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DementiaCare: A Dementia Health Monitoring System

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Abstract

Dementia is an escalating global health concern, affecting millions worldwide and placing significant strain on both patients and caregivers. This study introduces DementiaCare, a web-based health monitoring system designed to enhance dementia management by promoting patient independence and improving caregiver efficiency at Hayati Care Centre. The system features a responsive mobile-friendly interface accessible via standard web browsers, ensuring accessibility across devices without the need for a native app. Developed using programming principles and powered by a MySQL database, DementiaCare supports real-time data tracking, routine management, and streamlined communication among stakeholders. Utilizing the Waterfall software development model, the system emphasizes modularity, user-friendliness, and secure data handling. Findings indicate that DementiaCare improves adherence to care routines, enhances data accuracy, and reduces caregiver workload compared to traditional manual methods. Future work should explore expanding the system's capabilities to include predictive analytics and broader adaptability across diverse healthcare settings.

1. Introduction

Dementia, a progressive neurological disorder, affects millions of individuals globally and is anticipated to increase significantly due to aging populations. The World Health Organization (WHO) reports that over 55 million individuals live with dementia, with nearly 10 million new cases annually [1]. Dementia patients experience cognitive decline that severely impairs their daily functioning, necessitating extensive caregiving support [5]. Traditional caregiving methods, such as manual reminders and paper-based health records, often fail to address the complexities of dementia care effectively, resulting in caregiver burnout and diminished care quality [2]. These challenges highlight the necessity for innovative, technology-driven solutions to streamline care and improve patient outcomes.

The primary objective of this research is to develop DementiaCare: A Dementia Health Monitoring System, a digital platform designed to support dementia patients, caregivers, and healthcare professionals. The system focuses on automating routine reminders, tracking health data, and enhancing communication between stakeholders. By leveraging a user-friendly interface and robust backend technologies, the system aims to empower patients to adhere to daily routines independently and assist caregivers in efficiently managing patient health information. The research employs the Waterfall model methodology, covering requirements gathering, system design, implementation, testing, and maintenance phases.

The expected outcomes include improved patient independence, reduced caregiver workload, and enhanced healthcare provider support through accurate, real-time health data. The system's scope encompasses modules for patient registration, health tracking, routine reminders, and caregiver management. These features address

the identified gaps in current dementia care methods, offering a holistic solution tailored to the specific needs of dementia management.

This paper aims to explore the methodologies and implications of DementiaCare, showcasing its potential to enhance transparency, accountability, and efficiency in dementia care practices. The findings presented herein intend to provide actionable insights for refining the system, ensuring sustained effectiveness, and broadening its applicability within diverse philanthropic environments.

2. Related Work

The study of dementia management has evolved significantly, with a growing focus on integrating digital health solutions. This section reviews prior research on dementia care systems, categorized into three main areas. Existing systems often emphasize medication reminders, patient tracking, and caregiver support to ensure continuity of care. However, many lack real-time monitoring features or mobile accessibility, limiting their effectiveness in dynamic care environments.

2.1 Digital Health Data Recording in Dementia Care

Digital health data systems, such as Electronic Health Records (EHR), have been instrumental in improving the management of dementia care [6]. They enable structured and secure data storage, reduce transcription errors, and enhance communication between healthcare providers [1]. Research has shown that digital systems improve the tracking of patient vitals and adherence to treatment routines, thus reducing caregiver stress and enhancing patient outcomes [2].

2.2 Routine Reminder Systems

Routine reminder is key features in dementia care applications, aiding patients in adhering to daily routines such as medication intake and therapy sessions. Studies have demonstrated that time-based and event-based alerts improve task adherence and reduce caregiver workload [3]. However, challenges like alert fatigue and user adaptability remain critical considerations for system design [4].

2.3 Comparison with the Existing Systems

Several existing applications focus on specific aspects of dementia care. For instance, the comparison with the existing systems are summarized in Table 1. CLEAR Dementia Care emphasizes education and behavioral tracking, while Dementia Care - Avanyaa focuses on cognitive stimulation and caregiver support. Despite their utility, these systems often lack comprehensive features like health tracking and patient management, which are critical for effective caregiving. Calendar Clock focuses on time management and reminders but does not offer health tracking or patient management, making DementiaCare the most complete solution for dementia care. This gap highlights the need for integrated solutions such as DementiaCare.

Table 1 *Comparison with the Existing Systems*

Feature/Capability	CLEAR Dementia Care	Dementia Care - Avanyaa	Calendar Clock	DementiaCare
Register and Login	No	Yes	No	Yes
Profile Management	No	No	No	Yes
Daily Routine Reminders	No	Yes	Yes	Yes
Health Tracking	No	No	No	Yes
History	No	No	No	Yes
Notifications	No	Yes	Yes	Yes
Patient Management	No	No	No	Yes
Logout	No	Yes	Yes	Yes

3. Methodology/Framework

The development of DementiaCare follows the structured phases of the Waterfall model, chosen for its clarity in outlining the overall project scope, required tasks, and associated timelines. The methodology encompasses sequential phases including analysis, system design, implementation, testing, deployment, and maintenance, ensuring a systematic and organized development process.

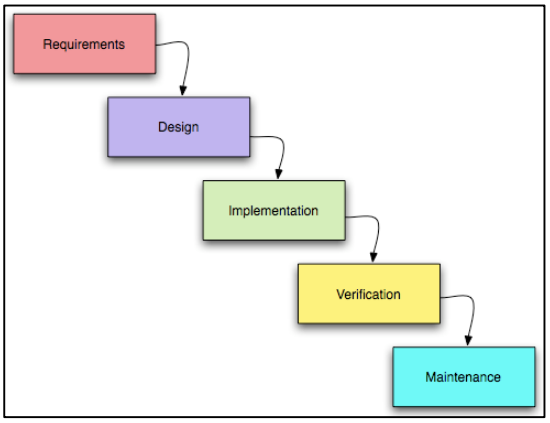


Fig. 1 *Waterfall Model [9]*

3.1 System Requirement Analysis

The level of requirements details could be classified into two types which are functional and non-functional requirements [7]. Functional requirement is defined as a main basic action or feature that must be included in a system to support the main driving system activities. Non-functional requirement is defined to present the tasks performance in term of the overall system [8]. The functional requirements are summarized in Table 2, while the non-functional requirements are summarized in Table 3. User requirement analysis is the process of documenting end user needs from a software system. This information is then used to design and build the system. It been summarized in Table 4.

Table 2 *Functional Requirement Analysis*

No	Function	Functionalities
1.	Register	The system shall allow user to register for the DementiaCare system by providing their personal information, including name, age, IC number, and contact information.
2.	Login	The system shall allow authorized user to log in using their credentials to access their profiles and utilize the system's features.
3	Profile Management	The system shall allow users to edit their profile information for accurate and up-to-date records.
4	Daily Routine Reminders	The system shall enable users to configure their preferences for receiving reminders related to their daily tasks such as medication, exercises, meals, and prayer times.
5	Health Tracking	The system shall allow admin to record their patient's vital signs at various times of the day, including upon waking and at bedtime. Admin can also add contextual notes to provide information about any pain or unusual symptoms they may be observe along with each measurement.
6	History	The system shall allow users to view historical health data by selecting a specific date. Users can access a list of recorded data, including measurement time, date and notes. Additionally, users have the option to delete specific entries from the history.
7	Notifications	The system shall allow users to set up notifications as their preferences.
8	Patient Management	The system shall enable admin to manage patient profiles, updating routines and health data. They can also add or delete patient profiles when necessary. It facilitates collaboration and shared access to patient data. Admin can add accounts for patients by providing a username and password.
9	Logout	The system shall allow the user to securely log out of the system, terminating their active session and ensuring the protection of their account and data.

Table 3 *Non-Functional Requirement Analysis*

No	Requirement	Description
1	Operational	The system shall have a user-friendly interface for easy navigation and interaction.
2	Security	The system shall ensure data security and compliance with healthcare data protection regulations.
3	Performance	The system shall have a response time of less than 3 seconds for user interactions.
4	Availability	The system shall be available 99.9% of the time to ensure accessibility for users.
5	Scalability	The system shall be scalable to accommodate potential growth in the number of users and data volume.

Table 4 *User Requirement Analysis*

No	User	User Requirements
1	Admin	1. Register for the DementiaCare system, providing personal information. 2. Log in securely using credentials to access profiles and utilize system features. 3. Edit their profile information for accuracy and currency, displaying patient details. 4. Configure their preferences for receiving reminders related to their daily tasks such as medication, exercises, meals, and prayer times. 5. Record their patient's vital signs at various times, add contextual notes to each measurement. 6. View historical health data by selecting a specific date, displaying measurement time, date and notes. 7. Delete specific entries from the history if needed. 8. Set up notifications as their preferences. 9. Manage patient profiles, update routines and health data. 10. Add or delete patient profiles under their care. 11. Log out securely, protecting their account and data.
2	Patient	1. Register for the DementiaCare system, providing personal information. 2. Log in securely using credentials to access profiles and utilize system features. 3. Edit their profile information for accuracy and currency, displaying patient details. 4. Configure their preferences for receiving reminders related to their daily tasks such as medication, exercises, meals, and prayer times. 5. View historical health data by selecting a specific date, displaying measurement time, date and notes. 6. Delete specific entries from the history if needed. 7. Set up notifications as their preferences. 8. Log out securely, protecting their account and data.

3.2 Requirement Phase

In the requirement phase of DementiaCare, information was gathered from stakeholders through WhatsApp communication. Key features were identified, such as health tracking, routine reminders, and secure profile management for patients with dementia. A detailed document was prepared, covering system features, a budget plan, and risk management. Stakeholder interviews helped identify the needs of caregivers and patients at Hayati Care Centre. A Gantt chart was also created to visualize the project timeline and ensure tasks were organized.

3.3 Design Phase

In this phase, the system design was developed based on the needs collected earlier. It involved planning the structure, features, and technology used in the system. Logical and physical designs were created to ensure the system runs smoothly and meets user expectations. The database design focused on storing patient data securely, while user interface sketches helped visualize app navigation. Diagrams such as use case, sequence, and activity charts were used to guide the system's structure.

3.4 Implementation Phase

The implementation phase involved coding the system based on the approved design. The patient module, made for mobile view, includes features like signup, login, and routine reminders. The caregiver module, accessible via web, helps manage patient routines and health records. Object-oriented programming was used to build a modular and flexible system. Iterative development using the prototyping model ensured continuous improvements during this phase.

3.5 Testing Phase

In the testing phase, the system was checked to ensure it worked correctly and met user needs. Alpha and beta testing methods were used to find and fix errors before the final release. Each module was tested based on a predefined test plan to ensure functionality. The goal was to make sure the system was stable, accurate, and ready for use. Testing continued until all problems were resolved and requirements were met.

3.6 Maintenance Phase

The maintenance phase began after the system was deployed to end users. Feedback from users was collected to make improvements and fix any issues. Small updates and regular maintenance were performed to keep the system running smoothly. This phase also addressed any problems not found during testing. Maintenance helps ensure the system remains reliable and up to date.

4. Result and Discussion

This section presents the outcomes of the project, encompassing various visual representations and analyses of the system's structure, functionality, and user interface design. It includes use case diagram, class diagram, and user interface designs, providing a comprehensive view of the system's architecture and user interaction models. These visual aids serve as critical components in understanding the system's behavior, user interactions, and overall functionality. Through a detailed discussion and analysis of these results, this section aims to elucidate the project's achievements, highlight key design decisions, and evaluate the system's alignment with the specified requirements and objectives.

4.1 Use Case Diagram

A use case diagram is a visual representation in the field of software engineering that illustrates the interactions between various actors. It shows the different use cases or functions that the system offers and how these interact with the actors to give a high-level view of how the system works. Use case diagrams are an important tool for system design and communication with stakeholders as they help to understand system requirements, how users interact with the system, and the overall scope of a project.

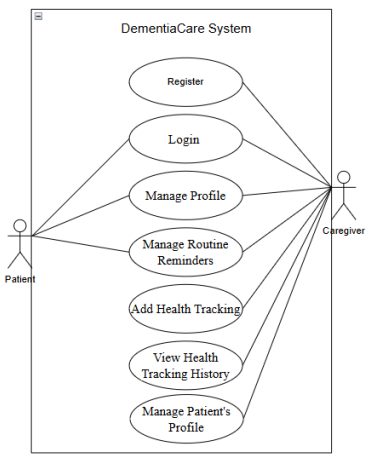


Fig. 2 *Use Case Diagram*

4.2 Class Diagram

A class diagram is a graphic representation of the organization and connections between classes in a system or software program. It visually represents the classes, characteristics, methods, and relationships between classes, offering a broad understanding of the system's structure. Class diagrams play a crucial role in object-oriented design by facilitating developers' comprehension of the system's components, their attributes, and their interrelationships. This, in turn, assists in the many stages of software development, including planning, design, and implementation.

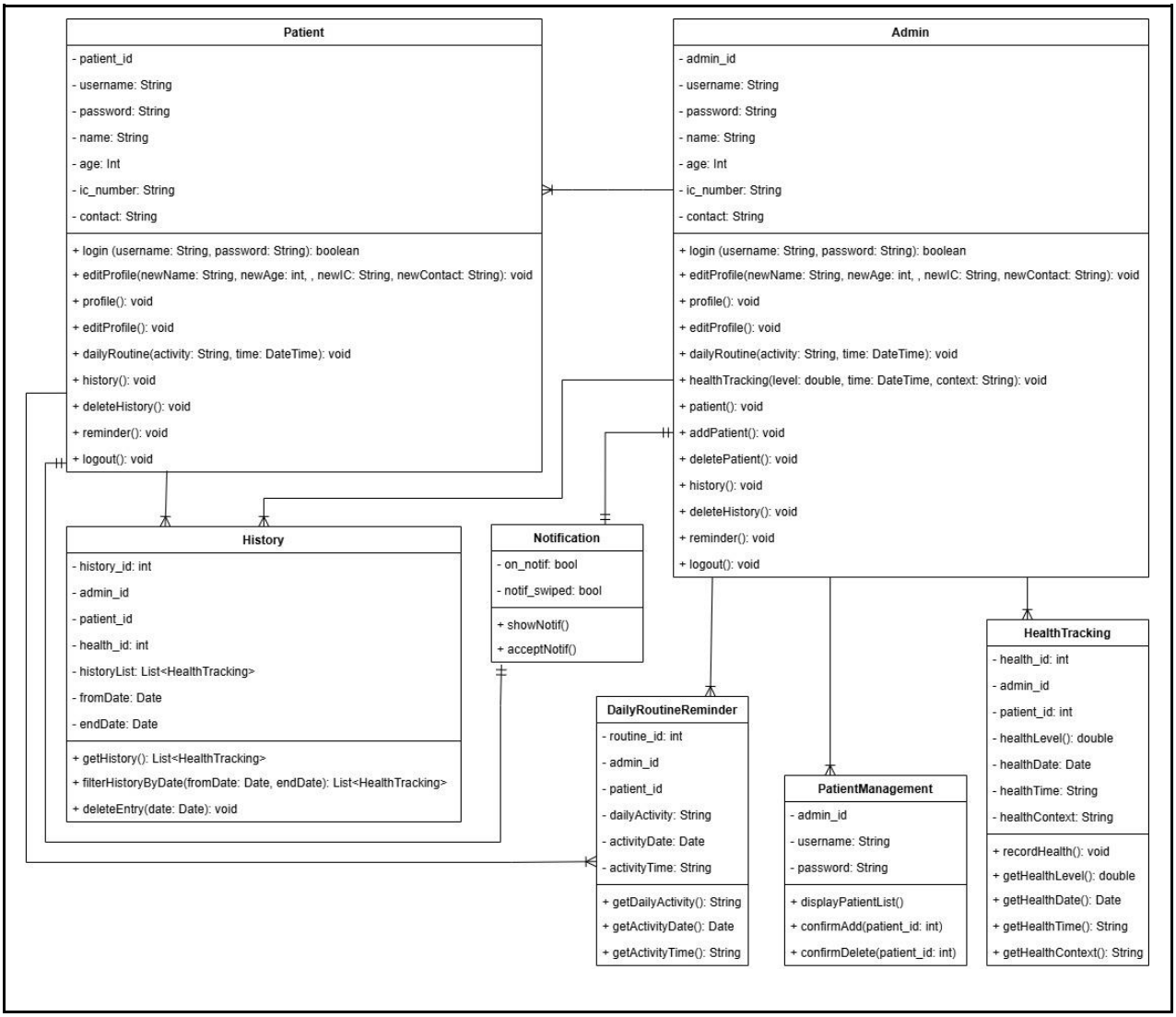


Fig. 3 *Class Diagram*

Database The schema data are listed as below:

- Admin (admin_id, username, password, fullname, age, ic_number, contact)
- Patients (patient_id, username, password, fullname, age, ic_number, contact))
- History (history_id, fk_admin_id, fk_patient_id, health_id, historyList, fromDate, endDate)
- Notification (on_notif, notif_swiped)
- DailyRoutineReminder (routine_id, fk_admin_id, fk_patient_id, dailyActivity, activityDate, activityTime)
- PatientManagement (fk_admin_id, username, password)
- HealthTracking (health_id, fk_admin_id, patient_id, healthLevel, healthDate, healthTime, healthContext

4.3 Implementation

The implementation of DementiaCare involves the practical development of the system's design and functionality, transforming initial concepts into a responsive and accessible web-based solution. This section outlines the technical processes and steps taken to build the system, with a focus on delivering a user-friendly

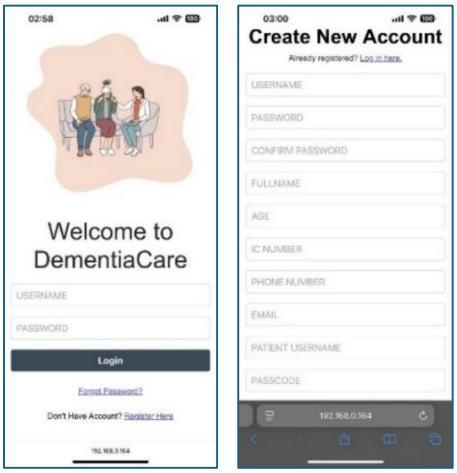
experience for both patients and caregivers. By constructing the system architecture, developing the web interface with mobile-friendly views, integrating the MySQL database, and embedding essential security measures, the foundational goals of the project are realized.

An iterative development model supports this phase, allowing continuous refinement based on stakeholder input and testing outcomes. Development is divided into key modules: the patient module, accessible via mobile browsers, includes features such as registration, login, and daily task notifications for medication, meals, exercise, and prayers. The caregiver module, designed for desktop use, provides tools for managing patient routines, viewing real-time health updates, and maintaining records. Each component is implemented using object-oriented principles to ensure modularity, maintainability, and scalability.

This section details the selection of appropriate web technologies, database integration strategies, and the technical challenges encountered during development. Through structured planning, responsive design, and user-centered development, the implementation phase brings the DementiaCare system to life, positioning it as a reliable and innovative tool for dementia care at Hayati Care Centre.

4.3.1 Registration and Login

The registration and login interfaces provide secure access to the DementiaCare system. The registration interface enables caregivers to create an account by submitting necessary personal information and login credentials, ensuring controlled access to the system. The login interface authenticates users, allowing only registered caregivers and patients to access the system's features and functionalities.



(a) **(b)**

Fig. 4 *(a) Registration Interface, (b) Login Interface*

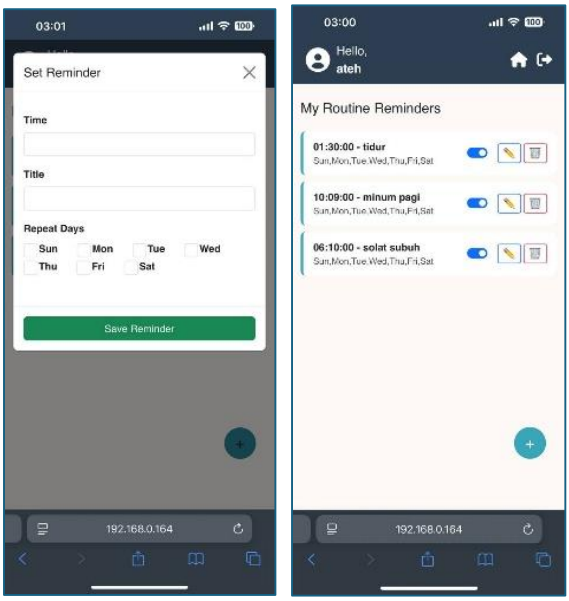
4.3.2 Dashboard Interface

The dashboard interface serves as the main control panel for caregivers, offering a centralized view of essential system modules such as routine reminders, health tracking, patient profiles, and history. It is designed to enhance navigation efficiency and provide quick access to caregiving tools, enabling seamless system interaction.

Fig. 5 *Dashboard Interface*

4.3.3 Set Routine Reminder Interface

The set routine reminder interface enables caregivers to manage patient schedules effectively. Through this module, caregivers can add routines such as medication intake, meals, and prayers, and view all scheduled reminders in a structured format. The interface supports editing and deletion functions to allow dynamic schedule adjustments based on patient needs.

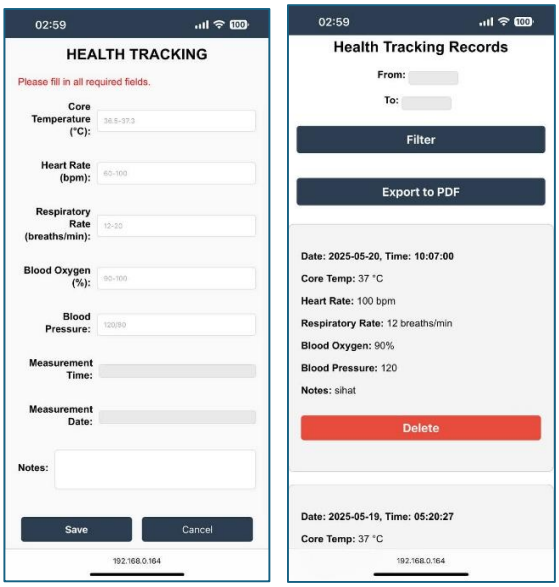


(a) **(b)**

Fig. 6 *(a) Add Routine Reminder, (b) Routine Reminder Page*

4.3.4 Health Tracking and History Interface

This module allows caregivers to input and manage patient health data efficiently. The health tracking feature supports real-time entry of vital signs and other health-related information, while the history interface displays previously recorded data with date-based filtering options. Additionally, the system provides an export-to-PDF function to facilitate health report sharing and documentation.



(a) **(b)**

Fig. 7 *(a) Add Health Tracking Interface, (b) History Page*

4.3.5 Caregiver Profile

The caregiver profile interface contains personal and professional details of the caregiver, including name, contact information, and login credentials. It allows users to update their information to maintain data accuracy and ensure proper identification within the system.

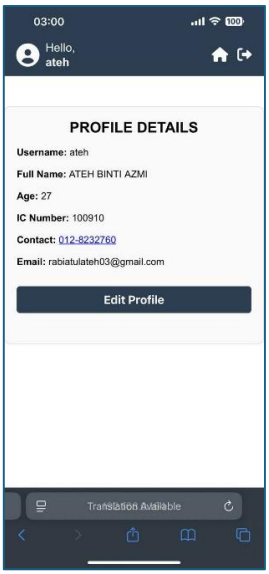


Fig. 8 *Caregiver Profile Interface*

4.3.6 Patient Profile

The patient profile interface stores comprehensive patient data, such as name, age, identification number (IC), and contact details. It functions as a centralized information hub that supports personalized and effective caregiving, offering quick access to each patient's profile for monitoring and management purposes.

Fig. 9 *Patient Profile Interface*

4.4 Testing

Testing plays a crucial role in various fields, including software development, education, and design processes. In software development, testing is essential for verifying requirements, validating software behavior, and catching regressions in products [10].

The testing section is dedicated to ensuring the reliability, functionality, and security of the DementiaCare system. Through rigorous testing methodologies including unit testing, integration testing, and user acceptance testing, the integrity of the application is verified across various levels. This section outlines the testing procedures employed to identify and rectify any potential issues or bugs, ensuring a seamless and robust user experience. By

prioritizing testing protocols, DementiaCare aims to deliver a high-quality, dependable platform that meets the needs of its users effectively.

4.4.1 Alpha Testing

Alpha testing in software development serves the crucial purpose of evaluating the functionality and quality of a software application before it undergoes beta testing and is released to real-world users. This testing phase, as highlighted in the research papers, involves direct testing of the software output to ensure it aligns with expected results [11]. The table below showcases the test cases designed and executed for this project.

Table 5 *Test Case*

Functional Module	Test Case	Description	Expected Result	Test Result (Pass/Fail)
Registration	Enter a valid name, email address, phone number and password.	Enter correct data for name, email, phone number and password.	System accepts all entered information without any issues.	Pass
	Enter mismatched passwords during registration.	Provide a password that does not match the confirmation password.	System displays an error message indicating password mismatch.	Pass
	Submit registration with incomplete fields.	Leave some required fields blank.	System displays an error message prompting completion of all fields.	Pass
Login	Login with correct username and password.	Enter valid username and password.	System successfully logs the user in, redirecting to the dashboard	Pass
	Login with incorrect username.	Enter an username that does not exist in the system.	System displays an error message indicating invalid username.	Pass
	Login with incorrect password.	Enter correct username but incorrect password.	System displays an error message indicating incorrect password.	Pass
	Login with both incorrect email and password.	Enter a username and password combination that do not exist.	System displays an error message indicating both username and password are incorrect.	Pass
	Attempt to login with empty email and password fields.	Leave both email and password fields blank.	System displays an error message prompting completion of both fields.	Pass
Forgot Password	Forgot password with a valid email address.	Enter a valid email address and request to reset password.	System sends a password reset link to the provided email address	Pass

Table 5 *Test Case (Cont)*

Functional Module	Test Case	Description	Expected Result	Test Result (Pass/Fail)
Forgot Password	Check the email inbox for the password reset link and click on the link provided.	Check the email inbox for the password reset link.	System verifies the link and allows the user to proceed to password reset.	Pass
	Change password after verification.	Enter a new password and confirm the new password.	System successfully updates the password and redirects the user to login.	Pass
	Attempt to verify an invalid link.	Use an invalid link.	System displays an error message indicating invalid link.	Pass
	Submit password reset request with an invalid or non existant email.	Enter an email address that is not registered in the system.	System displays an error message indicating that the email address is not registered.	Pass
Manage Routine Reminders	Add New Reminder	Caregiver adds a new reminder (e.g., medication at 8:00 AM)	Reminder is saved in the database and appears in patient's task list	Pass
	Edit Existing Reminder	Caregiver updates a time or description of an existing reminder	Updated reminder is reflected correctly in both caregiver and patient views	Pass
	Delete Reminder	Caregiver deletes a scheduled reminder	Reminder is removed from database and no longer appears in the task list	Pass
Add Health Tracking	Submit New Health Record	Caregiver submits health data (e.g., blood pressure, heart rate) for a patient	Health data is saved in the database and linked to the correct patient profile	Pass
	Validate Input Fields	System checks that all required fields are filled and properly formatted	Error message is shown for invalid or missing input; data not submitted	Pass
View Health Tracking History	Display Health Records	Caregiver views list of health records for patient	Records are accurately displayed in a readable table format	Pass
	Filter Records by Date Range	Caregiver filters records between two dates	Only health records within the selected date range are shown	Pass
	Export Records to PDF	Caregiver clicks "Export to PDF" button to download filtered records	A well-formatted PDF file is generated and downloaded with selected data	Pass

Table 5 *Test Case (Cont)*

Functional Module	Test Case	Description	Expected Result	Test Result (Pass/Fail)
View Health Tracking History	Check Data Accuracy in PDF Export	Verify exported PDF matches on-screen data after filter	PDF content is identical to the filtered view in the system	Pass
	Responsive Display on Web	Caregiver accesses the page from various screen sizes (desktop/tablet)	Health records and controls remain accessible and well-aligned on all devices	Pass

4.4.2 Beta Testing

Beta testing is a crucial phase in software development where the product is tested in real-world scenarios by external users before its official release [12]. This testing phase follows alpha testing and serves as a form of external user acceptance testing, allowing for the identification of bugs, performance issues, and user feedback to improve the software's quality and reliability [13]. The beta testing for DementiaCare has been carried out for two user groups: caregiver and patient. Detailed findings for each user group will be provided in the subsequent subsections.

4.4.2.1 User acceptance Testing for Caregiver

User Acceptance Testing was conducted with 11 caregivers to assess the usability, effectiveness, and satisfaction with the DementiaCare system. The aim was to evaluate whether the system met the functional requirements and expectations from a caregiver's perspective. The results indicate a high level of user satisfaction and system usability. All participants (100%) reported that the system provided clear and helpful error messages when incomplete information was entered, demonstrating the system's robustness in handling input validation. Regarding the registration and login process, 72.7% of caregivers found it very easy, while 27.3% rated it as easy, indicating a smooth onboarding experience. In terms of viewing health tracking history, all users (100%) successfully accessed this feature without issues, and 100% also reported being able to edit their profile information easily. When asked about the experience of inputting and saving health tracking data, 72.7% expressed being very satisfied, and 27.3% were satisfied, reflecting confidence in the system's data management functions.

The ability to set and receive routine reminders was also positively received, with 63.6% rating it as very useful and the remaining 36.4% as useful, affirming its value in daily caregiving tasks. Furthermore, the system showed strong recommendation potential, as 72.7% of users were very likely to recommend DementiaCare to others, while 27.3% were likely to do so. Finally, the overall functionality of the system was rated highly, with 72.7% rating it as excellent and 27.3% as good. These results confirm that the DementiaCare system fulfils its intended objectives and is well-received by caregivers for managing dementia patient routines and health data.

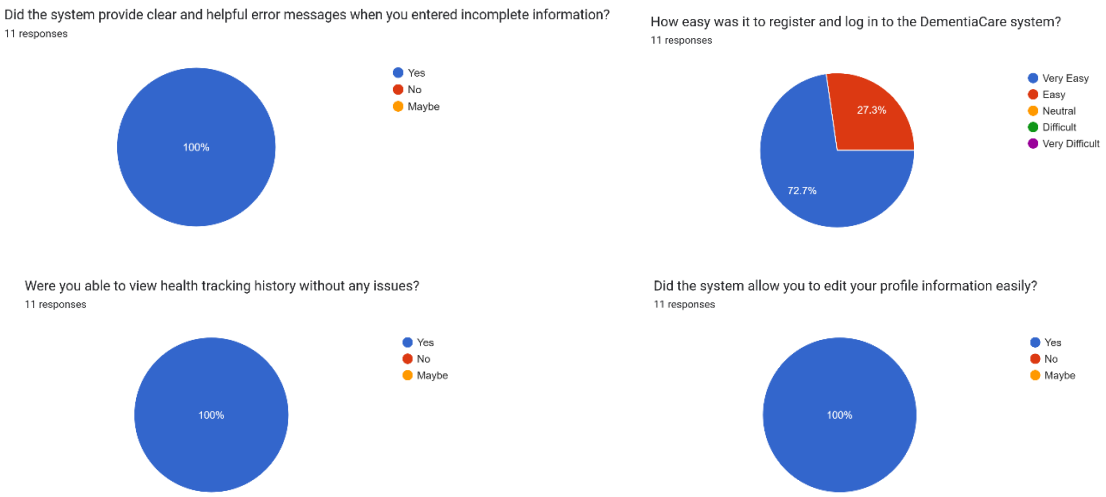


Fig. 10 *User acceptance Testing for Caregiver*

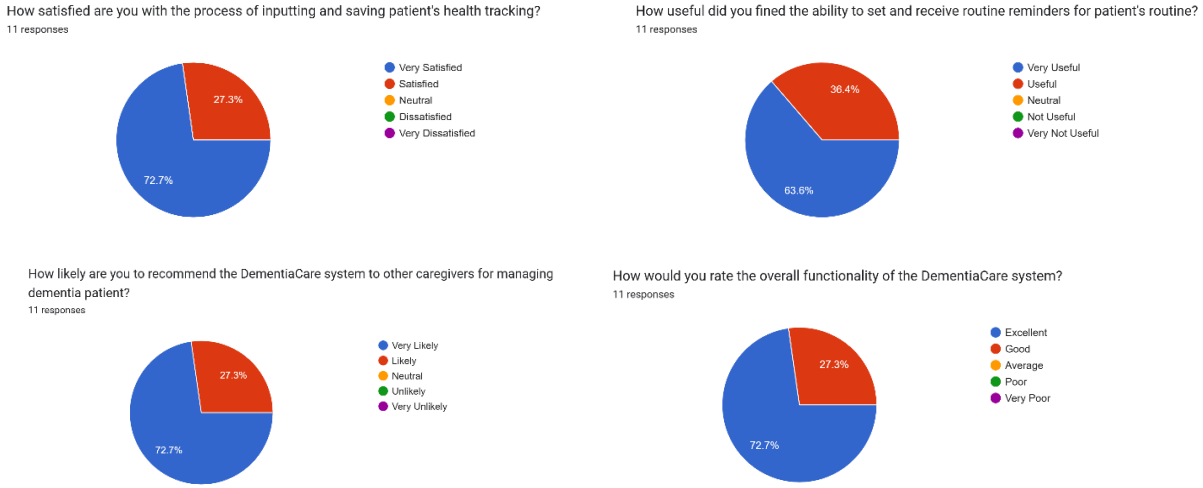


Fig. 11 *User acceptance Testing for Caregiver*

4.4.2.2 User acceptance Testing for Patient

User Acceptance Testing was conducted with seven dementia patients with the supervion from their caregiver to assess the usability, navigability, and perceived value of the DementiaCare system from the end-user perspective. The feedback provided key insights into the system's accessibility and functionality as experienced by patients. All participants (100%) reported that the system provided clear and helpful error messages when entering incomplete information or leaving required fields blank. Similarly, 100% found the login process to be straightforward and the navigation through the application to be intuitive, indicating a strong focus on user-friendly design. When evaluating profile management, all users (100%) confirmed that they could edit their profile information with ease. The ability to set and receive routine reminders—a core feature of the application—was positively received, with 71.4% rating it as very useful and 28.6% as useful. This suggests the feature successfully supports patients in managing their daily routines.

Additionally, the system demonstrated high potential for user satisfaction and adoption, as 71.4% of participants stated they were very likely to recommend the system to other dementia patients, and 28.6% indicated they were likely to do so. In terms of overall functionality, 71.4% of respondents rated the system as excellent, while 28.6% rated it as good, affirming that DementiaCare effectively meets the needs and expectations of dementia patients. These results validate the system's usability, accessibility, and benefit to its intended users.

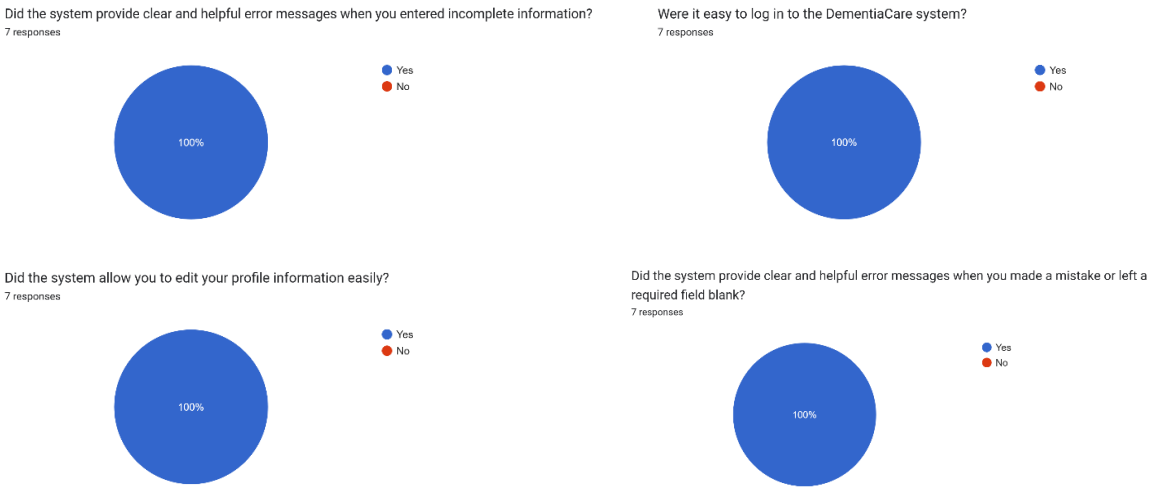


Fig. 12 *User acceptance Testing for Patient*

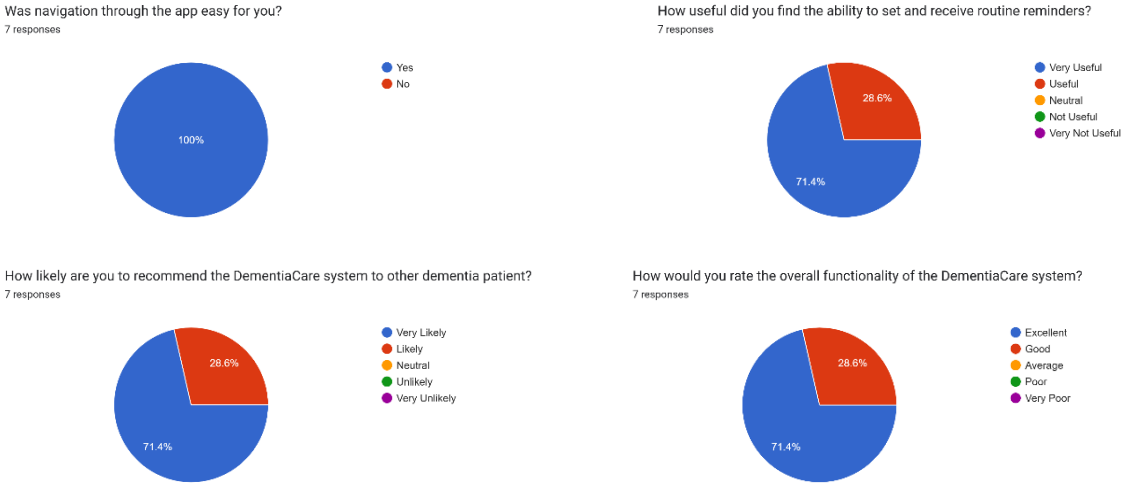


Fig. 13 *User acceptance Testing for Patient*

5. Conclusion

This study introduced DementiaCare, a health monitoring system addressing challenges for dementia patients, caregivers, and healthcare providers. It integrates routine reminders, health tracking and manage profile to streamline care. The system enhances patient independence, reduces caregiver workload, and improves communication through real-time health data. Despite its promise, limitations like the need for advanced analytics and predictive capabilities were noted. Future work should explore machine learning for early health deterioration detection and broader adaptability. DementiaCare demonstrates significant potential as a scalable and impactful tool in dementia care.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** Rabiatul Adawiyah Binti Azmi, Mazidah Binti Mat Rejab; **data collection:** Rabiatul Adawiyah Binti Azmi, Mazidah Binti Mat Rejab**; analysis and interpretation of results:** Rabiatul Adawiyah Binti Azmi, Mazidah Binti Mat Rejab; **draft manuscript preparation:** Rabiatul Adawiyah Binti Azmi, Mazidah Binti Mat Rejab; All authors reviewed the results and approved the final version of the manuscript.

References

[1] World Health Organization: WHO & World Health Organization: WHO. (2025, March 31). *Dementia*. Retrieved on June 9,2024 from https://www.who.int/news-room/fact-sheets/detail/dementia#:~:text=Currently%20more%20than%2055%20million,injuries%20that%20affect%20the%20brain

[2] L. Bradley, S. Shanker, J. Murphy, L.-A. Fenge, and M. Heward, "Effectiveness of digital technologies to engage and support the wellbeing of people with dementia and family carers at home and in care homes: A scoping review," *Dementia*, vol. 22, no. 6, pp. 1292–1313, May 2023, doi: 10.1177/14713012231178445.

[3] R. Harrad and F. Sulla, "Factors associated with and impact of burnout in nursing and residential home care workers for the elderly.," *PubMed*, vol. 89, no. 7-S, pp. 60–69, Dec. 2018, doi: 10.23750/abm.v89i7-s.7830.

[4] G. Livingston *et al.*, "Dementia prevention, intervention, and care: 2020 report of the Lancet Commission," *The Lancet*, vol. 396, no. 10248, pp. 413–446, Jul. 2020, doi: 10.1016/s0140-6736(20)30367-6.

[5] A. E. Budson and M. K. O'Connor, "What is dementia?," in *Oxford University Press eBooks*, 2021, pp. 3–10. doi: 10.1093/med/9780190098124.003.0001.

[6] S. Venters and C. J. Jones, "The experiences of grandchildren who provide care for a grandparent with dementia: A systematic review," *Dementia*, vol. 20, no. 6, pp. 2205–2230, Dec. 2020, doi: 10.1177/1471301220980243.

[7] J. D. Summers, S. Joshi, and B. Morkos, "Requirements Evolution: Relating Functional and Non-Functional Requirement Change on Student Project Success," *Summers, J.D., Joshi, S. and Morkos,* Aug. 2014, doi: 10.1115/detc2014-35023.

[8] S. Alsaleh and H. Haron, "The Most Important Functional and Non-Functional Requirements of Knowledge Sharing System at Public Academic Institutions: A Case Study," *Lecture Notes on Software Engineering*, vol. 4, no. 2, pp. 157–161, Sep. 2015, doi: 10.7763/lnse.2016.v4.242.

[9] The Traditional Waterfall Approach. (2021). The Traditional Waterfall Approach. Retrieved on June 9,2024 from https://www.umsl.edu/~hugheyd/is6840/waterfall.html

[10] S. Lawrence, "Testing," in Apress eBooks, 2023, pp. 365–391. https://doi/10.1007/978-1-4842-9234-1_12.

[11] T. Menora, C. H. Primasari, Y. P. Wibisono, T. A. P. Sidhi, D. B. Setyohadi, and M. Cininta, "Implementasi Pengujian Alpha dan Beta Testing Pada Aplikasi Gamelan Virtual Reality," Konstelasi, vol. 3, no. 1, pp. 48 60, Jun. 2023, https://doi.org/10.24002/konstelasi.v3i1.6625.

[12] A. Anand, N. Bhatt, D. Aggrawal, and L. Papic, "Software Reliability Modeling with Impact of Beta Testing on Release Decision," in Management and industrial engineering, 2016, pp. 121–138. https://doi/10.1007/978-3-319-48875-2_5.

[13] A. Anand, N. Bhatt, D. Aggrawal, and L. Papic, "Software reliability modeling with impact of beta testing on release decision," in Software Reliability Modeling with Impact of Beta Testing on Release Decision, https://doi.org10.1007/978-3-319-48875-2_5.