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FAZZA'AH: A Personalized, Scalable Mobile Platform for Empowering Elderly Care and Youth Volunteerism

Maha Mohammed
College of IT
University of Bahrain
202002565@stu.uob.ed.bh

Musherah Moqbel
College of IT
University of Bahrain
202002276@stu.uob.ed.bh

Noor Jaafar
College of IT
University of Bahrain
202007922@stu.uob.ed.bh

Hadeel Al-Obaidy
College of IT
University of Bahrain
halobaidy@uob.edu.bh

Abstract

This article presents an innovative solution for the development of FAZZA'AH, a technological advancement designed specifically for the elderly and volunteer enthusiasts in Bahrain. The proposed system aims to simplify daily tasks for the elderly, enhancing their quality of life through convenience and accessibility. Simultaneously, it fosters a culture of volunteerism among youth by offering meaningful engagement opportunities across various service categories. FAZZA'AH is highly adaptable and effective in bridging generational divides, inspiring social responsibility, and empowering both the elderly and youth to lead purposeful lives rooted in connection and service. Implementation results demonstrate that FAZZA'AH is a reliable, adaptable, and efficient system with significant potential to enhance the quality of life for its users and set a benchmark for elderly care technologies in the region.

I. INTRODUCTION

In recent decades, the rapid aging of the global population has presented unprecedented challenges, prompting an urgent need for comprehensive solutions that address the multifaceted aspects of elderly care. The increasing prevalence of issues such as limited mobility, social isolation, and psychological distress among the elderly has not only impacted their individual quality of life but has also exerted considerable pressure on families and healthcare systems worldwide. In this respect, the quality of elderly care represents a critical component in the success of societal well-being. Providing positive and supportive experiences is increasingly important for elderly individuals in today's rapidly aging world.

The proposed system named FAZZA'AH emerges as a transformative solution, uniquely crafted for Bahrain, designed to confront these challenges. This innovative platform leverages advanced technology to foster greater autonomy and social involvement among the elderly in Bahrain, aiming to shift the societal perception of aging from one of dependency to one of empowerment and active participation. FAZZA'AH identifies the challenges faced by the elderly in Bahrain and evaluates the effectiveness of the developed solution for addressing these challenges. Bahrain, known for its rich cultural heritage, faces several challenges in providing efficient and informative experiences for its elderly population, which often requires additional support and comprehensive care systems.

Nationality / Sex			الجنسية / الجنس						
Total		الجملة	Non-Bahraini		غير بحريني	Bahraini		بحريني	فئات السن
كلا الجنسين	إناث	ذكور	كلا الجنسين	إناث	ذكور	كلا الجنسين	إناث	ذكور	Age group
Both sexes	Females	Males	Both sexes	Females	Males	Both sexes	Females	Males	
38,933	16,477	22,456	12,764	3,248	9,516	26,169	13,229	12,940	64-60
21,728	9,214	12,514	4,483	1,342	3,141	17,245	7,872	9,373	69-65
11,445	5,189	6,256	1,685	583	1,102	9,760	4,606	5,154	74-70
6,680	3,382	3,298	733	307	426	5,947	3,075	2,872	79-75
4,466	2,447	2,019	413	211	202	4,053	2,236	1,817	84-80
3,734	2,134	1,600	748	416	332	2,986	1,718	1,268	+ 85
86,986	38,843	48,143	20,826	6,107	14,719	66,160	32,736	33,424	الجملة

Source: Information & eGovernment Authority — المصدر : هيئة المعلومات والحكومة الإلكترونية

Figure 1 statistics from the Information & eGovernment Authority

FAZZA'AH facilitates access to essential services that are critical for the daily life and well-being of senior citizens. The platform uses an Agile development process model and employs a modular architecture to optimize scalability, reliability, and maintainability. This approach ensures that the system can adapt to the evolving needs of its users while maintaining high standards of performance and security. The platform's innovative features include real-time service matching, context-aware recommendations, and user-friendly interfaces that cater to the specific needs of the elderly.

Statistics from the Information & eGovernment Authority reveal a pressing scenario in Bahrain: there are 86,986 individuals aged 60 and above, of which 66,160 are Bahraini nationals, comprising 33,424 males and 32,736 females. Additionally, Bahraini citizens over the age of 85 number 2,986. The number of non-Bahraini elderly males is significantly higher than that of females, with 14,719 males compared to 6,107 females. According to the Ministry of Health, global reports predict that the number of seniors over the age of 65 will triple by 2050. Currently, approximately 700 million people worldwide are over 60 years old, and this number is expected to reach 2 billion by 2050, constituting more than 20% of the Earth's population. This demographic trend underscores the growing need for services that can accommodate the specific needs of the elderly, particularly as they navigate the challenges associated with aging, such as reduced mobility, increased health risks, and social isolation.

The rest of this paper is structured as follows. A pertinent literature review is presented in Section2, Section 3 describes the study data and provides a statistical summary. Section 3 outlines the proposed system design. Section 4 presents the implementation and results. Finally, Section 5 concludes the study and highlights some directions for improvement.

II. RELATED WORKS

The application of technology in elderly care has seen significant advancements over the past decade. For instance, Chen et al. (2021) explored the use of artificial intelligence in monitoring elderly patients, highlighting how AI-driven applications can predict health deterioration based on real-time data analysis. Similarly, Lee and Kim (2020) discussed the integration of IoT devices in elderly care, emphasizing the role of smart sensors in enhancing home safety for seniors. Fernando, J.F., et al. (2022) highlight a mobile application designed to improve communication channels between caregivers and the elderly, enhancing the overall quality of care. This application integrates an entertainment module tailored to the cognitive and physical capabilities of its users, promoting better engagement and mental stimulation.

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Recent studies have also focused on the development of personalized elderly care applications. Koo et al. (2020) examined the use of adaptive interfaces that adjust to the cognitive abilities of elderly users, finding that such customization can significantly enhance user satisfaction and engagement. Moreover, Zhou and Wang (2021) investigated the potential of mobile health applications in managing chronic diseases among the elderly, highlighting the importance of continuous health monitoring and timely medical interventions.

Anderson and Taylor (2021) investigate the role of mobile applications in enhancing social connectivity among the elderly. Social apps designed for seniors facilitate communication and interaction with family and friends, reducing feelings of isolation and improving mental well-being. These applications promote an active and socially engaged lifestyle for the elderly.

Lopez and Garcia (2021) highlight the importance of user-centric design in developing elderly care applications. Designing interfaces that cater to the cognitive and physical abilities of elderly users enhances usability and engagement. A user-centric approach ensures that the application meets the specific needs and preferences of its users.

The Be My Eyes App is an innovative platform that supports blind and visually impaired individuals by connecting them with sighted volunteers via live video calls. This functionality enables users to perform daily tasks, navigate unfamiliar environments, and handle emergencies effectively. Its key advantages include accessible visual assistance and a global volunteer network that ensures help is available anytime, boosting user confidence. However, the app's scope is limited to visual aid, leaving broader accessibility needs and non-visual tasks unaddressed (Be My Eyes, 2022).

The Papa App bridges generational gaps by pairing elderly users with “Papa Pals,” typically college students, who provide companionship and practical assistance. The app addresses seniors' emotional and social needs while offering flexible scheduling and robust safety measures like background checks and rating systems. Despite these strengths, the Papa App is constrained by its reliance on university students, limiting the pool of volunteers. Additionally, its services focus on basic help and social interaction, excluding specialized care or medical needs, and its geographic availability is restricted to regions where the service is established (Papa Inc., 2022).

The Golden App, designed for India’s senior citizens, offers a comprehensive suite of services that enhance social engagement, ensure security, and provide preventive healthcare. Its user-friendly interface caters specifically to elderly users, making navigation simple and accessible. While the app excels in offering diverse services, its reliance on optimization for specific devices limits accessibility for users with older or incompatible devices, presenting a barrier to widespread adoption (Golden Senior App, 2022).

This literature review has examined various applications aimed at enhancing elderly care, each providing crucial support while facing unique challenges. Applications like Be My Eyes, Papa App, and Golden App offer significant benefits—from improving safety with emergency features to enriching social interactions and ensuring health monitoring. However, FAZZA'AH emerges as a particularly robust solution designed with the unique cultural and social context of Bahrain in mind, setting a new standard in elderly care technology.

Unlike the Be My Eyes app, which focuses solely on visual assistance, FAZZA'AH offers a broader range of services that cater to various needs of the elderly. This includes not only assistance with daily tasks and social interaction but also extends to health monitoring, providing a more holistic support system. FAZZA'AH offers a high degree of flexibility like the

Papa App but goes further by not restricting the volunteer base to university students. This open volunteer model enhances the availability and diversity of assistance, making the platform more robust and inclusive.

FAZZA'AH incorporates stringent safety measures that are on par with, if not superior to, those found in the Papa App. Background checks and continuous monitoring ensure that all interactions are safe and secure, addressing potential concerns about the safety of elderly users when interacting with volunteers. Contrasting with the Golden App, the FAZZA'AH App is designed to run seamlessly across multiple operating systems, including iOS and Android, ensuring broad accessibility regardless of device preference. This cross-platform compatibility allows the app to reach a wider audience, facilitating easy access for both volunteers and elderly users. By supporting multiple platforms, FAZZA'AH ensures that users can engage with the system from virtually any mobile device, enhancing the user experience and increasing the app's usability in diverse settings. This approach not only widens the potential user base but also reinforces the system's commitment to inclusivity and convenience.

FAZZA'AH stands out in the landscape of elderly care technologies by offering a comprehensive, flexible, and locally tailored solution. Its design addresses the limitations observed in other apps and expands on their capabilities, making it an innovative and practical choice for enhancing the quality of life for the elderly in Bahrain. As a non-profit initiative, it focuses on genuine care and personalized services to meet the unique needs of each user, combined with its adaptability to Middle Eastern cultural contexts. By integrating a range of services and ensuring high standards of safety and usability, FAZZA'AH not only meets the immediate needs of its users but also sets a new standard for elderly care applications.

III. PROPOSED SYSTEM DESIGN

This section provides an in-depth discussion of the system design, highlighting the integration of Human-Computer Interaction (HCI) principles and user stories to ensure an intuitive and user-centered experience. It also delves into the system architecture, offering a comprehensive overview of the platform's components and interactions. The included Figure 2 summarizes and visually represents the entire system architecture, providing a clear understanding of how the system operates as a cohesive whole.

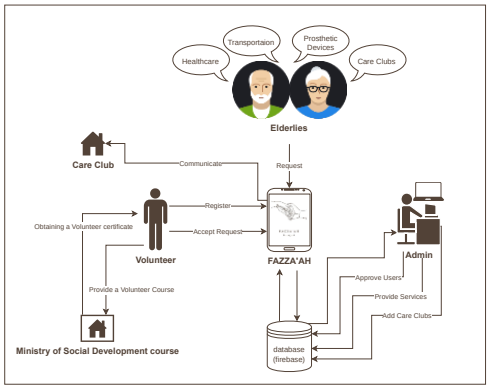

Figure 2 Conceptual Framework of FAZZA'AH System

A. *HCI Principles Integration*

The proposed system design for FAZZA'AH focuses on creating a comprehensive, scalable, and user-friendly platform tailored to the unique needs of elderly users and volunteers in Bahrain. This design leverages advanced technology and best practices in software engineering to ensure high levels of reliability, security, and accessibility, and FAZZA'AH incorporates persuasive HCI principles to motivate and encourage elderly users and volunteers to engage more deeply with the platform. This includes:

- **Design Principles**: Design Principles: The application uses specific interface elements that nudge users towards beneficial behaviors, such as more frequent social interaction and regular volunteering in community.
- **Behavioral Techniques**: Techniques like reinforcement through positive feedback, rating, and social and development ministry rewards for volunteers.
- **User Experience (UX)**: The UX is carefully crafted to reduce friction and make desired actions simpler and more rewarding. Immediate feedback and clear, accessible interfaces ensure that users feel confident and supported as they navigate the app.
- **Ethical Considerations**: The design maintains a strong ethical framework, emphasizing transparency and user consent. The application clearly explains how user data is used to personalize experiences and respects user privacy and preferences.

Additionally, the system emphasizes **Sociability**, encouraging interactions not only between users but also within the broader community. Features such as direct messaging capabilities and volunteering functionality make it easier for users to connect, share experiences, and build meaningful relationships.

The design also highlights **Flexibility** by accommodating varied needs and preferences. FAZZA'AH offers customizable user profiles, the ability to extend service times, and multi-language support to cater to diverse demographics and accessibility requirements.

Lastly, **Expressiveness** allows users to personalize their interactions and profiles, ensuring the platform reflects their unique preferences and the services they offer. By integrating these principles, FAZZA'AH stands out as a robust and inclusive solution for elderly care and volunteer engagement.

B. *System Users*

FAZZA'AH serves three main user groups—elderly users, volunteers, and admins—each with specific roles and features designed to meet their unique needs. Together, they ensure the platform operates smoothly and delivers high-quality services. Below is an overview of their capabilities and key user stories.

Eelderly Users shown in Figure 3 they will be able to register and receive approval or rejection after the admin evaluates their suitability based on provided information. They can resubmit certifications if initially rejected due to missing documentation. Elderly users have access to all service categories, can request prosthetic devices, view the nearest available volunteers, filter volunteers based on gender and highest rating, view volunteer ratings and reviews, request

specific services, specify the duration of the request, and cancel service requests before acceptance. They are limited to one service request at a time and can view all recent and previous requests. They can complete a service request after the specified duration or extend the time if needed. Additionally, they can rate volunteers post-service completion, view the history of completed service requests, update their profiles, report app-related issues, and call for emergency help.

User Stories for Elderlies

- **As an elderly user**, I want to be able to register and get immediate feedback on my application, **so that** I can quickly start accessing services.
- **As an elderly user**, I need to request specific services and specify duration, **so that** my needs are met according to my schedule.
- **As an elderly user**, I want to rate volunteers after service completion, **so that** I can provide feedback and influence the quality of future services.

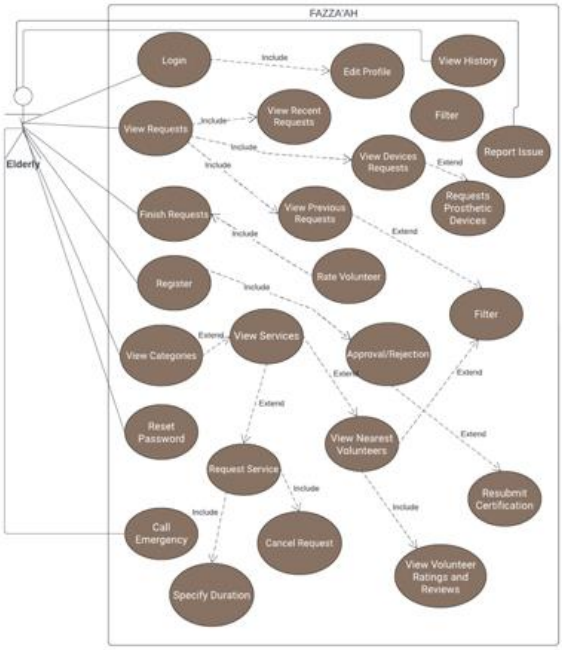

Figure 3 Elderly Use-Case Diagram

Volunteers shown in Figure 4 they will be able to register and receive approval or rejection after admin evaluation. Volunteers can resubmit certifications if initially rejected due to missing documentation. They can access all service categories except healthcare, which requires a valid healthcare certification. Volunteers can view all received and previous requests, filter requests, accept or reject service requests, complete accepted requests only after confirmation from the elderly client, and rate the elderly. They can also fulfill prosthetic device requests, are limited to one service request at a time, view the history of completed service requests, update their profiles, report app-related issues, and call for emergency help.

User Stories for Volunteers

- **As a volunteer,** I want to access and review service requests along with details and reviews of elderly users, **so that** I can make informed decisions to accept or reject requests.
- **As a volunteer**, I want to chat with the elderly, **so that** I can provide services more effectively and ensure the elderly receive the best possible care

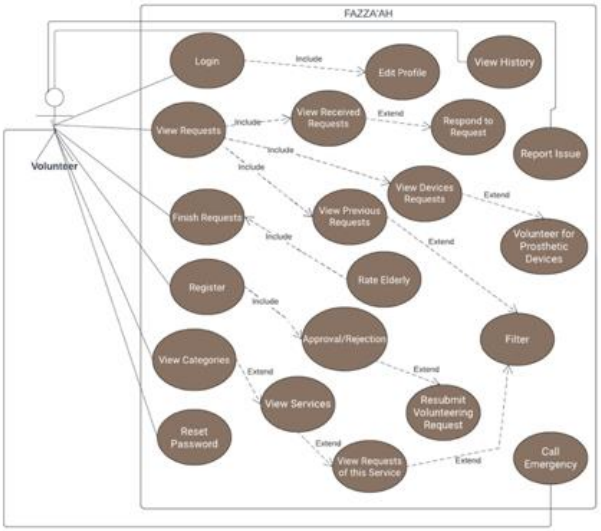

Figure 4 Volunteer Use-Case Diagram

Figure 5 shows the last type of users which is **Admin,** they have secure login access to the management website. They can reset their password, edit profile information, approve or reject volunteer and elderly requests, manage categories and services, view all registered users' details, view reported issues, track admin activities, and filter users, changes log, and reports.

User Stories for Admins

- **As an admin**, I need secure access to manage user account creation requests, **so that** I can maintain the integrity and smooth operation of the platform.
- **As an admin**, I want to view and track all activities on the platform, **so that** I can effectively oversee and optimize its usage.

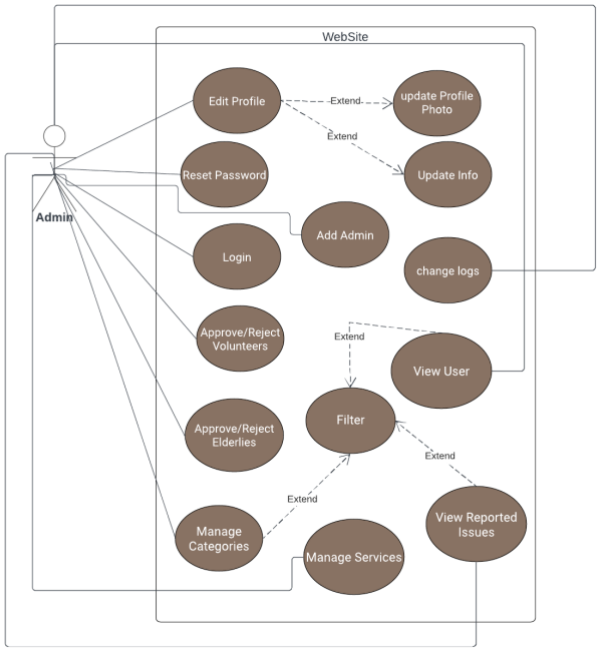

Figure 5 Admin Use-Case Diagram

C. *System Architecture*

The architecture of the proposed system FAZZA'AH is strategically designed to ensure robust performance, high security, and extensive interoperability across various devices and platforms. By adopting a layered architectural style as shown in **Error! Reference source not found.** and **Error! Reference source not found.**, the system efficiently separates concerns, which simplifies complexity and improves the maintainability of the codebase. This design approach also supports scalability and enhances the ease of future upgrades and integrations without impacting the system's ongoing operations.

- **Scalability**: The system is built to accommodate an expanding user base and a growing dataset, which is crucial as the number of elderly users and volunteers increases. Scalability is achieved through a modular design where services can be scaled independently based on demand.
- **Security**: Given the sensitivity of the user data, including health and personal information, security is paramount. The system uses encrypted data storage, secure communication channels, and strict authentication and authorization protocols to protect data integrity and confidentiality.
- **Interoperability**: With users accessing the system across various technologies, ensuring seamless operation on different platforms (iOS, Android, Web) is essential. The system uses a cross-platform development framework which allows for a single codebase to deploy on multiple platforms, ensuring consistency and reducing development time.
- **Maintainability**: The separation of concerns facilitated by the layered architecture allows for easier maintenance and debugging of the system. Each layer can be updated or replaced independently, minimizing the risk of system downtime.

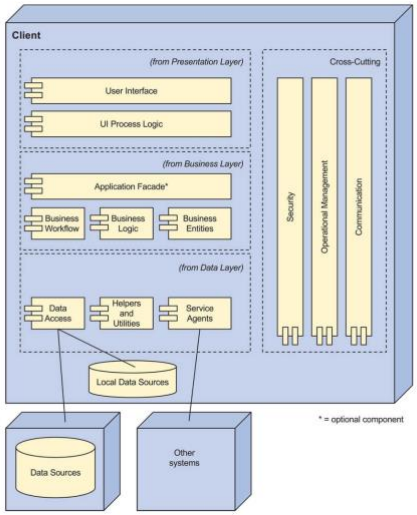

Figure 6 Mobile reference architecture

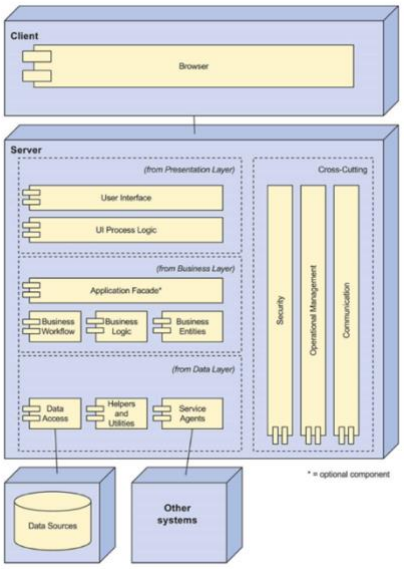

Figure 7 Web reference architecture

IV. IMPLEMENTATION AND RESULTS

The implementation of the FAZZA'AH system involved a series of well-coordinated steps, employing modern software engineering practices to ensure the platform is robust, scalable, and user-friendly.

A. *Tools and Technologies Used*

The tools and technologies used were carefully selected to support the diverse functionalities of the system. For mobile application development, Angular/Ionic was utilized for its cross-platform

compatibility, while TypeScript and JavaScript were employed for various frontend functionalities.

Incorporating cloud computing in elderly care applications has been shown to significantly improve scalability and reliability. As noted by Zhang et al. (2019), cloud-based systems allow for real-time data processing and storage, which is crucial for handling large volumes of user data and ensuring uninterrupted service. Additionally, the use of microservices architecture, as discussed by Kumar and Singh (2020), offers flexibility in managing various functionalities of the application independently, thus enhancing maintainability and scalability so, Firebase served as the backend for real-time database management, authentication, and cloud storage, connected through RESTful APIs. For the web management platform, Angular was used for the frontend, and Typescript was implemented for server-side logic, with Firebase Firestore managing user data, service requests, and feedback. Security was a paramount concern, addressed through Firebase Authentication for secure login, end-to-end encryption for data privacy, and third-party verification services for background checks on volunteers.

A custom development approach was adopted for building the website from scratch without relying on pre-built frameworks. This decision was made to gain finer control over the design and functionality, enabling us to tailor every aspect of the application directly to the specific needs of our project. This approach ensured a custom fit for the requirements and preferences of our users, enhancing the overall user experience.

B. Database Implemenration

The primary database technology selected for FAZZA'AH is Firebase Firestore. This NoSQL database provides a flexible, scalable solution for storing and synchronizing data across both user and admin interfaces. Firestore's cloud-based infrastructure supports high-performance requirements, which are critical for the project's expansive scope. Firestore offers excellent scalability, pivotal for handling the dynamic user base of FAZZA'AH. Unlike traditional SQL databases that can struggle under heavy load, Firestore excels in environments with massive read and write rates, ensuring that performance remains consistent as the number of users grows.

Firestore's flexible data structure is ideal for FAZZA'AH because our data does not follow a strict structure. This flexibility allows us to store and manage data more efficiently without the constraints and complexity of relational databases. Firestore's ability to handle hierarchical data structures is particularly advantageous for organizing complex and nested data relationships found within our platform. Additionally, Firestore enables robust querying capabilities essential for FAZZA'AH. Data is organized in collections, akin to tables in SQL databases, but with more flexibility. Collections contain documents, each capable of storing complex nested data, offering detailed structure within a single record. Administrators and users can perform detailed queries to filter, sort, and retrieve data based on specific field values, enhancing the interactivity and responsiveness of the user interface.

Choosing Firestore also provides integrated access to a suite of Firebase services crucial for the project, including authentication and storage. Firebase Authentication simplifies user management by providing comprehensive features for handling user registration, login, and security. Firebase offers robust cloud storage solutions, ensuring data durability and high availability. The cloud-native architecture of Firestore ensures that it can scale seamlessly to meet increasing demands without any degradation in performance, crucial for maintaining a smooth user experience as FAZZA'AH expands. These backend components are vital for maintaining the operational efficiency and security of FAZZA'AH, supporting its functionality across diverse user interactions. The integration of these systems into the project has streamlined development, enhanced security, and provided scalable solutions that meet the growing needs of the platform.

V. RESULTS AND DISCUSSION

This research has been conducted to design and implement the FAZZA'AH system with an innovative approach to enhance elderly care within Bahrain. The development of this mobile application uniquely addresses the dual needs of elderly individuals seeking assistance and volunteers eager to provide services. The implementation of FAZZA'AH was based on modern technologies such as Angular and Ionic for front-end development, and Firebase for backend functionalities. This technological framework supported the creation of a robust, scalable application capable of real-time updates and secure user interactions. The use of APIs for updating and editing the proposed system allows for future expandability, making it easier to add new features and capabilities.

The implementation process involved extensive phases of design, development, and testing to ensure the solution was user-centric and met practical needs effectively. The rigorous testing phases, including unit, integration, and user acceptance tests, affirmed the application's functionality and user satisfaction. Compared with existing elderly care systems, FAZZA'AH reveals substantial benefits from the impact of advanced technologies to enable software engineering development and deployment capabilities in creating and testing the system without investing in expensive infrastructure. It provides enhanced security and improved data security for software development. Its impact is reflected in promoting collaboration, scalability, and efficiency, leveraging the potential to build an innovative, robust, and scalable system.

Despite its success, FAZZA'AH has certain limitations. The application's requirement for a continuous internet connection could limit access for users in areas with unstable internet services, potentially excluding a segment of the target population. Additionally, the elderly often have varying levels of comfort and familiarity with digital technology. The application's design assumes a baseline level of digital literacy that some elderly users may not possess, which could hinder their ability to fully utilize the platform's features.

For future works, this research can be extended to examine the impact of user culture in designing the User Interface (UI) of the proposed system to study user behavior to improve the quality of the user experience. This could involve surveys or interviews with elderly users who interact with the application. Future versions of FAZZA'AH will support multiple languages and include advanced accessibility features to accommodate a diverse user demographic. Incorporating AI-driven CPR validations will streamline user verification processes, enhancing security and administrative efficiency. Implementing facial recognition technology to confirm service requests will further enhance security and user convenience, eliminating the need for traditional password systems.

Additionally, Future developments in FAZZA'AH could benefit from advancements in machine learning and predictive analytics. As suggested by Brown et al. (2022), integrating these technologies can enhance the personalization of care plans by predicting individual needs and preferences. Additionally, the potential of wearable technology in continuously monitoring health metrics and providing real-time feedback to both users and caregivers is another promising area for future exploration, as highlighted by Green and Johnson (2021).. Developing a dedicated website will facilitate easier access for users, providing a comprehensive platform for information, registration, and interaction. Collaborations with artists, designers, and developers can ensure engaging and visually appealing content is created. Incorporating software principles such as responsive design, accessibility, and security can further enhance the user experience and ensure the system's success in the market. The system's efficiency and responsiveness will ensure a smooth and seamless user experience.

In essence, FAZZA'AH represents a significant advancement in the application of technology to enhance social care. The project has set a precedent for future innovations in the region, proving that thoughtful technology solutions can profoundly impact community welfare and social cohesion. As the application evolves, it will continue to adapt and expand, ensuring that it remains at the forefront of elderly care technology.

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