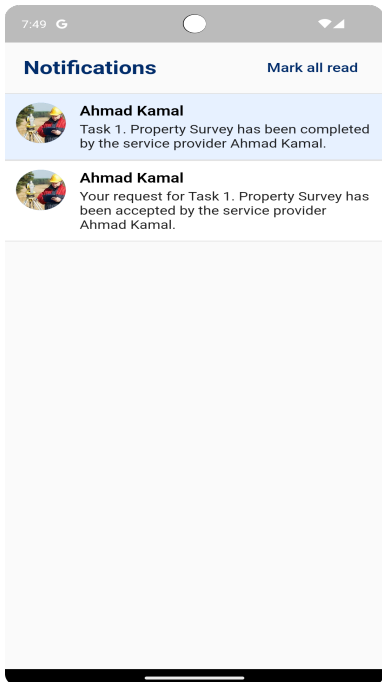
((a))



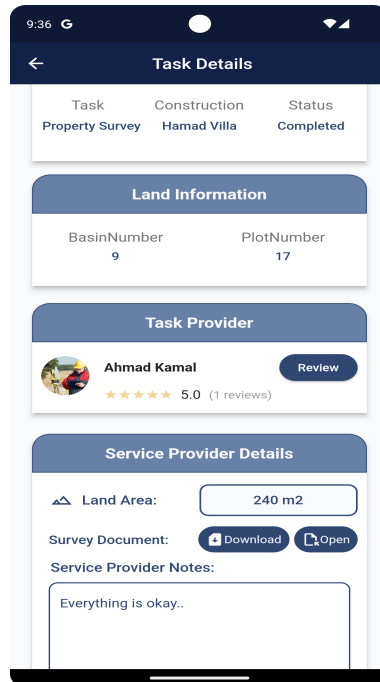
((b))



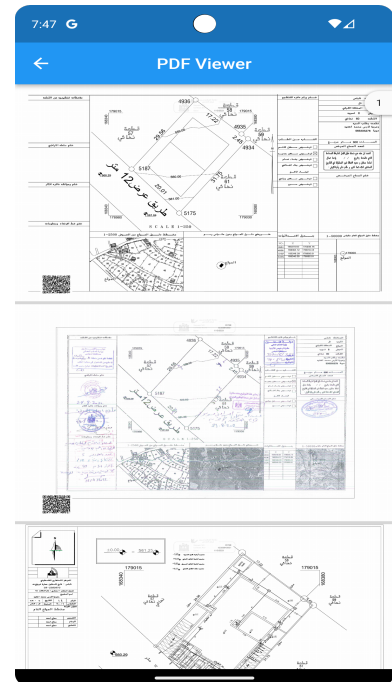
((c))



((d))



((e))



((f))

Figure 4.31: Homeowner Tracks Task Completion

Once the service provider completes the task, the homeowner has the opportunity to provide feedback. He can do it by clicking the 'review' button next to the service provider name. Here, the homeowner can share his opinion about the service provider, along with a rating on a scale of 1 to 5.

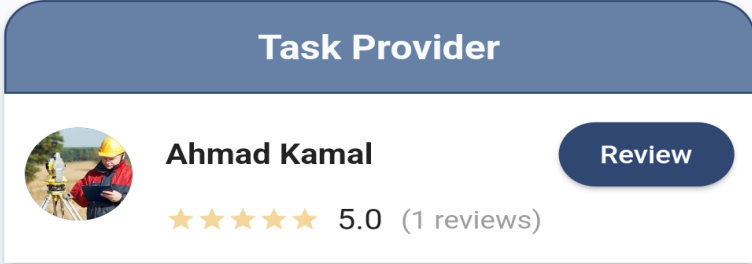


Figure 4.32: Homeowner add a review

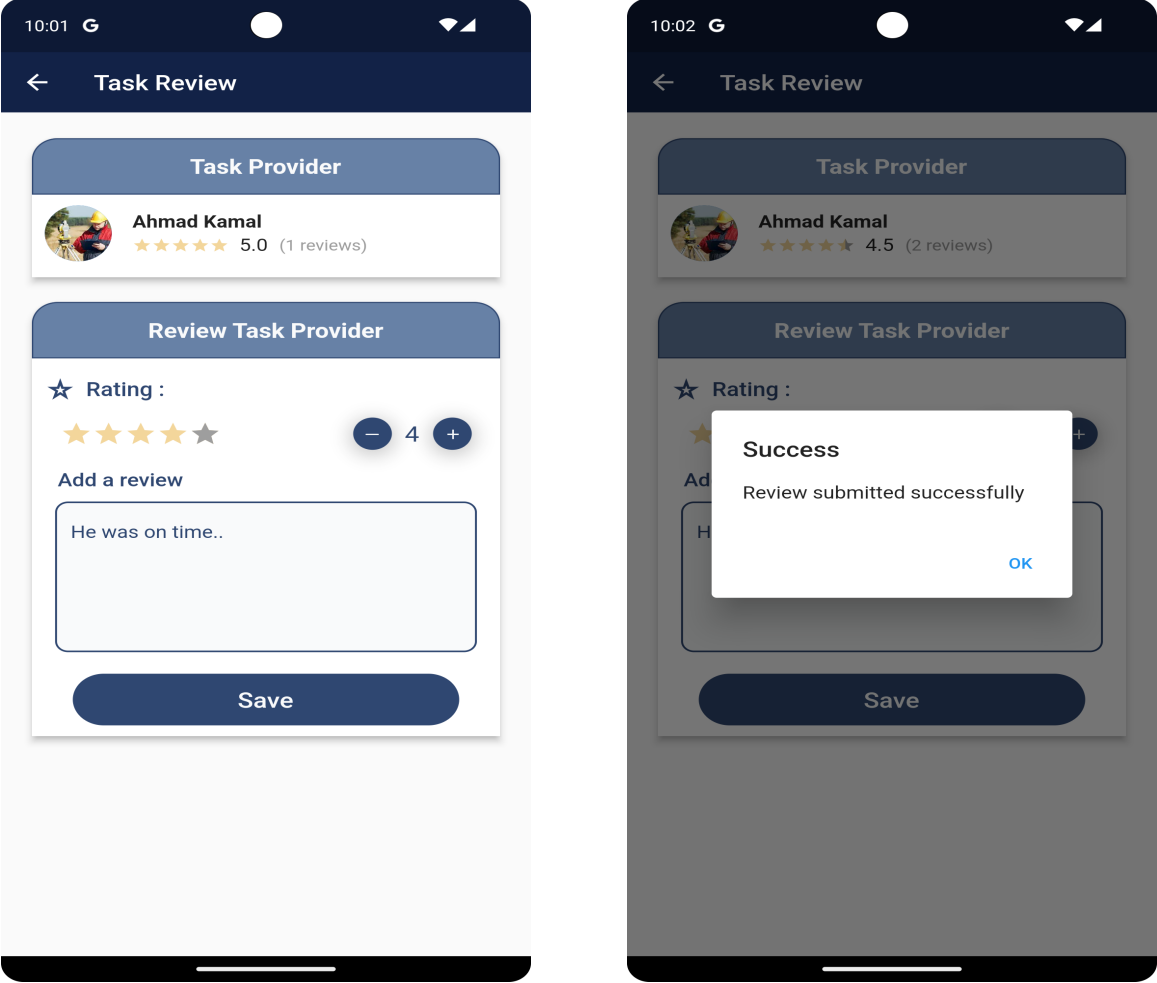


Figure 4.33: Homeowner submit a review

When the homeowner submits a review for a service provider, the system is designed to prevent the addition of multiple reviews for the same service provider by the same homeowner. However, the homeowner has the ability to modify their existing review. This approach is logical and fair, as it ensures that each homeowner's feedback is accurately represented.

4.2.6 Construction Tasks Workflow - HO Side

The task completion process is designed to be sequential and logically dependent. For instance, Task No. 5 cannot start until Task No. 4 is completed. It is crucial, particularly in cases where successive tasks are interdependent, like obtaining necessary approvals from the Engineering Association and the Licensing Authority. These approvals depend on the submission and readiness of preceding plans.

Moreover, some tasks demand homeowner input for progression. Take Task 4 (Design and Planning), where the homeowner must provide essential details like the number of rooms, floors, and the desired building area. Based on this information, the service provider (engineering office) designs and plans the required designs, then uploads them in the (task details) for this task, and then the homeowner will open them.

It's important to highlight that the architectural, civil, mechanical, and electrical plans are automatically transferred to the respective service providers responsible for the corresponding tasks. This automated handover process underscores the integral interdependence of each task, ensuring that every step is informed by the preceding ones and contributes to a cohesive and efficient workflow.

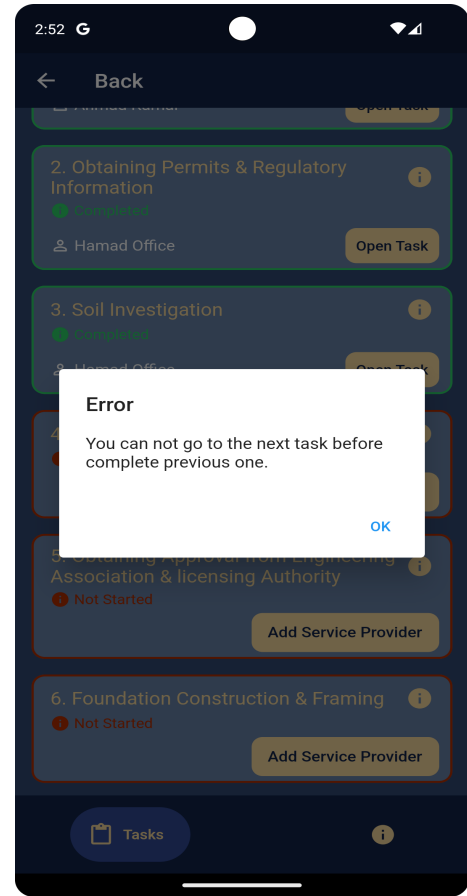


Figure 4.34: Sequential Task Dependency

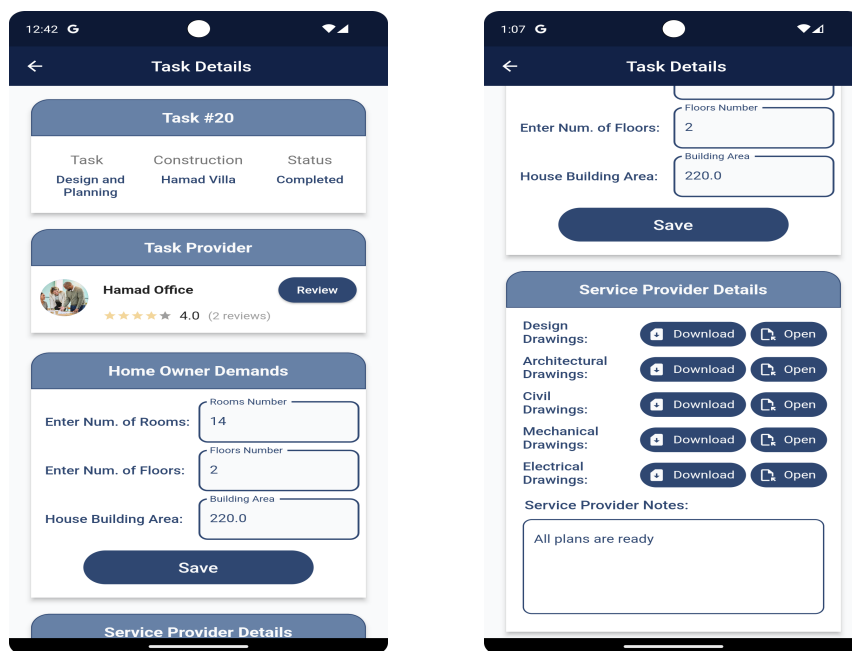
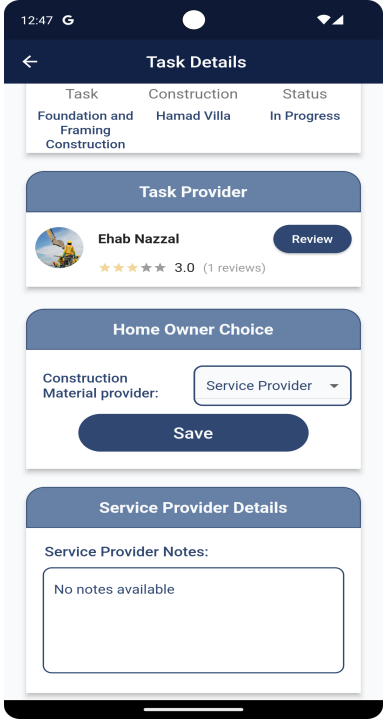


Figure 4.35: Task 4 Details - HO

Task 6 introduces an element of choice: the homeowner decides who procures the building materials—themselves or the service provider. If the homeowner chooses the (service provider), the service provider -constructor- purchases and utilizes these materials.



((a)) Task 6 Status -In Progress-



((b)) Task 6 Material Provider

Figure 4.36: Task 6 Details - HO



Figure 4.37: Project Progress At This Point

It's important to note that some tasks post Task No. 6 can be executed concurrently. Examples include “Rough Mechanical Work,” “Rough Electrical Work,” and “Insulation Work,” with “Insulation Work” being optional. The homeowner has the discretion to include or exclude this task.

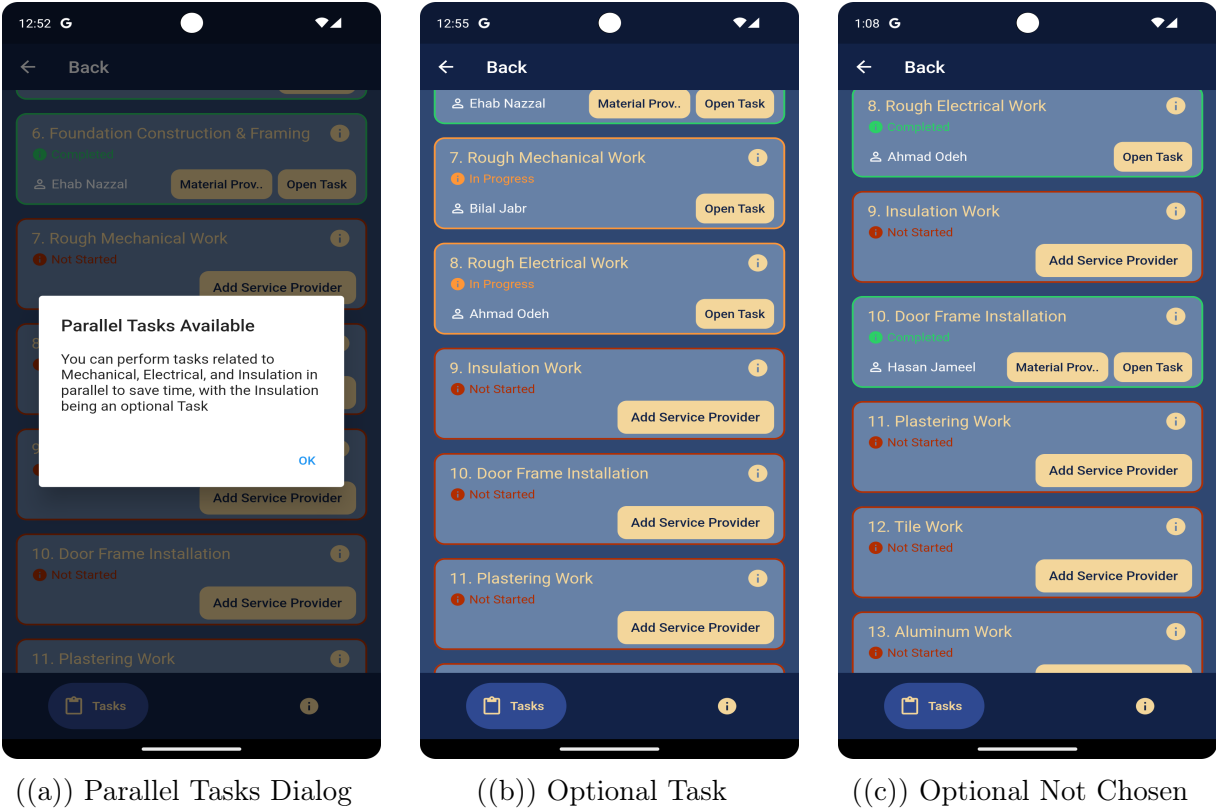


Figure 4.38: Parallel Tasks

Additionally, Task No. 16, 'Installing Fixtures and Finishing Up,' is identified as a static task. For this particular task, the homeowner will not assign a service provider, reflecting its unique nature in the construction process.

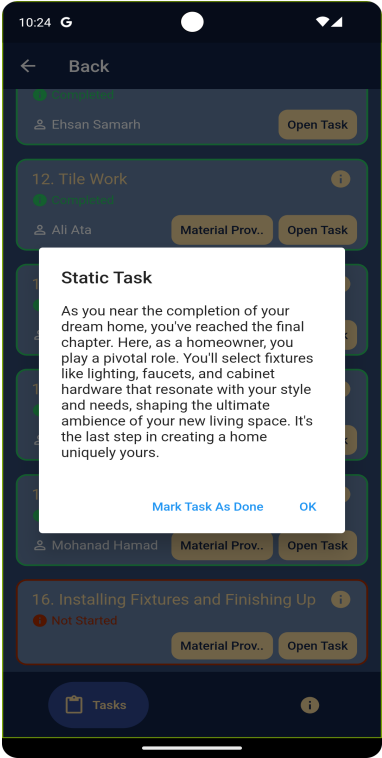


Figure 4.39: Static Task

Subsequent steps in the Workflow involve selections in areas like tiling, doors, aluminium works, and painting. In these tasks, the homeowner will choose among various types of tiles, what tile will be put for the house and what types for the bathroom. The same happens to doors (bedroom door, bathroom door, guestroom door, living room door). And the same thing applies on windows and other specifications. These choices are made through catalogues provided by the service providers. Even if the homeowner does not make a specific choice, the process does not stall. They can always communicate with the service provider via the system’s messaging feature to inquire about the availability or suitability of materials like a particular tile type or paint colour.

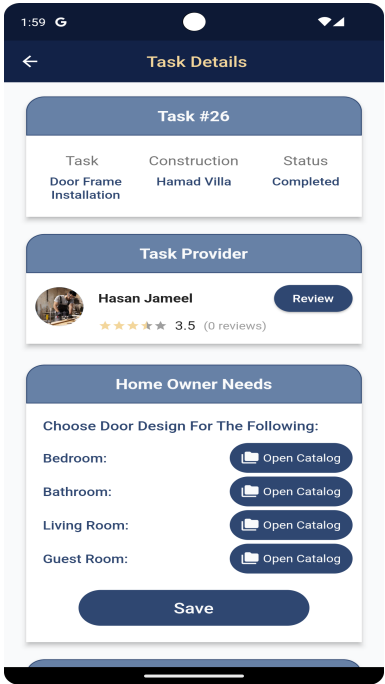


Figure 4.40: Homeowner Customization Options: Selecting Materials and Designs for Construction

Additionally, some tasks feature a 'Material Prov..' button. This tool is instrumental in linking homeowners to suppliers of necessary materials throughout the construction phase. Available in tasks such as tiling, painting, and doors, it facilitates access to stores selling the required supplies, enhancing the ease and efficiency of the construction process.

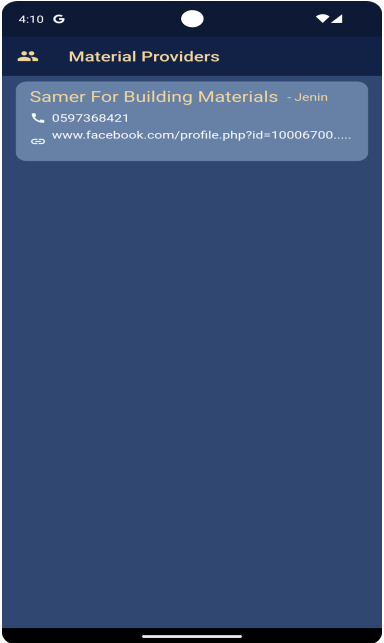


Figure 4.41: Material Providers

4.2.7 Construction Tasks Workflow - SP Side

The sequence of the homeowner side is crucial for each service provider working on the construction; for instance, in Task No. 2, "Obtaining Permits and Regulatory Information", the service provider can't proceed without access to the property survey document. Our system architecture ensures that all necessary documentation and information are relayed sequentially to facilitate the successful completion of each process. This structured flow of information is integral to the system's design, guaranteeing that every step is contingent on the fulfilment of its predecessor, thereby maintaining the integrity and efficiency of the project's progression.

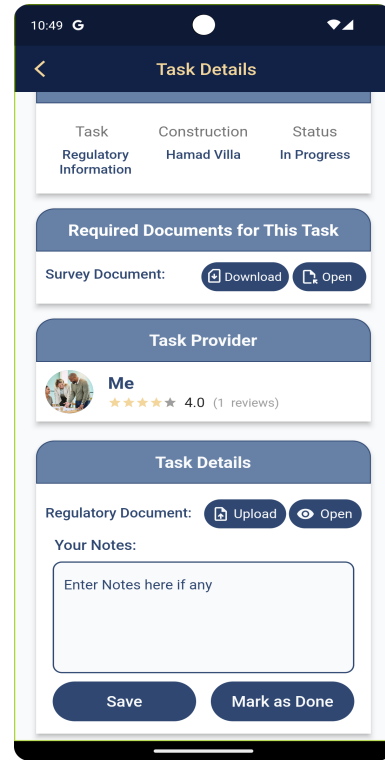


Figure 4.42: Task No. 2 Workflow - SP

For Task 4 (Design and Planning), the process is particularly critical as it involves planning and execution by the engineering office responsible for creating the project engineering plans. To accurately perform these steps, the office requires access to files from prior tasks, especially the regulatory information and soil investigation documents. These documents are foundational for performing engineering calculations and devising construction plans that adhere to engineering standards.

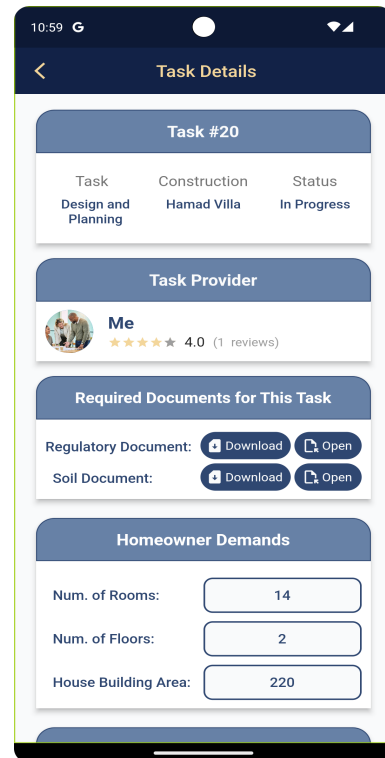


Figure 4.43: Task No. 4 Workflow 1 - SP

Additionally, the engineering office must incorporate the homeowner's specifications. For example, the number of rooms, floors, and the total construction area. With these details and homeowner preferences in hand, the engineering office can now move forward to create all the necessary plans, including architectural, civil, mechanical, and electrical designs." These plans are then collated into a single document - a design document - for the homeowner's reference.

The system design ensures that each plan is systematically passed on to the corresponding service provider, which enables the subsequent phases of the construction to proceed smoothly.

For tasks such as "Foundation Construction & Framing", "Rough Mechanical Work", and "Rough Electrical Work", the execution is reliant on the detailed plans produced by the engineering office. The system seamlessly facilitates the transfer of architectural, civil, electrical, and mechanical drawings to the respective service providers tasked with each phase. In the phase of "Foundation Construction & Framing", not only are the architectural and civil drawings integral, but also the homeowner's decision regarding the procurement of building materials is crucial. This decision, once made, is communicated through the system, ensuring that service providers are fully informed and can proceed with the necessary materials at hand, as per the homeowner's preference. This level of integration ensures that the workflow is not just sequential but also cohesive and well-coordinated across various stages of construction.

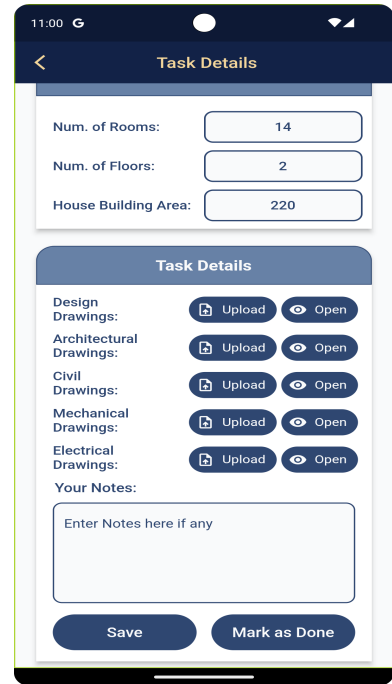
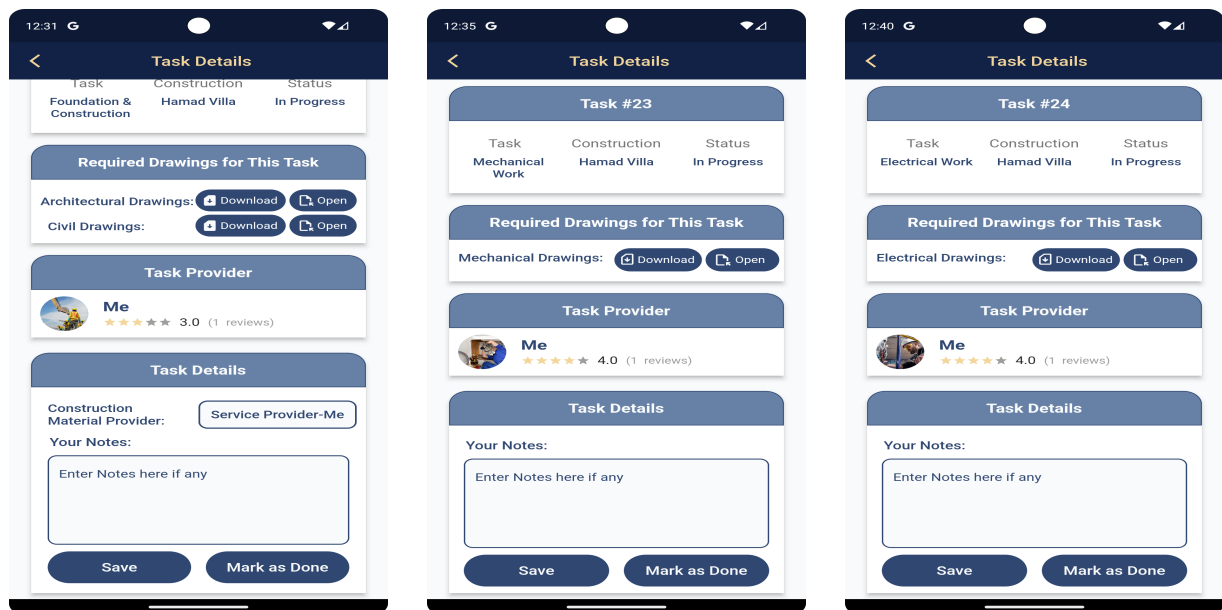


Figure 4.44: Task No. 4 Workflow 2 - SP



((a)) Task 6

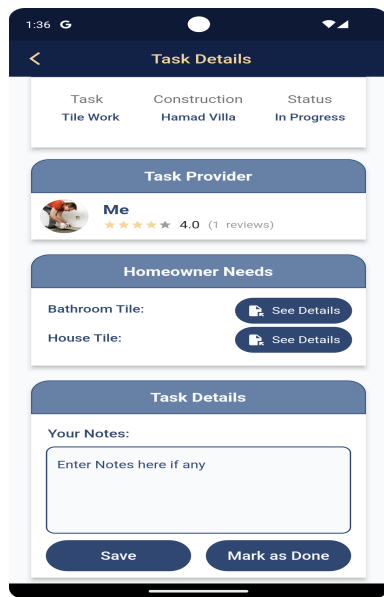
((b)) Task 7

((c)) Task 8

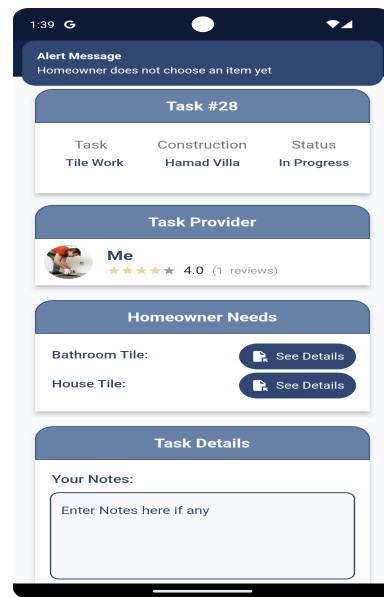
Figure 4.45: Task No. 6-8 Workflow - SP

For the tasks that depend on customization, such as "Door Frame Installation", "Aluminum Work", "Carpentry Work", and "Painting Work" the homeowner's personal touch comes into play. His selections include tiles for the living spaces and bathrooms, door types for different rooms, window styles, and other finishing details, which are crucial inputs that guide the service provider's work.

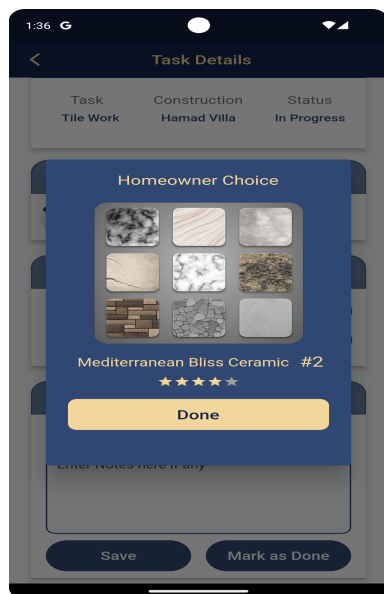
In the painting task, for example, the homeowner specifies his preferred paint type from the service provider offerings. In instances where a selection hasn't been made, or perhaps was overlooked, the task does not come to a halt. Instead, the service provider can reach out directly to the homeowner through the system messaging feature to prompt a decision, maintaining the construction process without delay. This interactive process ensures that every detail is accorded attention, reflecting the desires at every step of the construction.



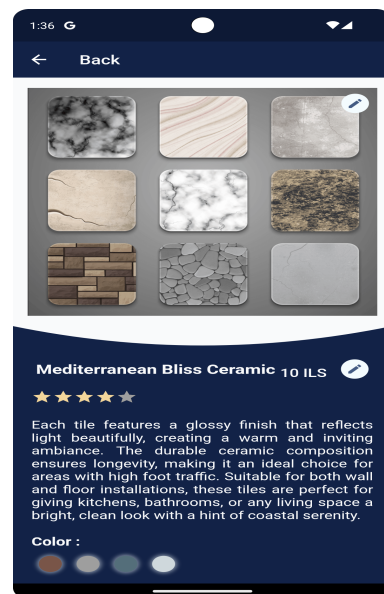
((a))



((b))



((c))



((d))

Figure 4.46: Task No. 12 Workflow - SP

4.2.8 Admin Side

The admin dashboard resembles a central hub for comprehensive oversight of the platform's activities, offering detailed insights into construction analytics, user engagement (homeowners and service providers), and task details.

These analytics enable administrators to navigate data points ranging from project completion rates to user activity levels. By integrating analytics on tasks, the dashboard provides a view of the construction ecosystem. Additionally, it incorporates functionalities for managing material providers, further enhancing the platform's utility and service reach.

Construction Analytics Overview

At the forefront of the dashboard's capabilities is its construction analytics feature. This site illuminates the geographical distribution of construction projects, offering visibility into how different areas, such as Ramallah, Nablus, and other Palestinian cities, are developing. It tracks the progress of constructions, categorizing them into four main completion stages: 0-25%, 25-50%, 50-75%, and 75-100%. This segmentation not only showcases the pace of development but also highlights areas of rapid growth or potential stagnation.

Moreover, the dashboard provides a status overview of each project, identifying them as 'Not Started', 'In Progress', or 'Complete'. This feature is adaptable, allowing for both a broad, general perspective and the capability to drill down into specific cities for a more detailed analysis. For instance, administrators can isolate the construction landscape in Nablus, examining the number of projects at various stages of completion, thereby tailoring the analytics to meet their informational needs.

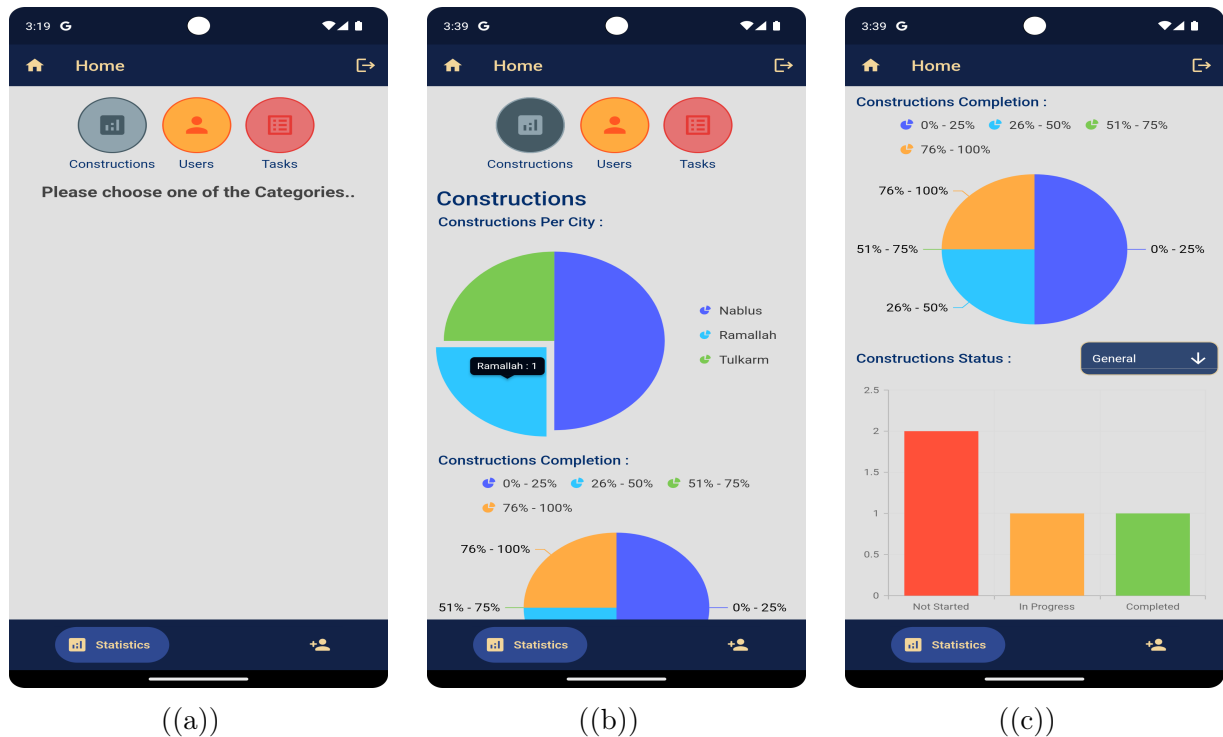


Figure 4.47: Construction Analytics Overview

User Analytics Overview

In the user analytics, the admin dashboard offers detailed insights into the distribution of homeowners and service provider users across various Palestinian cities. This view allows for an in-depth analysis of user distribution, enabling administrators to tailor strategies and services to specific regional demands.

Furthermore, the dashboard tracks the number of service providers according to their ratings, ranging from one to five stars. This feature is pivotal for maintaining quality control and enhancing user satisfaction. Administrators can view these evaluations on a broad scale, encompassing all service providers across all cities 'General', or to drill down into specific cities for a more targeted analysis.



Figure 4.48: User Analytics Overview

Tasks Analytics Overview

Within the domain of task analytics, the admin dashboard extends its overview to include detailed statistics on task completion and status, organized both by service and by city. This encompasses a thorough count of completed tasks associated with each service offering, providing a clear picture of operational efficiency and service fulfilment rates.

Additionally, the dashboard offers a view of task statuses, segmented by city. This allows administrators to monitor the progress of tasks, including their completion status, across different regions. Administrators can choose to view task statuses on a broader scale, covering all cities, or narrow their focus to a specific city.



Figure 4.49: Tasks Analytics Overview

Add Material Provider

The admin dashboard is not only a hub for monitoring and analyzing user and task statistics but also plays a crucial role in enriching the platform's ecosystem by integrating Material Providers. Administrators can onboard new material providers by inputting their detailed information, including contact details, social media links, and their areas of expertise.

For instance, the addition of a store specializing in lighting fixtures allows homeowners, particularly in the task "Installing Fixtures and Finishing Up" phase of construction, to easily discover vendors that cater to their specific needs. This feature is designed to streamline the process for homeowners to find and select the right materials for their construction, enhancing user experience and satisfaction.

Furthermore, by creating a dedicated space for material providers, the platform subtly lays the groundwork for future advertising opportunities. This strategic move not only expands the service offerings within the application but also opens up potential revenue streams, marking a forward-thinking approach to application development and monetization.

The screenshot shows a mobile application interface for adding a material provider. At the top, the status bar shows the time 7:37 and signal strength. The app header is dark blue with a white plus icon and the text "Add Material Provider". Below the header, the instruction "Enter the following fields:" is displayed. The main form area has a light gray background and contains a circular profile picture placeholder with a yellow sunburst logo and the text "EBDAA LIGHTING" and "إبداع للإضاءة". Below the placeholder is a "Pick Picture" button. The form fields are: "Company Name" with the value "Ebdaa Lighting", "Social Link" with the value "www.facebook.com/kafesha2014", "Phone Number" with the value "0597863142", "Service Type" with a dropdown menu showing "Finishing", and "City" with a dropdown menu showing "Ramallah". At the bottom of the form is a large blue button labeled "Add Material Provider". The bottom navigation bar is dark blue with a white home icon on the left and a white plus icon with the text "Add" on the right.

Figure 4.50: Admin Adds Material Provider

4.3 Website System Features

By using a browser-based interface, the BuildNex web application increases the platform's usability and expands its reach. The web application uses Flutter's adaptability to replicate the features and functions of the mobile app, resulting in a unified and smooth user experience across all platforms and devices.

Users that prefer desktop settings or bigger displays for resource access, collaboration, and project management can utilize this browser-based solution. The online application has the same user-friendly layout and extensive feature set as the mobile application, including all the features such as:

- **Project Management:** User will be able to control each component in his building project, including the tracking system for the tasks.
- **Communication Hub:** Utilize the integrated messaging system to simply collaborate and communicate with contractors, service providers and homeowners.
- **Search for Services:** User will browse and narrow down the engineering offices and service providers who are eligible based on their particular requirements using the filtration system.
- **Document Management:** All project-related documents may be accessed and managed safely and systematically.

Please refer to Appendix A for detailed demonstration of the web application interface. Users may manage their project and keep updated at anytime, anywhere.

Chapter 5

Results and Analysis

In the development phase of BuildNex, the app designer planned the platform design and technology choices to address the identified challenges within the construction industry.

5.1 Results Overview

The researchers developed BuildNex's core functionalities with high expectations to revolutionize construction management by introducing several key features:

- **Colour-Coded Task Tracking System:** helps offer real-time updates on project progress. The task system aims to enhance transparency and facilitate easier project management for homeowners.
- **Dynamic Marketplace for Construction Services:** Initial simulations and market analysis suggest that BuildNex can perfectly connect homeowners with a wide range of service providers. This marketplace can increase job visibility for contractors and offer homeowners more choices, potentially leading to better project outcomes and increased satisfaction.

5.2 Analysis

The development and testing phases of BuildNex have focused on ensuring the platform addresses the construction industry's key challenges:

- **Enhancing Communication and Transparency:** BuildNex's interface and features, such as the colour-coded tracking system, were specifically designed to improve the flow of information between homeowners and service providers. Analysis suggests that these features can significantly reduce misunderstandings and project delays.
- **Streamlining the Hiring Process:** The platform's marketplace functionality is anticipated to make finding and hiring skilled workers more efficient.
- **Improving Project Management Efficiency:** By allowing homeowners to track their project's progress in real-time and facilitating communication with service providers, BuildNex is expected to lead to more projects being completed on time and within budget.

Chapter 6

Conclusion and Future Work

The issues of inefficiency, lack of transparency, and poor communication in the construction sector were effectively addressed by the BuildNex initiative. BuildNex provides a comprehensive solution that improves communication, simplifies workflows, and encourages responsibility among stakeholders with its revolutionary platform and user-centric design. BuildNex can automate processes, centralize data, and offer real-time visibility. These features can help:

- Cut down on building costs and timescales to perhaps increase the accessibility and affordability of homes.
- Enable open communication between stakeholders and make project data easily accessible to foster openness and confidence.
- Provide consumers with customisable options and a searchable database of certified service providers so they can make well-informed judgments.

BuildNex has shown to be a vital instrument for revolutionizing the construction sector, as seen by the favorable outcomes received during the development and testing phases. Widespread acceptance and good effect are possible due to the platform's feature-rich feature set, user-centered design, and easy-to-use interface.

6.1 Future Work

In the next phases of BuildNex's evolution, our vision extends towards a more integrated and comprehensive ecosystem for construction management, aiming to automate and streamline the construction process. This phase involves several ambitious yet impactful enhancements and expansions:

- Integration with International and Local Authorities: A pivotal development goal for BuildNex is to establish direct integrations with essential regulatory and professional bodies, such as the Ministry of Tourism and Antiquities, the Licensing Authority, and the Engineering Association across all Palestinian cities. This integration aims to digitize and automate approval processes, allowing homeowners to navigate regulatory requirements seamlessly from within the app. By facilitating

direct submissions, status tracking, and receiving certifications through BuildNex, homeowners will adhere to all construction-related legalities without needing physical visits to these authorities.

- **Expansion into Advertising and Financial Profitability:** Another strategic direction involves leveraging BuildNex as a platform for targeted advertising and financial growth. By introducing a new user category for suppliers of construction materials and tools, BuildNex can serve as a marketplace where suppliers showcase their products and costs and offer the convenience of online purchasing. This expansion diversifies the platform utility and opens new revenue streams through advertising and transaction fees. Such a marketplace would enrich the BuildNex ecosystem, providing users with direct access to quality materials and competitive pricing.
- **Broadening the Spectrum of Service Providers:** To enhance the platform offerings further, we plan to onboard a variety of service providers. This expansion will include more specialized roles and trades, ensuring that homeowners have access to a comprehensive directory of professionals for every conceivable construction need. Each service provider category will be detailed meticulously, stressing simplicity and clarity in presentation to facilitate easy understanding and selection by homeowners.
- **Implementing Project Planning and Financial Tools:** A significant addition under consideration is the development of project planning features, including a detailed timeline and material planning for each construction phase. This tool will provide homeowners with estimates of total and monthly financial costs alongside expected timeframes for each stage. Such planning tools will empower users with foresight and financial planning capabilities, making budgeting and scheduling more manageable and predictable.

References

[1] allbetter LLC. allbetter, 2020. Accessed: 2024-02-03.

Appendix A

Website Screenshots

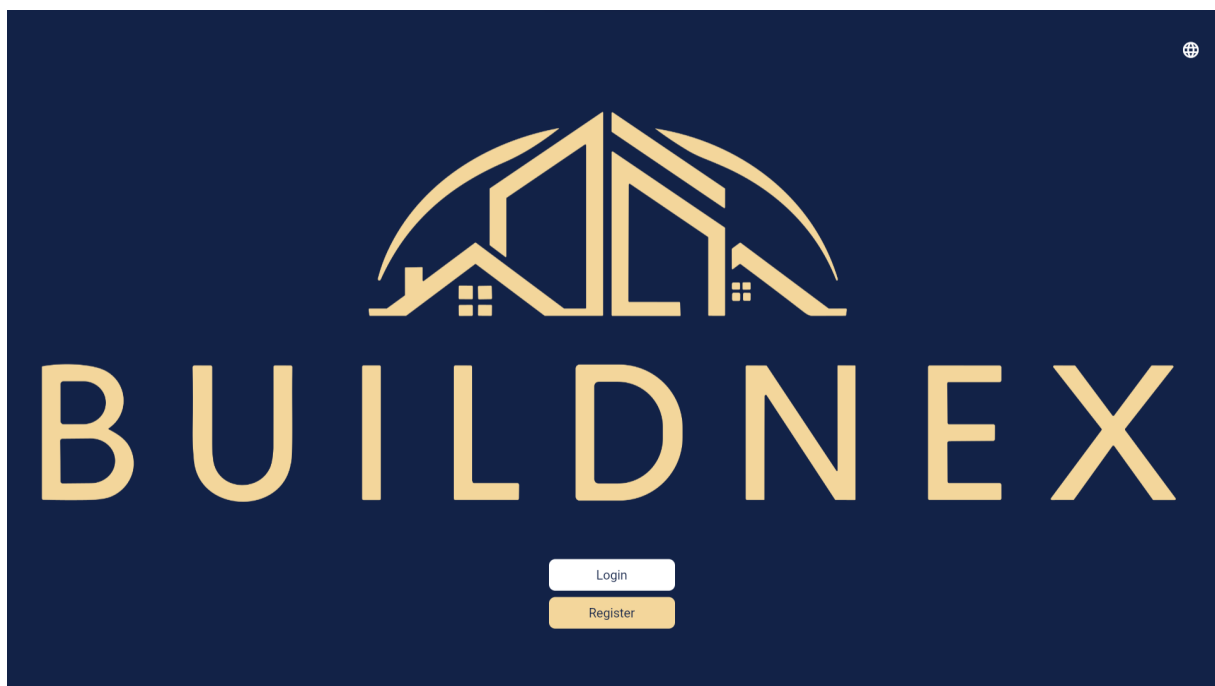


Figure A.1: Welcome Page



Registration form on a dark blue background. It includes the following fields:

- First Name
- Last Name
- Your Role (with a dropdown arrow)
- Email Address
- Password (with an eye icon for visibility toggle)
- Confirm Password (with an eye icon for visibility toggle)

Below the fields is a white "Continue" button. At the bottom, there is a link: "Already have an account? [Login](#)".

Figure A.2: Register Page



Login form on a dark blue background. It includes the following fields:

- Email Address (with the example text "talahamd99@gmail.com")
- Password (with masked characters "*****" and an eye icon for visibility toggle)

Below the fields is a white "Login" button. At the bottom, there are two links: "Don't have an account yet?, [Register](#)" and "Forget Your Password?, [Reset Password](#)".

Figure A.3: Login Page



Figure A.4: Tutorial Guide - HO

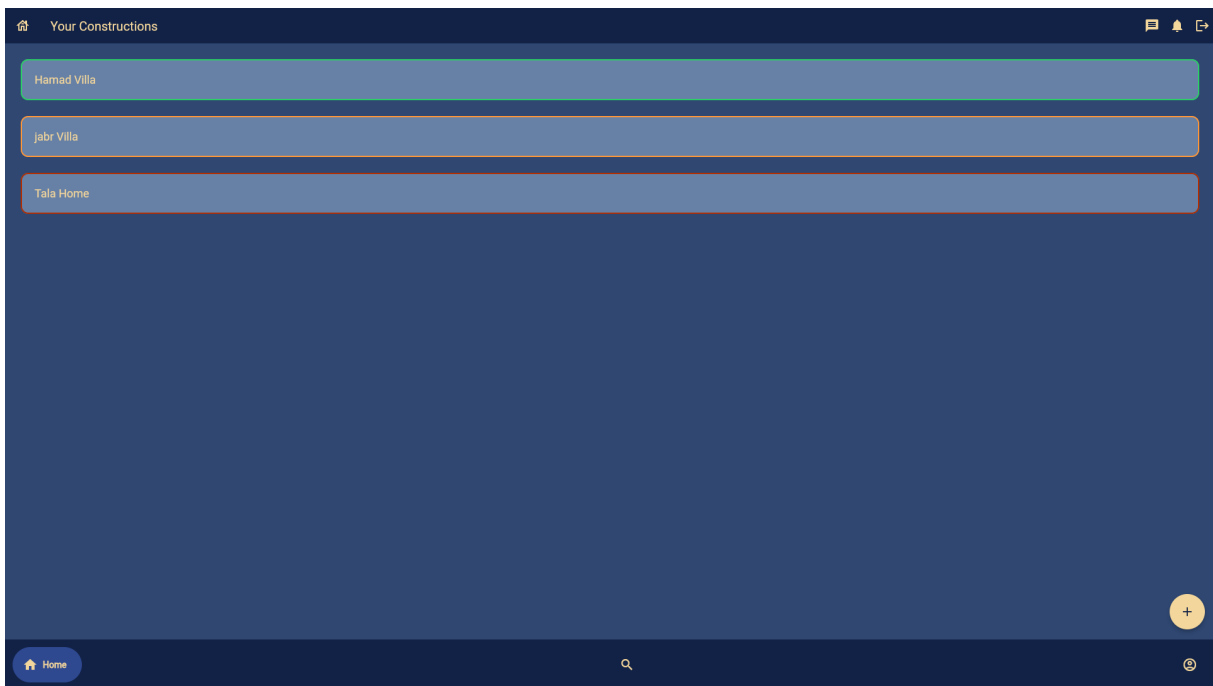


Figure A.5: Home Page - HO

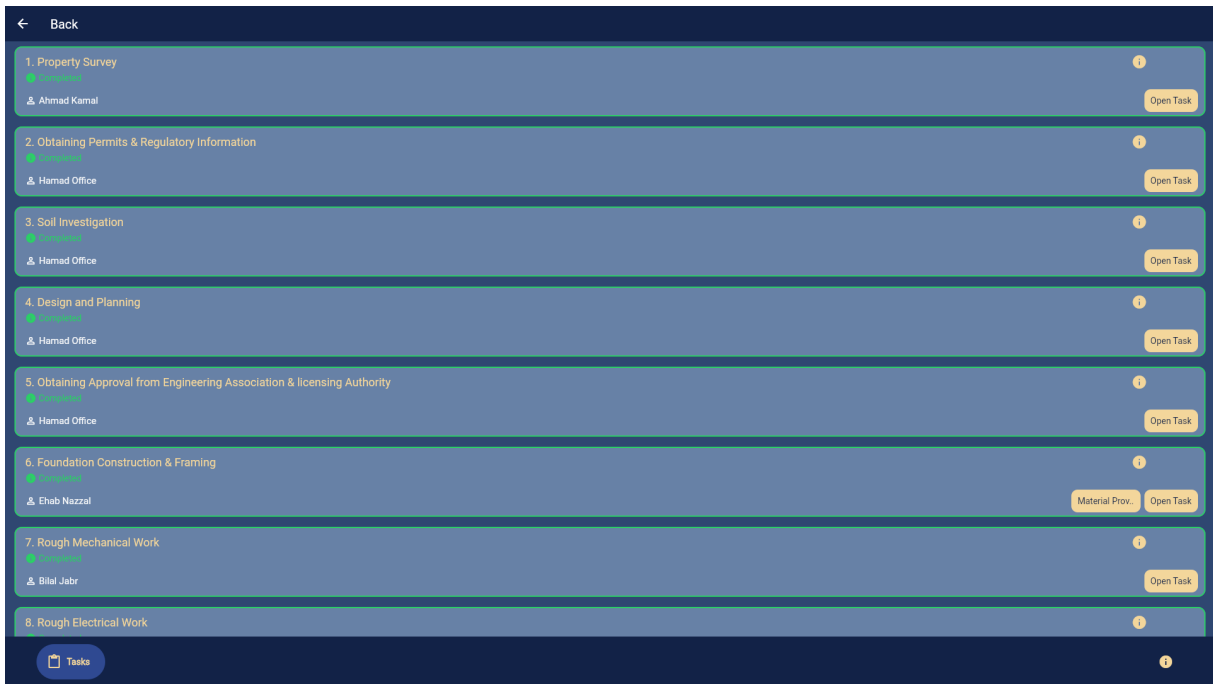


Figure A.6: Tasks Page 1 - From Scratch - HO

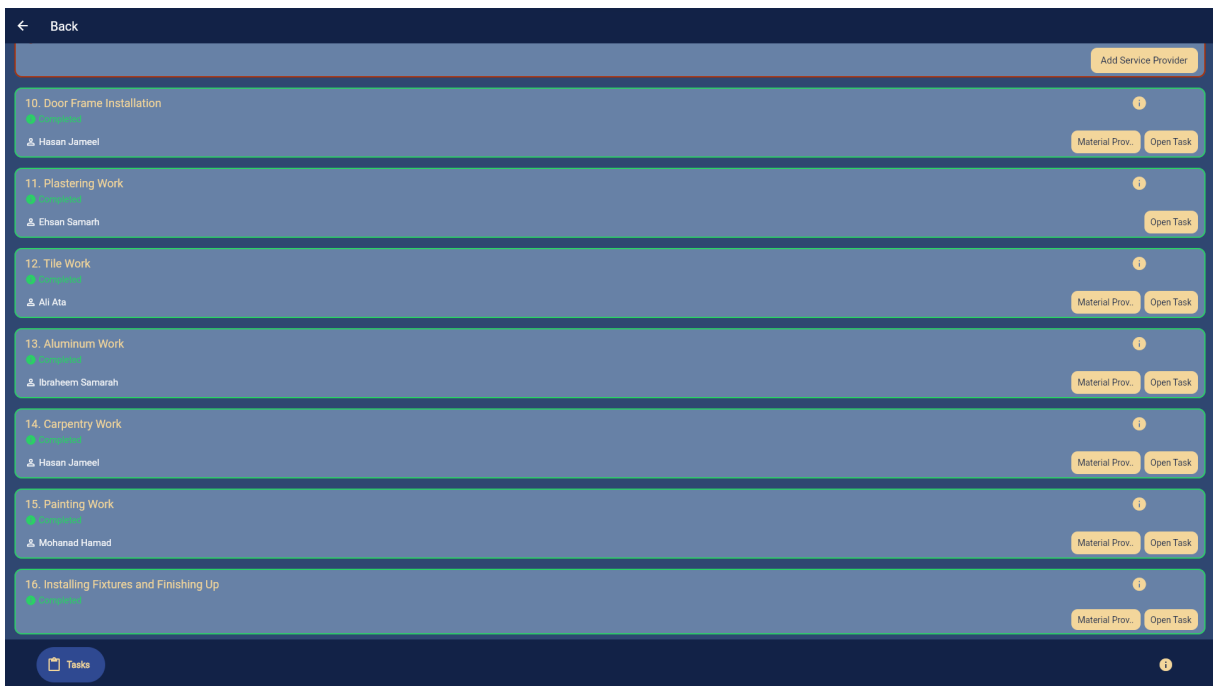


Figure A.7: Tasks Page 2 - HO

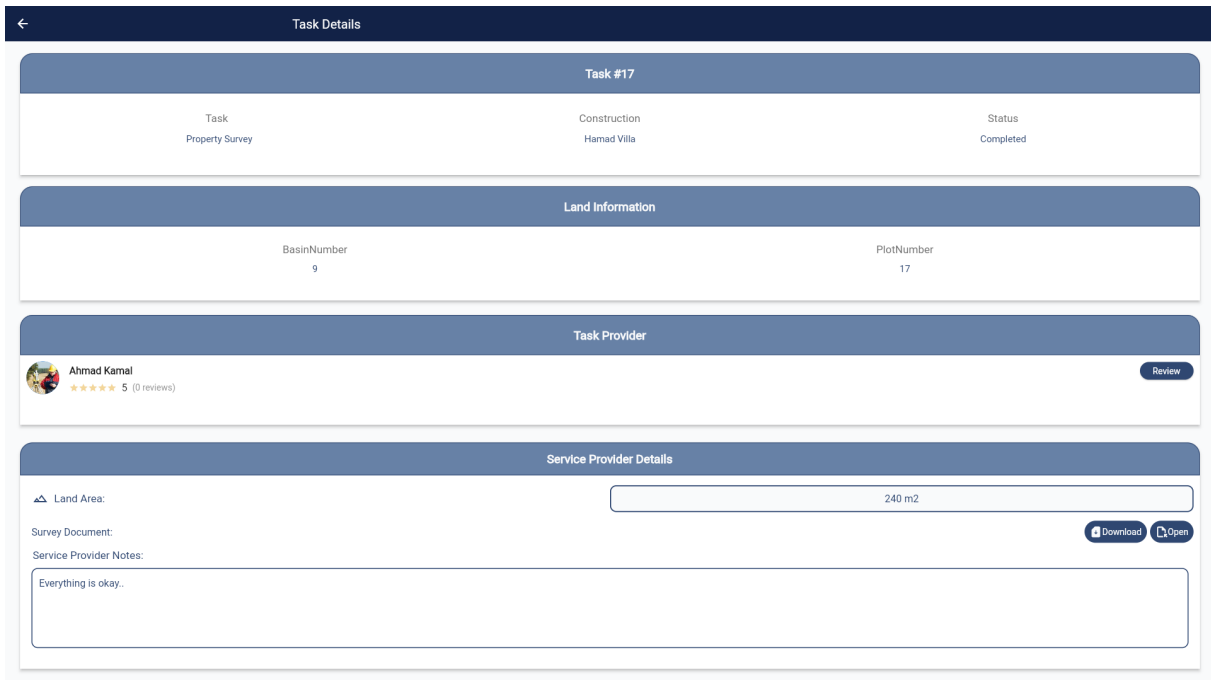


Figure A.8: Task Details Page - HO

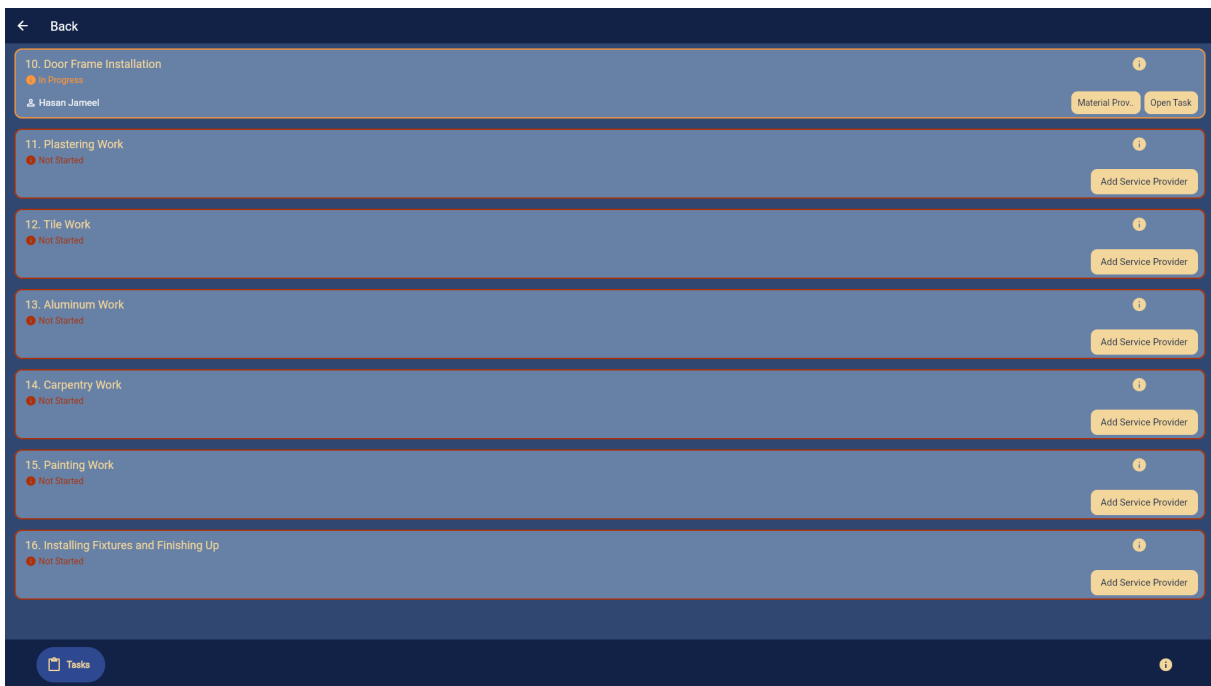


Figure A.9: Tasks Page - From Middle - HO

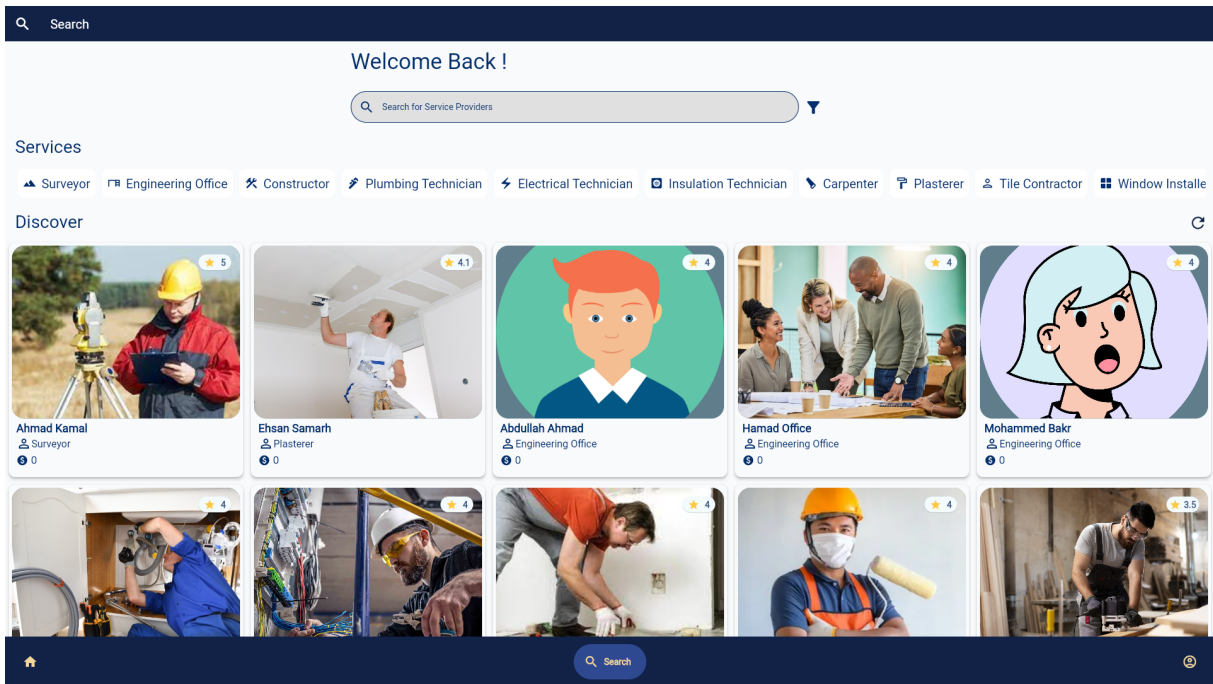


Figure A.10: Search Page - HO

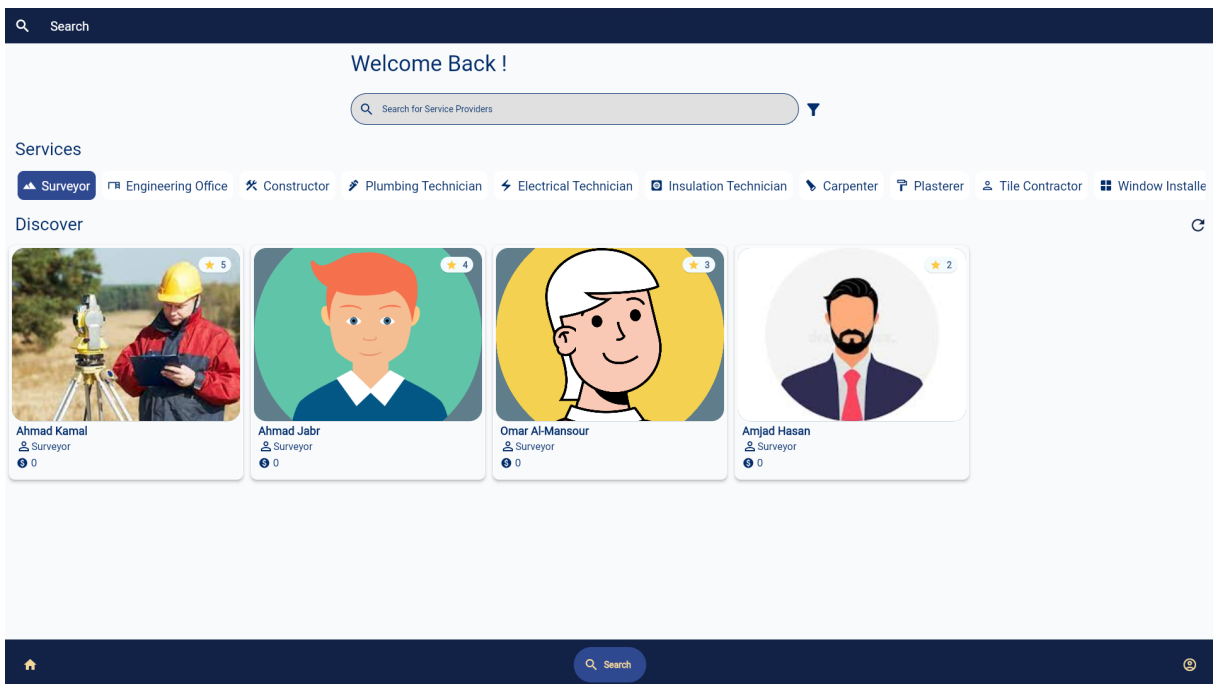


Figure A.11: Search by service type - HO

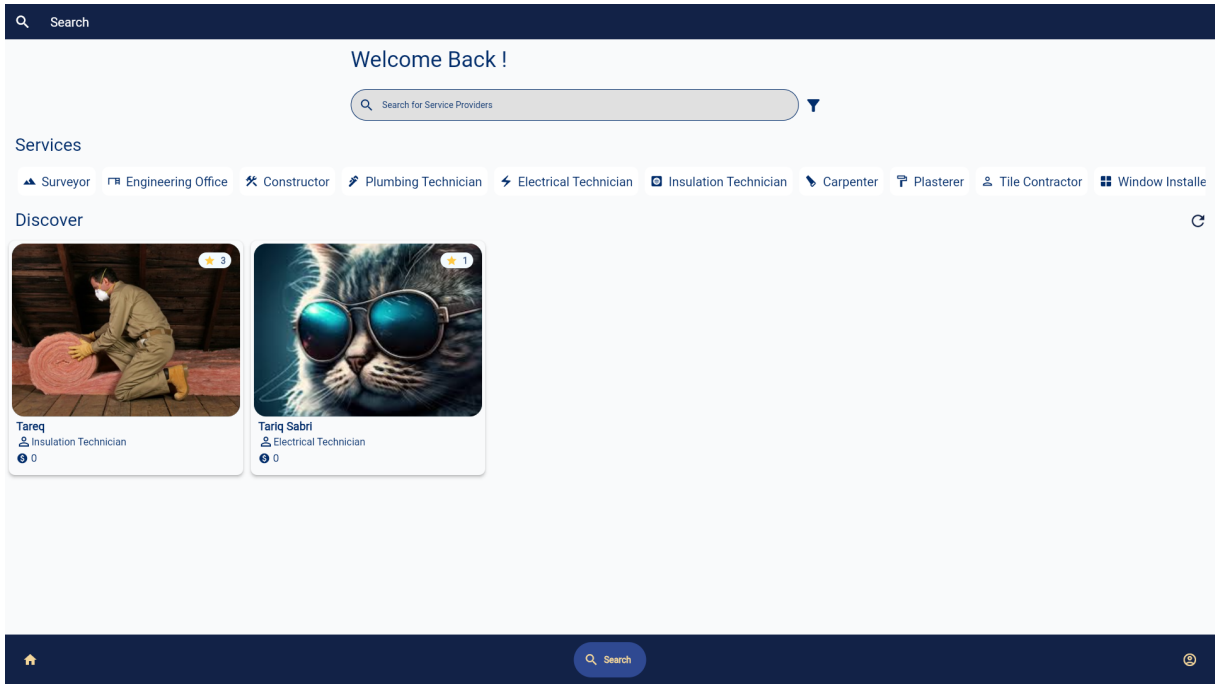


Figure A.12: Search for Tareq - HO

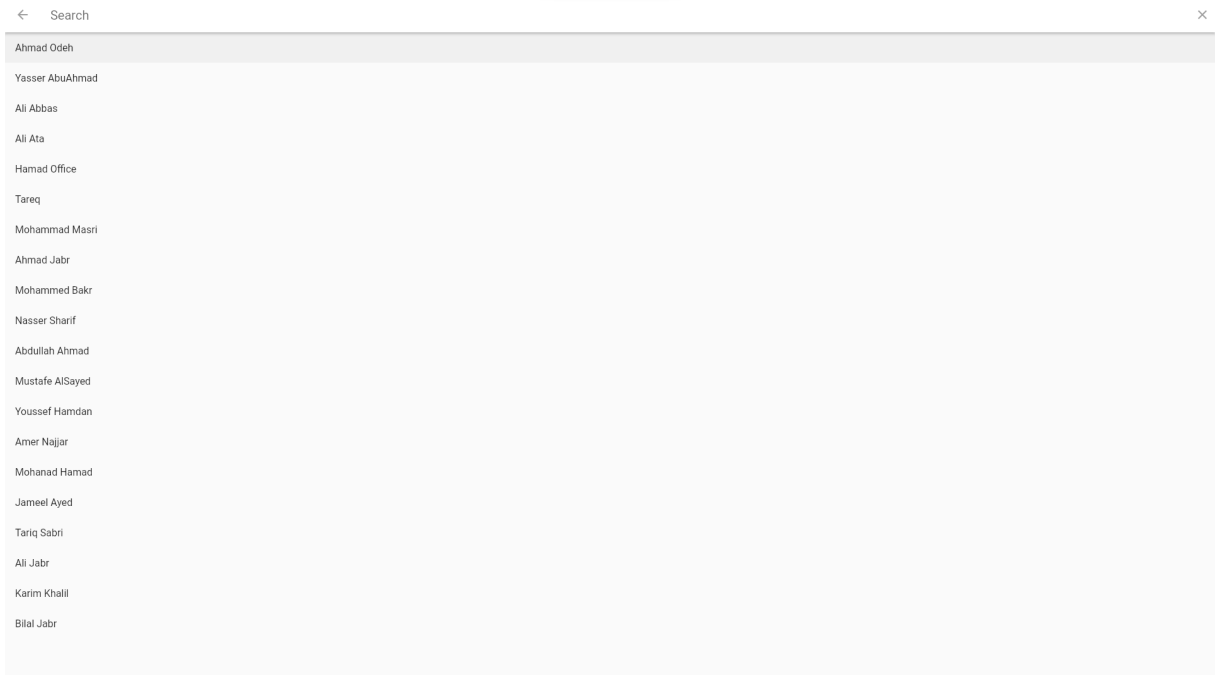


Figure A.13: Search Nav Bar - HO

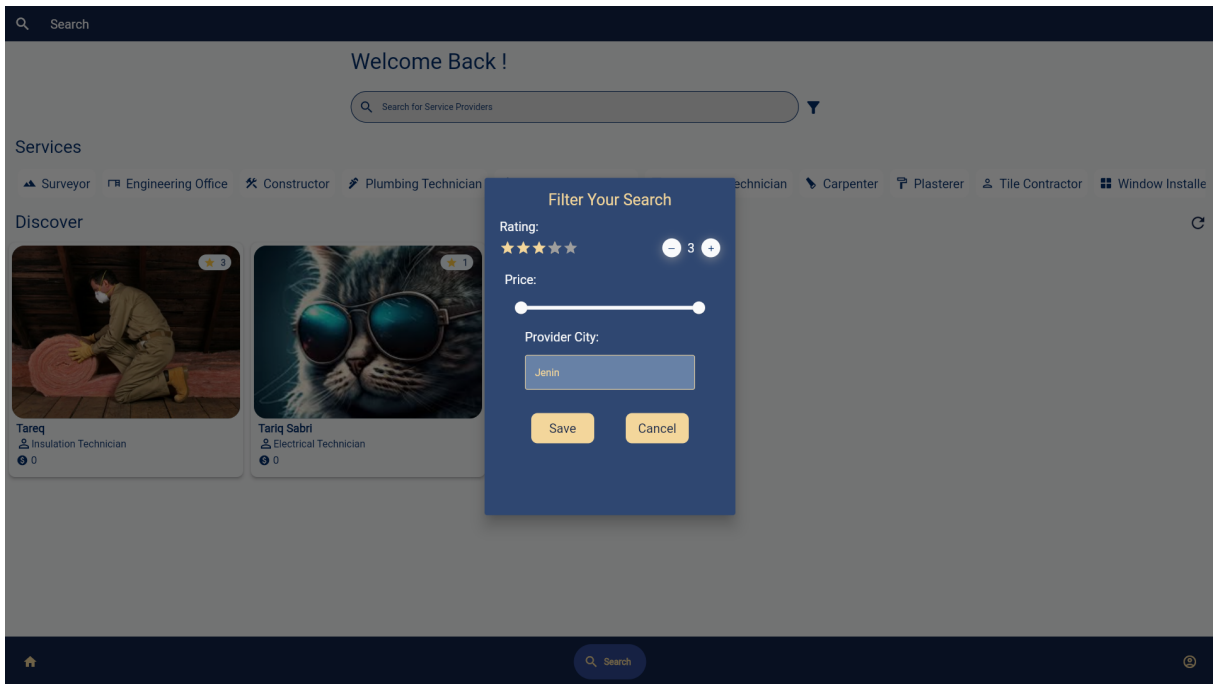


Figure A.14: Filter Search - HO

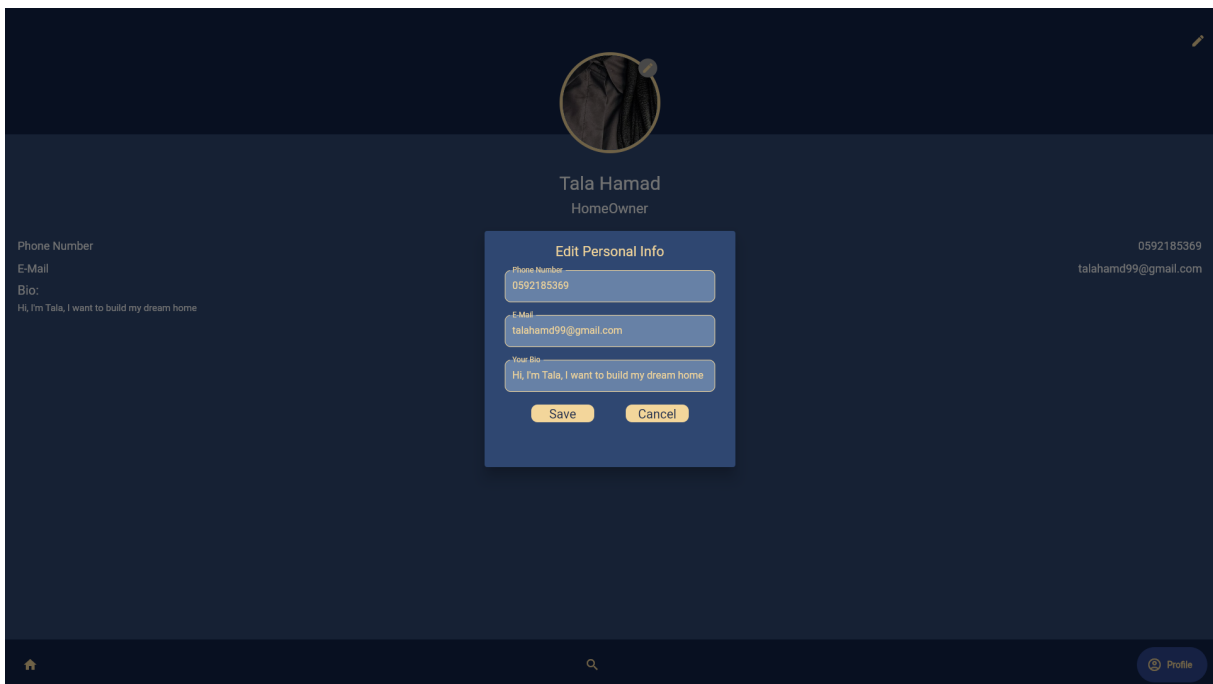


Figure A.15: Edit Homeowner Details - HO

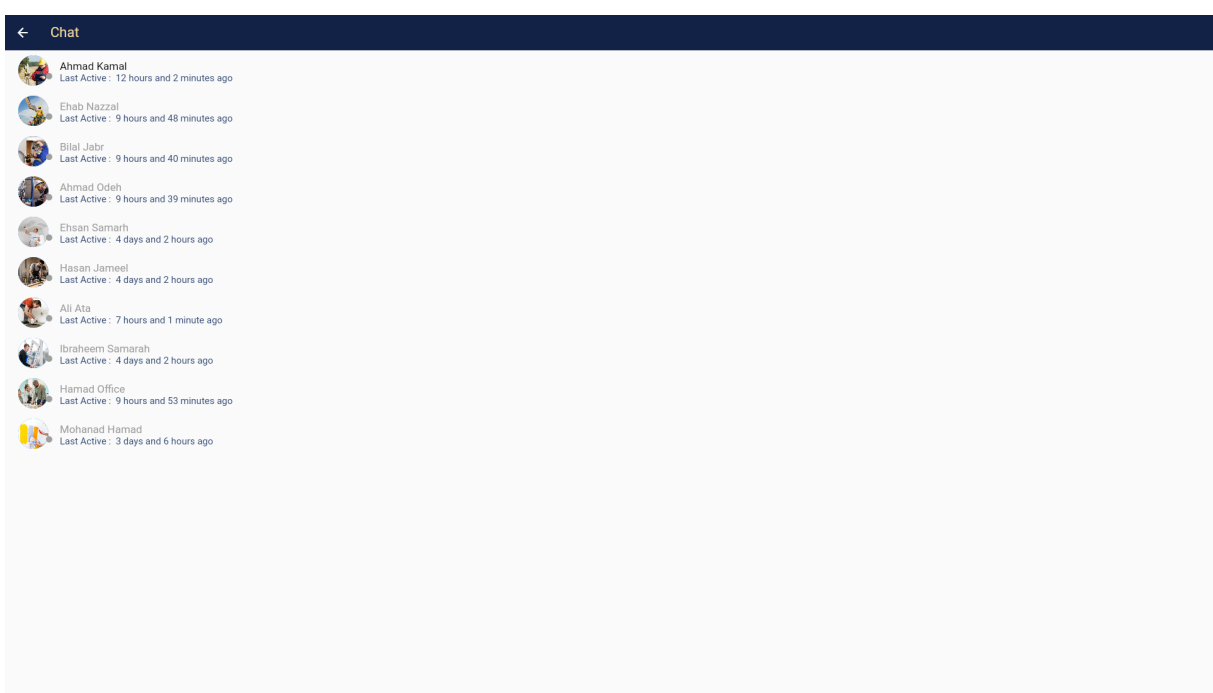


Figure A.16: Inbox Page - HO

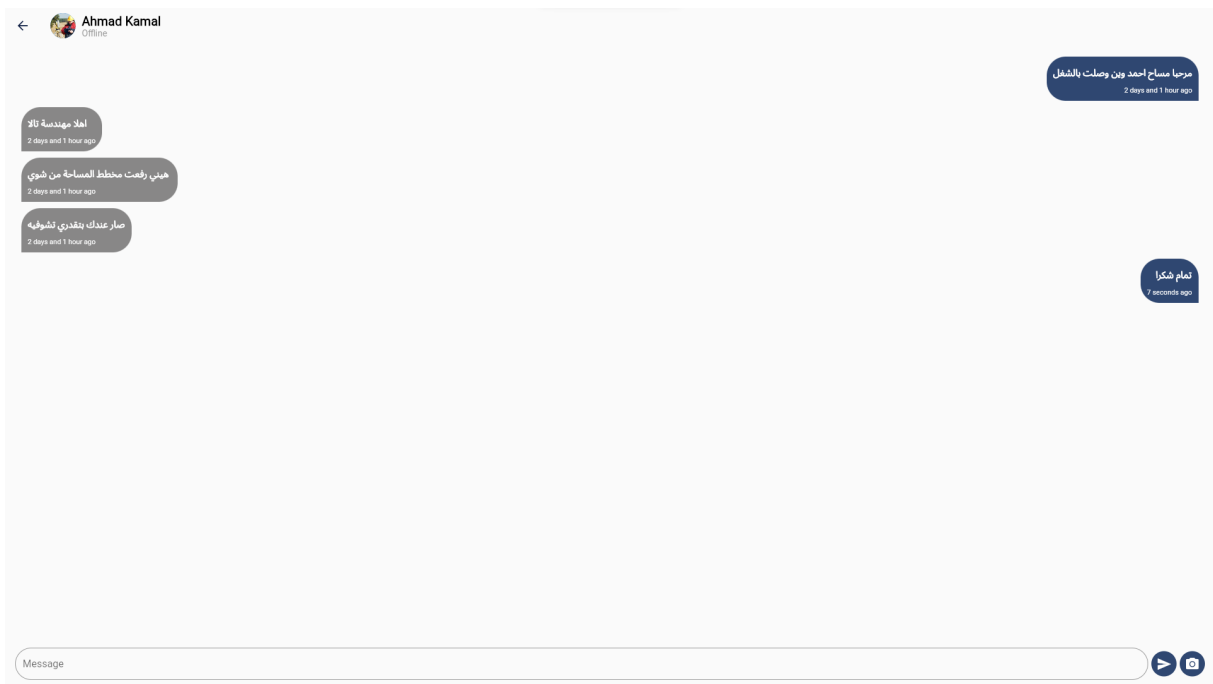


Figure A.17: Chat Page - HO

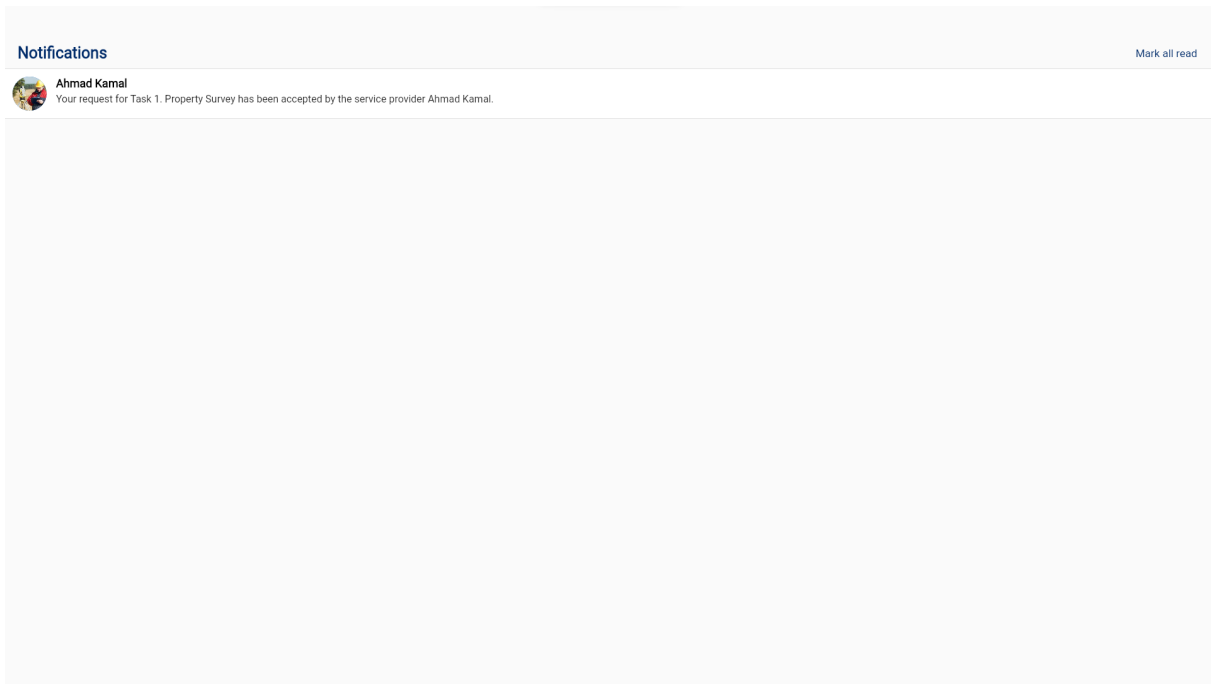


Figure A.18: Notifications Page - HO

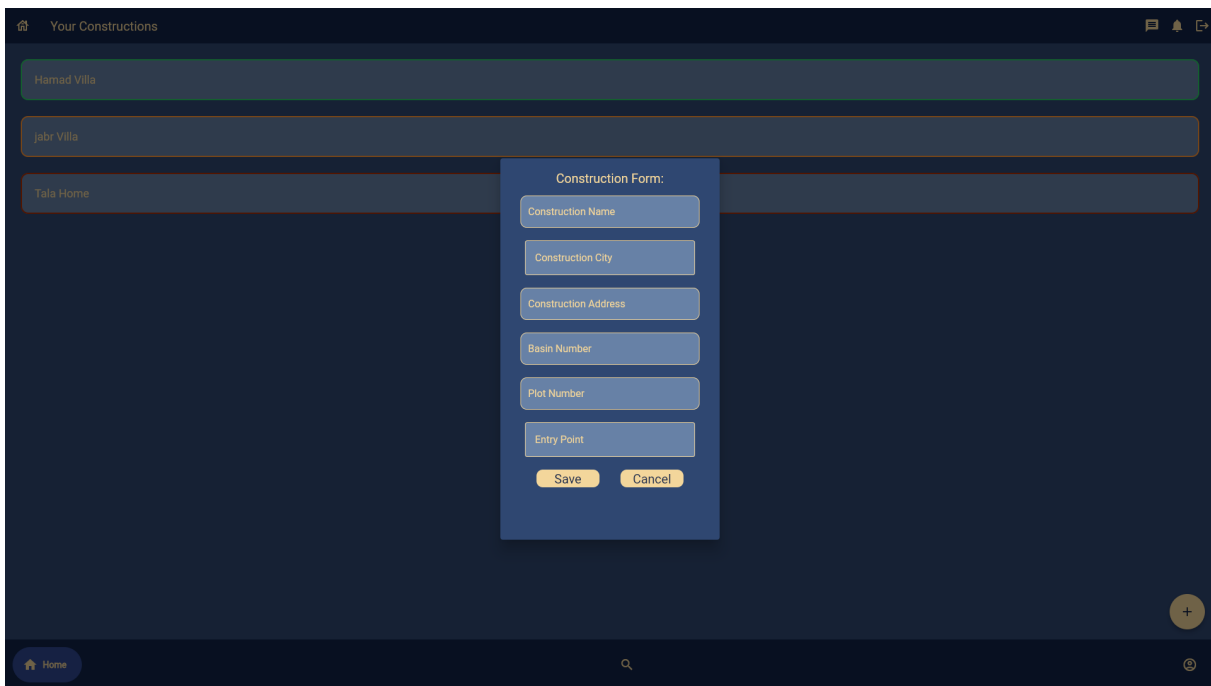


Figure A.19: Add Construction - HO

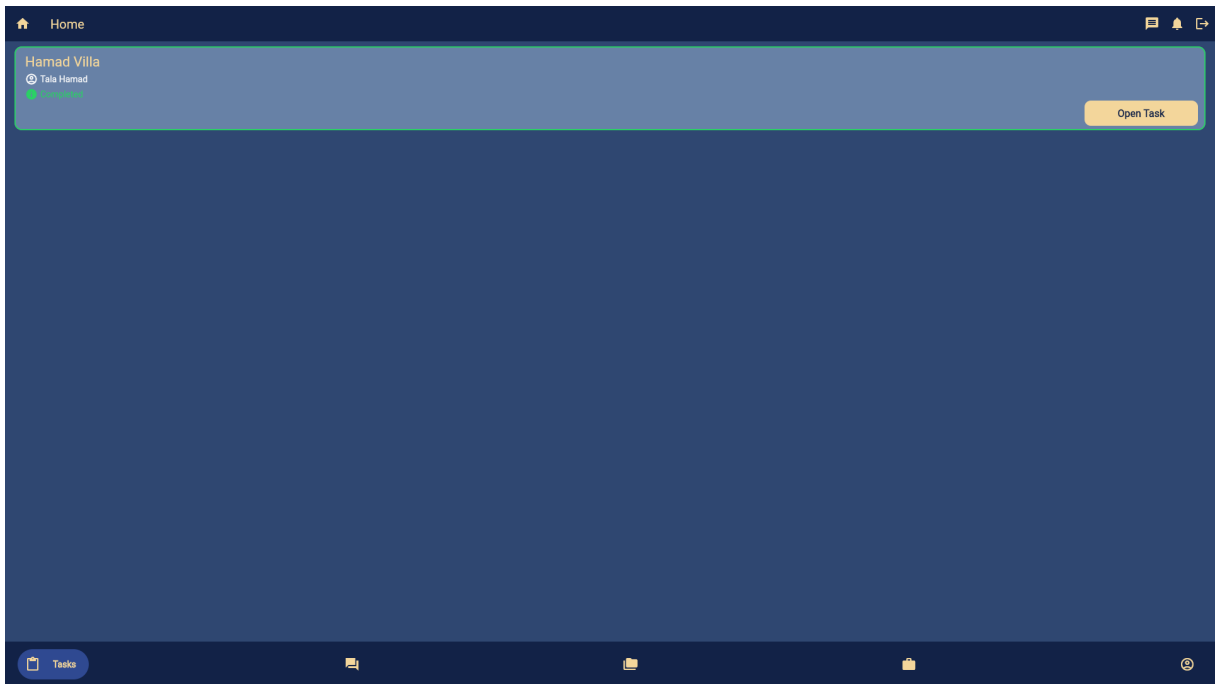


Figure A.20: Home Page - SP

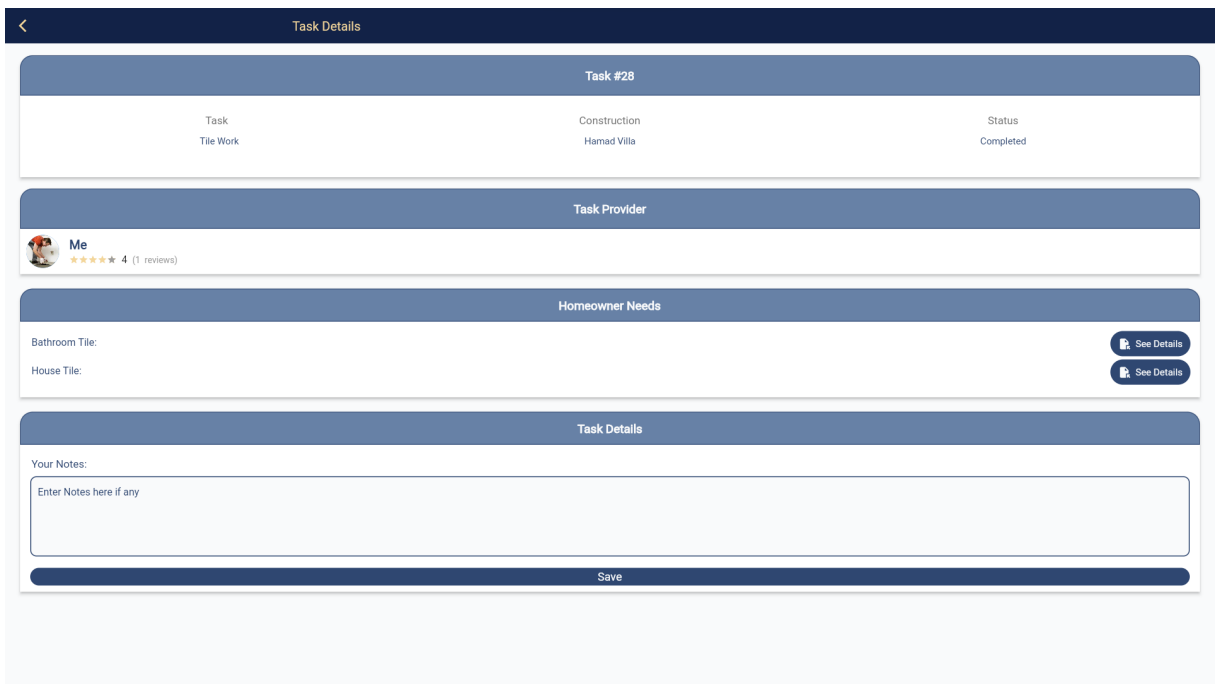


Figure A.21: Tasks Details Page - SP

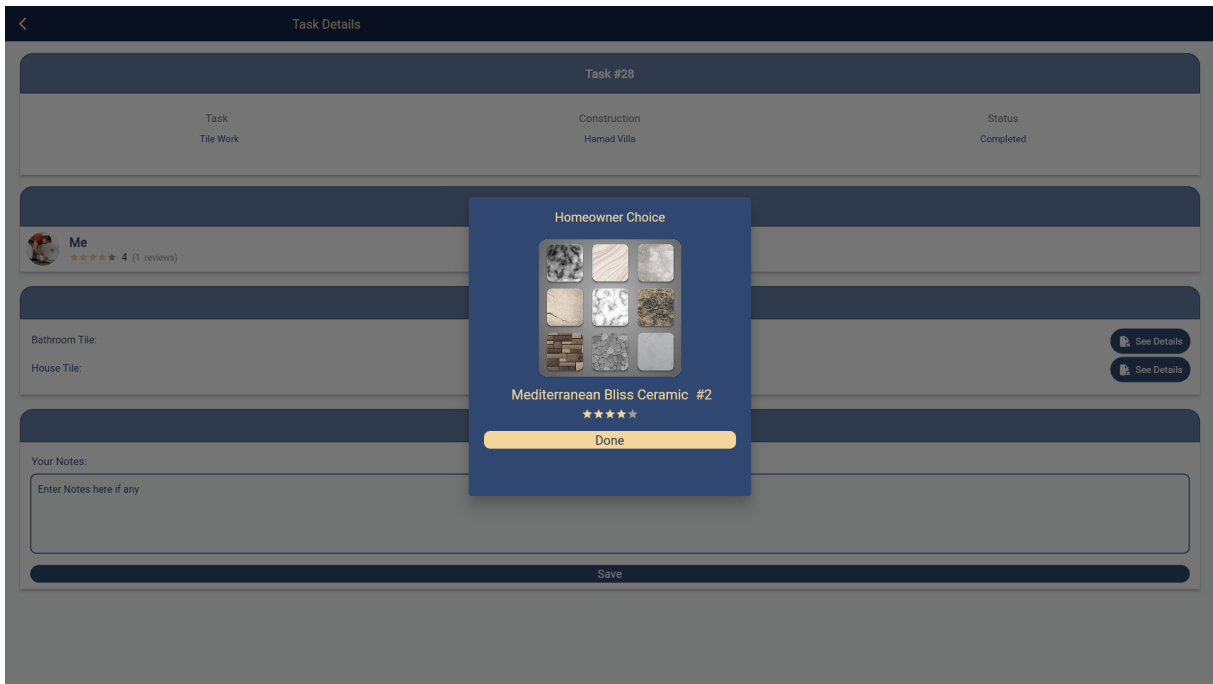


Figure A.22: Tasks Details Page - See Item Details - SP



Figure A.23: Catalog Page - SP



Figure A.24: Add New Catalog Item - SP



Figure A.25: Catalog Item Details - SP

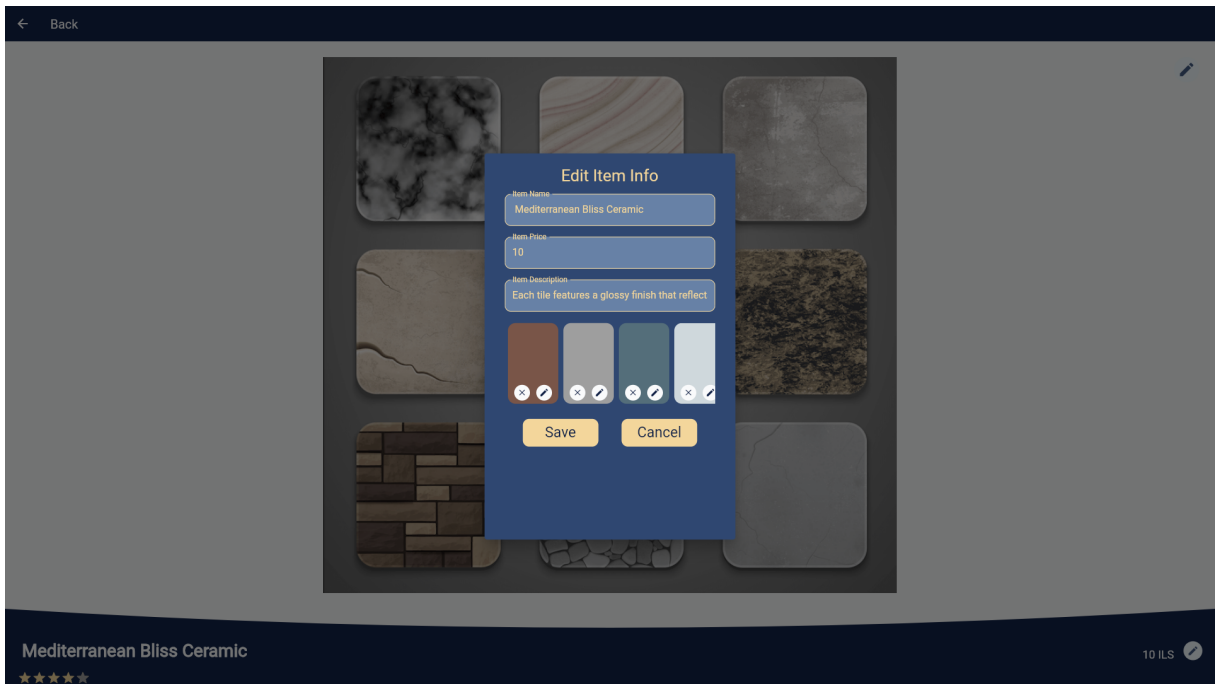


Figure A.26: Edit Catalog Item Info - SP



Figure A.27: Work Experiences Page - SP

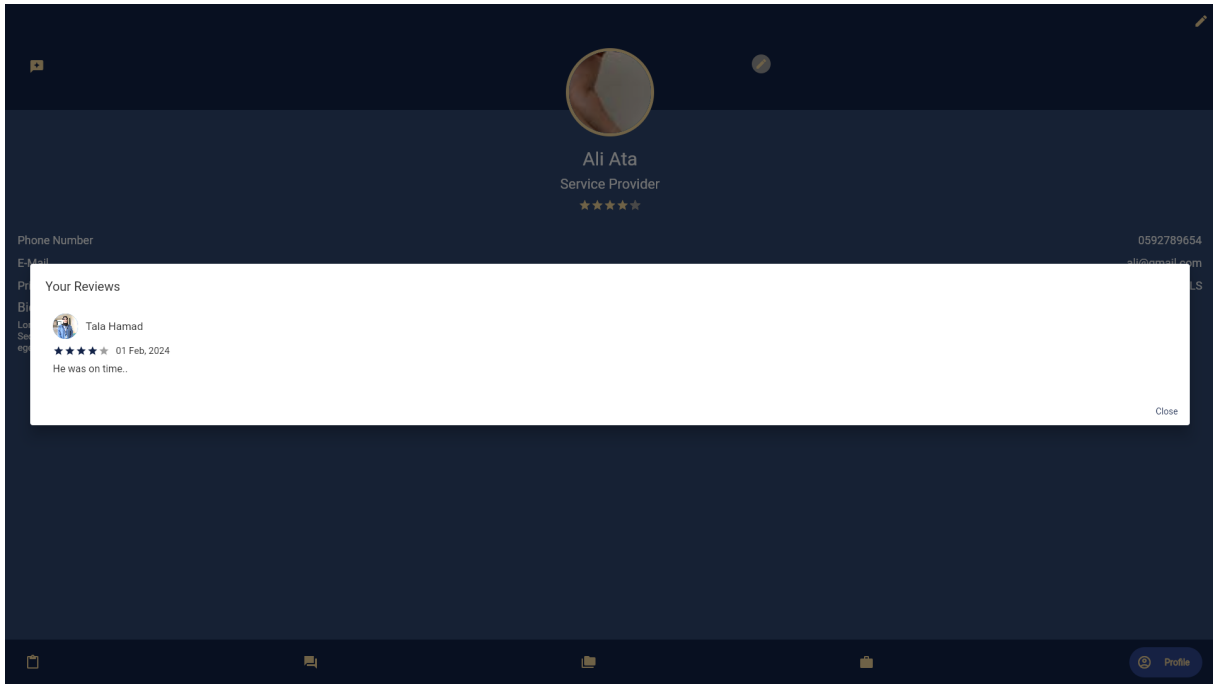


Figure A.28: Edit Service Provider Details - SP

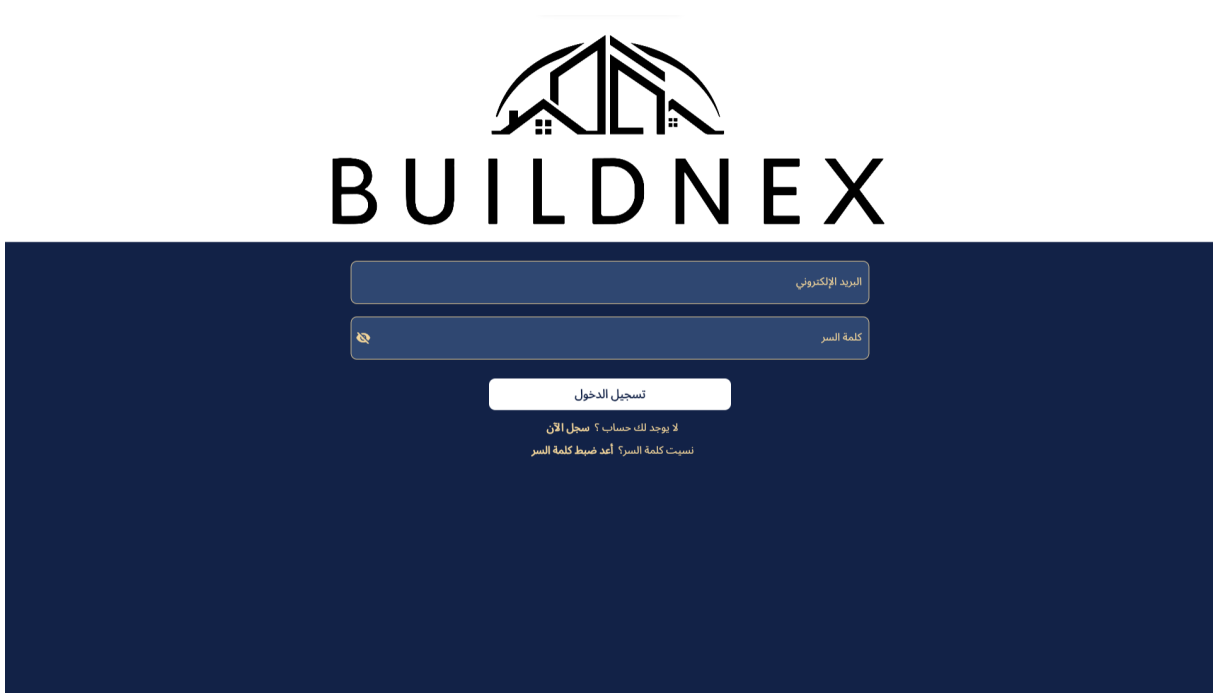


Figure A.29: Login In Arabic

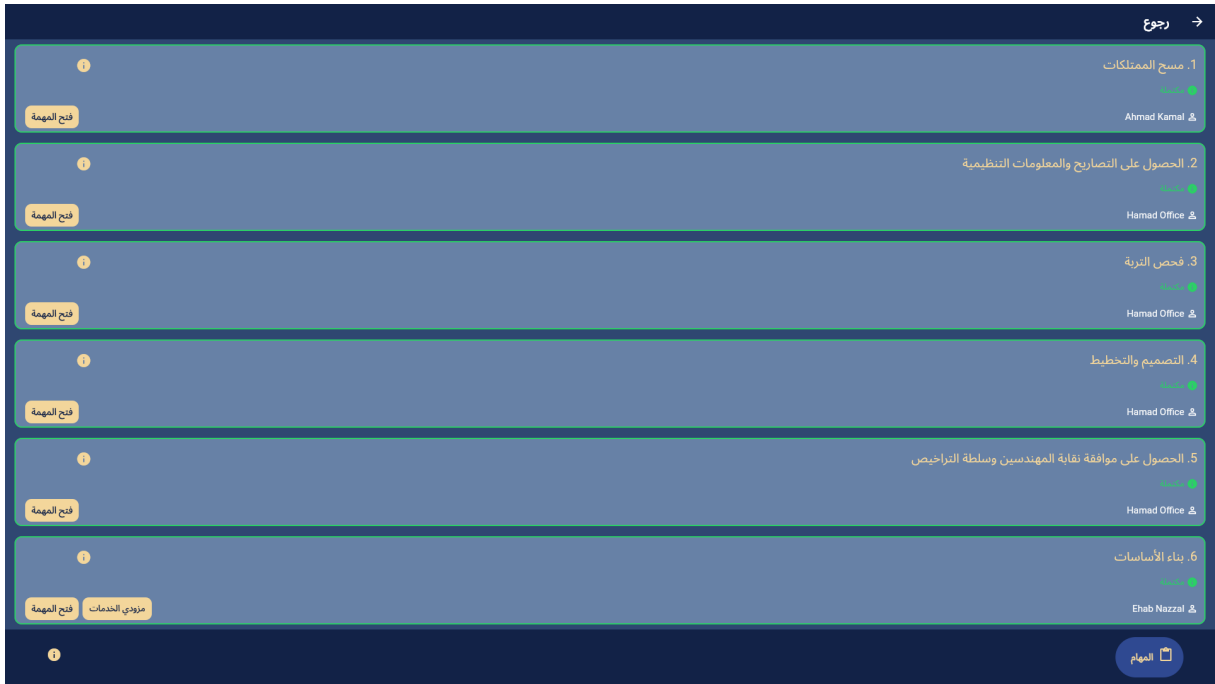


Figure A.30: Task Page 1 - Arabic - HO

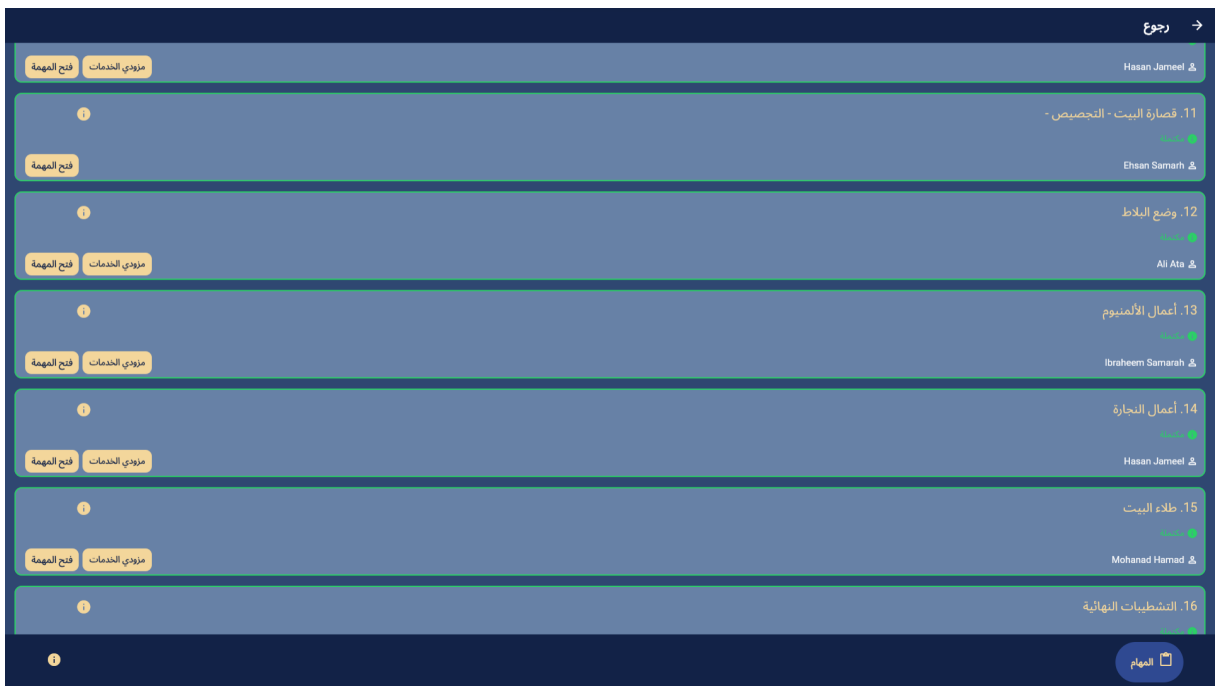


Figure A.31: Task Page 2 - Arabic - HO



Figure A.32: Material Providers - Arabic - HO

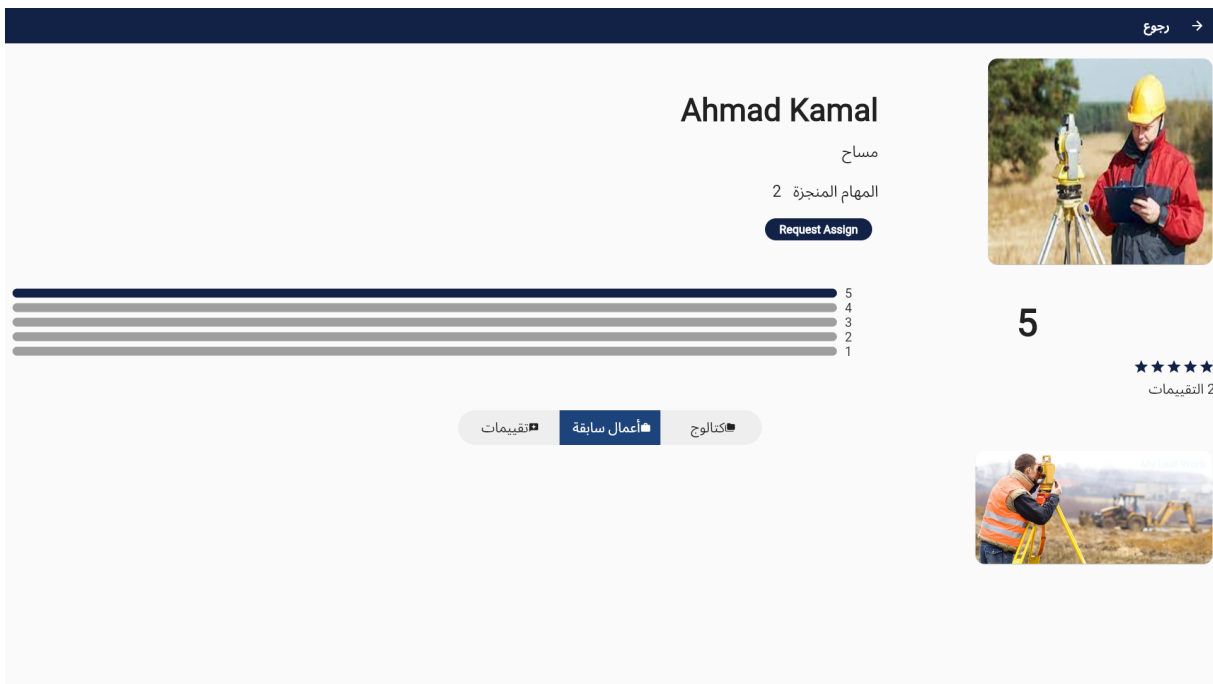


Figure A.33: Service Provider Profile 1 - Arabic - HO

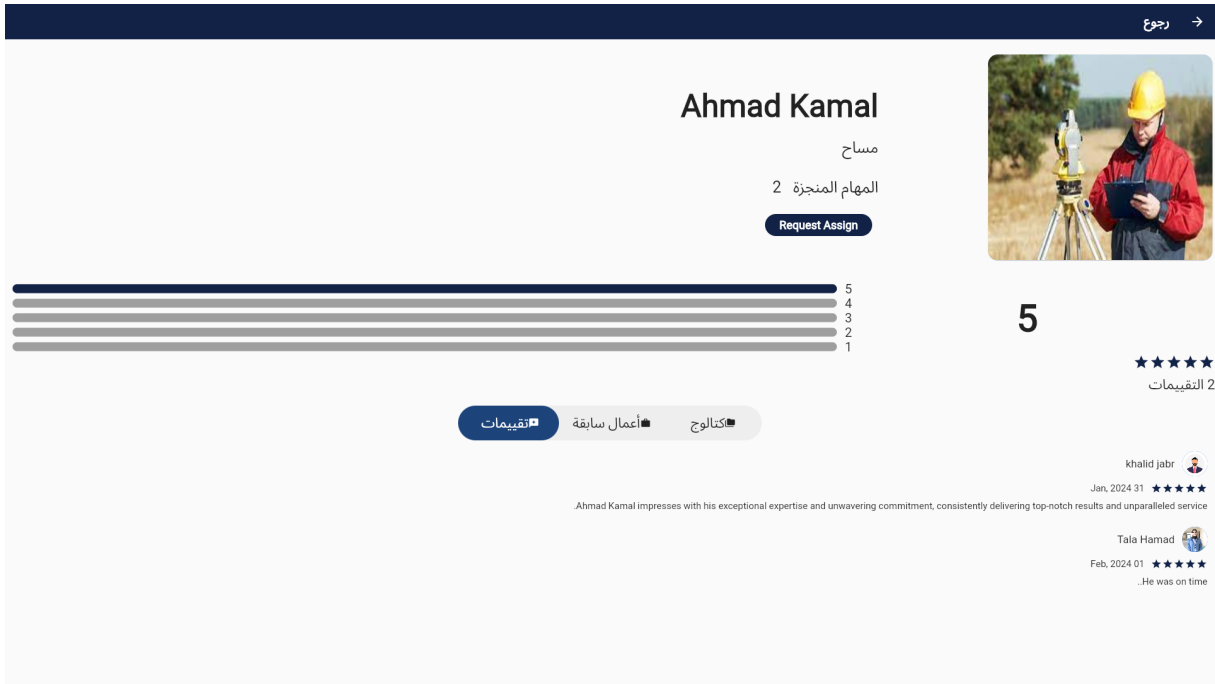


Figure A.34: Service Provider Profile 2 - Arabic - HO

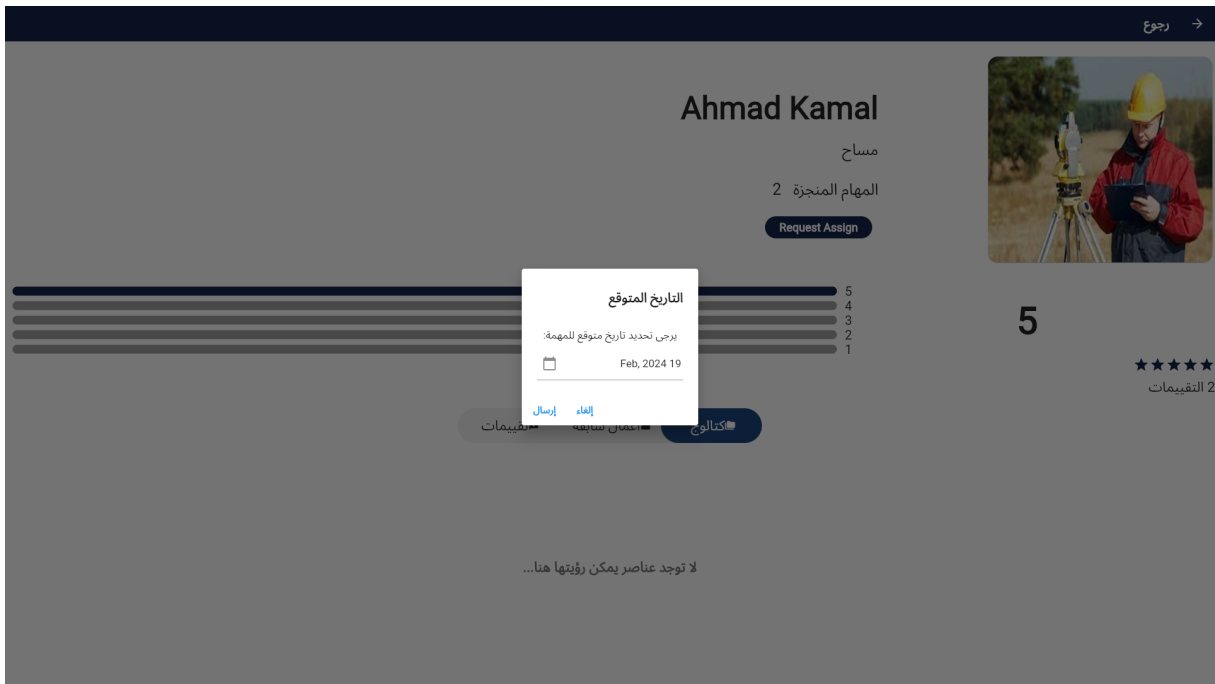


Figure A.35: Request Assign - Arabic - HO

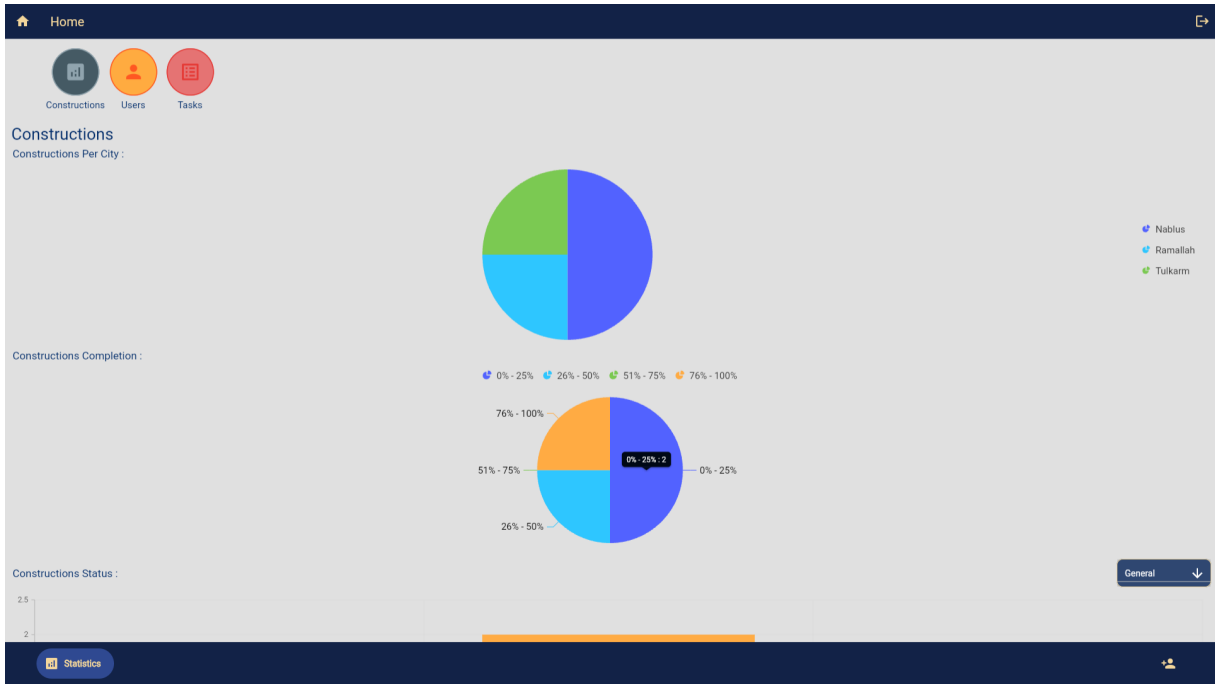


Figure A.36: Construction Analytics Page - Admin

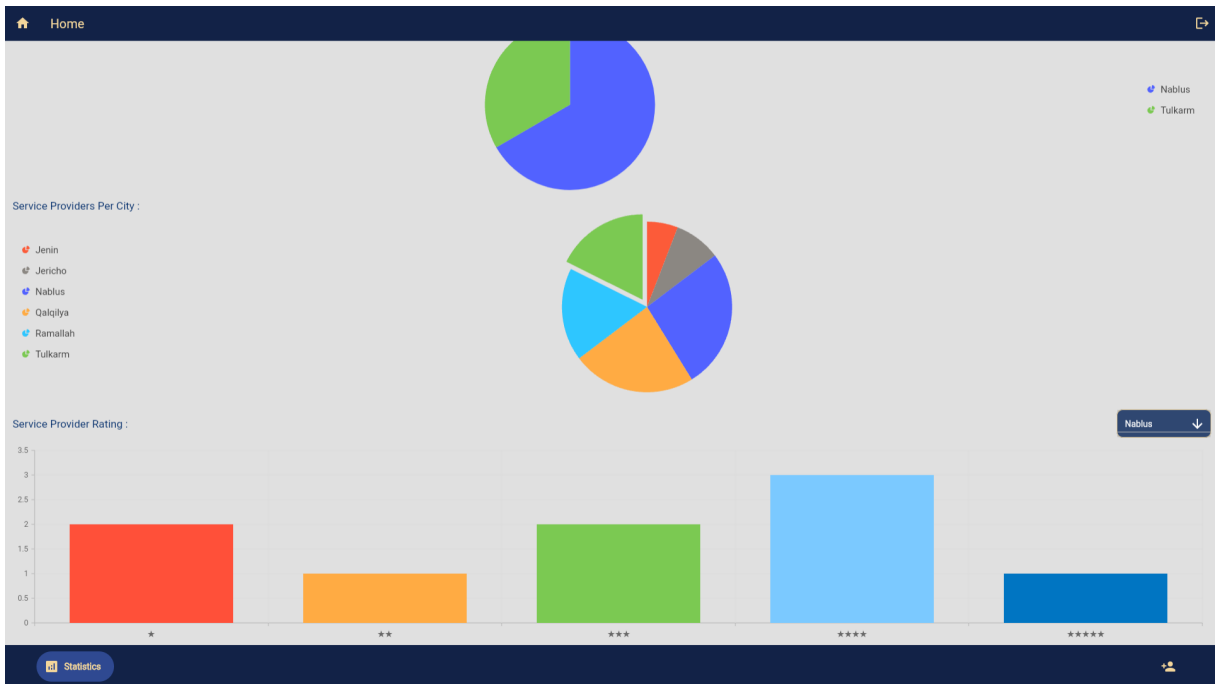


Figure A.37: User Analytics - Admin

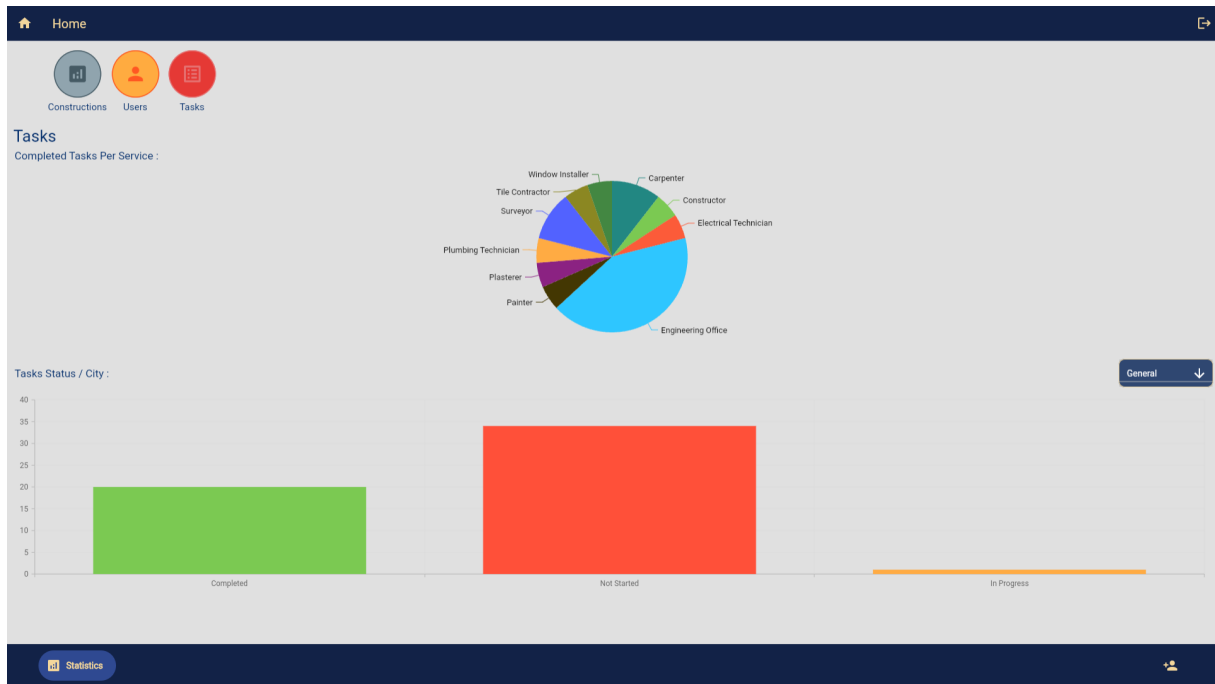


Figure A.38: Tasks Analytics - Admin

The screenshot shows the 'Add Material Provider' form. At the top, it says 'Add Material Provider' and 'Enter the following fields:'. The form includes a logo for 'EBDAA LIGHTING' with the Arabic text 'إبداع للإضاءة'. Below the logo is a 'Pick Picture' button. The form fields are:

- Company Name:** Ebdac Lighting
- Social Link:** ok.com/kafesha2014
- Phone Number:** 0597863142
- Service Type:** Finishing
- City:** Ramallah

At the bottom of the form is a large blue button labeled 'Add Material Provider'. At the very bottom of the page, there is a 'Statistics' icon on the left and an 'Add' button on the right.

Figure A.39: Admin Adds Material Provider