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Web-based Dementia Care Monitoring System

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Abstract

Dementia is a group of symptoms causing cognitive decline, which hinders the daily life of the elderly as it progresses and becomes worse. The current solution to care for a dementia individual is through a caregiver, but they would not be able to cater to their every need. Expensive technological devices and the confidentiality of patients' conditions also affect well-rounded caregiving. This project highlights these issues through the proposed monitoring system. The development of the system follows the cycle of the Prototype Model through the implementation of C# language and SQL server, while incorporating functionalities such as journaling and photo album features for emotional well-being. Wireframe, ERD, and DFD diagrams are done during the design phase of the prototype. The final testing of the system successfully meets users' requirements as it helps caregivers in keeping track of dementia patients' cognitive and emotional state through cognitive assessments, photo albums, and journaling.

1. Introduction

Dementia is a term for diseases affecting an individual's memory, thinking skills, and ability to carry out daily activities [1]. This condition has been proven to affect most of the aging population. However, dementia could also be diagnosed in young individuals before the age of 65, which is referred to as young-onset dementia. Symptoms of dementia commonly include memory loss, changes in personality, and severe mood swings that can lead to physical, emotional, and financial burdens on caregivers and family members [2]. Therefore, a dementia care monitoring system can help to reduce the strain on caregivers and improve the well-being of individuals affected by dementia.

Formal caregivers are professionals employed to provide care and assistance to individuals or groups of individuals in a standard environment. They are usually the substitutes for individuals with dementia, apart from family members or friends. This is because family members or friends of the affected individual would not be able to commit time and effort entirely to caring for them. Unfortunately, caregivers alone are not capable of caring for and keeping an eye on the well-being of dementia individuals all the time, which sometimes causes problems to arise. This is where technology, such as a monitoring system, can assist caregivers with aspects of the physical and mental health of dementia care recipients that they may have missed. A monitoring system offers valuable data and alerts, but the caregivers are the ones to interpret and make final decisions in the best interest of dementia patients [3]. The collaboration between human caregivers and a monitoring system ensures that the specific needs and preferences of each dementia individual are met [4].

The system's objectives are to design a dementia care monitoring system using a web-based approach, develop a web-based dementia care monitoring system that allows the caregiver to monitor individuals with dementia, and implement testing on the functionality of the developed dementia care monitoring system. This

web-based dementia care monitoring system should provide users with features to monitor the activity of dementia individuals weekly or monthly, write journal entries on their observations, save images into the gallery to view them later, and an appointment scheduler for medical appointments.

The next section will cover related works of this web-based system. It focuses on comparing three existing systems with the proposed system. The third section covers the methodology used in developing this web-based system, the prototype model. The methods and techniques, such as ERD and DFD implemented to create the application are elaborated further. Then, the fourth section focuses on the results and discussion of the web-based application. The last section will discuss the conclusion of this report.

2. Related Work

Dementia is a neurological disorder where a person's cognitive and functional abilities progressively decline due to biological aging. Eventually, dementia individuals will depend on caregivers for their needs [5]. The rise of the aging population has caused a massive revolution of technology in the medicine industry, especially dementia care. The invention of systems and devices helps manage the lifestyle of dementia individuals better. The algorithms in these systems and devices can analyze data and produce useful insights [6]. Thus, it can be said that a system to monitor dementia individuals is essential to caregivers and family members in providing proper care for dementia individuals.

This section discusses the system's related work, including a web-based system and a monitoring system, and compares similar existing systems and the proposed system.

2.1 Web-based System

A web-based system is a system that relates to or is done using the web or a system of connected documents on the Internet [7]. Multiple programming languages can develop and display this system using any Internet browser, such as Google, Microsoft Edge, or Mozilla Firefox. There are two categories of a web-based system: a hosted system and a downloaded system [8]. A hosted system is used after a user registers their account online, while a downloaded system can only be used after it is installed on the user's laptop or computer.

A web-based system is developed for the proposed system due to its various user benefits. This type of system can be accessible anywhere worldwide, with the only requirement being a steady Internet connection. It ensures that users can always use the system on the go, even from the other side. One more benefit of a web-based system is the cross-platform feature. Users can deploy the system from their computers, smartphones, and tablets.

2.2 Monitoring System

The monitoring system is software that helps those who use it, such as system administrators, to monitor people or infrastructure. Monitoring systems are widespread in many fields, such as medicine, technology, agriculture, and others. The system is usually paired with the Internet of Things, Blockchain, or Artificial Intelligence to enhance the monitoring of individuals with dementia. A remote health monitoring system can monitor tasks of dementia individuals over a network with lesser cost and reduced human error [9].

A monitoring system is beneficial for individuals with dementia because it allows caregivers and family members to observe and track the physical and mental condition of the dementia individuals without invading their privacy. The system is best for individuals who dislike wearing electronic gadgets or feel discomfort from having surveillance cameras around their homes. The monitoring system analyzes vast amounts of data from targeted individuals' daily activities. Then, the system summarizes the collected data into a summary report. Caregivers and family members can consult with medical professionals or psychiatrists using the report to identify the behavior and mental health of dementia individuals, make treatment plans, or implement more personalized dementia care from caregivers.

2.3 Comparison of Existing System

The features of the three existing systems, Livindi, TeQ-Home, and envoyatHome, will be studied further to improve the proposed web-based dementia care monitoring system. Table 1 compares the various features of the three existing systems with those of the proposed system.

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Table 1 *Comparison of the existing systems and proposed system*

Features	LivindiApp	TEQ-HOME	envoyatHome	Web-based Dementia Care Monitoring System
User Management	Available	Available	Available	Available
Cognitive Assessment	Available	Available	Available	Available
Journaling	Available	Not Available	Not Available	Available
Photo Album	Available	Not Available	Not Available	Available
Alert and Notification	Available	Available	Available	Available
Appointment Scheduling	Available	Available	Available	Available
Available in Malaysia	Not Available	Available	Not Available	Available
Internet Requirement	Available	Not Available	Available	Available
Platform	Android	Web-based, Android	Web-based, Android	Web-based

Based on Table 1, the LivindiApp has most of the features available, but mainly operates on the Android platform. TEQ-HOME and envoyatHome also have some features such as user management, cognitive assessment, alert and notification, and appointment scheduling. The advantage of the web-based dementia care monitoring system is that it can keep track of a large number of cognitive assessment reports, appointments, and journal entries input by the user.

3. Methodology

A prototype model is a system development method where a sample model of the final system is created to be built and tested for functionality at minimal cost. In this model, an incomplete system that meets most user requirements is released to the user for feedback and improvement rather than developing the complete system first. The prototype model has three crucial steps: development, testing, and continuous improvement. It will repeat these three steps a few times to test if each system functionality suits the user's requirements. The prototype model can be used to clarify specifications and technical matters that the customer does not understand to the software developer regarding the specifications of the desired requirements [10].

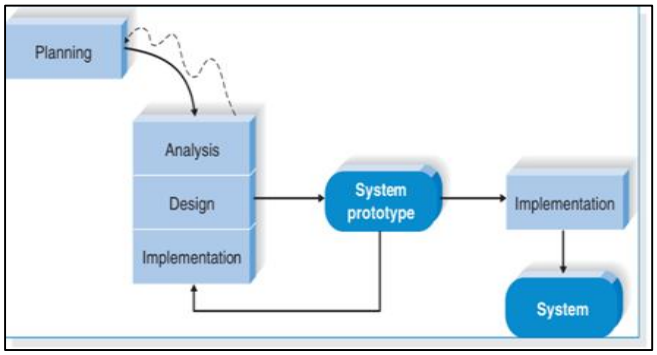

Fig. 1 *System Prototype Model*

Figure 1 shows the prototyping processes with the phases within the model. This model consists of the planning phase, analysis phase, design phase, implementation phase, and system prototype in developing a system. The following subtopic will cover the steps in more detail.

3.1 Planning Phase

The planning phase is the first phase in the prototype model. It is a foundation for the starting process of system development. Problem statements, objectives, and scope of the system related to the caregiving of dementia individuals are the main aspects that should be laid down and approved for the direction of the web-based dementia care monitoring system. This statement is supported by Dailey J, who states that "parts of the planning process would include the assessment and approval of project requirements, as well as resource allocation" [11]. In short, the planning phase is a way to identify if the project will be able to provide value to the users, who are family members and caregivers.

3.2 Analysis Phase

In the analysis phase, a clear understanding of the system's requirements is achieved to fulfill them. Requirement gathering from caregivers and family members of dementia individuals is essential as it determines what functionalities and features will be developed in the system. The requirement-gathering method used in the project is interview sessions and questionnaires. Data gathered from these two methods will be analyzed to determine if the system functionalities are relevant and if additional features, such as the checklist, need to be added to the system. The interview and questionnaire results will also help design the context diagram, Entity Relationship Diagram (ERD), and Data Flow Diagram (DFD). Besides that, an analysis of the technologies used in development, which are hardware and software, is crucial. This is to ensure that the hardware used in developing the system is compatible with the software and to prevent malfunctions during the system's development process.

3.3 Design Phase

After completing the previous phase, the design phase proceeds to acquire the hardware and software needed for the system design and starts the design process for the structure and layout of the system. Each component, like wording, images, and buttons within the system, is appropriately arranged so that the final output is user-friendly and easy on the eyes. For example, the system's functionality involves the navigation system and the input and output to family members and caregivers. In contrast, the system's design involves the color palette, text font, and images used. In this case, a wireframe would be the most suitable method for imagining the system's prototype design. It serves as a sample mock-up system for visualization and as the prototype of the finalized system.

Low-fidelity prototyping was chosen to develop the prototype as it can quickly create the web-based system's structure. The wireframe of each interface will be visualized and drawn on Figma, an online tool that provides features for the organization of the layout and navigation of the system. This prototyping process is a vital element in the designing phase as it allows the developer to continuously make changes to the design of the web-based system according to the family members' and caregivers' feedback. It would result in the enhancement of the usability of the system and the flow of data within the system.

3.4 Implementation Phase

The implementation phase is where the coding and implementation of features in the system are done based on the chosen programming language and tools. This phase requires the utmost focus and attention as it determines the final output of the system. As stated in the previous chapter, the system was developed through Visual Studio Community IDE, which connects to the SQL server database to satisfy all user requirements. Each system module is developed from the back end for functionalities and then connected to the database for data storage. Ultimately, the front-end design will complete the aesthetic and user engagement system. Finally, initial testing of each module in the system is conducted after completion of the system development to ensure the features in the system are functioning normally.

3.5 Testing Phase

The testing phase begins immediately after the initial prototype is developed. In this phase, users thoroughly test every feature and functionality of the prototype for defects. Testing is done three times during the development process in the order of the prototype cycle, the second prototype cycle, and finally, after the proposed system is completed. This is to ensure that interfaces and navigation button links are working as usual and to avoid any disruption to the performance of the system functionality. Feedback regarding the system is also collected for its continuous improvement [12]. Once the system is completed, a full system test will be conducted to check for bugs. Any bugs or glitches in the system are determined and fixed in the shortest time.

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4. Result and Discussion

This section discusses the analysis and user interface design used in developing the proposed system. Sections 4.1 to 4.3 will contain system analysis focused on Context Diagram, Data Flow Diagrams, and Entity Level Diagram. Next, section 4.4 will discuss system requirement analysis that covers functional and non-functional requirements and user requirement analysis

4.1 Context Diagram

This diagram will cover the overall functionalities of the system. Besides that, the context diagram shows interactions between the user with the system and the data movement within the system. The arrow in the diagram represents the input and output of data moving from user to system and vice versa. Figure 2 explains the interaction of two entities, the user and the admin, with the system. The user can log in and out, add assessments, journals, photos, appointment information, and reminders, and send inquiries to the admin in the system. The user will receive the input records when requested. On the other hand, the admin is responsible for managing user accounts, viewing the graphs that monitor the number of user inputs, and responding to user inquiries.

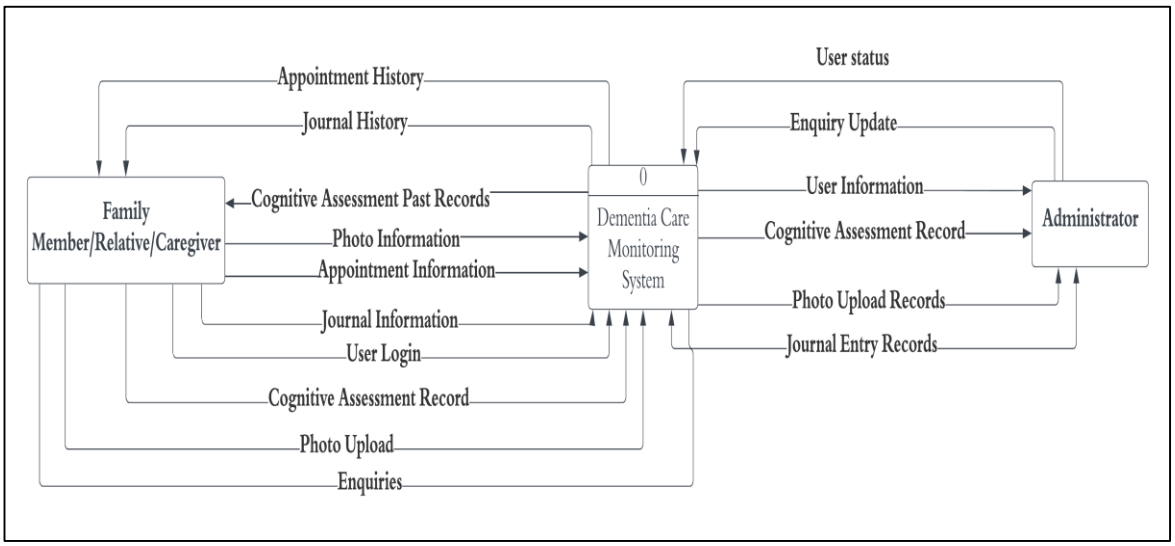

Fig. 2 *Context Diagram*

4.2 Data Flow Diagram (DFD) Level 0

A Data Flow Diagram represents data flow more easily through graphics. The diagram is used to display the main processes in the system, the components of the system, and how each component interacts with one another in each process. Each process is differentiated from the others through a numbering system. Figure 4.2 shows the proposed system's Data Flow Diagram (DFD) Level 0. The design has seven processes: registration, login, cognitive assessment, journaling, photo viewing, appointment scheduling, and reminder.

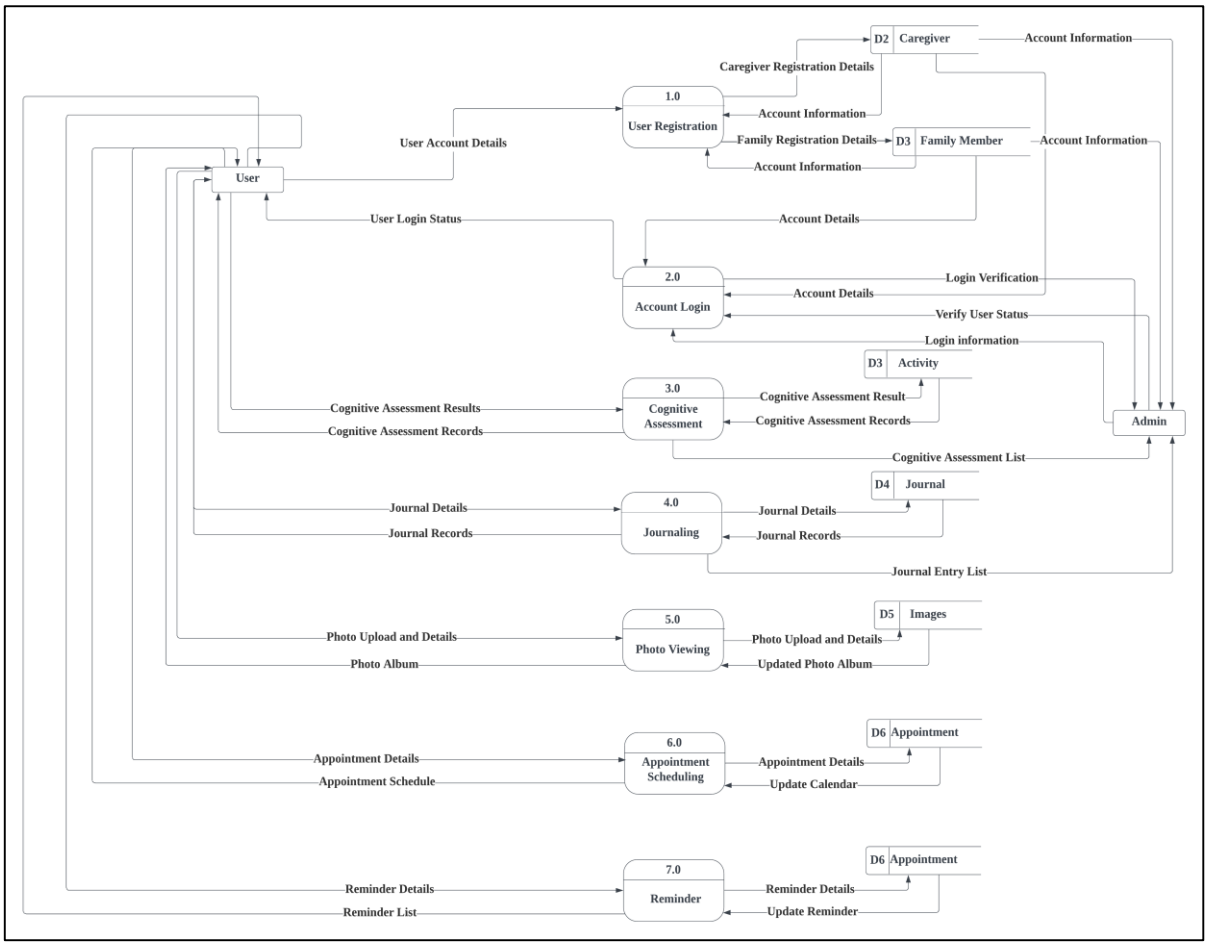

Fig. 3 *DFD Level 0*

4.3 Entity Relationship Diagram (ERD)

The connection between entities is depicted in a model named Entity Relationship Diagram (ERD). Defining entities, attributes, and relationships between entities and features will help construct a logical database structure. This diagram helps document and design a database. Figure 4 shows the Entity Relationship Diagram for the proposed system.

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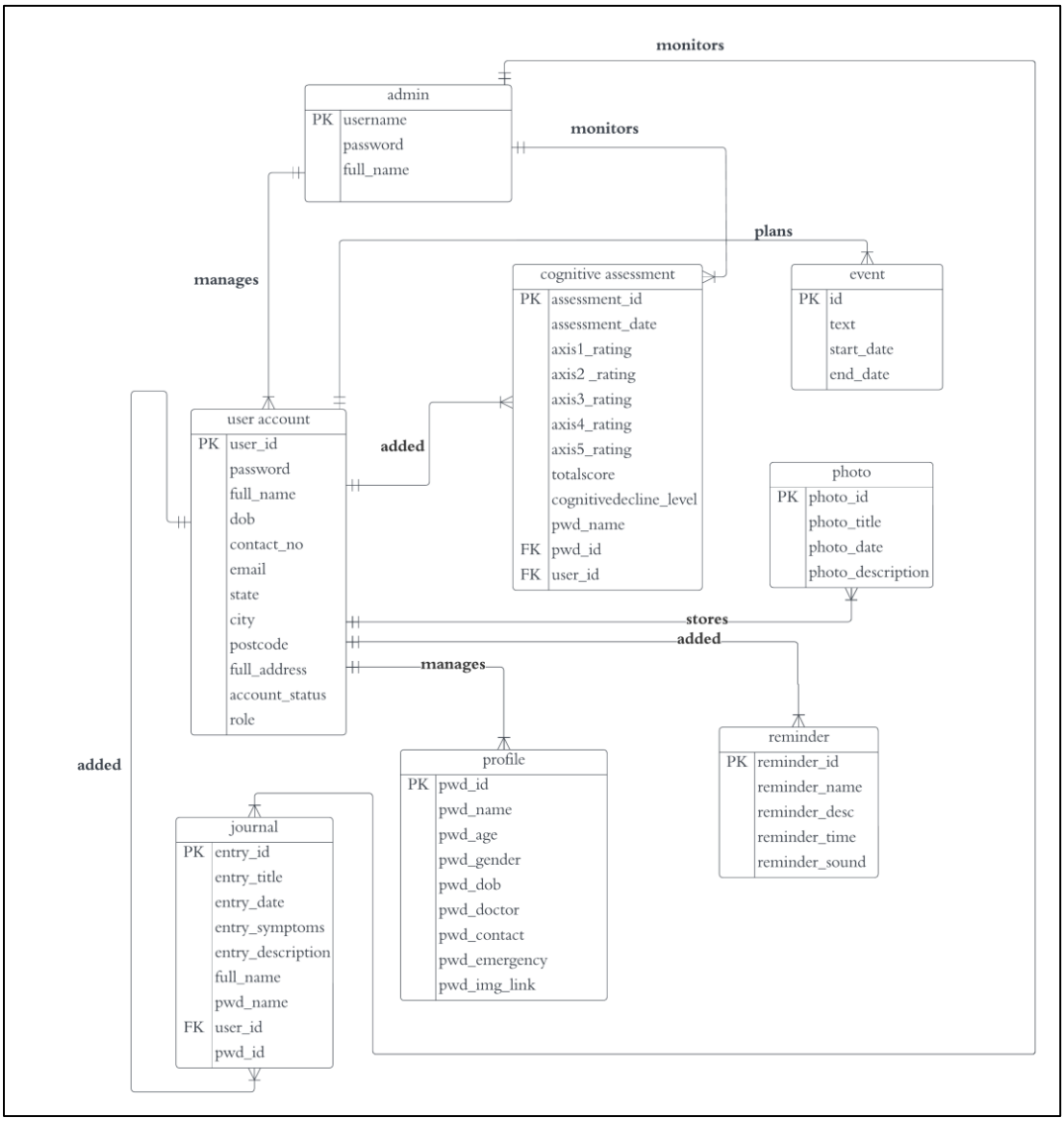

Fig. 4 *ERD Diagram*

4.4 Functional and Non-Functional Requirements

Requirement analysis refers to determining the needs and requirements of the developed proposed system [13]. System requirements need to fulfill two types of requirements, which are functional and non-functional requirements. Failure to meet either of these requirements will result in the system being unable to work properly or meet the user's requirements.

Functional requirement depicts the functionalities of the system. It tells the functions that must be implemented to accomplish a particular task. This requirement focuses on the user's requirements of the system. Table 2 outlines the functional requirements of the proposed system.

Table 2 *Functional Requirement of the proposed system*

No	Function	Functionality
1.	Register	Allow caregivers, family members, and relatives to register for an account by entering personal details.
2.	Login	Allow users to log into the system using a user ID and password.
3.	Cognitive Assessment	Allow users to add weekly or monthly cognitive assessments into the system.
		Allow users to view past entries entered into the system.
4.	Journaling	Allow users to add daily journal entries into the system.
		Allow users to view journal entries.
5.	Photo Album	Allow users to upload images into the system.
		Allow users to view the images after upload.
6.	Reminders	Allow users to add and view any reminders that are added to them.
7.	Appointment Scheduling	Allow users to add, edit, and delete appointments into the scheduler.
		Allow users to view the appointments after adding.

A non-functional requirement is the description of how a specific system should perform. This requirement focuses on the user's expectation of the system. It benefits the system's growth in terms of usability and reliability. The non-functional requirements of the proposed application are shown in Table 3.

Table 3 *Non-functional Requirements of the Proposed System*

No	Requirement	Functionality
1.	Performance	The system is accessible at any time.
2.	Operational	The system will only operate with an internet connection.
3.	Security	The system should be protected from unauthorized access.
4.	Cultural and political	The system should work on any web browser.

4.5 Implementation of Module and Testing

This section will cover implementing and testing the Web-based Dementia Care Monitoring System. This web-based system was developed using the software Visual Studio Community 2019 and the ASP.NET framework. Visual Studio Community 2019 is an integrated development environment that allows users to write code to

create web applications. The backend code is stored in the .aspx.cs extension file and is responsible for the overall webpage functionalities and buttons. In contrast, the front-end code stored in the .aspx extension file will display the user interface.

Otherwise, system testing will be split into two types: Functionality testing and User acceptance testing (UAT). The functionality testing ensures the system works smoothly without errors with the buttons, drop-down lists, and switching between pages. The UAT testing gathers users' responses who test every system module. Then, the users will rate whether each module's functionality and features work correctly and meet their requirements.

4.5.1 Database Connection

Based on Figure 5, the code illustrates that the namespaces are imported, which will allow developers to start connecting to the database. The functionality of System. Configuration is used to access configuration settings like connection string in the web. config file, System.Data allows developers to retrieve and execute SQL commands using the System.Data.SqlClient is responsible for connecting to the SQL server database. Figure 6 shows how the connection to the SQL server is opened and configured before inserting SQL commands.

```
7   using System.Configuration;
8   using System.Data;
9   using System.Data.SqlClient;
```

Fig. 5 *Packages declared for the SQL server configuration*

```
string strcon = ConfigurationManager.ConnectionStrings["con"].ConnectionStri
using (SqlConnection con = new SqlConnection(strcon))
{
    con.Open();
    SqlCommand cmd = new SqlCommand("INSERT INTO Tasks (TaskText, IsChecked,
    cmd.Parameters.AddWithValue("@TaskText", taskText);
    cmd.Parameters.AddWithValue("@IsChecked", isChecked);
    cmd.Parameters.AddWithValue("@Username", username);
    cmd.ExecuteNonQuery();
}
```

Fig. 6 ***Code segment that connects to SQL server***

4.6 Implementation of Module

The web-based dementia care monitoring system consists of six modules: the user management module, cognitive assessment module, journaling module, appointment scheduling module, reminder module, and photo album module. There are two types of users: family members or relatives and caregivers. The following section will discuss the details of the module accordingly.

4.6.1 Implementation of User Management Module

Figure 7 illustrates the user interface of the system's login, sign-up, and profile page. All users must sign up for an account by filling in fields such as full name, date of birth, contact information, address, user ID, role, and password. Users will then be redirected to the login page to enter their user ID, password, and role to access the system. The profile page allows users to update their personal information.

Figure 8 illustrates the user interface of the system's admin login, dashboard, and user management page. All admins have a specific login page for their ID and password. The dashboard page keeps track of total users, assessment logs, journal entries, and the number of photos entered into the system. The to-do list below allows the admin to add any task to the system, cross it out, and delete it when completed. Lastly, the user management page allows the admin to control user account status. The choice is active, pending, and inactive according to the button's color. The delete button lets the admin permanently delete a user account from the system.

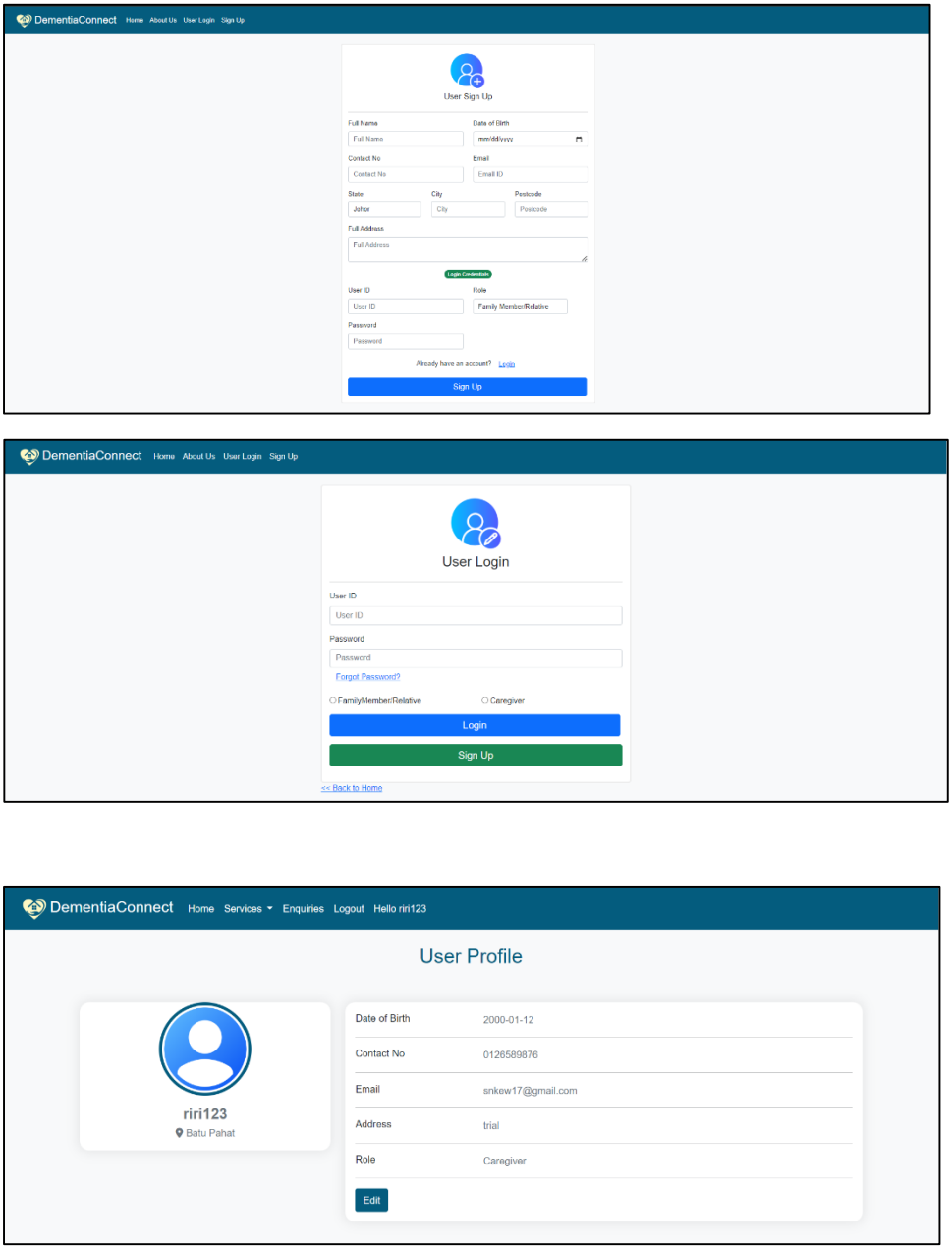

Fig. 7 (a) Interface of Sign-Up Page, (b) Sign-In Page, (c) User Profile page

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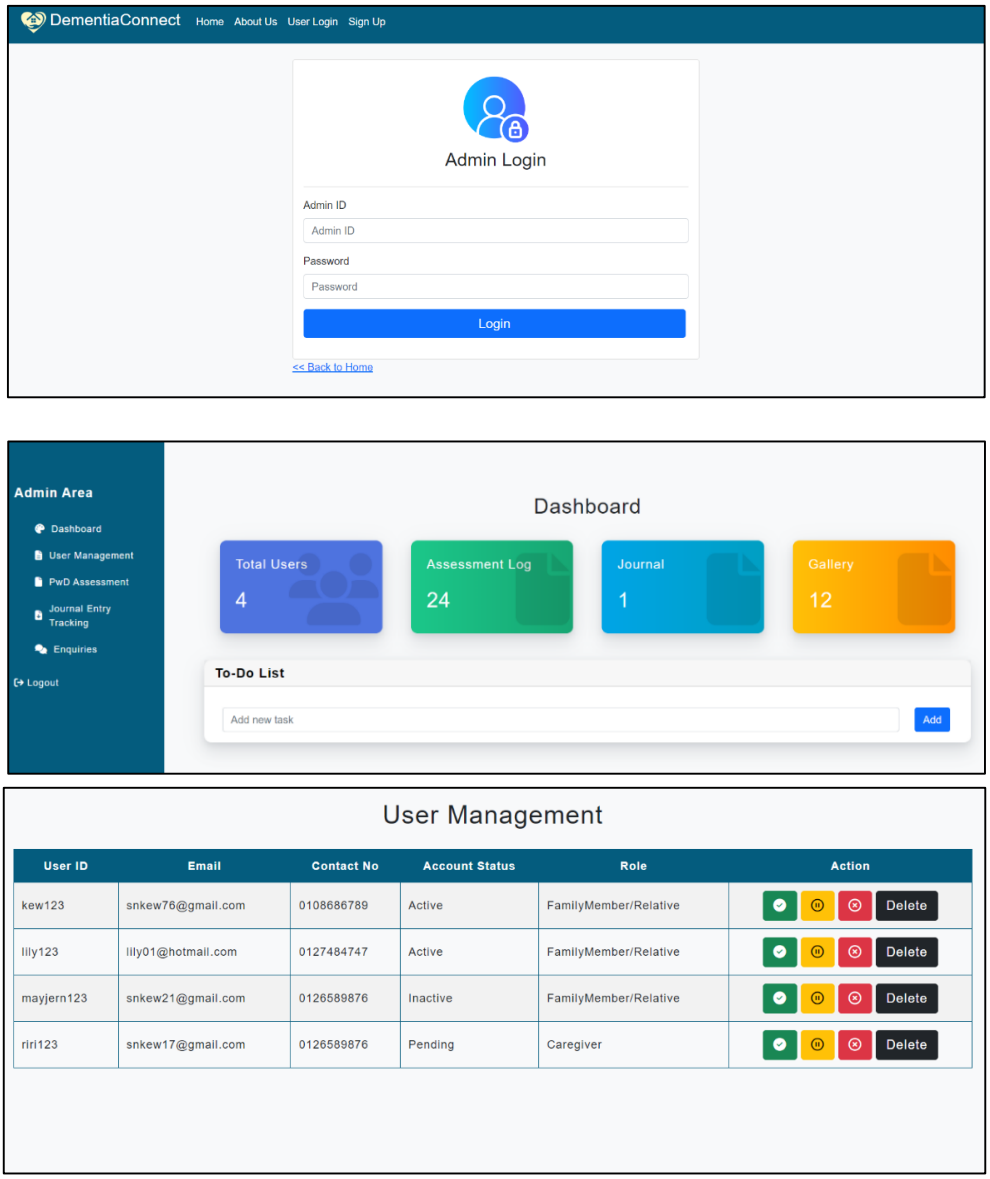
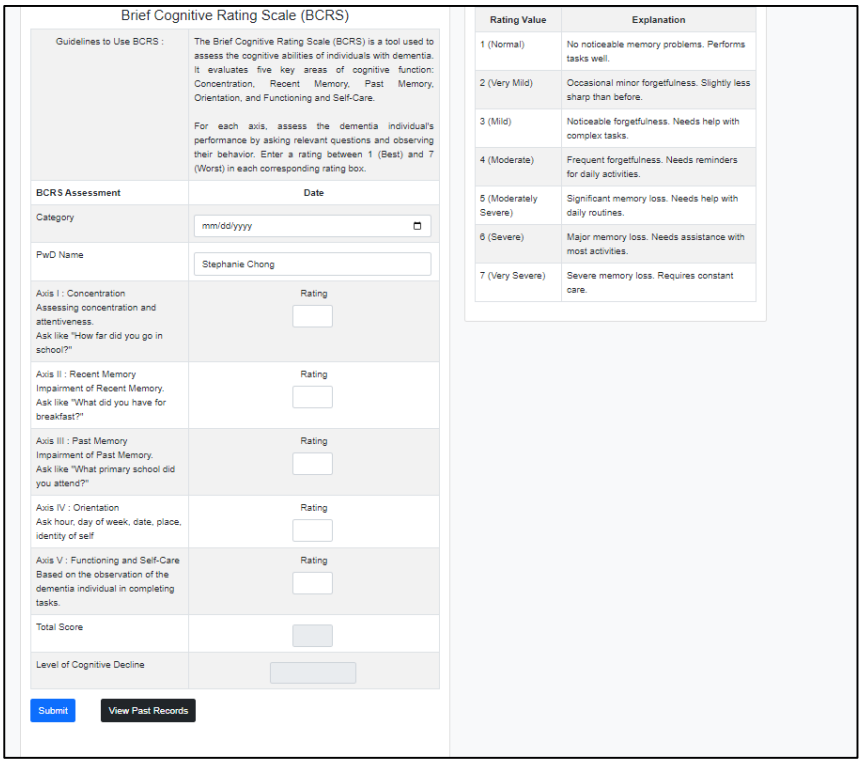


Fig. 8 *(a) Interface of Admin Login Page, (b) Dashboard, (c) User Management Page*

4.6.2 Implementation of Cognitive Assessment Module

Figure 9 illustrates the user interface of cognitive assessment and the past records page of the system. The user needs to add a new record weekly or monthly by filling out the date, PwD name under their care, and the five rating scores of the assessment. After clicking the submit button, the severity level for dementia is displayed, along with suggestions on how to better care for dementia individuals. The user can also view previous records entered by pressing the view pass records button and searching for a particular record or printing previous records to consult with a general practitioner or doctor for medical advice.

Figure 10 shows the admin's interface for tracking the cognitive assessment for each PwD that is added based on the user's account. The Admin can select the PwD name to change to their respective record and hover over the graph to view the number of assessment records.



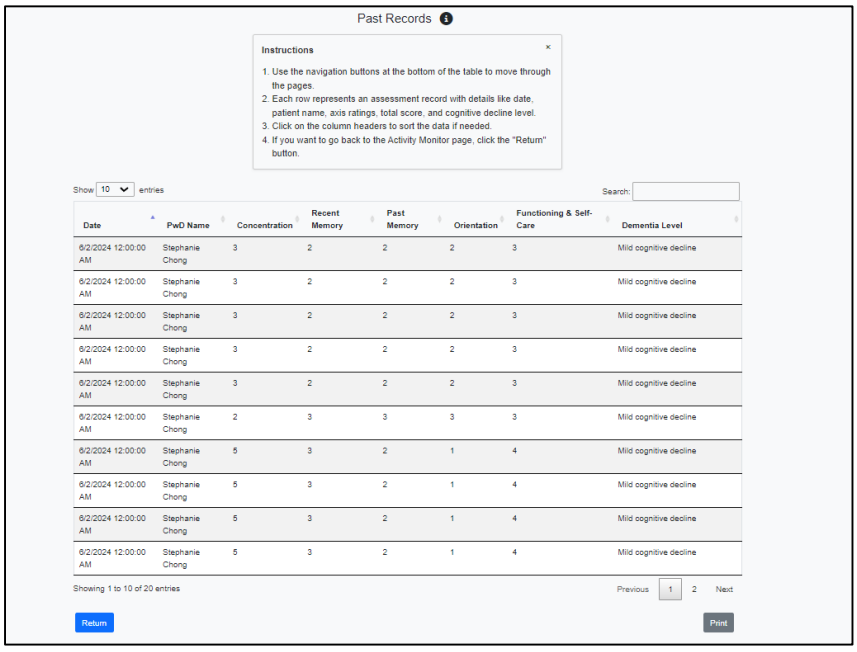


Fig. 9 *(a) Interface of Cognitive Assessment Page, (b) Past Records Page*

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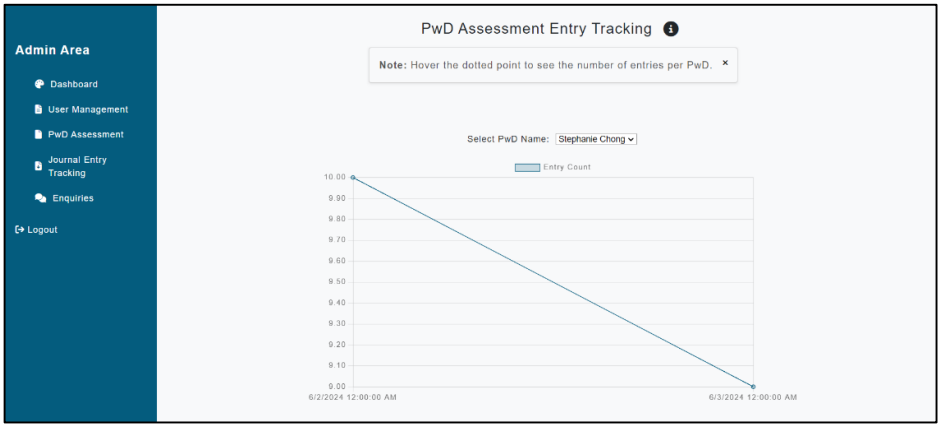

Fig. 10 *Interface of Admin for PwD Assessment Entry*

4.6.3 Implementation of Journaling Module

Figure 11 illustrates the user interface of the journaling module of the system. The user must select the PwD name and the dementia individual under their care and enter the entry title, date, behavioral and psychological symptoms, and other descriptions. Users then need to press the add button to add a new journal entry, the update button to update new details of the journal entry, and the delete button to delete any journal entry. The records of past journal entries are displayed on the right side of the journal entry form.

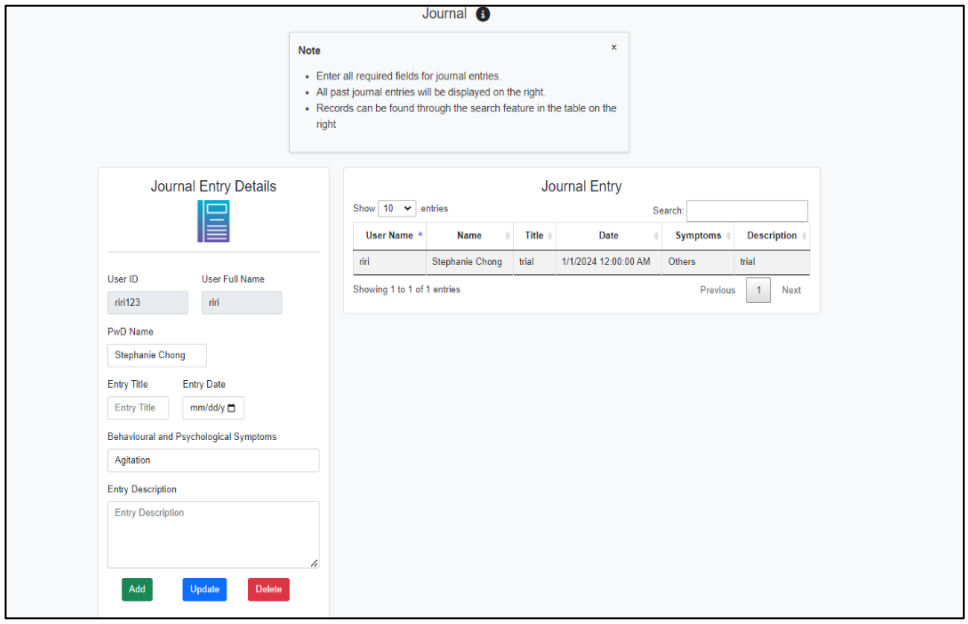

Fig. 11 *Interface of Journaling Module*

4.6.4 Implementation of Appointment Scheduling Module

Figure 12 illustrates the user interface of the appointment scheduling module, adding appointments to the calendar and deleting appointments from the calendar. The user can add appointments by dragging them down from the start of the column date until the desired time. Then, a panel will appear to ask users to input the appointment description and change the appointment time or date. Pressing the save button will save the appointment description into the database and display it on the calendar. Other than that, users can also edit a saved appointment by double-clicking on the appointment and renaming or deleting the appointment.

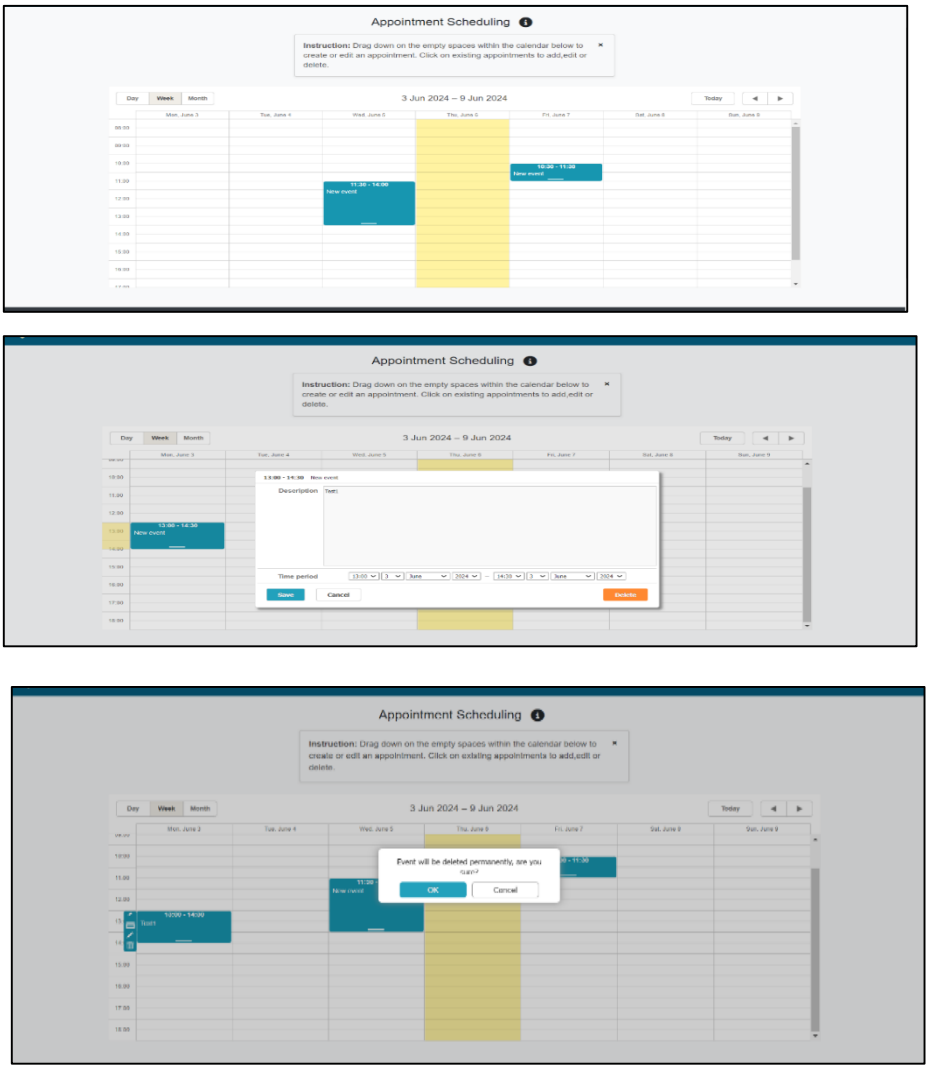

Fig. 12 *(a) Interface of Appointment Scheduling, (b) Add appointment, (c) Delete Appointment*

4.6.5 Implementation of Reminder Module

Figure 13 illustrates the user interface of the reminder module of the system and the add reminder feature. The user can add a new reminder by filling in the required fields, such as the time, ringtone, name, and description. Then, after pressing the Save Reminder button, the reminder is saved to the alarm list on the right side of the form. Reset Settings button clears the current user input. In the alarm list on the right side of the page, the user can start the reminder, edit it, or delete it based on its button.

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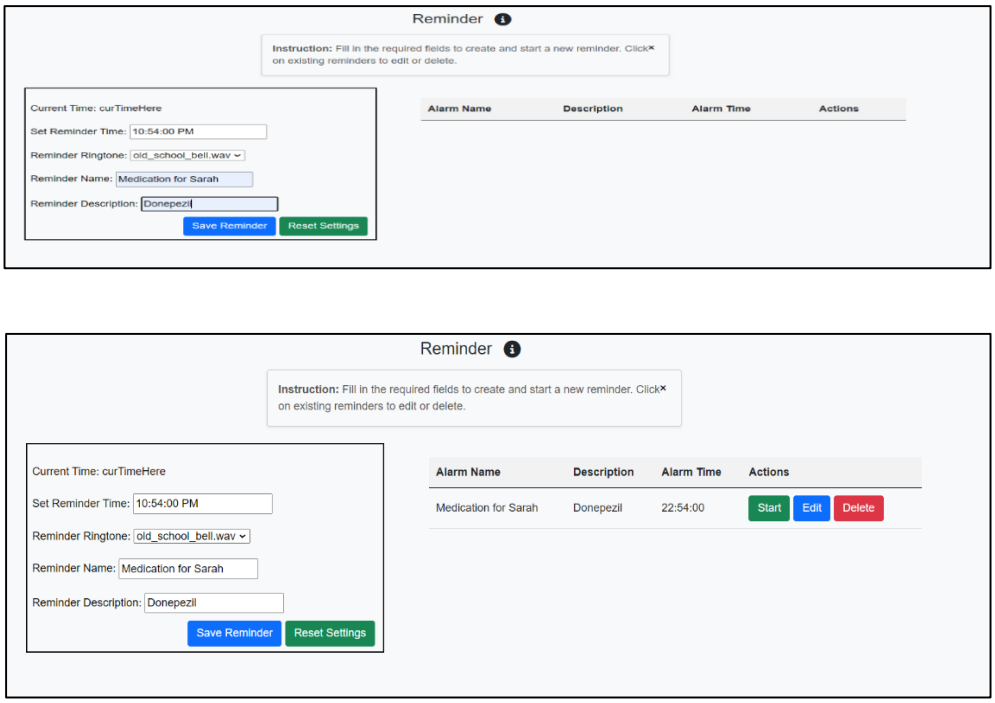

Fig. 13 *(a) Interface of Reminder Module, (b) Add reminder*

4.6.6 Implementation of Photo Album Module

Figure 14 illustrates the user interface of the photo album module of the system. The user can add a new reminder by filling in the required fields, such as the time, ringtone, name, and description. Then, after pressing the Save Reminder button, the reminder is saved to the alarm list on the right side of the form. Reset Settings button clears the current user input. In the alarm list on the right side of the page, the user can start the reminder, edit it, or delete it based on its button.

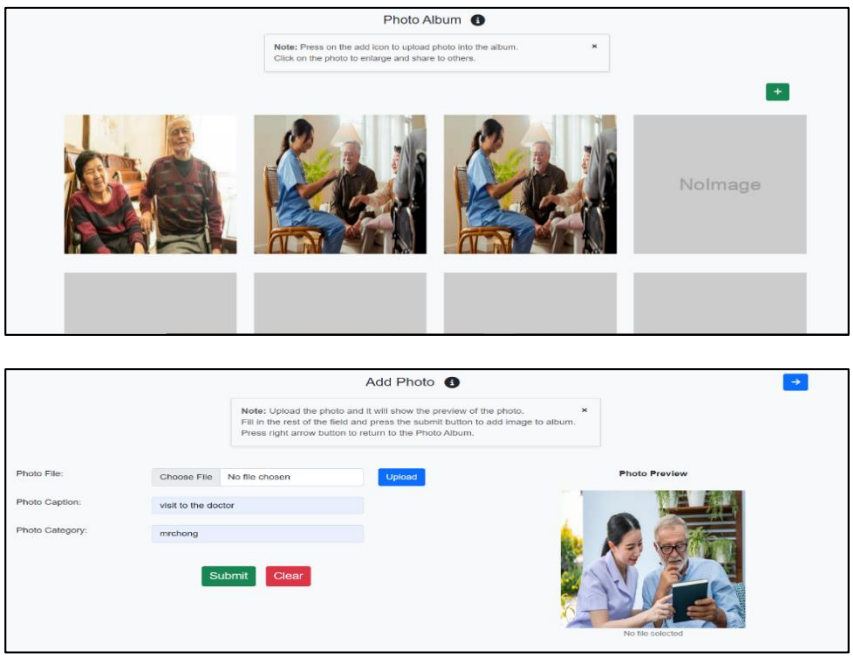

Fig. 14 *(a) Interface of Photo Album Module, (b) Add and Upload Photo*

4.6.7 Implementation of Enquiry Function

Figure 15 illustrates the user interface for user-side inquiry and admin-side inquiry. The user can submit a new inquiry by filling in the required fields: name, email, category, and message. Then, after pressing the submit button, the inquiry is sent to the admin. The close button will return to the system. The admin side can view all the details the user sent to them and update the issue status by selecting the drop-down list and entering a message.

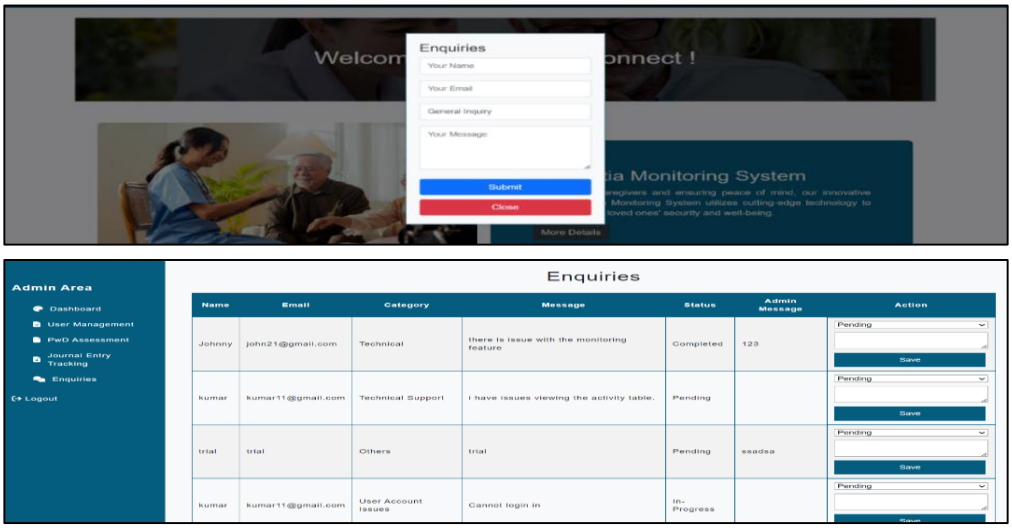

Fig. 15 *(a) Interface of User-Side Enquiry, (b) Admin-Side Enquiry*

4.7 Testing Plan Result

A test plan is defined as a document that outlines the verification and validation of the overall system under several test cases. It helps developers to determine potential bugs and hidden defects in the system before releasing the system [14]. The test plan results of the proposed web-based dementia care monitoring system for user and admin are shown in Tables 4 and 5.

Table 4 *Test Plan Result for Functionality of System on User Side*

No	Functions	Expected Result	Actual Result
1	Sign-Up	i)Create a new user account	Pass
	i)Enter personal information in all fields.	ii)Display an error message if there is empty input for some field.	Pass
	ii)Press the Sign-Up button.	iii)Alert message if the account with the same user ID exists in the database.	Pass
2	Login	i) Successfully log into the account and view the home page.	Pass
	i)Enter the user ID and the password details.	ii)Display an error message if there is empty input for some field.	Pass
	ii) Press the Login button.	iii)Alert message if the account does not exist or if entered a wrong password.	Pass
3	Cognitive Assessment	i) Display an error message if there is empty input for some field.	Pass
	i)Enter all relevant fields.	ii) Display the calculated cognitive level correctly.	Pass
	ii)Press the Submit button.	iii) All care suggestions are displayed correctly according to the cognitive level.	Pass

Table 4 *Test Plan Result for Functionality of System on User Side (cont)*

4	Journaling i) Enter all relevant fields. ii) Press the add, update, or delete button.	i) Display an error message if there is empty input for some field. ii) The grid view table displays all journal entry records correctly. iii) The journal entry information can be updated and deleted.	Pass Pass Pass
5	Appointment Scheduling i)Drag down a date to create a new appointment for the date. ii)Add a description to the appointment. Change the time and date if necessary. iii)Press the delete button to delete an appointment.	i) All appointments added to the system are displayed correctly. ii) The pop-up panel for adding a description to the appointment appears and asks for input. iii)The appointment details are saved in the scheduler and database even after logging out of the account.	Pass Pass Pass
6	Reminder i)Enter all required fields. ii)Press the Save Reminder button. iii)Press the Start button to start the reminder.	i) All alarms and their details added to the system are displayed correctly in a list. ii)Display an alert message for any empty fields. iii)The alarms can start and ring on the time set and be deleted if the reminder is incorrectly set.	Pass Pass Pass
7	Photo Album i) Click the images to enlarge them. ii)Click the add icon button to add images iii)Upload and enter the relevant fields to upload to the album.	i)All photos are displayed in 4 columns and can be enlarged. ii) The Add Photo page displays an error message if the photo caption or photo category is empty or no photo has been uploaded.	Pass Pass
8	Enquiry i)Add all necessary enquiry details. ii)Press the Submit button.	i) The enquiry pop-up panel appears when the button is pressed. ii) The details are successfully submitted to the admin. iii)Close the panel when pressing the close button.	Pass Pass Pass

Table 6 *Test Plan Result for Admin Management*

No	Functions	Expected Result	Actual Result
1	Dashboard i)View the updated number of total users, assessment log, journal entry, and photos. ii)Enter the to-do list in the input provided and delete it when completed.	i)Display the correct number according to the record in the database. ii) Add a new to-do list item to the to-do list when the add button is pressed. iii)Delete the to-do list item when the delete button is pressed.	Pass Pass Pass
2	User Management i) View details of all user accounts. ii) Press the active, pending, inactive, or delete button.	i) Display details of all users in the system correctly. ii) The active, pending, and inactive buttons change the user account status. iii)The delete button permanently deletes the user from the system.	Pass Pass Pass
3	PwD Assessment Tracking i)View the number of assessment entries and the graph formed. ii)Select the drop-down list to change between PwD names.	i)The graph, the details of the assessments, and the PwD name are displayed correctly. ii)The drop-down list changes names and displays the graph according to the PwD names.	Pass Pass
4	Journal Entry Tracking i) View the number of journal entries and the graph formed. ii)Hover over the graph to check the entries.	i) The graph, the details of the entries, and the user ID are displayed correctly. ii)Display an alert message if the graph is not generated and displayed.	Pass Pass
5	Enquiry i) View user enquiry. ii)Click the drop-down list to update the status of the inquiry. iii)Press the Save button to save the status and message to the user.	i)All user inquiries are displayed correctly according to the field. ii) The options in the drop-down list and the message can be saved in the database.	Pass Pass

4.8 User Acceptance Testing (UAT)

User Acceptance Testing determines whether the system's functionalities and features are satisfactory. This testing is crucial in ensuring that the development of the system is effective in solving and providing what users want and need from the system [15]. Additionally, this testing is conducted via Google Forms so that users can evaluate and measure acceptance levels towards the functionality and features of the system. Of the 20 respondents involved in the testing, 15 tested on the family member or relative and caregiver side of the system, while 5 tested on the admin side.

Tables 7, and 8 show the assessment results of the respondents' testing on the system's family member or relative and caregiver side for functionality and features. All respondents are satisfied and highly satisfied with the sign-up and login page. Around 1 or 2 respondents feel good about the cognitive assessment, journaling, photo album, appointment scheduling, and enquiry. The overall functionality of the system meets users' requirements. Regarding the user-side features, 1 or 2 respondents feel that improvement can be made on the understanding, navigation, and interface. Therefore, changes must be made to improve the 3 aspects stated.

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Table 7 *User Acceptance Testing Result for System Functionality on User Side*

Functions	Highly Unsatisfied	Unsatisfied	Good	Satisfied	Highly Satisfied
Sign-Up	0	0	0	7	8
Login	0	0	0	7	8
Cognitive Assessment	0	0	2	8	5
Journaling	0	0	1	9	5
Photo Album	0	0	2	7	6
Appointment Scheduling	0	0	1	9	5
Enquiry	0	0	2	5	8

Table 8 *User Acceptance Testing Result for System Features on User Side*

Functions	Highly Unsatisfied	Unsatisfied	Good	Satisfied	Highly Satisfied
Easy to Use	0	0	0	7	8
Easy to Understand	0	0	2	6	7
Clear Navigation	0	0	2	6	7
Interface Design	0	0	2	7	6

Tables 9 and 10 show the assessment results of the respondents' testing on the system's admin side. All respondents were either satisfied or highly satisfied with all functionalities except for 1 respondent regarding the enquiry functionality. The majority of respondents were satisfied and highly satisfied with the admin-side features. However, there is 1 respondent who feels good about the interface design of the admin side of the system. Overall, the functionality of the enquiry section and the interface design are aspects to improve on in the future.

Table 9 *User Acceptance Testing Result for System Functionality on Admin Side*

Functions	Highly Unsatisfied	Unsatisfied	Good	Satisfied	Highly Satisfied
Login	0	0	0	1	4
Dashboard	0	0	0	0	5
User Management	0	0	0	3	2
PwD Cognitive Assessment Tracking	0	0	0	3	2
Journal Entry Tracking	0	0	0	4	1
Enquiry	0	0	1	2	2

Table 10 *User Acceptance Testing Result for System Features on Admin Side*

Functions	Highly Unsatisfied	Unsatisfied	Good	Satisfied	Highly Satisfied
Easy to Use	0	0	0	4	1
Easy to Understand	0	0	0	2	3
Clear Navigation	0	0	0	2	3
Interface Design	0	0	1	1	3

5. Conclusion

In conclusion, the system has achieved all goals and objectives set in monitoring dementia individuals. The system contains features that would assist family members and caregivers in monitoring their physical and mental health through assessment records stored in the database, journals, and photos. Besides that, the system also provided suggestions on providing better care for dementia individuals based on the severity of their dementia level.

Despite achieving the objectives, the system does have some limitations. One of the limitations is that the system is only accessible through an Internet connection. Users who stay in areas with slow or limited Internet access would experience a less desirable system performance. Another limitation of the system is its layout. The system's layout is designed to the screen size of laptop and computer screens. Users viewing the system through smartphones or tablets will display a messy or out-of-place design.

Therefore, improvements need to be made to improve the limitations stated. Modifying the code to suit other screen sizes would enhance the user experience for smartphone and tablet users. This change is beneficial as most users online would usually access systems through their smartphones and tablets for convenience.

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Conflict of Interest

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

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