Team HomeAide

Requirements Specification

Version 1.0

November 20, 2020

Accepted as baseline requirements for the project:

For the client: _____ Date: _____

For the team: _____ Date: _____

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I. INTRODUCTION

Assistive Technology (AT) includes thousands of products that enable persons with disabilities and those experiencing aging-related limitations to be more productive and self-sufficient in daily activities. Items range from simple to complex, inexpensive to costly and commercially available to customized. Devices can be used at home, work, school, or in the community to reduce barriers, enhance participation and increase or regain independence. Assistive technology devices help people to **compensate** for lost function. For example, a flashing light doorbell alert can be used by a deaf person to let them know that someone is at their door, or assistive technology can be used to **enhance** and support a declining ability – installing grab bars in the bathroom so that a person with poor balance can use the toilet without falling. High tech wheelchairs with sophisticated controls allow people with paralysis to be independently mobile and even drive vehicles. Small speech generating tablet devices produce speech for people unable to talk as a result of brain injuries, strokes, cerebral palsy and autism.

A quick Google search for "assistive technology" will yield pages of results, but deciding on a specific product that matches a particular person's needs related to their type of disability or limitation, what they want to accomplish, where they will use it and their budget is complicated. Individuals with disabilities, older adults and family members are often unfamiliar with the resources available to obtain assistive technology information and support.

Market wise the Assistive Technology market is expected to reach $26 billion by 2024 which is almost doubled in size compared to $14 billion in 2015. Also, with the number of individuals in the United States alone who are age 60 and over is more than 65,000,000 people and of those - nearly 23,000,000 have at least one identified disability they are living with; accordingly there is a great need for these devices in people's homes as well as a consumer need for learning what's available and useful to the person who needs it.

Our sponsor is Northern Arizona University's Institute for Human Development (IHD). IHD is one of NAU's oldest Institutes and focuses its research, teaching, training/technical assistance initiatives, community service and dissemination efforts on issues that affect persons with disabilities across the age span. As a federally designated University Center for Excellence in Developmental Disabilities, emphasis is placed on advancing positive attitudes, universal access and full inclusion in all aspects of life for people with intellectual and developmental disabilities.

Leading the IHD team of more than 45 staff members is IHD Executive Director Kelly Roberts Ph.D., and Jill Pleasant, MA, OTR/L Associate Director. Dr. Roberts is a researcher, tenured professor and has many years' experience with assistive technology. Ms. Pleasant has an extensive occupational therapy background specializing in assistive technology. IHD is also the home to the Phoenix based Arizona Technology Access Program (AzTAP), Arizona's designated Assistive Technology Act Program. Their staff members are also contributing AT content area expertise to this project centering on matching product knowledge to consumer needs.

IHD is funded primarily through grants and contracts awarded by various governmental agencies and private foundations. Current or past funders include (but are not limited to) the US Department of Health and Human Services, the US Department of Education, the National Institutes of Health, the Arizona Department of Education, the Arizona Division of Developmental Disabilities, the Arizona Developmental Disabilities Planning Council, the Navajo Nation, the Christopher and Dana Reeve Foundation and the Arizona Community Foundation.

In this document, we begin by presenting the problem that needs to be solved. After establishing that the problem is significant, we discuss our solution that we will implement. To describe the details of the solution, we move onto the specific requirements to determine what our solution will do and how it does it. After detailing the requirements, we need to consider the potential risks associated with this project along with the plan to minimize those risks. The last step before concluding is to detail our project plan. Finally, we end this document with a confident conclusion and a glossary for technical information.

II. PROBLEM STATEMENT

In the United States, it is estimated that about 65 millions Americans are over the age of 60. Of these, about 35% have at least one form of disability. Although there are thousands of AT devices on the market right now, most of these Americans are limited in their methods of gaining knowledge of these devices. These devices could not only assist them with their limitations, but would also allow them to remain independent and continue to age safely.
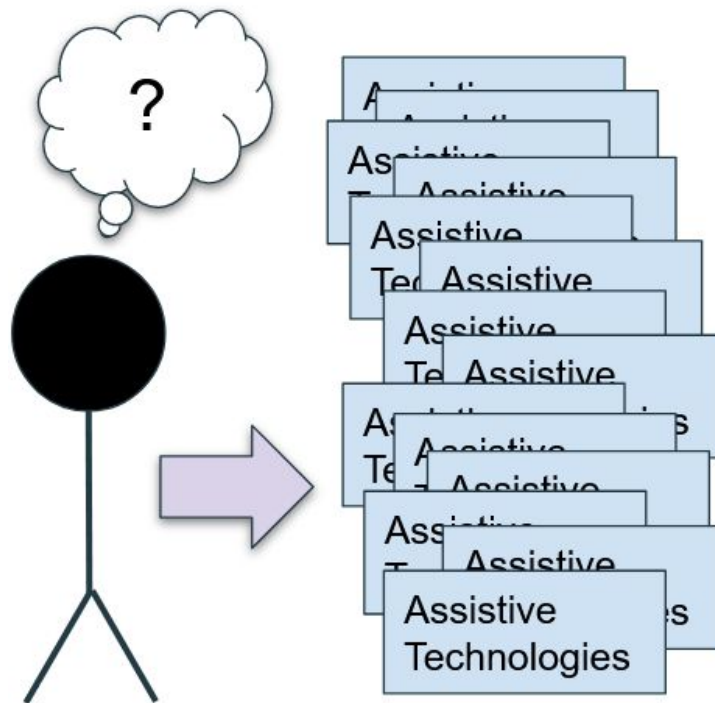

Figure 1: Connecting user to AT devices

The diagram above (Figure 1) shows an example of a user who is confused with the process of finding an assistive technology that is right for him or her. In addition to this situation, there are also many people who could benefit from assistive technologies but aren't even aware of these devices that can make their lives at home easier and more comfortable. Currently, those same people would never know about available devices, and they may never know unless someone were to tell them or if they meet with a knowledgeable professional. This is a scenario that happens frequently. In the next section, we discuss how we plan to solve this problem.

III.   SOLUTION VISION

In order to solve the problem described in the previous section, we are building a cross-platform mobile application that will help guide users to find assistive technologies and helpful information and to pair them with the devices that they need. This application will be a means for helping walk people through the process of determining various solutions for in the home, and recommend assistive technologies that are catered to their specific needs. The goal is to help those individuals age safely in their own home while retaining their independence through the help of these assistive technologies.
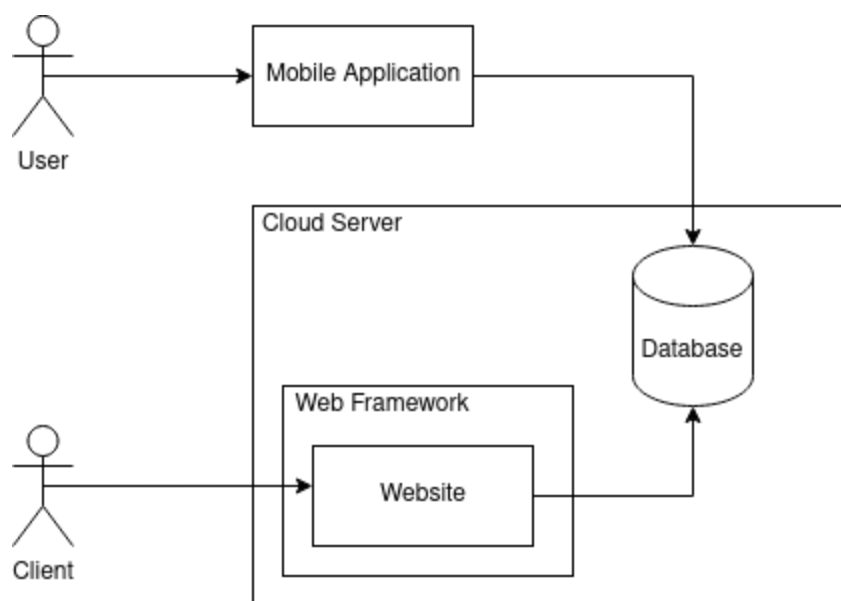

Figure 2: The project structure.

The diagram in Figure 2 above provides an overview of how the different technical components need to interact. The website is created within the web framework and connects to the database. The website will give the client a way to manage the inventory of assistive technologies which are stored in the database. Both of these components live on the cloud server where they are easily accessible. A user on the mobile app will be able to receive recommendations from the app. In order to give a recommendation, the app needs access to the inventory located in the database. If the client wants to send a notification to the user, he or she can do so by using the website. The website will take care of storing the notification in the database and the app will receive it when it connects to the database.

Specific Features

- Storing information:
  - The user can access data from assistive technologies.
  - The system will store the various assistive technologies in an inventory.
  - The client will be able to manage the stored information.

- A method for determining the best fit technology:
  - The method will be based entirely on the user's response to areas in which they have troubles in the home.
  - This will be cross referenced against the technologies stored in the database.
  - Users will indicate which area of the home they have the most difficulties.

- Accessibility:
  - The app will implement different modes for color blindness.
  - The app will provide text-to-speech and speech-to-text for users who are more comfortable speaking and listening rather than typing or reading.

- Providing advice:
  - The application will offer advice since some difficulties may not need assistive technology.
  - The app itself will recommend advice to the users based on their input.
  - The app will refer the user to resources for their particular location to be able to find and speak to people who work in specifically helping these individuals.

This application will change the way in which our client works and interacts with those individuals directly as it will reduce the time it takes to find the appropriate technologies to help them. It will also help them in reaching their goal of having people with disabilities be able to participate in all life experiences. This application will also help the client in increasing awareness of assistive technologies and advice that exist to enhance the user's life and to reach a greater audience.

This mobile app will introduce individuals to the world of AT in a way that is much faster than the process of interviewing people who have reached out for help and pairing them with AT. In the next section, we will provide details about what our solution will do and how it will do it.

IV. PROJECT REQUIREMENTS

In this section, we outline all the project requirements for our system. First, we describe our functional requirements. These detail what the system can do. Next, we lay out our non-functional requirements, also called performance requirements. These specify how the system can do its functional requirements. Lastly, we provide our environmental requirements. These are the constraints from external sources and laws. After this section, we present the risks associated with this project.

A. FUNCTIONAL REQUIREMENTS

The functional requirements describe what the system can do. To describe these, we use a hierarchical approach. First we provide a more general high level requirement and then break it down into more specific lower level requirements. In the sub-section following this, we describe the non-functional requirements.

1. Mobile App

    a) The user needs to be able to provide their general limitations.

    There will be a list of general limitations (ie, joint pain, memory loss, etc). The user will be able to select their limitations from this list (the user will also be able to make multiple selections).

    At the bottom of this list will be a [SELECT] button that will allow the application to remember these selected limitations. See section 4 for more information on how the application will remember the selected limitations.

    b) The user needs to be able to identify their trouble areas in the room.

    The user will be able to select clickable room objects within a house diagram. Once this room has been selected, the application will "zoom in" to the room and give more information about that room.

    In here, there will be generic situations where the user can learn more information about (which will also be conducted via clickable buttons).

Once the user has clicked on a room, they will be given an option to tell the application to remember than room. See section 4 for more information on how the application will remember the selected room.

c) The user needs to be able to change rooms.

Once a user has selected the room, the application will "zoom in" to that specific room and give information only about that room. At the top of this "zoomed in" screen will be a button that will allow the user to "zoom out" of the room and return back to the house diagram.

d) The app needs to remember user limitations.

(1) There will be an array of some sort that will be used to remember the user's limitations. There will be two arrays, one to store their specific limitations, and another that will remember the specific rooms that they have the most difficulties in.

(2) When the user selects from the list mentioned in 1a, their selection will be placed into the array. At the bottom of this list will be a [SELECT] type button. When this button is submitted is when the information will be updated to the array.

(3) When the user has gone into the house diagram and selected a room mentioned in 2c, there will be a [SELECT] type button at the top of the room diagram. When this button is clicked, the application will store the room information into the array.

Note: neither of these arrays will allow for duplicate entries.

e) The user needs to be able to create a user profile.

The app will guide the user to a create account page if they are not already signed up where they will create a profile with some basic information such as: email address, password, age range, state, user icon.

f) The user needs to be able to log in to the app.

The app will first guide the user to the login page where the user will enter in their login credentials which will remember their profile and information.

g) The user will be able to recommend new AT devices.

The user will have the option to send in information about new AT devices that they have found so that administrators can look at these recommendations and add them to the database accordingly.

h) The app will have an option to give the user a fresh start and create a new profile.

The app will have an option under the edit profile button that will clear the users data of all previously input information so that the user may reenter information if they choose to do so.

i) The app needs to give recommended AT based on the difficulty of a task in a particular area of the home.

(1) The app will take in the information that the user provides based on the area of the home where they struggle.

(2) The app will take in the information that the user provides based on which part of their body they have issues with.

(3) Based on the user input, the app will provide the user with the proper AT recommendation that is tailored to their specific needs.

j) The app needs to allow the user to save their favorite products they have viewed.

The app will give the user an option when viewing a product to save that product which will place the AT in a list where the user can see all of their saved products.

k) The app needs to refer the user to local services contact information.

The app will provide the contacts for local services based on the state the user has provided upon creating a profile for the app, giving them the contact information for their particular state.

l) The app asks users if they would like to share via email or printer their AT recommendation/profile with the local resources.

The app will send this information to the email address of their local services to get in contact with someone in person to get more information about questions or comments they may have about the AT.

2. Website

a) Client needs to be able to manage the assistive technology (AT) inventory in the database.

The website will provide a frontend for the client to manage the database.

(1) The client needs to be able to add an AT device to the database.

The website will need a button to initiate adding an AT product to the database, and a form for inserting the data for that product. When the information has been filled in, a submit button will initiate error-checking on the data and insert the entry into the database if there are no issues.

(2) The client needs to be able to search the database for an AT device.

In order for the client to view a specific product's details, modify them, or remove a product from the database, the client needs the ability to search for products. This functionality will be provided by the website. The results will be displayed in a page.

(a) The client needs to be able to search for a device by keyword.

Using a text input, the client will be able to input a character string to search for in the database. By default, the search will look through the product name, company, and product description to find hits on the search string.

(b) The client needs to be able to perform an advanced search by specifying the categories to search in.

An advanced search allows the client to modify the search criteria, limiting which categories the search query looks in. The client can include or exclude specific categories for the search query.

(3) The client needs to be able to modify an AT product in the database.

To modify an entry, the client can search for the item in the database using the function described in the point immediately above. The results of the search will include a button to edit each result. When the client clicks this button, it will provide a form similar to adding an entry filled with the existing data. The client can modify the fields as needed and click a button to save the changes. Optionally, the client can cancel the changes. If the changes are saved, the data will be validated and the entry in the database will be updated.

(4) The client needs to be able to remove an AT product from the database.

When the client is viewing the results of a search query, in addition to the button to edit the entry, there will also be a button to remove the entry from the database. Alternatively, there will be a button to remove an entry when the client is viewing the form to edit the data. In both cases, the website will ask for confirmation before removing the entry.

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(5) The client needs to be able to add more categories to the AT table.

After this project goes live, the client may want to track more categories of the AT products than initially planned. Therefore, the client should be able to add more categories for the products to the table. These additional categories will not have built-in functionality for the app, and exist only to provide additional information. The website should provide a way for the client to add these additional columns, and a default value for existing products in the database.

(6) The client needs to be able to remove added categories from the AT table.

With regard to the additional categories described in the above point, the client may wish to remove them. The website should provide a way for the client to remove the additional categories, but not the initially built-in categories.

(7) The client needs to be able to modify added categories in the AT table.

The client may also wish to rename an additional category after it was created. The website should provide a way for the client to modify the name of the additional categories only. The names of the built-in categories cannot be changed.

b) The client needs to be able to send a Qualtrics survey to the users.

The website should provide a way for the client to send a survey to the users using the Qualtrics framework.

c) The client needs to be able to view the results of a Qualtrics survey.

The website should provide a way for the client to view the results of the Qualtrics survey that was sent to users.

d) The client needs to be able to create administrative accounts on the website used to manage the database.

The website will have a built-in default admin user. Using this account, the client will be able to add more administrative users to the website for managing the database. These administrative accounts need to have a password associated with them.

e) The client needs to be able to remove administrative accounts on the website used to manage the database.

When looking up the administrative user accounts, there will be an option to select accounts and then delete them from the system.

B. PERFORMANCE REQUIREMENTS

The performance requirements, or non-functional requirements, describe how the system will achieve its functional requirements. In this section, we have again used a hierarchical approach when a requirement can be broken down into more detailed requirements. In the sub-section following this one we present our environmental requirements.

1. Mobile App

    a) App needs to sync to the database regularly.

    App needs to know if the phone has data access. The app needs to have permission from the operating system to check if it has access to data. This requires that the user grants permission to the app to access data.

    App needs to check the database for pending notifications and surveys from the client once every three hours.

    b) The app needs to accommodate color blindness.

    This will be implemented using some built in Flutter tools that will allow users to select color blind options.

    c) The app needs to accommodate screen readers.

    The organization of the text and interactive elements on each screen need to be valid tab stops and use alt text. Any text inputs need to have a label and default text which describe the purpose of that text input.

    d) The app will autosave the session in case the user leaves the app so that they can pick up where they left off.

    e) The app needs to be able to perform a query or display a timeout in less than 10 seconds.

    If the response from the database is not received within the 10 seconds, it will display an error to the user about a timeout and ask to try again.

f) The app needs to accommodate text-to-speech/speech-to-text options.

Using built in Flutter utilities the app will be able to give the user text-to-speech option for easier accessibility options.

2. Website

a) The administrative website should require user authentication.

In order to protect access to the website, administrative users will use a password to log in.

3. Database

a) The database needs to be secure from unauthorized access.

Access to the database will require that a user is authenticated using Django's authentication system.

C. ENVIRONMENTAL REQUIREMENTS

These requirements are constraints that are imposed by external standards or laws that our system must comply with. They are presented in a hierarchical layout where a more generalized requirement is broken down into more detailed requirements.

1. HIPAA compliance for user privacy.

a) User email addresses are protected under HIPAA regulations.

We plan not to store user email addresses in our database. Instead, we will use a unique user ID code when a user first uses the app. This unique user ID will be assigned by the web server. In using a unique user ID to associate an account with a user, we do not need to be concerned with HIPAA regulations.

b) User medical information is protected under HIPAA.

We will not be storing any user medical information in our database. Instead, we will ask the user for general physical difficulties or mobility problems without asking for any diagnoses. This does not involve HIPAA compliance because it is not considered medical information.

c) User birthdate is protected under HIPAA.

We will ask the user for an age range instead of asking for a specific age or birth date to avoid any potential issue with HIPAA.

d) User location is protected under HIPAA.

The regulation mandates that storing a user's residence for a unit smaller than a state would fall under HIPAA privacy regulations. We will only ask for location at the state level.

V.   POTENTIAL RISKS

In this section we discuss the risks which may occur while the end product is in use and how each risk is dealt with. After presenting the potential risks with a mitigation plan for each, we will present our project plan.

In Table 1 below, we list the risk, the probability of the risk occurring, the potential impact of the risk, and an overall average risk assessment. Each category is scored "low," "medium," or "high." A risk that combines low with medium will average to a medium to be on the safe side.

Problem	Probability	Impact	Average
Data Loss in Database	Low	High	Medium
Cloud Service Down	Low	High	Medium
Data Compromised	Low	Medium	Medium
App gives incorrect recommendation	Medium	Low	Medium

Table 1: Risks and their impact.

In Table 1 above, every risk has a medium average impact evaluation. Since our project depends heavily on database functions, there are more risks involving the data rather than with the app itself. However, some of these risks can range from low to high depending on the exact circumstances. For example, if the cloud service is down for only a minute, it may not even be noticed by the end users at all. If the cloud service was to go down for an entire day, it would likely cause a lot of user frustration. A small amount of data lost in the database would likely have only a small impact, however if the entire database was lost it would have a major impact. We tried to err on the cautious side to account for worst-case scenarios.

A. Mitigation Plan

- **Data Loss in Database**
  To recover from the potential of data loss in the database, whether partial or complete loss, we will implement a backup schedule and recovery plan to restore the database to a previously saved state. There still may be some data loss in that new data entered after the backup was created will be lost, but this plan will minimize the impact.

- **Cloud Service Down**
  To mitigate the risk of the cloud service going down for a period of time, we will recommend deploying to two different regions so that at least one should be up at any given time. In the rare chance that both regions go down, we can only wait for one of them to restore service.

- **Data Compromised**
  To protect the data from being compromised, we will use secure user authentication on the website that is used to manage the data. In addition, we will use database encryption to help protect the data in the event that data is stolen. When the app communicates with the database, it will create a secure connection and use authentication. All these steps combined will be used to minimize the impact.

- **App Gives Incorrect Recommendation**
  The app will never give any guarantee that a recommendation is perfectly accurate. The user will be made aware that these recommendations are only suggestions and not a substitute for a professional diagnosis by being shown a disclaimer when starting to use the app. In addition, the app will ask for feedback on the recommendations that it has provided. The client can use this feedback to modify the product in the database for more accurate recommendations.

VI.   PROJECT PLAN

In this section we will discuss the project plan for the team to build the project that has been outlined in the previous sections. The project plan is important for providing milestones which need to be reached during planning and development. After presenting our plan, we will move onto the conclusion.

There are three main milestones in our plan since the inception of this document. These include: this document, a design review presentation, and a demonstration of the technology. Each of these three milestones has two phases: a draft or plan, and then the final version.

- Requirements Specification Document

  This document provides the details for the project, including justifications and a catalog of features to be implemented. It also serves as a contract between our team and the client to outline the expectations from our team to declare a satisfactory finished product. This document was created with the help of our clients and includes their input.

- Design Review 1

  This presentation preludes the final version of the Requirements Specification Document mentioned above. It presents much of the same information in less detail, but as a video with presenters. This video is available on our team website (https://ceias.nau.edu/capstone/projects/CS/2021/HomeAide-F20/documents.html#design-review-1).

- Technological Demonstration

  In order to prove the integration of our chosen technologies that were introduced in the Technological Feasibility Document which was created before this document, we have created a demonstration which is to be performed for both our team mentor and our clients. The demonstration is important because we cannot continue with development until we have proven that our chosen technologies work together.
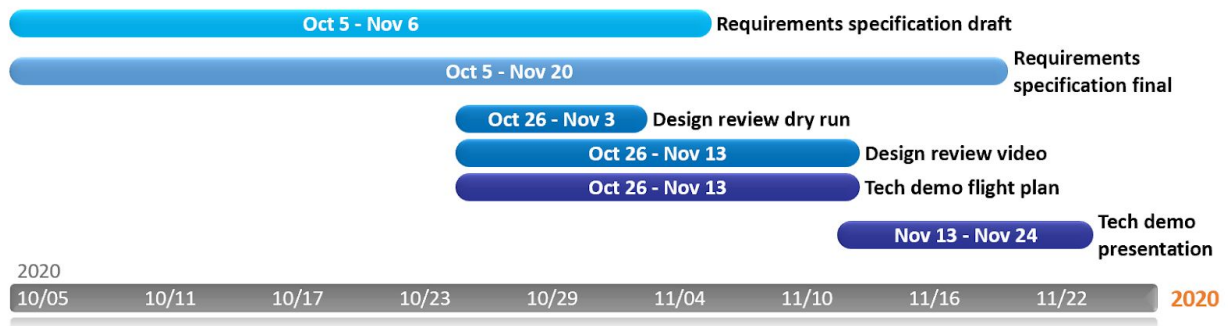
Figure 3: Schedule for 2020

The above graphic (Figure 3) shows our team plan since the inception of this document to the end of this term on November 24, 2020. It does not include the milestones which have already passed before this document.

In the next term which begins in January 2021, our team plans to provide updates every two weeks. Each of these updates will be shared with our client so that we can incorporate feedback regularly. The project plan going forward will be modified to incorporate the course structure in the upcoming term.

VII. CONCLUSION

Most people want to remain independent as they age; living in their own homes for as long as possible and being capable of carrying out daily activities without help. However, adults who are aging, including adults with existing disabilities, can challenge those assumptions when a person begins to experience some of the struggles associated with growing older: difficulty with mobility and balance, hearing or vision loss, forgetfulness, etc.

Aging is inevitable, but the goal is to age well by having access to resources, services, and support including a continually expanding number of assistive technology (AT) products designed to promote safe independence. The problem is that although there are thousands of AT devices on the market, many older adults and their family members do not have the knowledge or resources to connect with these devices or even realize they exist. This is where our solution comes in; we aim to create an easy to use mobile application that will guide individuals towards information and AT targeted to their specific needs to help maintain or achieve more independence especially for routine tasks that they do at home on a daily basis.

This document was created to introduce and outline the problem at hand and to provide insight towards what our client desired in terms of a solution. This document also helped us explain and create a detailed solution that addresses the exact needs our client presented to us. It has also led the team to create a plan of action as to how this solution will be created and propels us forward towards a better understanding of our project as it evolves. The main ideas iterated here will lead us to develop a product that meets the client's requirements. After everything we've considered and discussed in this document, we feel confident about the state of our project and know we are on track to delivering a promising product to our client.

VIII.   GLOSSARIES AND APPENDICES

Array: is a type of data structure (defined below).

Assistive Technology (AT): a type of technology that can assist people in a variety of ways. Some assistive technologies are aimed at those with limitations and others are not aimed towards any group of people at all. However, many assistive technologies are designed with disabilities in mind.

Client: Kelly Roberts, Ph.D and Jill Pleasant, MA are the clients for this project. This means that they have requested that this product be developed by Team HomeAide and will take over the product maintenance and further development once the initial development period has finished.

Data Structure: is a digital structure (much like a list) designed to store multiple bits of information at a time.

Database: a software that specifically is used for storing similar information in an organized manner. A database can be thought of as an inventory of raw information.

Encryption: is a type of security measure that will be applied to the database to protect sensitive user information. Encryption is a methodology that will scramble information into a format that a human cannot read or make sense of (often displayed as a long string of random characters). When information needs to be accessed, a key will be used to unscramble (decrypt) this information into a form that is readable.

End Product: refers to the applications itself and is the product that users will have direct interaction with.

Front End: similar to end product defined above, but this is more specific to the website that will host the database. In this context, front end merely refers to the part of the website that the client will have direct interaction with (such clicking on buttons or typing text into text boxes). Backend refers to something that the client will not have direct access to, such as the database, and will only be able to update the database through front end actions.

HIPAA: Health Insurance Portability and Accountability Act of 1996. Regulation that protects the privacy and security of certain health information.

Limitation: a type of impairment that someone may have that limits their ability to complete certain tasks.

Physical Limitation: is a type of limitation that is physical in nature (such as vision impairment or paralysis).

Mental Limitation: is a type of limitation that is mental in nature (such as memory loss or confusion).

Screen Reader: An assistive technology (AT) device that scans a screen for key text elements and reads the description to a user who may have difficulty seeing them.

Tab Stop: Interactive elements such as text fields or buttons that receive input focus when a user presses the "Tab" key on their keyboard. Repeatedly pressing the "Tab" key will get the next tab stop element or cycle to the first one if it was on the last tab stop.