Designing the User Interface of a Sleep Management System for an Elderly Population

By

Purabi Panigrahy, MBI

A MASTER'S CAPSTONE PROJECT

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Capstone Advisor

Holly Jimison, Ph.D.

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Acknowledgements

Abstract

BACKGROUND: Often the elderly people and their family are unaware of the seriousness and potential morbidity associated with sleep problems in older people, distinct from the morbidity of concurrent disorders. The paper does not intend to deliver an in depth review of sleep and sleep disorders in older persons. Rather, it presents an overview of sleep patterns of the elderly patients measured by the sensors and providing the output through any output screen and suggests appropriate evidence-based recommendations for assessing and treating sleep disorders in the older adult population.

OBJECTIVE: This capstone project is proposed to design a user interface using mock-ups (using PowerPoint) for the variety of stakeholders and perform usability testing of multiple display options. The result of these evaluations will be design guidance for developers of sleep management coaching systems. This project is related to a system and a method for improving sleep quality. It will benefit the users in learning about their specific sleep quality and receive recommendations related to their everyday behavior in layman's terms, using the displays described in this paper.

METHODS: The purpose to provide cost-effective and reliable sleep quality diagnostic and screening techniques which can be used by any end-user without special education or professional support will be accomplished by a sleep management system consisting of sensor for monitoring the physiological parameters of a sleeping elderly .The Graphical user interfaces for targeted users i.e. elderly patients, Family members and health coach. The interface mock-ups designed for the variety of stakeholders and perform usability testing and after this being tested by all kind of targeted users, their feedback will be collected and modifications or enhancements will be made to this proposed design.

CONCLUSION: This project can serve as a guide for designers for designing other user-centric sleep management systems. Based on the recommendation and suggestion these guidelines can always be modified when necessary and used for provide direction for design, for providing a better and effective GUI for the interactive devices of the sleep management system.

1 Introduction

Sleep disorders are very prevalent in elderly people, involving a disrupted sleep pattern and abnormal behaviors with sleep. Sleep quality is an important yet often overlooked aspect of health. Sleep disturbances are especially common in the elderly and affect both cognitive and physiological health outcomes by decreasing the quality of life, causing tiredness, and lack of energy[10]. Poor quality of sleep also can lead to confusion, difficulty concentrating, and poor performance on tasks. Most often sleep problems in the elderly are due to disease, environment, or lifestyle[11]. With the recent advent of new sensors for monitoring sleep in the home environment, we now have the opportunity to detect sleep problems and also monitor the effectiveness of coaching interventions. With the advent of these sleep monitoring sensors in home environment, it will help us to understand the causes of disruption of normal sleep and also to identify the times when the elderly persons have been awakened. Quality is an important aspect of a healthy lifestyle. Health-oriented programs designed to help in sleep management, not only in providing simple management techniques, but also with coaching or training. One important issue in the success and usefulness of these systems is the user interface for summarizing the monitoring and intervention adherence information for various users: elderly users in the home, coaches, family support, clinicians, and researchers.

2 Background and significance

Sleep disorders are most common among the elderly population, and the prevalence of this disease increases as the age advances[9]. Even though this is a common misconception of clinicians that this is a normal and expected but the complications that generate due to the sleep disorders in elderly people can pose important challenges to clinicians. Often the elderly people and their family are unaware of the seriousness and potential morbidity associated with sleep problems in older people, distinct from the morbidity of concurrent disorders. As a result, these issues are often under investigated or completely ignored.[1]

A Gallup survey conducted with more than 1,000 Americans aged 50 and older (43% of whom were aged 65 and older) found that 80% answered ''a great deal'' when asked whether sleep was important for healthy aging. In the same survey, and contrary to the myth that older adults need less sleep, 45% believed that they required more sleep than when they were younger, and 25% believed they had a sleep ''problem.''[3]

There are not many recommendations available to help the elderly patients, their family members and also the health care professionals' in the sleep management care practices. Although there are a large number of publications concerning sleep and sleep disorders in elderly populations, there are currently no recommendations for systematically approaching the assessment, treatment, and follow-up of sleep disorders in the older adult population.[2, 4, 5]

A sleep management system is a patient-centric tool that can strengthen patients' and caregivers' ability to actively manage their own health and health care. Although the

capabilities of Sleep management systems vary significantly in the current marketplace, they typically include provisions to capture information about an individual's diagnoses, medications, allergies, lab test results, etc. related to their sleep management. It will also provide communication tools to assist patients in connecting with various health care professionals.

The paper does not intend to deliver an in depth review of sleep and sleep disorders in older persons. Rather, it presents an overview of sleep patterns of the elderly patients measured by the sensors and providing the output through any output screen and suggests appropriate evidence-based recommendations for assessing and treating sleep disorders in the older adult population. The sleep management system user will receive daily feedback on sleep scores and suggestions to improve quality of sleep. The system and method use data processing software, feedback and coaching strategies.

3 Purpose of this Project

In this capstone project I propose to design a user interface using mock-ups (using PowerPoint) for the variety of stakeholders and perform usability testing of multiple display options. The result of these evaluations will be design guidance for developers of sleep management coaching systems. This project is related to a system and a method for improving sleep quality. It will benefit the users in learning about their specific sleep quality and receive recommendations related to their everyday behavior in layman's terms, using the displays described in this paper. This will likely play a large role in helping to improve their sleep quality. In addition, I will synthesize the findings in terms that will inform future graphical display interface designs.

Methods

The aim of this project is to provide cost-effective and reliable sleep quality diagnostic and screening techniques which can be used by any end-user without special education or professional support. This objective will be accomplished by a sleep management system consisting of sensor for monitoring the physiological parameters of a sleeping elderly user, a processor unit for analyzing data received from the at least one sensor, a user interaction device for receiving a feedback from the user which feedback in particular reflects a subjective perception of the user, and for providing information output to the user, wherein the processor unit is adapted to correlate the feedback and an objective quality of sleep of the user assessed from the data. It will be a great benefit to the users as they will learn on the sleep quality and consequently will receive suggestion from the information output which can help improve the objective quality of sleep of the user.

The physiological parameters which time spent in bed total sleep time - sleep architecture / sleep profile percentage of and duration in minutes of respective sleep stages, number of awakenings wake time - sleep onset latency sleep fragmentation sleep apnea events.

From the physiological parameters calculated above, the quality of sleep will be calculated from the individual's sleep profile, sleep efficiency, number and duration of awakenings and number of sleep cycles per night. Hence a sleep quality index will be produced as the output of the system by which a user may advantageously evaluate themselves or of their dear ones and will be able to find out which factors have influence on their sleep quality. If the system detects any serious disorders of sleep in a user then the output recommendation would be to consult a physician or any healthcare professional first.

The sleep management system will comprise a relay, which will transfer data from the sensors to the processor unit. There will be no user interaction required for the relay of data.

The Relay

The relay detects when the user enters the rooms where the sensors are fixed, and will start and stop measuring automatically.

The data storage and Processor unit

There will be data storage in the system which will store the sleep profiles of the elderly people, the processor unit will compare an actual sleep profile to stored sleep profiles of the user and/or to a standard sleep profile. By this way any deviation in the user's sleep profile can be detected. This can help any individual in detecting any sleep disturbance.

Interaction device

There will be a portable user interaction with a screen and at least one input means. The sleep data assessed by the system will be available to the end users by the interaction device. The user interaction device will preferably have larger screen for better readability of the information, feedback and coaching and this device can be touch – screen or can have button menus depending on the user's preferences. A level of processing power, storage and display resources preferably allows running sleep management software. There will be multiple ways of feedback such as text format, graphics, color coded, audio, video and speech. Use of the user interaction device is advantageously simple, as a variety of standard actions is preferably addressable in a one button manner. Active user input is advantageously possible, for example to fill in questionnaires about the subjective evaluation of the user's sleep. The following questions can serve as the initial assessment regarding sleep[12].

- What time do you normally go to bed at night and wake up in the morning?
- Do you often have trouble falling asleep at night? If you do wake up during the night, do you usually have trouble falling back asleep?

- About how many times do you wake up at night?

- Does your bed partner say (or are you aware) that you frequently snore, gasp for air, stop breathing ,ever walk, eat, punch, kick, or scream during sleep?

- Are you sleepy or tired during much of the day?

- Do you usually take one or more naps during the day?

- Do you usually doze off without planning to during the day?

- How much sleep do you need to feel alert and function well?

- Are you currently taking any type of medication or other preparation to help you sleep?

- If symptoms of a sleep complaint are indicated in this initial screening, further questions will be asked in taking a sleep history.[6]

- Do you have the urge to move your legs or do you experience uncomfortable sensations in your legs during rest or at night?

- Do you have to get up often to urinate during the night?

- How much physical activity or exercise do you get daily?

- Are you exposed to natural outdoor light most days?

- What medications do you take and at what time of day and night?

- Do you suffer any uncomfortable side effects from your medications?

- How much caffeine and alcohol do you consume each day and night?

- Do you often feel sad or anxious?

- Have you suffered any personal losses recently?

The patient's responses should indicate how to precede with any further history, focused physical examination, or laboratory investigations.

The following recommendations from the above can be used for providing recommendations/suggestions based on the data collected by the system of an individual.

Thus a compliance of the user with the recommendations can be achieved by the monitored parameters and/or by the feedback by coaching and monitoring the users in sleep times and assessing sleep quality. There will also reminders and alerts configured in the system further for getting to sleep or other recommendations for increasing sleep quality will be shown. The system will monitor the activity level in day and night daytime and if necessary suggesting good times and ideas for doing exercises. For the alcohol in takers, reminders for lowering the alcohol intake will be suggested. We visualize that by coaching the elderly people, the quality of sleep will be increased. The data intake by the system can also be available to their personal physicians to get personal advice by them. The coaching strategy will be according to the preference of the individuals.

Since this system has much user's active involvement, it should be attractive and user-friendly to a large extent. The UI of the interactive device screen should be designed keeping the end user and thus making it suitable advantageously suitable for different types of users. The users in the initial step (after Login) can enter their preferences which will be fed into the system. The input initialization will update and reviewed/updated regularly. The recommendation will be adjusted according to the user's preference.

If the data measured during nights suggest, that the underlying problem of a sleep

disturbance is a sleep apnea or a depressive episode, however, the recommendation will

be to have this checked by professional personnel for a correct diagnosis.

The significance of the quality of sleep management information has been recognized in

the health care field. How will health information reach people, including patients, health

care providers, family members, and etc? Effort is needed for the information flow

seamlessly among systems in a secure environment. The individuals will be able to

access, manage and share his/her health information with authorized health providers.

Hence an effective user interface design is essential for improving the usability of

interactive systems of the sleep management system. Creating design guidelines and

principles for this system is an emerging need due to the reality that in the current health

care environment, multiple vendor systems coexist and each of them has unique styles

and design constructs. Therefore, the UI responsibilities in the process of sleep

management interactive system design must be recognized by UI designers who work in

the related fields. In this study, a prototype of the UI design for the interactive devices of

the sleep management will be created to demonstrate how constructing and integrating of

intuitive graphic design is carried out, and how to make interactive devices of the sleep

management system more user-friendly by incorporating patient's daily sleep related data

into personal health decision making and medical care. How time consuming and

problematic a system is depends largely upon its user interface design. How well a sleep

management system serves its functions in a complex care environment is the direct

result of an interface that is designed to collect, organize, and display patient information

in a manner that is meaningful to clinicians at the point of care, consistent, and aligned

with cognitive workflows.

4 Assumptions

This study operates a number of assumptions, described below:

- Since the medical institutions, health insurance system and health-related education in the United Sates cannot represent all such institutions in the world, the research results and theories used in this report cannot be completely applicable in other countries and areas.

- There should be some universal principles and guidelines that are applicable to all medical care places.

- The prototype only demonstrates how the guidelines could be applied to a sleep management record design process.

- With the change in location and time the principles and guidelines should be adjusted according to the situation.

- This study is conducted to explore how to visually and logistically design a better experience for sleep management system users, so legal and financial issues will not be addressed in the prototype.

- This study doesn't conduct any research work on different backend database approaches that can be employed.

5 Scope and Limits

This study was conducted based on the following scope and limits:

- The focus was to gain more knowledge from the end user's perspective, and to guide designers to design a more user-friendly sleep management system.

- The approach used in this study was to gather information on various aspects of sleep management systems.

- The studied products and participants will be chosen in the United States of America.

- Due to time limitations, the research of developing a user behavior and thinking modern how to incorporate user's daily activities into personal health decision making and medical care may not be in-depth

6 Design Guidelines

While designing it should be kept in mind that the design elements should be kept consistent and simple. Certain guidelines should be followed and applied to every single item designed for the sleep management system. Emphasis should be given to integrate the disparate elements to look like parts of a cohesive whole. Definitions should be clear, as well. Throughout development, definition statements allow the designer to decide if potential features and behaviors make sense. The user interface needs to provide users a simple and user-friendly way to locate information. Since the sleep management system is a user-centric system, all information and data should be organized and displayed in the manner so that it can be easily read and understood by the users. This will benefit the users from using this system.

Design process

The first stage is to establish what exactly is needed with the key issues explored; the hierarchies of tasks and goals will be laid out. User interaction interfaces will be developed according to the sequence of use. Then from the scenarios, a prototype of the user interface will be developed. When the design is completed, the product must be created and deployed. In this study, only a prototype will be created to demonstrate how the design principles and guidelines are applied in sleep management UI design. In this research phase, this product is studied. The issues reported introduced after the deployment will be studied and analyzed. Further, design criteria, including principles and guidelines are generalized from the analysis of primary user research. Based on the

analysis, the development will start from the requirements concentrating on what the system is eventually expected. The next activities will concentrate on how the system will provide the services from it, which requires an architectural design which will provide a decomposition of the system description and this will allow integration of separate components later. Based on the detailed design, which is a refinement of the architectural component description provided by the architectural design, a prototype will be developed and evaluated by user testing. In the end, the conclusions will be summarized, and recommendations will be made based on the testing results.

Branding

The display of the sleep management application should emphasize the brand identity and core principles of the organization or company.

The origins of branding were reflected in the American Marketing Association (AMA) 1960 definition of the brand, which focused on tangible brand attributes as points of differentiation: "A name, term, sign, symbol or design, or a combination of them intended to identify the goods and services of one seller or group of sellers and to differentiate them from those of other sellers." The logo should be placed at the very top of each page, leveraging all of the credibility and power through its recognizable design and wording. In addition, the logo is effectively displayed throughout the system illustrating "what it is," "how it works," "who we are," and "who use it," the features, and pictures implying good care. This will make the site professional and motivational through the consistency in its layout, navigation and aesthetics values.

A good branding logo for our sleep management system should deliver the message clearly, confirm the credibility, connect targeted prospects emotionally and motivate the consumer.

Content Types

There should be proper differentiation of content types from general content to current page by using text, colors, contrast, or graphic cues. By clearly distinguishing between different types of contents, a designer is able to intentionally guide the users through a pre-determined hierarchy of information.

Preferences

The Users should have the ability to adjust their privacy preferences. The patients should be given the option to adjust their account setting to safeguard their privacy. For an integrated sleep management system, both the credibility and performance can be upgraded by account settings to assists patients with decision making. By providing options in account and privacy settings, the sleep management system will gain more credibility and achieve a higher performance.

7 Registration process

An integrated sleep management should process identification information in a secure and timely manner. Always Privacy and confidentiality are the most primary concerns for any health information exchange system. Hence care must be taken during user registration and identification and it needs to be processed in secured steps with clearly stated rules and procedures. An illustration of registration process should be provided to encourage users to register. While registering, users should be constantly informed which step they are at in the registration process. The system administrator should keep the users informed about the process and they should be available during their working hours to help the users for any issue or help they seek.

8 UI design

On accessing the application, the users will be prompted with login screen for entering user id, password and user type. The user type will be "patient"; "Family" and "Health Coach" and user have to choose the appropriate user type from the drop down list. If the user doesn't choose the user type then the login screen will provide a user friendly error message.
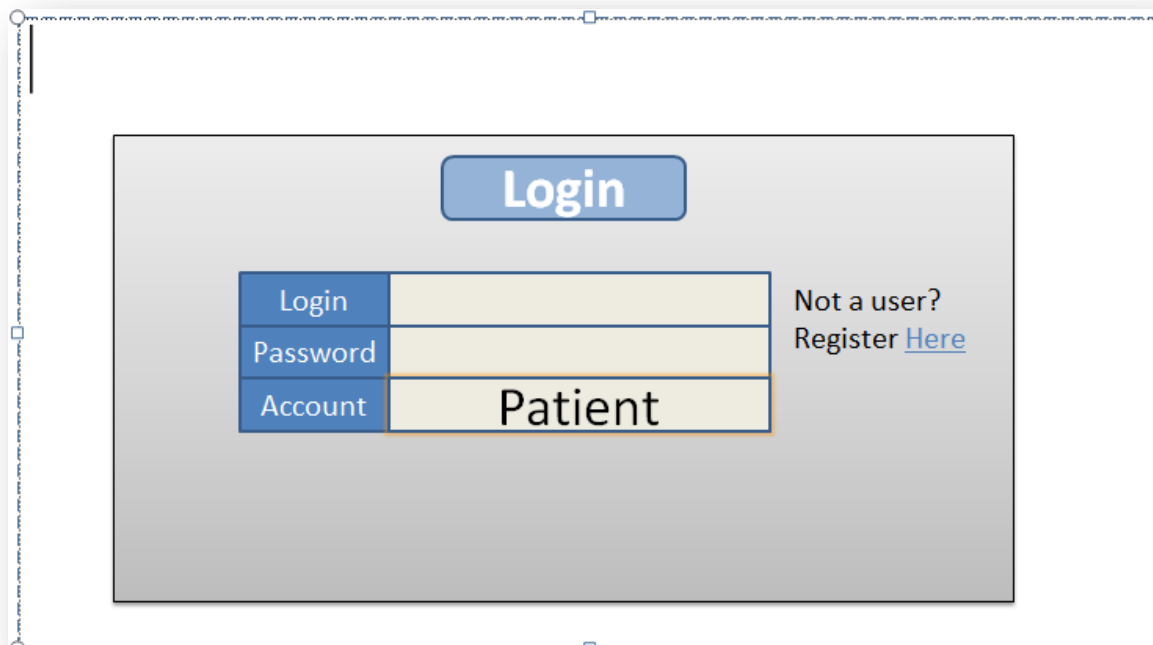
Figure 1 Login Screen

After entering the credentials and selecting the correct the system will check if all of them are correct (UserId and Password).If any of them is wrong, then the system will prompt for re-entering/correcting the credentials.

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After n (where n = 1, 2, 3……) times of wrong trial, the account will be locked. If the account gets locked then the system admin can get this resolved again. After validating the credentials, if they are correct, then login will be successful.

8.1 **UI for Patient**

For older people, too much complex UI designs can create confusions to the utilization of the application itself. Hence the proposed designs are simplified and this will reduce irrelevance information and functions as much as possible.

After the login of a patient is successful, the user will land in the Home page of the application.
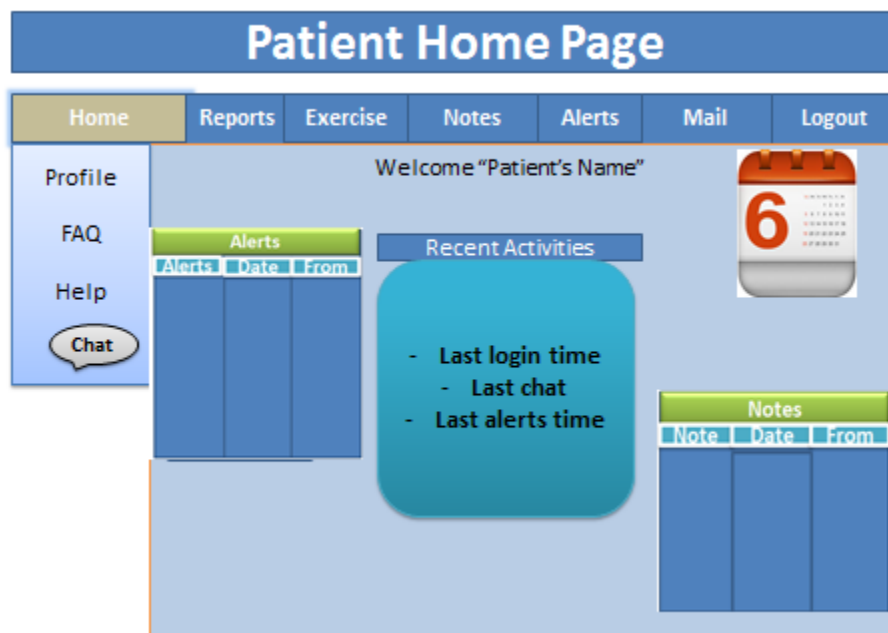
Figure 2 Patient's Home Page

Details of the main tabs and sub-tabs

Home Page

The homepage is the most important page. It will help the users find what they need.

They will also serve in offering an easy access to recent activities.

The "Home" page will be the default landing page. This page will have the following

placeholders:

- **Alerts:** All the new alerts since last time user logged, will be listed.

- **Mail:** All the new email messages since last time user logged will be listed.

- **Recent Activity:** All the recent activities of the user will be listed.

- **Welcome message:** The top of this page will have the welcome message for the user.

- **Calendar:** There will be calendar showing the system date being highlighted.

Reports

The reports provide the sleep data or any other reports associated with sleep of the elderly

patients. The sleep management system depends upon reports of sleep records to monitor

the sleep statistics of the elderly community and to provide the basis for sleep

management action. This report page can serve as the guide for timely action by the

health coach and the family members of the elderly patients and this teamwork will make

possible important benefits in sleep management.
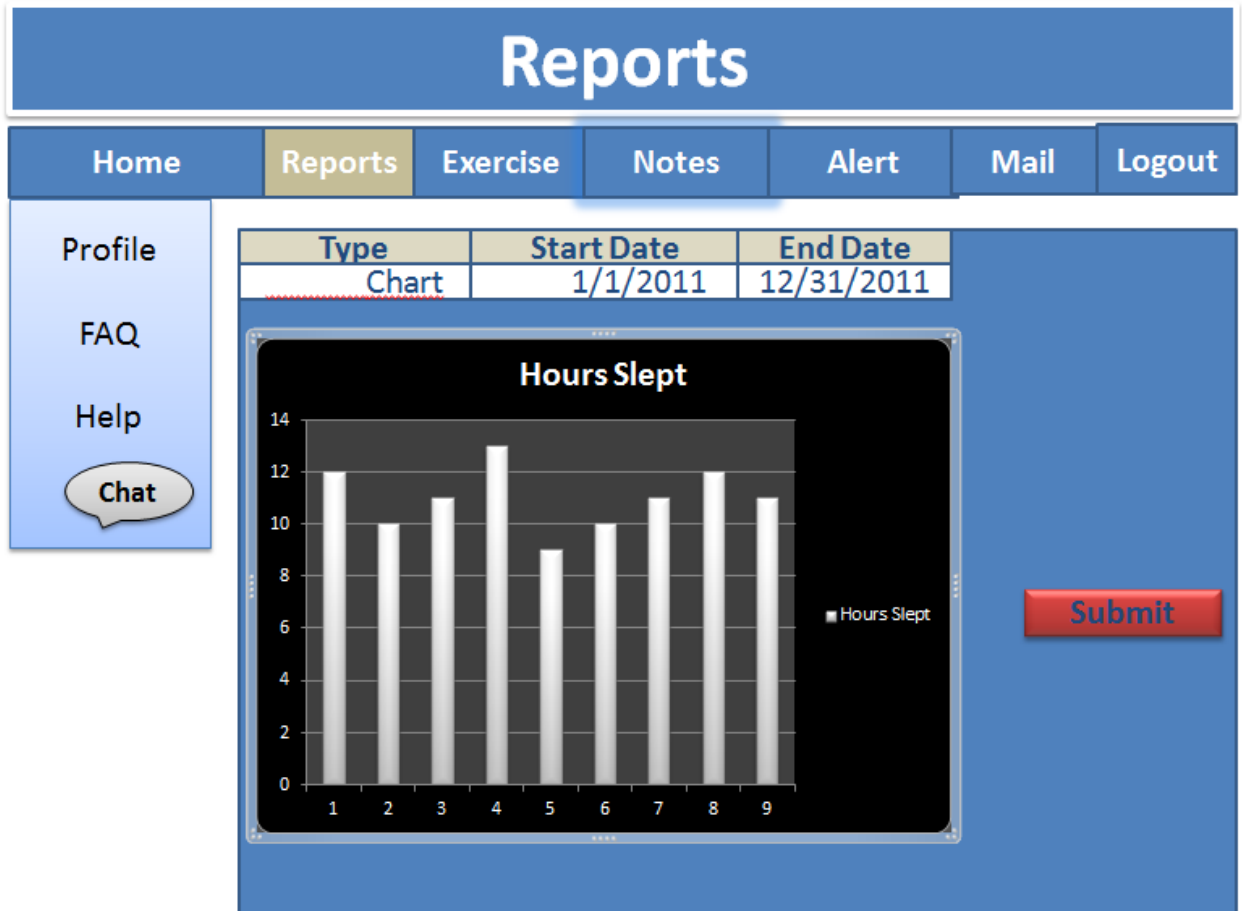
Figure 3 Patient's Report Screen

The contents of the page will be:

- The end user can view the sleep statistics in a format as per their preferences (Graphs or charts) for a selected period date range with the "start Date" and "End Date". The "Type" box will have drop down list contain "Graph" and "Chart" options. Once the User clicks "Submit" button, the desired report will be pulled out and displayed in the UI.

- By default, this page will display the records of recent 15days in the form of chart. Hence by default the "End Date" will the system's date and "Start Date" will be 15 days ago from the End date and the "Type" will be Chart.

It provides a general idea of the pattern of the elderly people while in sleep mode whether they are awake or asleep by interpreting their movements, helping us track things like how long it takes them to fall asleep, how long they sleep, and interruptions to their sleep during the night.

Graph

Chart

Figure 5 Patient's Sleep trend in chart

Exercise

Exercises play a vital role in sleep management. Timely physical exercise can reduce stress and anxiety as well as improve sleep. Hence this feature has been included in our sleep management system. The patients will assigned some goals related to physical exercise and their daily stats will recorded.

This page has 2 sub tabs: 1.Activity and 2.My stats
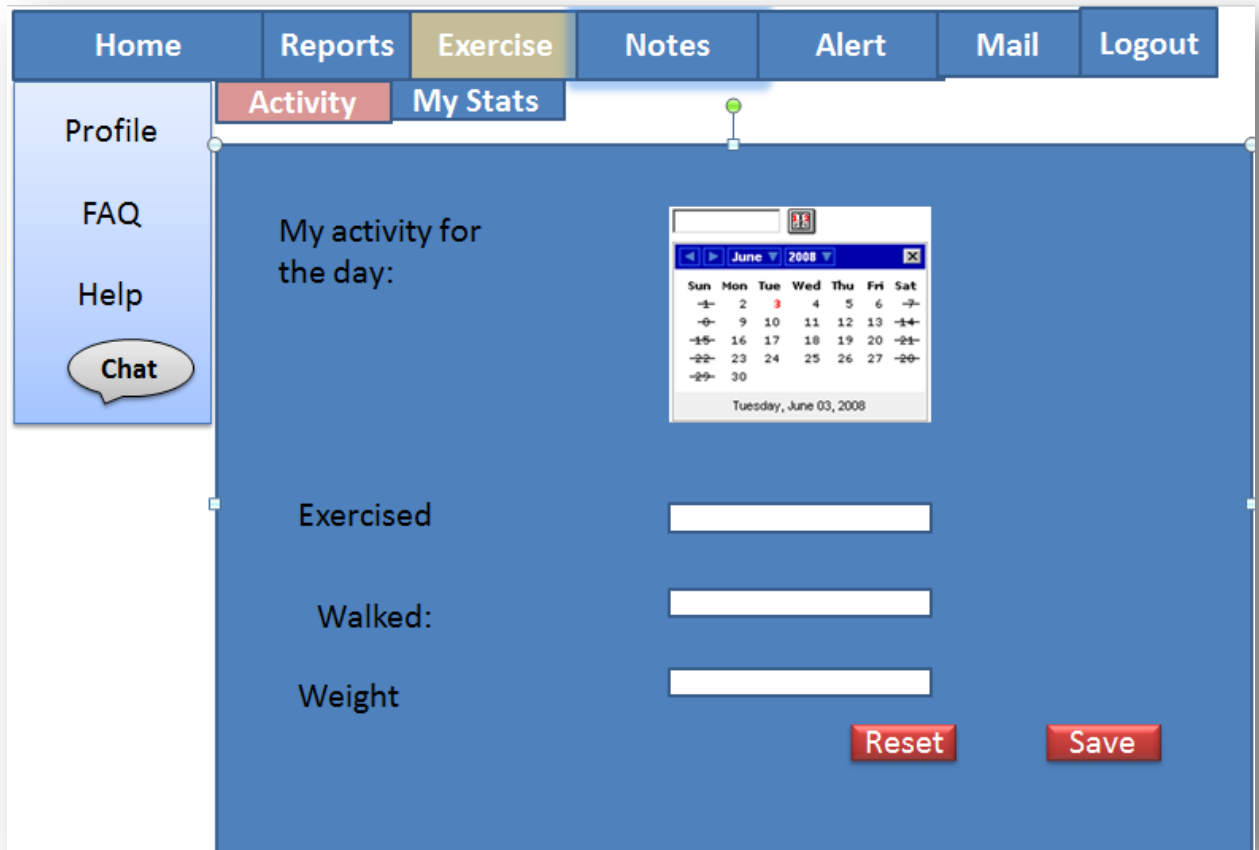
Figure 6 Patient's Exercise Screen

This page will have the following contents:

- By default, this page will provide the screen to enter the data related to exercise for the current date (System's date). Once the user enters the values, they need to save the data by clicking on "save" button. The "Reset" button will clear the values entered. The user cannot enter the data for future dates but they can change the values of previous date.

- The sub tabs "My stats": clicking the tab will provide the exercise statistics since the user has registered.
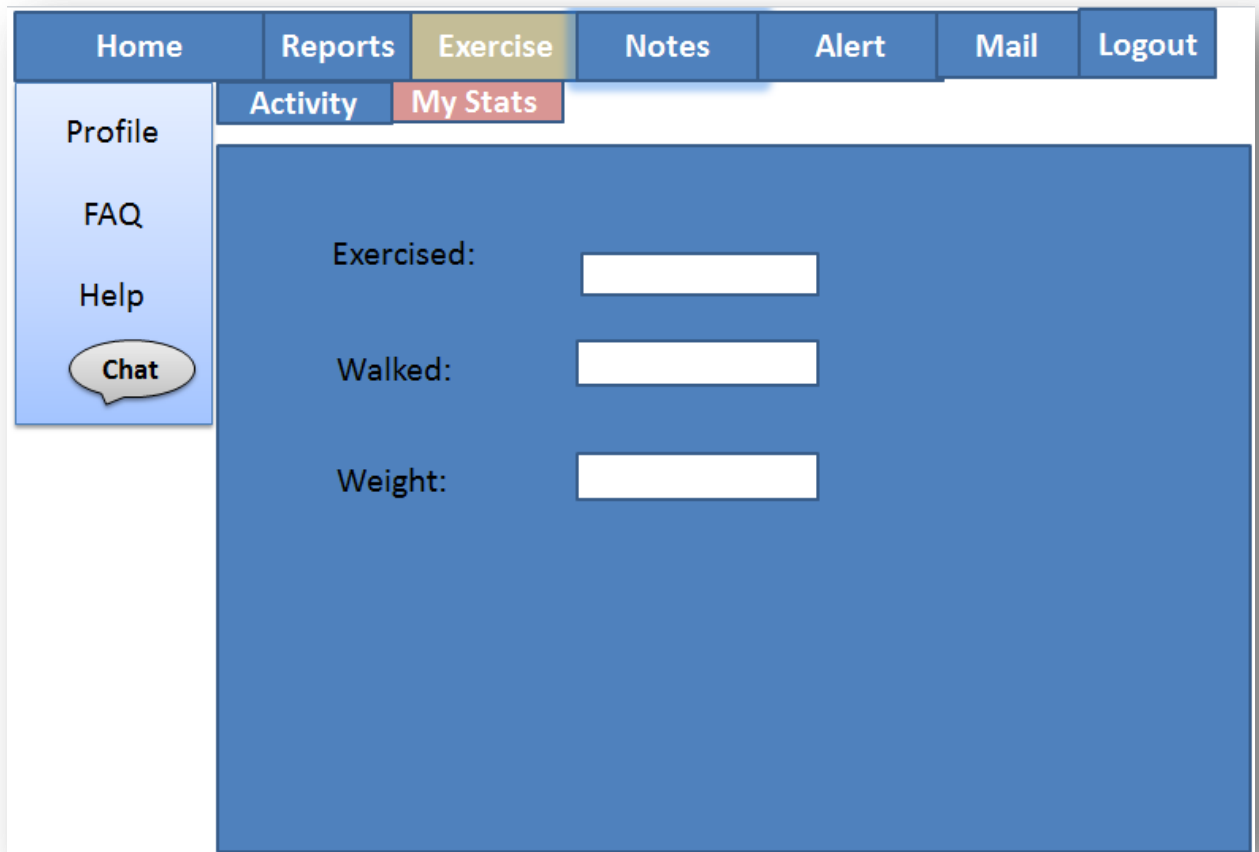
Figure 7 Patient's Exercise - My Stats - Screen

Notes

Notes can serve as kind of medical record where the users will record about clinical status or achievements during the course of treatment. Through this feature the notes can sometime serve as reminders to the respective users and will help them in achieving better quality. They should be readable and concise and must be flexible enough to logically convey to others. Notes not meant for a user will not show up.

This page has two sub tabs: 1.View Notes 2.Add Notes
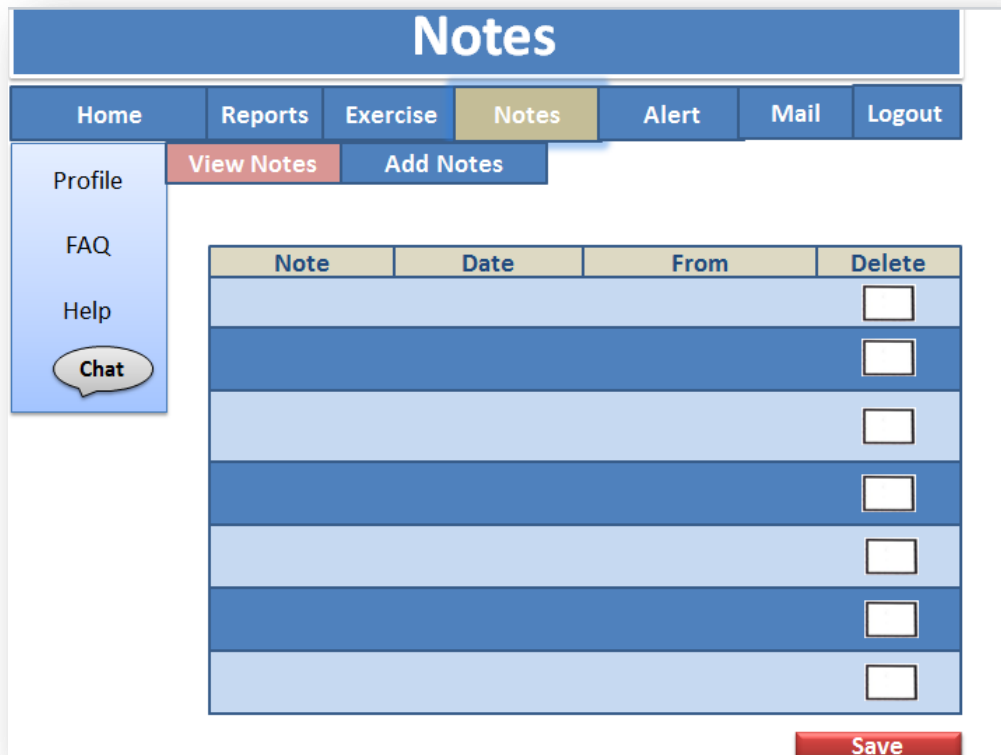
The contents of the "View Notes" page are:

- The "Note" column will have the first few words of the note.

- The "date" column displays the date the note is meant for.

- The "from" column displays the name of the initiator.

- The "Delete" column has check boxes. If the user can delete the desired notes by clicking on the check boxes. The changes will be implemented by clicking "Save" button.

- Clicking on the notes will show a pop-up displaying the exact note.

  There will be a Sub-tab: "Add Note" for adding note.

Add Note

This feature will allow the user to Add note.

The content of this "Add Note "page are:

- There will be a text box "This is a note for:" .The user will be given with option to choose Self/Health Coach/Family from the drop down list.

- The next field is for "Add your note here". The user will be entering his/her note here.

- By default the "Date" will be always the Current date. But the user has the option to edit /choose any date from the calendar, by clicking the calendar icon near the textbox.

- All the values entered will be saved by clicking the "save" button.

Alerts

Alerts help in focusing to the needs of the patients that may have slipped between the cracks and insures that the patients get what they need. Alerts are commonly used to support time-sensitive care. This Alert page designed has two Sub tabs: 1.View Alerts and 2.Add Alerts.

View Alerts

Through this feature, the user can view the Alerts with the latest being in the top of the list. The user will also have the ability to order by priority also. This completely depends on the preferences of the user.

Figure 10 Patient's Alert's Screen

The contents of the "View Alerts" page are:

- The "Alerts" column will have the first few words of the note.

- The "date" column displays the date the Alert is meant for.

- The "Priority" column displays the severity of the

- The "from" column displays the name of the initiator.

- The "Delete" column has check boxes. If the user can delete the desired Alerts by

  clicking on the check boxes. The changes will be implemented by clicking "Save" button.

- Clicking on the notes will show a pop-up displaying the exact Alert.

- There will be a Sub-tab: "Add Alert" for adding Alert.

Add Alerts

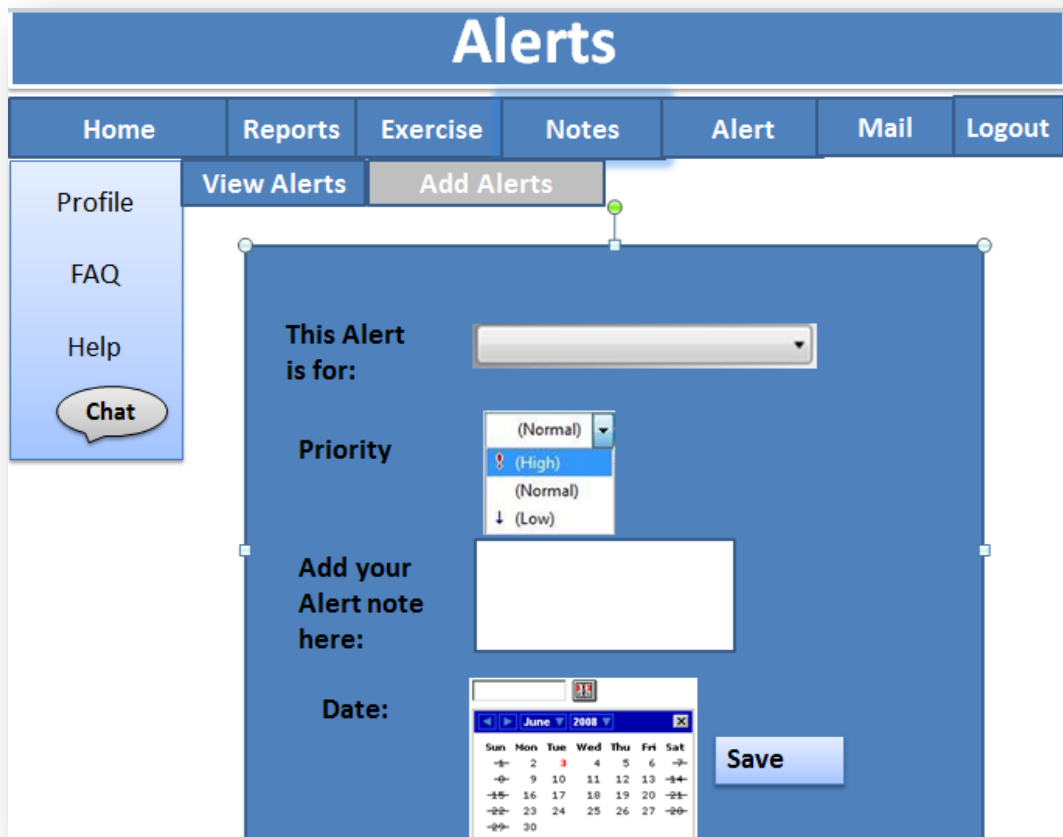This feature allows a user to add alerts. The content of this "Add Alert "page are:

Figure 11 Patient's Add Alert Screen

- There will be a text box "This is an Alert for:" .The user will be given with option to choose Self/Health Coach/Family from the drop down list.

- The next field is for "Add your Alert note here". The user will be entering his/her note here.

- "Priority" provides the user to choose the severity from the drop down list.

- By default the "Date" will be always the Current date. But the user has the option to edit /choose any date from the calendar, by clicking the calendar icon near the textbox.

- All the values entered will be saved by clicking the "save" button.

Mail

This feature is a popular and most commonly-used method of communication; and can be used for coordinating healthcare appointments and attendance reminders. This will serve as two way clinical communications between health coach, patients and their family members.

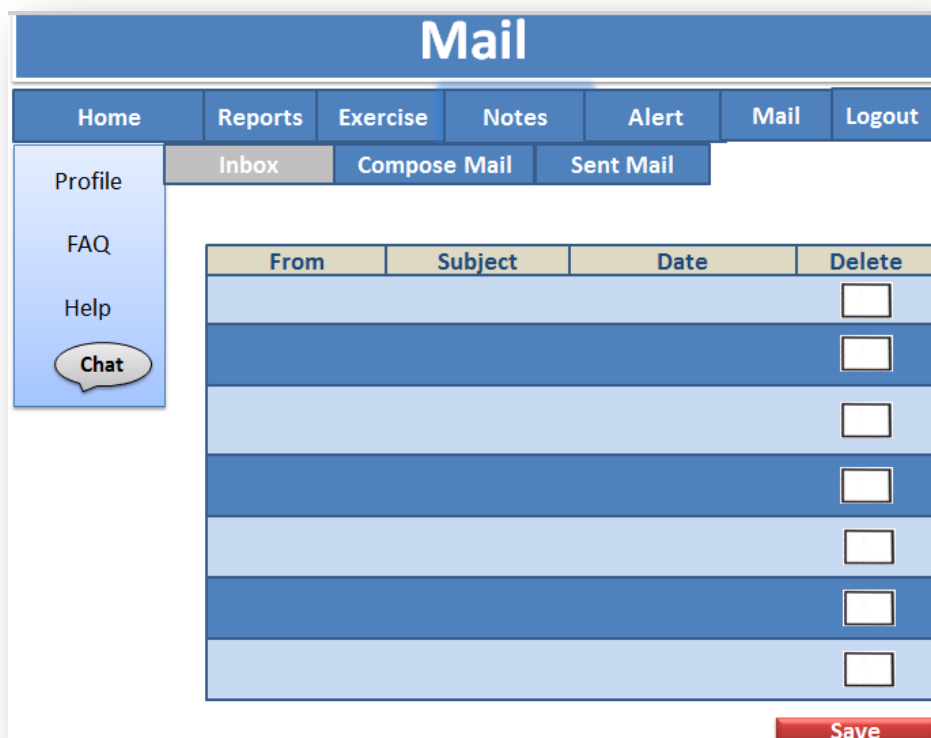This page has three sub tabs: 1.Inbox, 2.Compose mail and 3.Sent mail

Figure 12 Patient's Add Alert Screen

Inbox

With the help of this feature, the user can view the messages received with the latest unread being at the top of the list.

The contents of the page "Inbox" are:

- The "Subject" column will have the first few words of the mail.

- The "date" column displays the date the mail is meant for.

- The "from" column displays the name of the initiator.

- The "Delete" column has check boxes. If the user can delete the desired mails by clicking on the check boxes. The changes will be implemented by clicking "Save" button.

- Clicking on the subject will show a pop-up displaying the exact message.

Compose Mail

Users can send email to any intended recipients by clicking on "compose mail" tab.

The Contents of the page "Compose email":

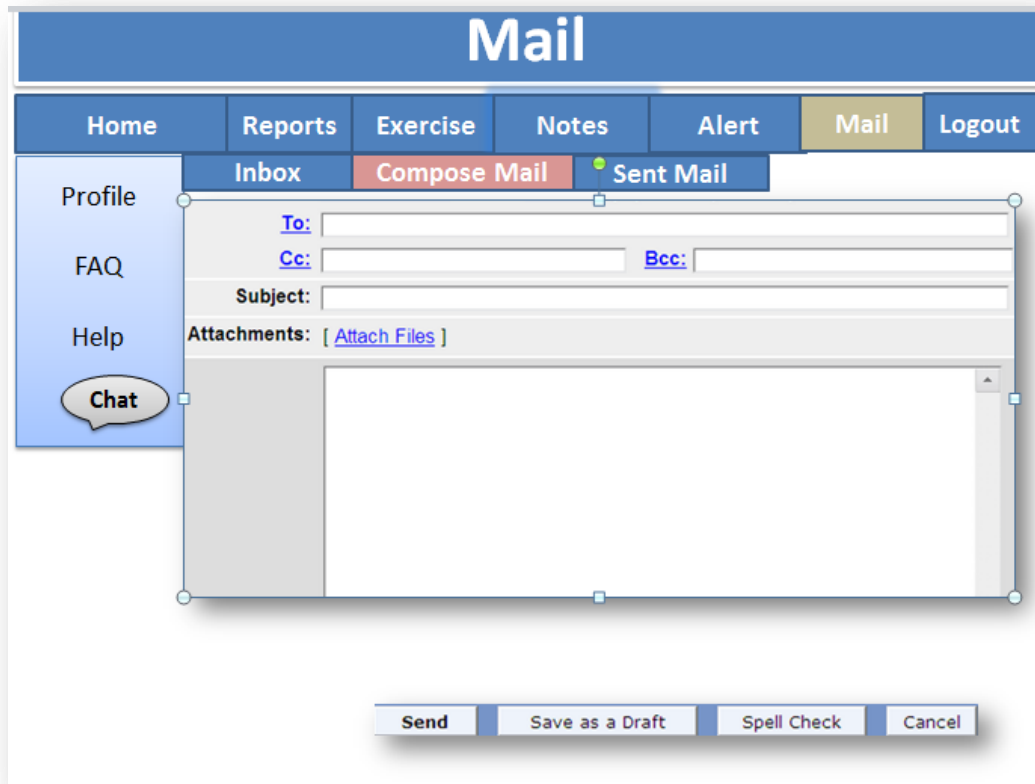**Figure 13 Patient's Compose Mail Screen**

- The "To", "cc" and "bcc" field signifies the name of the recipients.

- The "Subject" field signifies the subject of the email content.

- There will be an editor box for composing the email.

- Clicking the "Send" button will send the mail, "Save as draft" will be save the mail, "Spell check" will check the spelling of the message content" and "cancel" will cancel the mail.

Sent mail

This serves as the data to view the mails sent by a user.

The tables and fields are same those of the "Inbox"
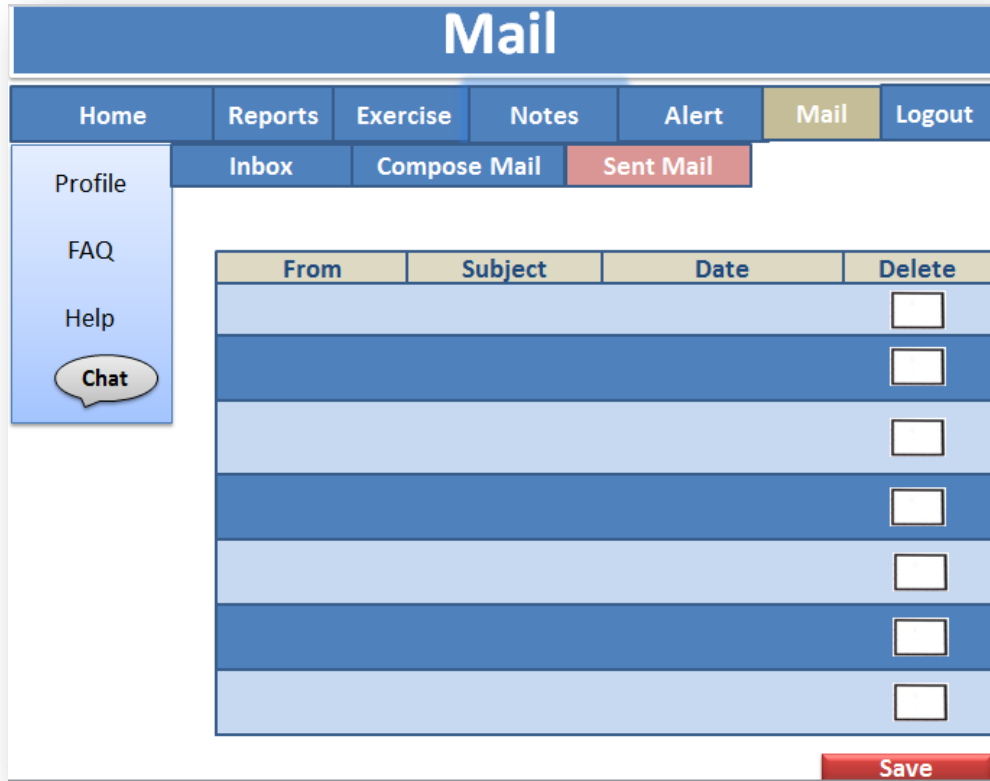
Figure 14 Patient's Send Mail Screen

Logout

When this function is executed, all the session variables that you set up for the user will be destroyed. Clicking on the tab will log off the user from the application.
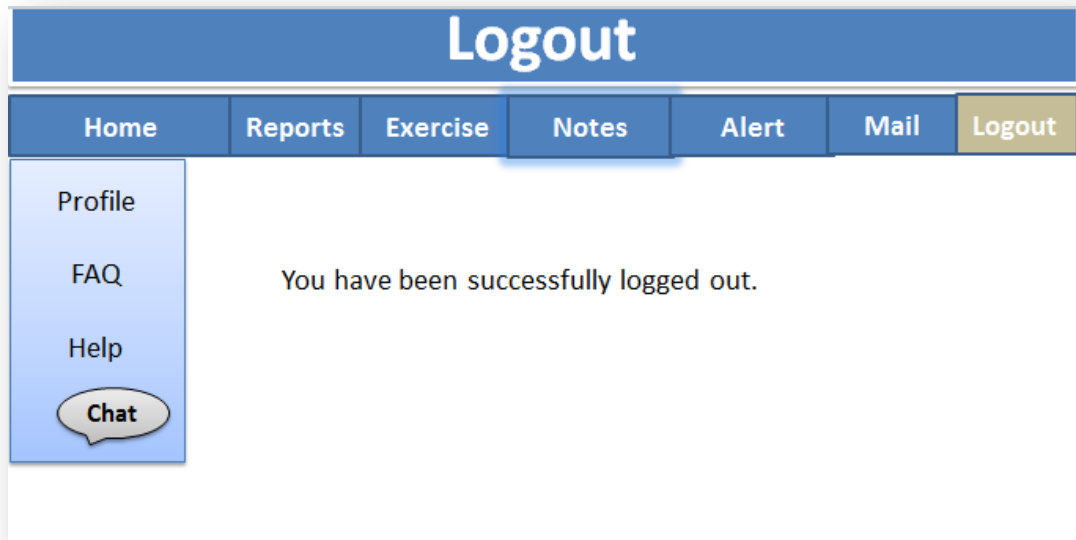
8.2 **UI for family members**

All the GUI features of the family members are almost same as those of the patient's described above. So here in this section we will describe the features which are different from the GUI of the patient's i.e. home page. Unlike the patients, the family members don't have separate main tabs for "Exercise" and "Reports" and these are consolidated in the "Home page".

Home Page

Figure 16 Family Member's Home Page

- If a family has more than one patient are enrolled in the sleep management, all of them are listed in the "Patients from your family". By default the patient recently added will be on the first in the list and also the default data in Alerts, Reports, Exercise and notes will be related to the patient in the first in the list. So when click on the patient in the list, all the related records will be pulled out and displayed.

- The "Notes" section displays the recent notes since last login with most recent note in the top of list for the selected patient.

- The "Alerts" section displays the recent notes since last login with most recent Alert in the top of list for the selected patient.

- The "Exercise" section has two sub tabs: "Stats" and "Goals". The family member can view the data here but cannot edit/enter any new data.

- The family members can view the sleep records of the patients in the report section.

8.3 GUI for Health coach

All the GUI features of the health coach are almost same as those of the family member's described above. So here in this section we will describe the features which are different from the GUI of the family member's i.e. home page, Alert page and notes page.

<u>Home Page</u>

Figure 17 Health Coach's Home Page

Unlike the Family member's GUI, the Health coach can update goals in the Goals sub tab of the "Exercise" section.

The "Patient list" has the same features as those of the family member's GUI except that here there is search button for searching any patient assuming that there will be a lot of patients assigned to a single health coach.

Notes

The "View notes" subpage is same as those of family member and Patient's. The "Add notes" is also same as of other's GUI except that it has separate field for "Name of the recipient". There is a search icon in the text box which will help in quick finding of the recipient. If the health coach choose any options other than self for the "This note is for" then the nest field "Name of the recipient" will be enabled.

Alerts

Figure 19 Health Coach's Add Alert Screen

The "View Alerts" subpage is same as those of family member and Patient's. The "Add Alerts" is also same as of other's GUI except that it has separate field for "Name of the recipient". There is a search icon in the text box which will help in quick finding of the recipient. If the health coach choose any options other than self for the "This Alert is for" then the nest field "Name of the recipient" will be enabled.
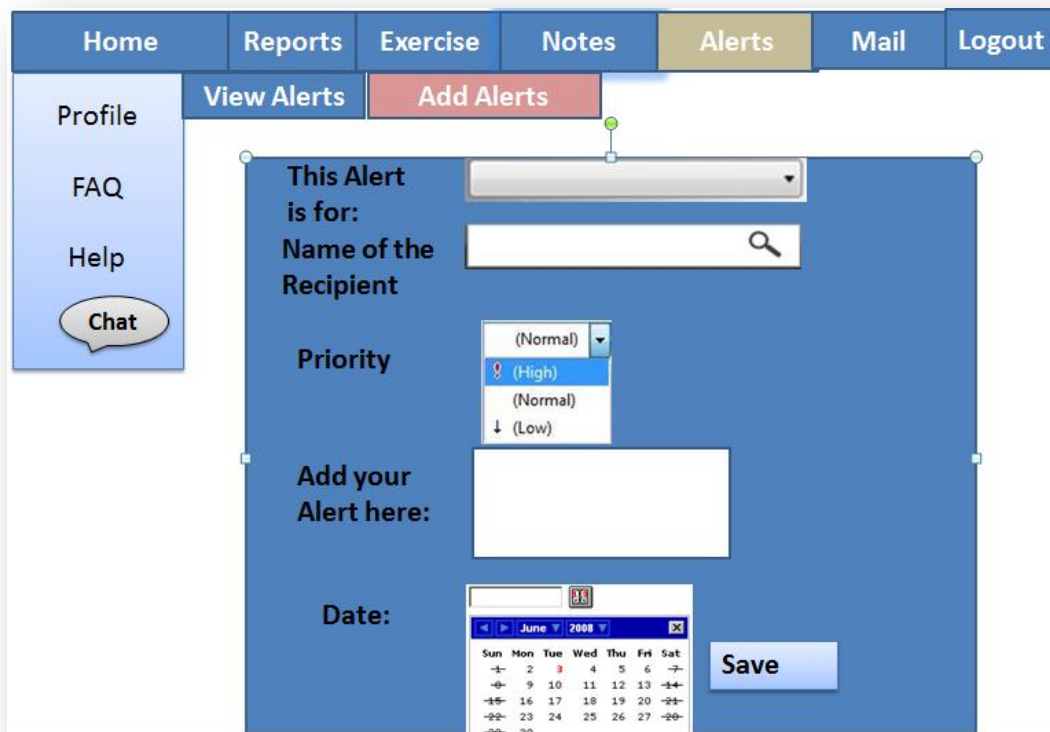
8.4 **Consistent Navigation Controls**

The use of navigation should remain consistent throughout the application unless there
are areas requiring custom control unique to a specific function.

The use of the controls and the navigation tools should be consistent, so that the end users
will find it easy to recognize the navigation tools and will help in having a better
navigation. The application should keep a set of navigation elements in the same place
throughout the site with the use of consistent wording and appearance to avoid confusion
to the end users.

Each screen will have the consistent top and left navigation set in the entire main and
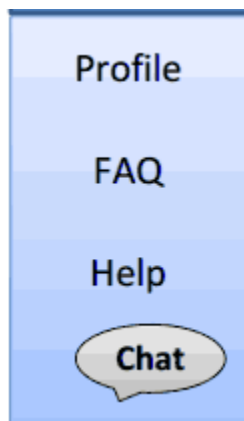Subpages.

Left navigation set:

Figure 20 Left Navigation

Details of the left navigation contents

<u>Profile</u>

The profile will have all the basic information acquired during the registration process.

This information can be edited. The users can view only their own profile data.

Figure 21 User Profile Screen

Other information that also needs to be included in the profile of the patients is:

- Personal identification, including name, birth date, and Social Security number

- People to contact in case of emergency

- Names, addresses, and phone numbers of physician, dentist, and other specialists

- Health insurance information

- A list and dates of significant illnesses and surgeries

- Current medications and dosages

- Immunizations and their dates

- Allergies

- Important events, dates, and hereditary conditions in family history

- A recent physical examination

- Opinions of specialists

- Important tests results

- Correspondence with providers

- Permission forms for release of information, operations, and other medical procedures

- Any other miscellaneous information about patient health such as exercise regimen, medications, and any counseling.

User's data will be safe and secure from unauthorized access and all activity can be tracked, ensuring that the practice is fully protected.

Help

This page will have all the contact details of the management and the help desk support team. So whenever a user has issues with the system, they can contact the right person/team with the help of the information provided in the "Help" page. This information should be correct and up to date.

FAQ

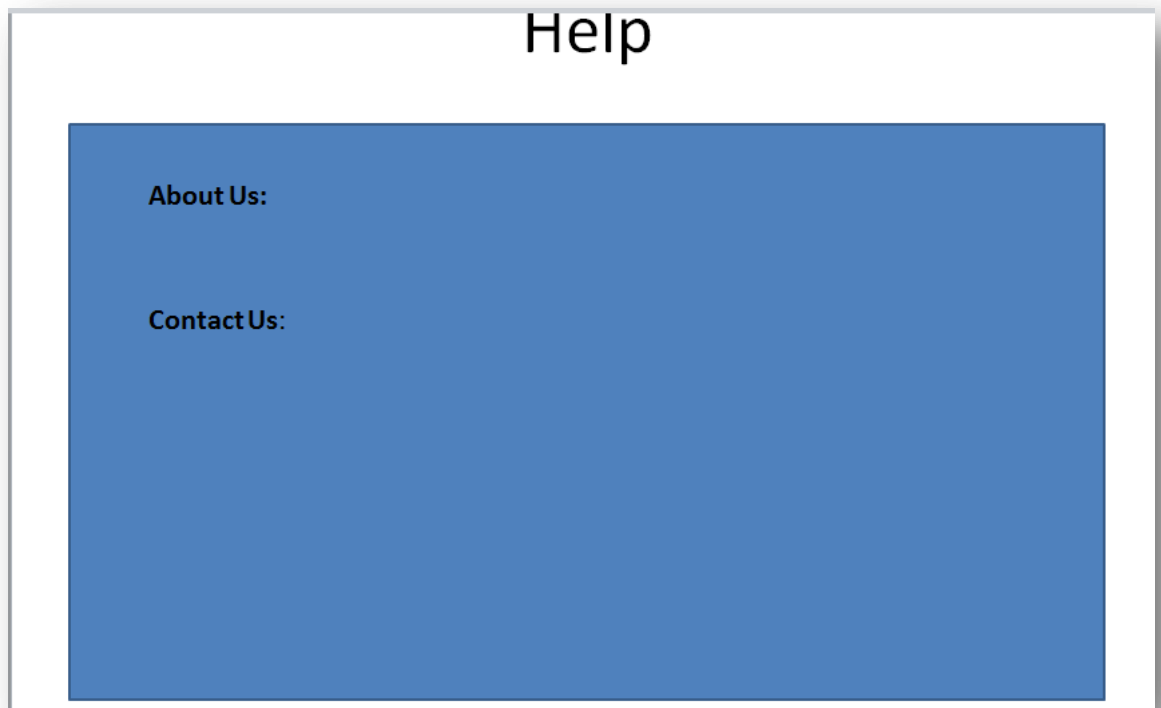This page will have all the frequently asked question and answers. This will be the place where members can go to and find the answers to commonly asked questions regarding the sleep management system. This feature also serves as knowledgebase of information

to the users.

FAQ

Question

Answer

Question

Answer
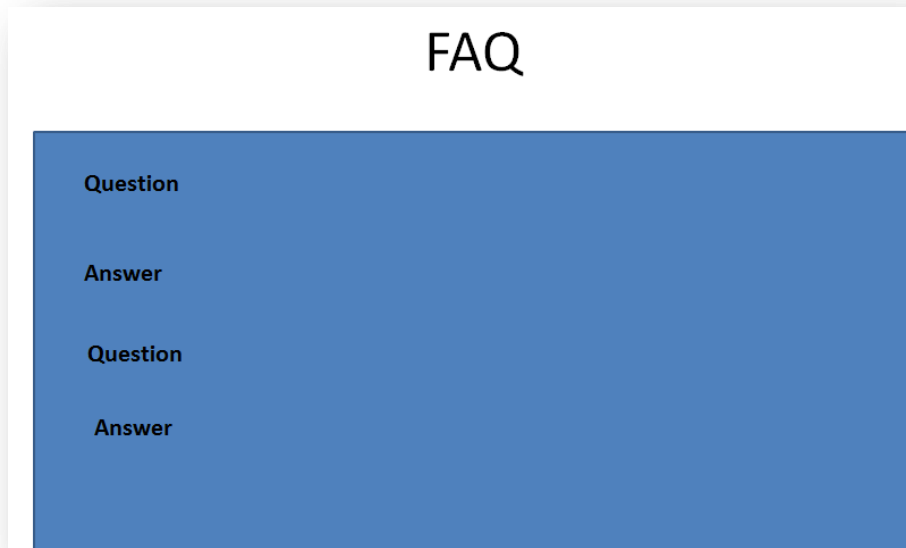
Figure 23 FAQ Screen

Chat

Chatting and socialization are these days an important tool of communication. So this feature will serve in connecting the users while the patients are undergoing the treatment. This page will have a right most container displaying all the online members available for chat. There will be a link to "Conversation History", which can display all the recent conversations saved in the system.
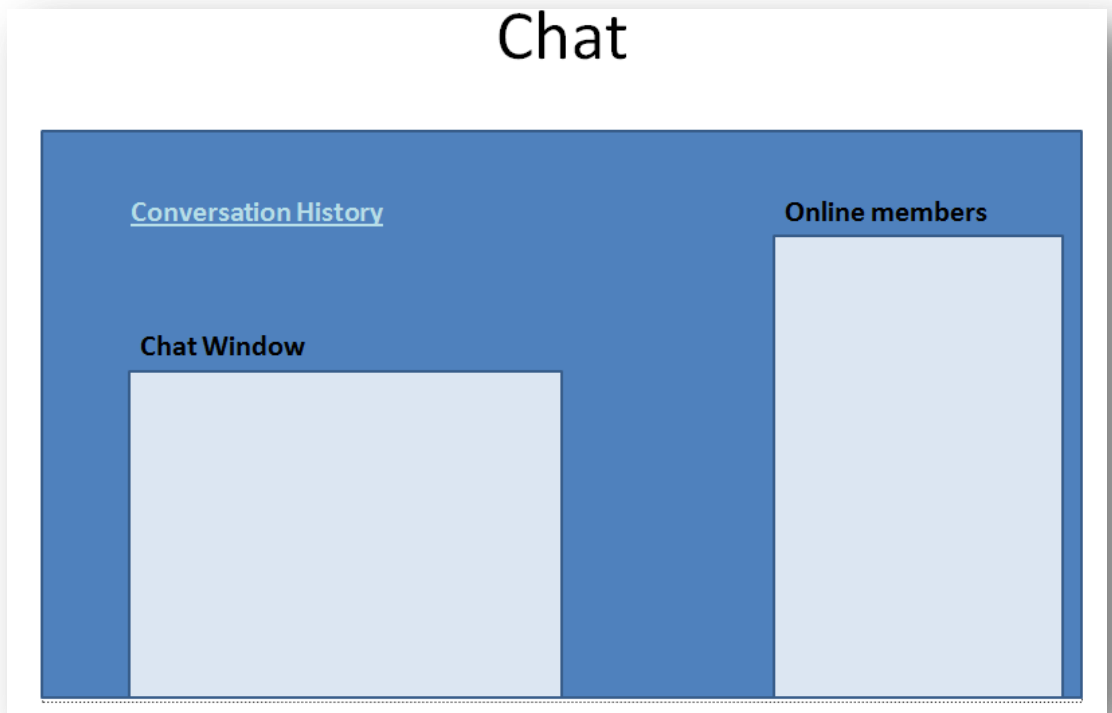
Figure 24 Chat Screen

9 Registration workflow

The user will first click on "create an account" button and fill out all the basic

information, including name, birth date, primary email and password. The user then will

be asked to provide a primary phone number with two options, "phone call," or "text

message," to receive a confirmation code. When the user gets the code on their registered

phone, he or she enters to proceed. Then, the user provides his or her social security

number and birth date. The user then will be asked to read and sign the terms and

conditions to release healthcare information. By checking all the Terms and conditions,

she or he will complete the registration by clicking "complete the registration" button.

Figure 25 Registration Flow

10 Workflow for adding family members to the system

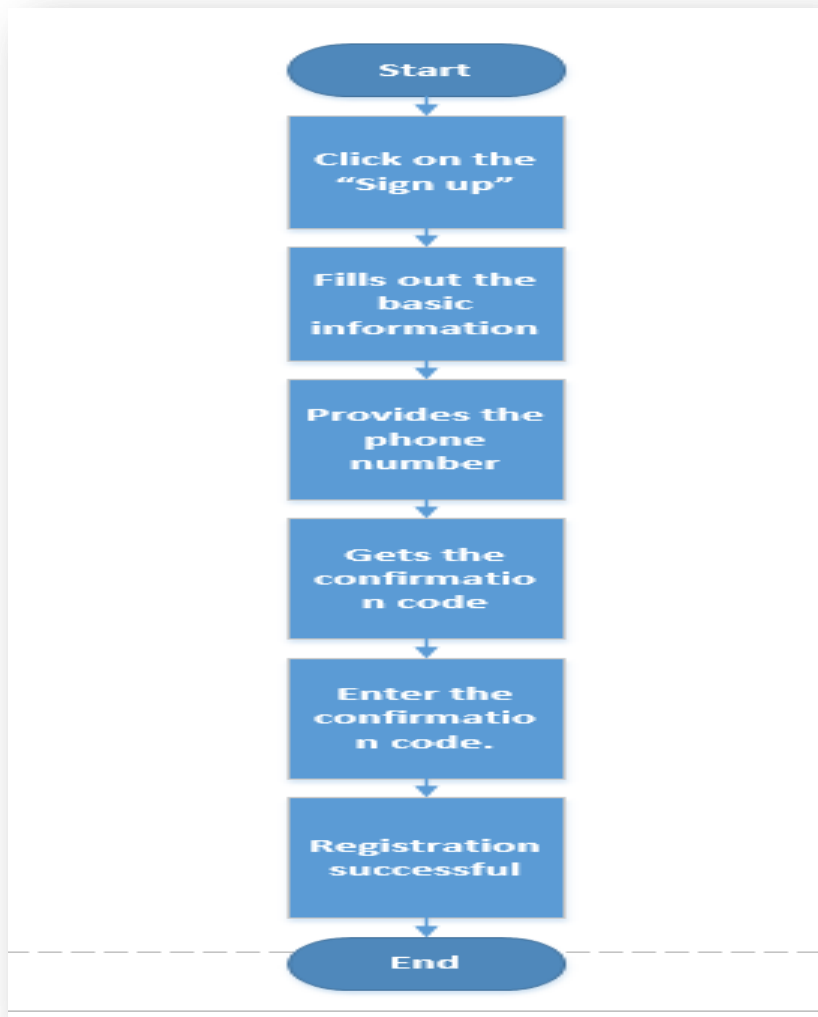Request for adding family members will be done through the patients' only. Within patient profile there will be an "Add member" button as one of their profile requirement that help a patient in associating to their family members. When the patient will click on the button, the screen will prompt to enter the family member's name, address with Email, and relationship with the patient, their phone numbers and other information. Then this action will trigger an automated request placed to system administrator. Once the family member is approved after all the verifications by the system, they will be provided the link to download the application. The system admin will then send an approval notification these will be sent in a secure message to the personal email address of the family member provided by the patient. Once they get this information the family member can login to web portal and get started with registration workflow stated above. Not all the patient information might be visible to their family members. Under patient's portal there will be setting that would allow patient to disclose certain information to enrolled family members and only those data would be visible to them. Some of this information might include alerts, physician feedbacks, notification of patient's admission at healthcare, information box for communicating with the healthcare provider and much more.

11 Workflow for editing family members to the system

The elderly patients can the privilege to edit the family member profile in order to update with latest information including adding or replacing existing member. Then this action will trigger an automated request placed to system administrator. The system administrator will then send a notification to the personal email address of the family member already in the system about the modification request. In order to completely delete a family member profile the patient has to fill a special paper form with family member details and that matches with their profile and submit at healthcare facility. The request might take few weeks to process during which the family members will have access their patient's health data. Once the family member profile is deleted then they won't have access to their patient's health data.

12 Workflow for login to the system

The login will be successful when both the credentials entered are correct and authenticated and if any one of the credential is incorrect then the system will throw error. Since elderly patients are one of the targeted users, the users will be given 10 attempts for each unsuccessful login. If after 10 unsuccessful attempts, the account will be locked.
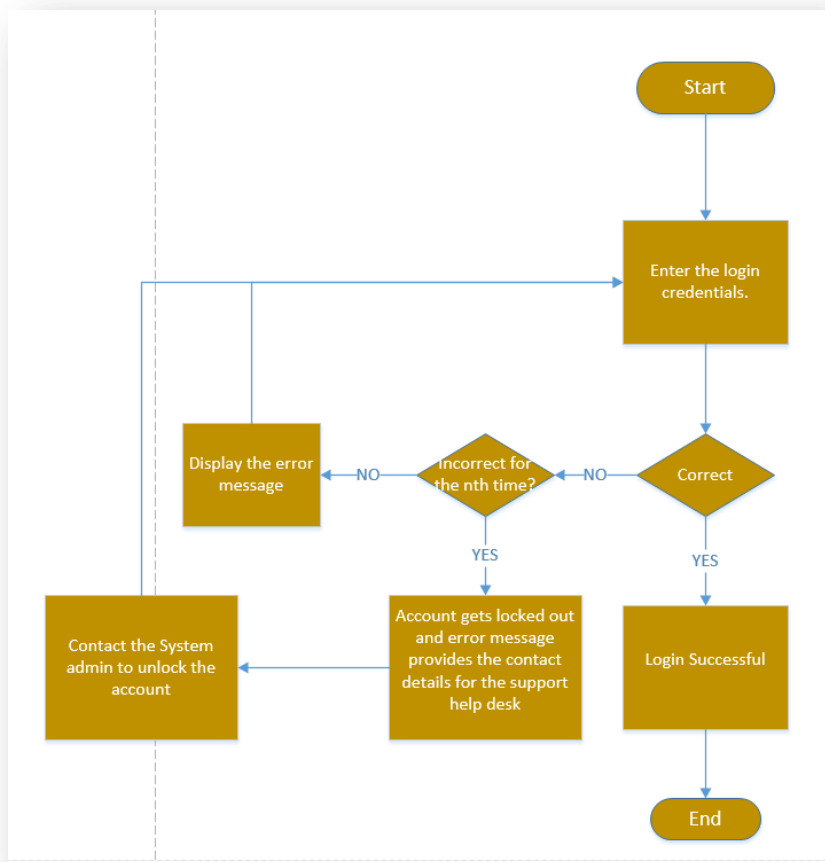

Figure 26 Login Workflow

13 Sleep Hygiene and Sleep Education

Sleep hygiene and sleep education is always good when coupled along with the recommendation for the treatment of sleep disorders. The recommendation screen will accompany these hygiene guidelines along with the suggestions. These include examining sleep habits and environmental factors that can have an effect on sleep. A health coacher practitioner can educate patients about common habits or practices that may interfere with their sleep and implement strategies for avoiding them.[7]

Some of the sleep hygiene rules[8] are:

- Avoid Frequent daytime naps

- Do not spend too much time in bed

- Sufficient daytime activities .Never goes to sleep right after exercise.

- Sufficient day light exposure

- Lower the intake of caffeine and alcohol particularly before bed

- Avoid Smoking in the evening

- Avoid Late, heavy dinner. Always good to take light snack before bed. Avoid excessive intake of fluid before bed.

- Avoid Watching television or engaging in other stimulating activities at night

- Anxiety and anticipation of poor sleep

- Clock watching

- Establish a calm and quiet bedroom environment.

- Ensure a comfortable bed room temperature.

14 User Testing

A pilot test will be conducted to quickly assess the effectiveness of the prototype. And this will be tested by all kind of targeted users. They will be asked to give their honest opinion while viewing the application, creating an account and viewing their user profile and accessing the different Graphical user interfaces.Their feedback will be collected and modifications or enhancements will be made to this proposed design.

Conclusion

This set of GUI designs will be geared towards designing a user-centric and integrated Sleep management system. They can always support guiding designers along the design process. In addition, they could be used in designing other user-centric or personal information management systems. Based on the recommendation and suggestion these guidelines can always be modified when necessary and used for provide direction for design, for providing a better and effective GUI for the interactive devices of the sleep management system. The prototype will be evaluated by series of surveys and questionnaire. Enough information will be collected to create a better GUI.

References

1. Reid KJ, Martinovich Z, Finkel S et al. Sleep: A marker of physical and mental health in the elderly. Am J Geriatr Psychiatry 2006;14:860–866.

2. Vaz Fragoso CA, Gill TM. Sleep complaints in community-living older persons: A multifactorial geriatric syndrome. J Am Geriatr Soc 2007;55:1853–1866

3. Gallup Poll: Sleep and Healthy Aging. 2005. The Gallup Organization [online]. Available at http://www.gallup.com/poll/20323/Older-AmericansDream-Good-Nights-Sleep.aspx Accessed July 21, 2008.

4. Gammack JK. Light therapy for insomnia in older adults. Clin Geriatr Med2008;24:139–149.

5. McCall WV. Diagnosis and management of insomnia in older people. J Am Geriatr Soc 2005;53:S272–S277

6. Zee P, Bloom HG. Understanding and resolving insomnia in the elderly.Geriatrics 2006;61:1–12

7. Evidence-Based Recommendations for the Assessment and Management of Sleep Disorders in Older Persons Harrison G. Bloom, MD, AGSF,ab Imran Ahmed, MD,c Cathy A. Alessi, MD,de Sonia Ancoli-Israel, PhD,f Daniel J. Buysse, MD,g Meir H. Kryger, MD,hi Barbara A. Phillips, MD,MSPH, FCCP,jk Michael J. Thorpy, MD,cl Michael V. Vitiello, PhD,m and Phyllis C. Zee, MD, PhD

8. Joshi S. Non-pharmacological therapy for insomnia in the elderly. Clini Geriatr Med 2008;24:107–119.

9. Quinnell TG, Smith IE. Obstructive sleep apnea in the elderly: recognition and management considerations. *Drugs Aging*2004;21:307-22.

10. Wagner J, Wagner ML. Non-benzodiazepines for the treatment of insomnia. *Sleep Med Rev*2000;4:551-81.

11. Glass J, Lanctot KL, Herrmann N, et al. Sedative hypnotics in older people with insomnia: meta-analysis of risks and benefits. *BMJ*2005;331:1169.

12. Harrison G. Bloom, Imran Ahmed,et al. Evidence-Based Recommendations for the Assessment and Management of Sleep Disorders in Older Persons. PMC 2009 November 1