CALIFORNIA STATE UNIVERSITY
FULLERTON™

Department of Computer Science

This project has been satisfactorily demonstrated and is of suitable form.

This project report is acceptable in partial completion of the requirements for the Master of Science degree in Software Engineering.

EasySearch

Project Title

Doan Tran

Student Name

Ning Chen, Ph.D.

Advisor's Name

Advisor's signature Date

Reviewer's Name

Reviewer's signature Date

Abstract

The creation of the Internet was one of the most important breakthroughs in modern-day society. For the first time, a large population of society gained access to a vast repository of knowledge and information. The Internet was supposed to be the great equalizer that united people and created a level playing field. In specific ways, it did exactly that, but in others, it failed or was subject to improvement.

The Internet promoted equality by serving as a resource for people from the most impoverished and remote nations, granting them access to the same information the most privileged people enjoyed. However, as pivotal as the internet is, it is far from perfect. People with visual impairments still have difficulty navigating and interpreting information on the internet. As more and more users use the internet, the demand for websites has grown. Developers must keep up with demand, and accommodating this minority group might not be a top priority. In other cases, a lack of awareness and training on accessibility standards could also have contributed to the accessibility problems the visually impaired face.

The problem is that, although this is a minority group, a study by the Web Accessibility Initiative showed that roughly 5% of the population suffers from some form of visual impairment. The 5% are a part of the larger group of individuals with disabilities, controlling an annual disposable income of over $13 trillion. Due to this, promoting and enforcing accessibility standards benefits not only the users, but also the companies implementing them.

My project will address this problem and further enhance my knowledge on making accessible web applications. The project aims to design and develop a voice-assisted AI chatbot that allows users to access information generated by natural language processing (NLP). Furthermore, this chatbot will be made specifically for the visually impaired. As they are the primary user group, every design choice will be made with them in mind. By completing the project, I will learn how to utilize AI and speech-to-text technology to design a more accessible product.

TABLE OF CONTENT

Introduction

Guided navigation has become an integral part of modern society, enabling individuals to move with confidence and precision across both familiar and unknown environments. This evolution in guided navigation has been propelled by technological advancements that have profoundly simplified the process of traveling from one location to another. Central to this revolution are applications that utilize real-time data, GPS technology, and interactive interfaces, making daily commutes and long-distance travels not only easier but also more efficient.

However, despite these advancements, they are not tailored towards all user groups. Traditional forms of navigation are designed for the masses and individuals with visual impairments are often disregarded. It has been established that navigation is important for everyone, but it is especially important for people who have some form of visual impairment. Most people would agree that having good vision is one of the most important factors for

navigation. The harsh truth is that there are 2.2 billion people worldwide who have some form of visual impairment. This makes navigating quite challenging for them. Nonetheless, many of these people still manage to live independent lives.

Just as there are assistive tools to aid this minority group in the physical world, there are also tools in the virtual realm. Assistive technology has become increasingly important and beneficial for people with a visual impairment. Research shows that people with disabilities are increasingly utilizing assistive technologies in their daily lives, particularly for navigation (Fernandes et al., 2019). These tools are designed to help this minority group overcome barriers and live independent and productive lives.

This project aims to bring light to this issue. By applying user-centered design principles and building upon the latest research, the aim is to develop a unique travel application aimed at visually impaired travelers. This will make it easier for them to explore the world independently. Assistive technology represents a significant breakthrough, and this project aims to contribute to its advancement.

Objectives

Traveling has evolved from a recreational activity to a source of discovery, personal development, and a form of bonding in today's interconnected society. It allows people to explore new cultures, develop personal skills, and connect with others. However, traveling can be a significant challenge for people with visual impairments. Traditional travel resources do not always meet the needs of the visually impaired. This is why EasySearch is designed with a clear vision: to revolutionize travel for visually impaired individuals by creating an accessible, intuitive, and supportive digital environment. This app is not just a navigation tool, it is a comprehensive travel companion tailored to meet the unique needs of visually impaired travelers through innovative use of technology and community engagement.

The proposed project aims to address this problem by creating an all-in-one travel assistant application for visually impaired travelers. It will include a voice-assisted AI chatbot that will

provide advice and recommendations for their travel needs. One of the primary focuses is on improving accessibility and usability. By leveraging generative AI and speech-to-text technology, EasySearch will create a travel-based accessibility tool that gives this user group the same freedom as any other traveler. The application will utilize natural language processing (NLP) algorithms to allow users to interact with the chatbot through spoken communication, allowing them to ask questions about their travel, receive advice, and obtain information in a way that suits their preferred communication style.

The project's main objective is to enhance the travel experience for people with visual impairments. It will do this by providing them with a helpful tool that will help them improve their overall travel experience. The design process will prioritize the preferences and needs of the visually impaired traveler, making sure that each feature of the application is carefully designed to meet their requirements.

To ensure that EasySearch meets the actual needs of its users, the development process is complemented by comprehensive user research. Through surveys, interviews, and usability tests, I will gain insights into the specific challenges and requirements of visually impaired travelers. This iterative technique enables continuous improvement of the app by incorporating genuine customer feedback, hence boosting its usefulness and satisfaction among users.

The project will serve as a Minimum Viable Product (MVP) to evaluate the potential of generative AI and speech-to-text technologies in addressing accessibility issues on the web. The knowledge and perspective gained from this project will play an important role in utilizing generative AI and speech-to-text features in the accessibility landscape.

Mission Statement

EasySearch aspires to be more than just a travel app; it seeks to become an indispensable resource for visually impaired travelers, enhancing their travel experiences, fostering community connections, and ultimately promoting greater independence and quality of life. Through continuous development and community feedback, EasySearch is positioned to transform the landscape of travel for the visually impaired, making every journey more accessible and enjoyable.

Core Values

EasySearch is dedicated to developing an application that is accessible to all users, ensuring that it serves as a tool that removes obstacles rather than generating them. This involves creating interfaces that are compatible with screen readers, incorporating voice commands and feedback, and ensuring that all interactive elements are easily navigable through tactile and auditory means. In addition to accessibility, two other core values of EasySearch are innovation and continuous improvement.

Accessibility

EasySearch is dedicated to developing an application that is accessible to all users, ensuring that it serves as a tool that removes obstacles rather than generating them. This involves creating interfaces that are compatible with screen readers, incorporating voice commands and feedback, and ensuring that all interactive elements are easily navigable through any tactile and auditory challenges. Accessibility also means tailoring user experiences to accommodate a range of visual impairments, from low vision to total blindness, ensuring that the app is as inclusive as possible.

Key Points

- Our application will be accessible to all users, with a focus on those with visual impairments.
- Features such as alternative text for images, compatibility with assistive tools, and responsive design will enhance usability.
- High-contrast color schemes, universal design, and clear visual indicators will be utilized to improve visibility and accessibility.

Innovation

Innovation in EasySearch is defined by the pursuit of creative and effective solutions to enhance the travel experience of visually impaired users. This involves leveraging cutting-edge technologies like AI, machine learning, and NLP to create features that are not only functional but also revolutionary. For instance, the voice-assisted AI chatbot within EasySearch isn't just a tool for communication—it's a sophisticated system capable of understanding and adapting to the unique preferences and needs of each user. Innovation also means staying ahead of the curve in terms of technological advancements and thinking laterally to solve problems in new ways.

Another area of innovation is personalization. Instead of offering a one-size-fits-all solution, EasySearch will be tailored to meet the unique needs of our user base. The project intends to

customize the application to the unique needs of our users through the implementation of iterative development processes and user-centered design principles. This approach will allow us to create an application that feels right for them. In addition, we aim to explore new ways of exploring user interaction by integrating voice-assisted capabilities, allowing our users to communicate with the AI chatbot through their voice. This innovative feature is designed to make the travel experience more natural and accessible for all.

Key Points

- The project will focus on the user experience, tailoring the application to the specific needs of visually impaired travelers.
- Voice-assisted capabilities provide a more intuitive and inclusive experience, enriching the user journey for all users.
- Generative AI will be used to improve the accessibility and usability of the application.

Continuous Improvement

The application will undergo continuous improvement based on the user's feedback. The development and maintenance process will be iterative, with each stage contributing to the overall improvement of the application. The project team will collect feedback from users and stakeholders to identify key areas that require further improvement. This feedback will help the team figure out how users' wants and needs are changing over time. The team will also use surveys, interviews with users, and usability tests to gather information. The team will follow an agile-based development process, splitting up the requirements and tasks into short sprints lasting more than a week. Agile approaches will encourage ongoing learning, development, and collaboration by embracing values like cooperation and flexibility.

Key Points

- An agile-based development and maintenance process will be used.

- User feedback collected from surveys, forums, interviews, and open engagement will be addressed and included in the development stages.

Impact, Benefit, and Competitive Advantage

Key Features and Future Enhancements

Integration of Text-to-Speech**:** Via spoken language, visually impaired passengers can ask questions, get advice, and access information via voice commands, which provide them with a natural and straightforward way to communicate with the AI chatbot. Users can interact with the chatbot hands-free by incorporating voice commands into the application's UI, which does away with the requirement for conventional text-based input techniques.

ChatGPT API: This API is one of the most popular AI models and hosts one of the most advanced versions of a large language model (LLM) to date. The integration of this API will allow the application to have access to an expansive OpenAI repository of learned data. EasySearch will use the API and integrate our own customization to fit our userbase of travelers.

Accessibility

The importance of adhering to accessibility standards and guidelines

When creating a web application, it's essential to consider people with visual impairments. To make the website accessible, it should follow the Web Content Accessibility Guidelines (WCAG). This helps not only people who are blind or visually impaired but also those with hearing loss or mobility problems. Adhering to these guidelines ensures that a wide range of users can access the site with ease. This includes clear navigation, labeled buttons/links, and easy-to-read content. Moreover, following WCAG guidelines can help businesses avoid legal problems. Websites that don't meet these guidelines can be sued by disabled consumers who cannot use the site.

Core Principles of WCAG

The four key principles of WCAG are perceivable, operable, understandable, and robust. These principles are essential and depend on the production of accessible web content. WCAG guidelines were created by the World Wide Web Consortium to make websites easy to use.

Perceivable: Data and user interface elements should be displayed in a manner that is understandable to users. Meaning, users must be able to obtain information that is presented to them regardless of their sensory capacity.

Operable: Interface components and navigation should be operable by users. This principle helps to ensure that the interface of the website works without any disruption so that the user can interact freely, even if he/she has a particular disability.

Understandable: Both the displayed data and the user interface's operation must be simple to understand. This implies that the intended audience must be able to understand the content and the functions of the interface with ease.

Robust: The data must be reliable enough to be consistently understood by different web tools and users, including assistive devices. Content needs to be suitable enough to be unambiguously interpreted by a broad range of user agents, including assistive technologies. Here, the users can get the content even as the technologies are changing.

An accessible website improves not only the user experience but also its overall rating, which raises the website's visibility in search engine results. According to the Centers for Disease Control and Prevention, one in four adults in the country has a visual disability. Not accommodating people with disabilities violates the American with Disabilities Act, and companies can face legal repercussions.

Designing For Accessibility

While the internet has made huge progress and the adoption of WCAG standards has helped, many websites and apps still exhibit accessibility and usability problems, mostly causing users annoyance, especially old or visually impaired ones. Among the most widespread difficulties the site owners face are visual clutter, poor navigation, and the presence of inaccessible elements in the site, such as dynamic elements and carousels.

A study found that important accessibility issues are frequently missed when developing mobile apps and websites, especially for blind or visually impaired people. To improve accessibility, WCAG 2.1 needs to be improved, and standards should be followed better. Some serious accessibility issues include dynamic content, carousels, inaccessible captchas, challenging navigation, and labeling.

Web Content Accessibility Guidelines (WCAG) have been developed and adopted by many countries to improve web accessibility. However, with the constant development of online technologies, accessibility remains a problem. Some common accessibility issues for visually impaired users include inadequate feedback, missing alternative wording, a lack of button titles, challenging navigation, and complex pages packed with content.

Accessibility issues also exist on mobile devices, which pose challenges for blind or visually impaired people. Many important accessibility issues are often overlooked in the development of mobile apps and websites. These issues include dynamic content, carousels, inaccessible captchas, challenging navigation, and labeling, among others. Social media platforms also face accessibility issues, including embedded content in photos that is not readable for visually impaired users.

The application will address inclusion and accessibility with the following:

Visual Clutter: Websites and applications often suffer from visual clutter, including excessive use of colors, fonts, and animations. This can overwhelm users, making it difficult for them to find relevant information or perform desired actions, especially for those with cognitive disabilities or visual impairments. To combat visual clutter, our designers will embrace the principles of minimalism, focusing on simplicity and functionality. Employ a consistent layout with ample white space to enhance readability. Use color and typography strategically to guide users' attention rather than distract them. Prioritize clarity and ease of navigation in the design process.

Navigation: Navigation issues are prevalent in many digital platforms, characterized by complex menus, inconsistent navigation patterns, and poorly labeled links. Users, especially those who use screen readers or other assistive technologies, may get lost in this, making it hard to figure out how to use a site or app successfully. We will solve this issue by designing clear, consistent, and logical paths through the content. Use descriptive labels for all links and controls and ensure that the navigation structure is intuitive.

Text Size and Color Contrast: Making text bigger and using colors that stand out from each other helps people with vision problems or color blindness read more easily. The project will pick fonts and colors carefully to make sure the text is easy to read and can be adjusted for different needs.

Alternative Text for Photos and Multimedia Content: For users who rely on screen readers, the project will add descriptions to images and videos. This way, visually impaired travelers can get the same information from pictures as everyone else, helping them make travel decisions.

User Interface Design

Personas

Character Type and their characteristics

Temperament	Communication Style	Problem Solving Approach	Source of Self-Esteem	Seeking
Guardian	Concrete	Cooperative	Reliability, Good Deeds, respectability	"Security" and community and membership
Idealist	Abstract	Cooperative	Authenticity and Empathetic action.	Deep relationship, unique identity
Rational	Abstract	Utilitarian	Independence and competence in action	"Knowledge", and achievement

Communication Style

Concrete: Focuses on the facts and concrete world of everyday reality. Values statistics and facts in their communication. Their communication style is to convey information in a straightforward, practical, and grounded manner.

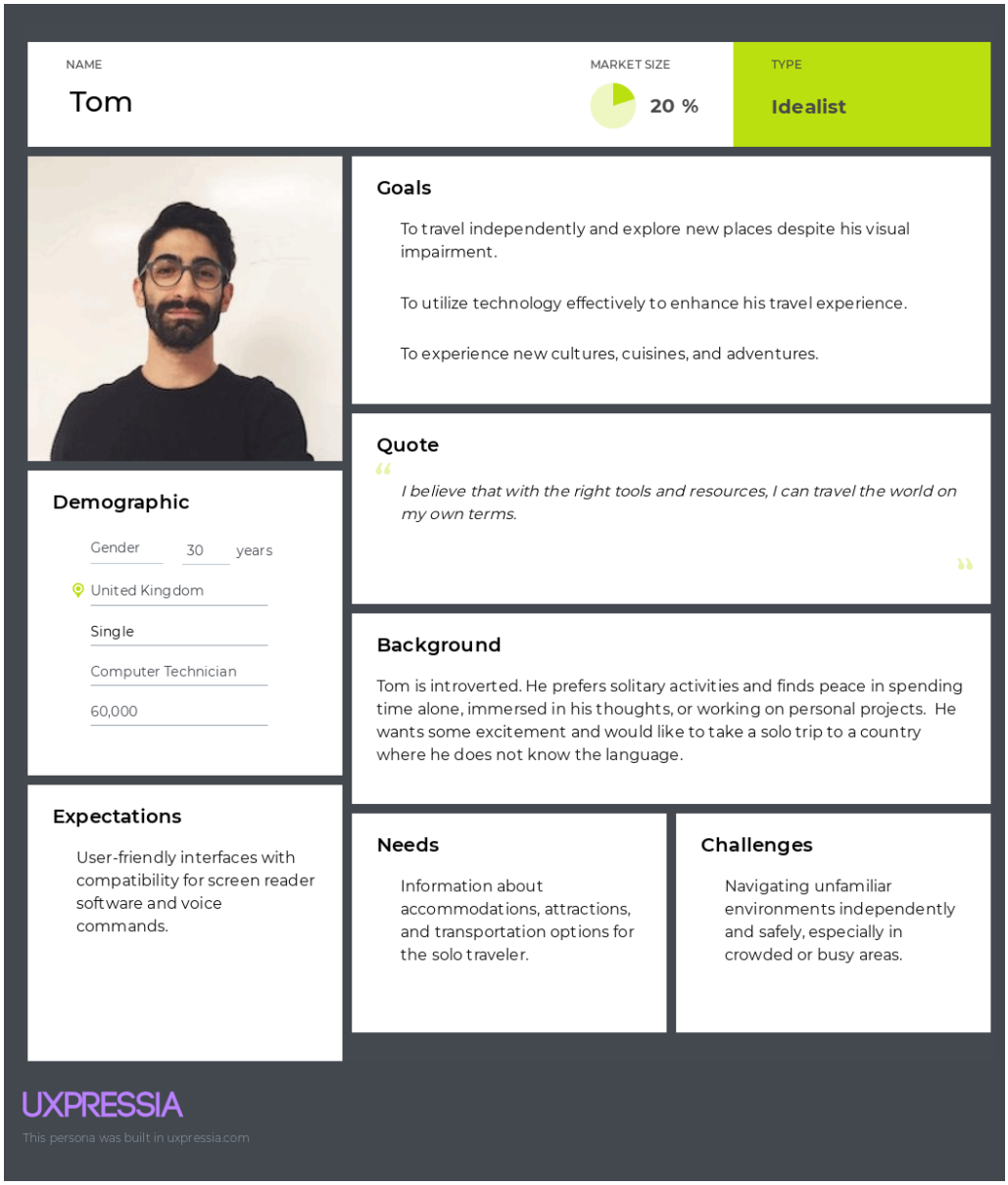
Abstract: Communicate using philosophies, beliefs, theories rather than focusing solely on concrete and tangible details.

Problem Solving Approach

Cooperative: Pay attention to other people's opinion and thoughts. They are more concern with doing "the right thing".

Utilitarian: Prioritize their own thoughts or feelings and are more concerned with doing what works.

Idealist: Idealists communicate in an abstract manner, focusing on philosophies, beliefs, and theories, rather than just the tangible. They are cooperative in their approach to problem-solving, valuing empathy and authenticity, and often strive to achieve a deep relationship and a unique identity. They draw their self-esteem from actions that are aligned with their values and from authentic and empathetic connections with others.



PERSONA: Kelly

NAME

Kelly

MARKET SIZE

15 %

TYPE

Idealist

Goals

Experience new things

Meet new people and make connections

Quote

I believe life is about making new connections and making every second count

Demographic

Gender 30 years

America

Married

Singer

60,000

Background

Kelly is extroverted and free-spirited. She loves social interaction and meeting new people. She wants to meet new people and seeks new friends with whom she can make genuine connections. She doesn't know where to go and prefers to make plans as she feels like it. She also has slight dyslexia, which makes reading long and compact paragraphs hard.

Expectations

A travel application with a simple interface to assist her in her journey. She doesn't know where she wants to go but wants insight on the best place to visit.

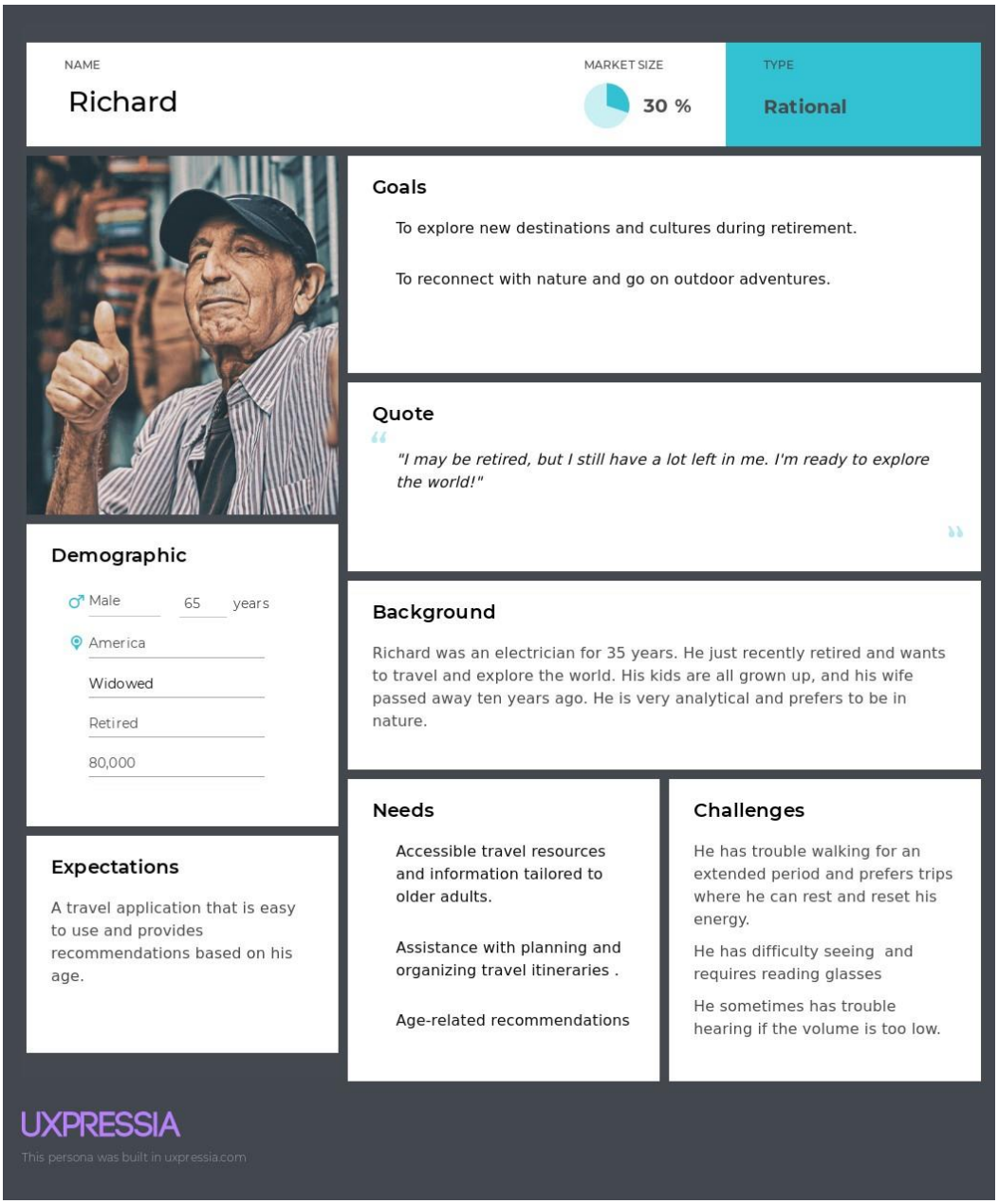
Needs

A simple travel-based application that will help her navigate a three-month trip across Europe.

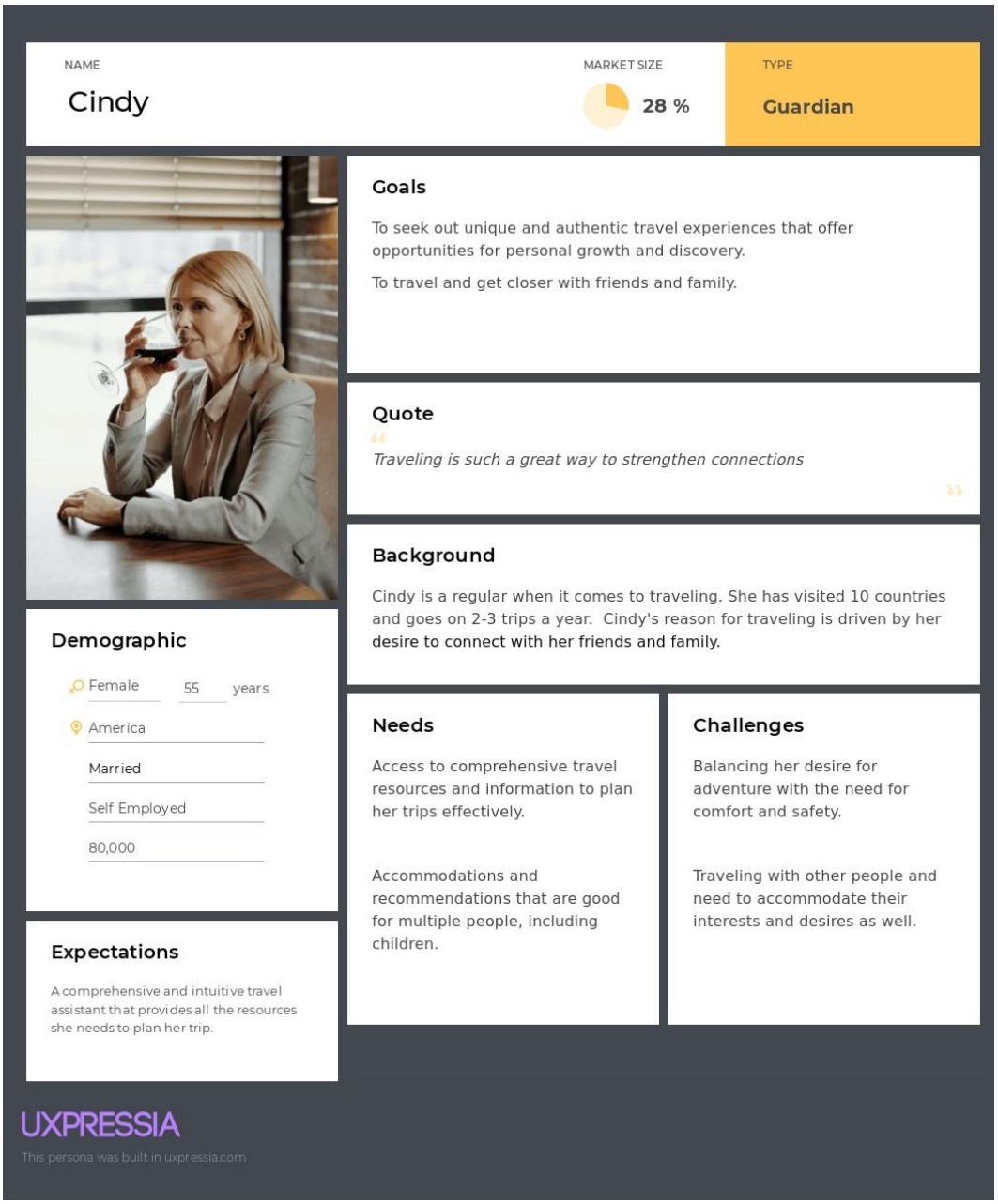
Challenges

With her slight dyslexia, she had trouble with information overload.

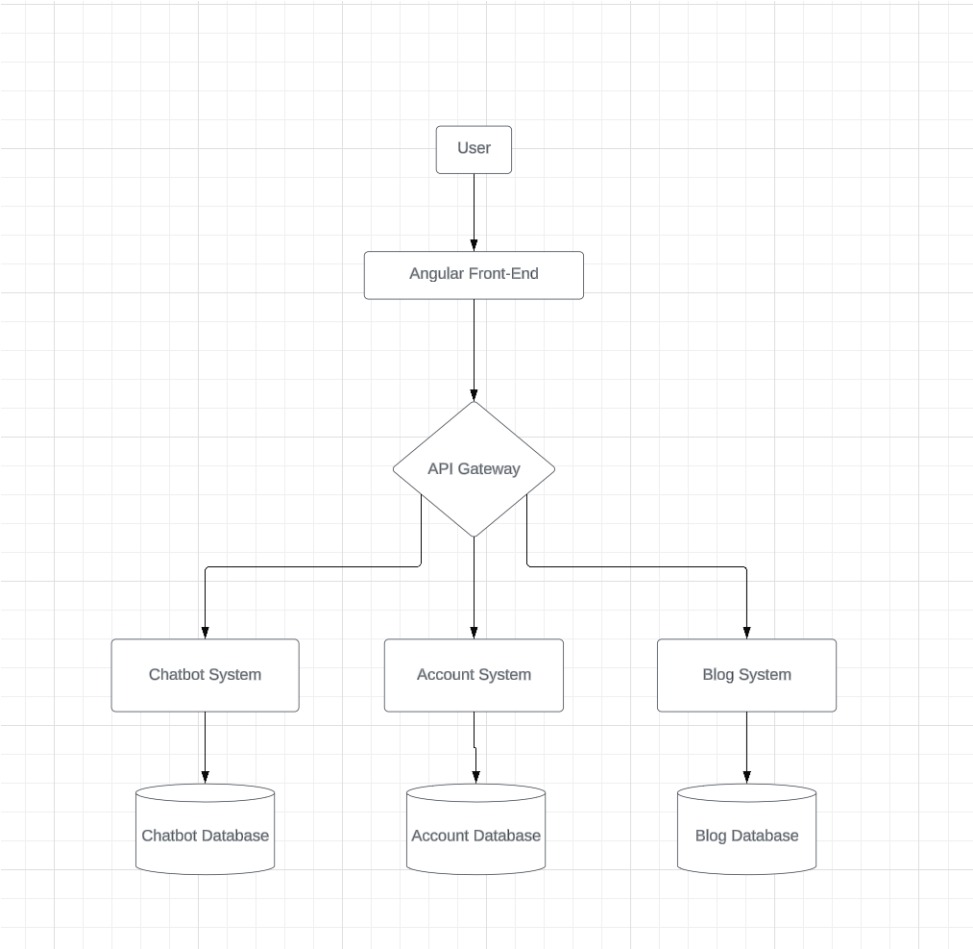
Rational: Rationales engage in abstract thinking, comfortable with theories, models, and strategic planning. They have a utilitarian approach to problem-solving, emphasizing efficiency and what works practically over collective consensus. Rationales seek independence and competence, often valuing knowledge and personal achievement. Their self-esteem comes from their ability to act independently and competently in pursuing their goals.



Guardian: Guardians are pragmatic and grounded. They prefer concrete communication, valuing clear facts, and practical details in interactions. They adopt a cooperative problem-solving approach, seeking input and consensus, often prioritizing the group's harmony and "doing the right thing." Their sense of self-esteem is tied to reliability, good deeds, and respectability. Guardians seek security and a sense of community membership, often upholding traditions, and established structures.



System Design



Microservice Architecture

Introduction to Microservice

Microservices architecture is a way to build software systems that organizes an app as a group of services that are not tightly connected to each other. In monolithic architecture, all an application's parts are linked together and released as a single unit. Microservices architecture, on the other hand, separates the application into smaller, more independent parts that can run as separate services. Each service can be built, deployed, managed, and scaled up or down independently.

Decision to use the Microservice architecture

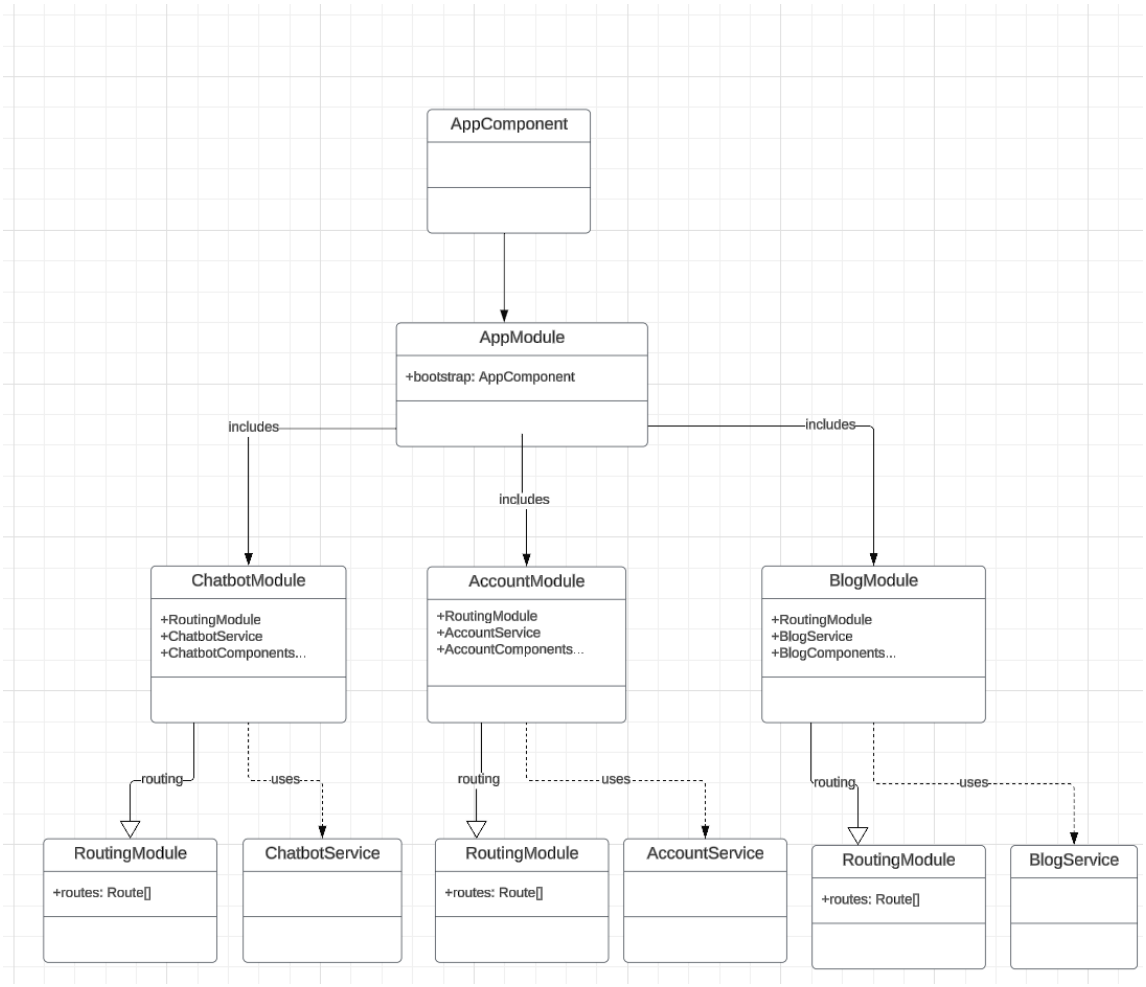
EasySearch has decided to apply microservices, which is motivated by the demand for scalability and easy maintenance. Our vision to dominate the niche of travel-based apps on the world stage requires a solid plan for scalability. With microservice architecture in the picture, we can handle improved application maintenance and offer exceptional uptime across all services.

The utilization of microservices guarantees the separate operation of our systems, therefore, in case a service's unexpected collapse occurs, all other systems remain functioning. This is a crucial feature as it guarantees unbroken service to our customers, trust, and therefore reliability in our solution. With our startup EasySearch still in the developmental stage, resource efficiency is of utmost importance. Microservice architecture is the best option for building our core systems and letting us scale each services independently.

This is because scalability is a primary concern. As the user base grows and the demand for new features increases, the system must be able to handle an increasing amount of work and interact seamlessly with other systems and services. Microservices enable just that by allowing individual system of the app to scale independently. For instance, if the service handling voice-assisted interactions experiences higher demand, it can be scaled without the need to scale the entire application. This targeted scalability is cost-effective and efficient, ensuring that resources are used judiciously, enhancing the overall performance of the application.

Maintainability is another criteria in the choice of utilizing microservices for EasySearch. In a microservices architecture, each service is developed around a specific business capability and can be updated independently of others. This modularity allows developers to update parts of the application without affecting others, significantly reducing downtime and the risk of introducing bugs into the system. It also facilitates continuous deployment and integration practices, allowing teams to roll out updates more frequently and with less risk.

Front-End



Angular: will be used as our front-end framework. Angular provides a simple and effective use of modules which work well with our microservice architecture. Each microservice will have its own front-end module.

Back-End

Repository Pattern & Specification Pattern: The repository pattern and specification pattern will be implemented to improve reusability, maintainability, and readability of the application. The repository pattern will allow us to create clear interface to interact with the database and external API's, allowing our controllers to free of this logic. In addition, by separating our

business logic into separate specification, we can reuse these specification as needed. Furthermore, by implementing these two patterns improve the maintainability by making it easier to locate and modify needed logic or queries.

Example of Implementation will be provided in the “Additional Deliverable” section.

Engagement Strategies

Surveys: Surveys and other forms of user input will be used throughout the development and maintenance stages to collect information about their preferences, difficulties, and opinions. The collected information will be leveraged in the design and development phases by helping to prioritize features and enhancements that correspond to the collected feedback. Furthermore, there will be a constant communication stream with users who want to provide their input, as well as a quarterly question and answer session. This will allow us to prioritize issues and refinements that are most important to our users. As more insight is provided, the direction of the application will be adjusted to shift user expectations and market dynamics.

Online Blog: An online blog will also be created where users can interact and exchange resources and information regarding their travels. Users can use this platform to connect with other travelers, ask for help, and share ideas. This will give our users a way to form meaningful relationships and friendships.

Content and Feature Updates: Keeping the content and features maintained is essential for long-term engagement. Regular updates with new functionalities, improved accessibility features, and content such as accessible travel stories or tips will give users a reason to return. An important aspect is the implementation of user feedback in these updates, demonstrating that user input directly influences the evolution of the app.

Gamification: Gamification can significantly increase user engagement. Elements like travel challenges, rewards for frequent usage, or community leaderboards can encourage users to

interact more with the app. For instance, users could earn badges for visiting new places or sharing travel tips. These fun elements can make the experience more enjoyable and engaging.

Marketing Strategy

Understanding Our Audience

Before implementing specific strategies, it is of paramount importance to develop a detailed knowledge of our target clients and user base; these are travelers, most of which will have some form of visual disabilities. Our marketing strategy will rely on market research reports as well as data analytics to provide knowledge of the market we operate, and a hit at the impact of our marketing actions.

Content Marketing

Educational Content: Develop and share content that is full of essential info that the people that we want to attract need and are excited about. The content of different forms such as blog posts, how-to guides, and videos on accessible travel tips, app use tutorials, and user stories will be published.

SEO Optimization

It is important to optimize all write-ups for search engines, especially for keywords to do with accessible travel and technology for the visually impaired. A lead generation and back-link creation strategy will be incorporated to make sure we are the first one to show up on search engines.

Email Marketing

Newsletter: Attach a monthly newsletter with the latest news, travel inspiration, user success, and the inside scoop of things going on. This way our audience gets the necessary information and makes the EasySearch community stronger.

Personalization: Split the email database into segments to give out the content matching the audience based on their preferences and actions. This gives our platform extra credibility and using it more efficient way.

Paid Advertising

Targeted Ads: Aside from using Google AdWords and social media ads to target the people who are actively searching for travel options such as daily transport, user-friendly apps, etc. By personalizing our ad messages against user interests, behaviors, and travel-oriented searches with disability elements, we ensure that our marketing efforts reach the most possible customers.

Retargeting: Create remarketing campaigns to draw back the audiences that have displayed intent to join EasySearch but have not yet downloaded the app. This might get the attention of still undecided users. It could lead to new customers in the market.

Measuring Success

To ensure efficient marketing results, it is critical to identify a set of metrics and key performance indicators (KPIs). These include user acquisition rates, time spent on the app, frequency of app usage, conversion rates from marketing campaigns, and user feedback scores. Analyzing these figures periodically is the most effective way to identify data patterns and make targeted decisions that can bring about the desired outcome.

To summarize, EasySearch will adopt a broad and integrated marketing strategy that goes beyond traditional forms of advertising. Our approach will involve building strategic partnerships, advocating for equal access, promoting technological innovation, engaging with communities, and establishing a positive track record. Our aim is not only to attract people to EasySearch, but also to create an ecosystem that enriches the travel experience for visually impaired travelers worldwide.

Conclusion

Disclaimer: Please note some parts of this work may contain forward-looking statements that describe things that may or may not exist at the present time.

The proposed project aims to create a full-stack web application using the microservice architecture. It will leverage the power of speech-to-text technology and generative AI to create a chatbot search tool for travelers with visual impairments. Mainstream generative AI is a relatively new development in the technology space. Speech-to-text technology is also a very underutilized tool in the grand scheme of web application features. The combination and potential of these two tools will be explored to find unexplored use cases in the field of accessibility.

The relationship between accessibility and the user experience goes hand in hand for the visually impaired. Travelers with visual impairments face unique challenges with web interactions that others do not experience. As a result, one of the top priorities will be focusing on the user experience. Since travelers are often on the move and their phones are one of their most powerful assets, they will need a tool that can let them do things efficiently and effectively. Furthermore, since the primary user group will be the visually impaired, the application will be designed with the best choice of contrast, color, font sizing, and accessibility features in mind. It will follow a responsive design so that users can utilize the application with any device that best fits their requirements.

In essence, the creation of this project will be a holistic endeavor to research and redefine the user experience and accessibility landscape for the visually impaired. It will first start out as a voice-to-text generative AI chatbot search tool but will evolve into much more. The grand vision of the application is the creation of a platform that travelers with all types of disabilities can utilize to assist them anywhere they travel. Ongoing research and collaboration with the user communities will be conducted throughout the first phase of the platform. As the user base

grows and more data points are collected, the application will grow to encompass a wide range of features.

The first phase will serve as an experiment on how the user interacts with the application. It was designed to learn what the user likes and dislikes about the current application. This knowledge will be used in further design and feature creation. To support this first phase and the grand vision, the application must be able to scale to support evolving user needs. This was the driving force behind the decision to implement the microservice architecture. Since we are trying to explore unknown territory, the modularity and scalability of this architecture design make it a perfect fit for the project's evolving needs. New functionalities can be added without disrupting existing systems in place. Resources can be given and taken in underutilized areas.

The second phase of development will be focused on personalization and community building. It will include personalized travel recommendations, food options, and the best places to see based on individual preferences and accessibility requirements. The user will have access to their own individual account. In the process of creating an account, they will have to take a survey that will help the platform understand their accessibility needs, preferences, and requirements. The survey will have questions related to travel activities, destinations, types of experiences sought, and favorite travel scenarios to help build a detailed user profile. Additionally, the survey will ask questions regarding mobility, dislikes, and limitations to help the platform learn about their individual accessibility needs. Users with disabilities often face discrimination, whether it is direct or indirect. As a result, the second phase will also focus on community building. To help strengthen inclusion and accessibility on the Internet, there must be collaboration and communication. This is why a travel blog will be introduced. People can post about their experience at a particular destination, and other users can comment, like, and follow their profile. They will be able to add pictures of them at those locations and give their insights on those locations. The idea of the travel blog is for people with the same disabilities to share their viewpoints. Different users can comment and ask specific questions that they are

uncomfortable asking anywhere else. The shared bond and commonality of their impairments will make for more personalized and meaningful recommendations.

Depending on feedback from the user, further improvements can be made to refine the blog and provide personalized recommendations. Feedback will help identify pain points and improve the overall user experience and current features. Issues such as unclear directions and difficulty using certain functionalities can be discovered that weren't apparent during the design and development process.

All in all, the creation of this platform will serve as a test and research to create a better, more inclusive, accessible, and all-encompassing travel application for the visually impaired. The first phase will consist of building the architecture and incorporating speech-to-text technology and generative AI to develop a chatbot search tool. The technology stack and architecture were chosen to best cater to the continuous incremental improvement developmental process that this application is going to use. The second phase will focus on personalization and community building, introducing features like personalized recommendations and a collaborative travel blog to provide a platform for users to share experiences and suggestions. Further phases have not been designed, as the direct feedback from phases 1 and 2 will determine the future trajectory.

Additional Deliverables

Test Planning Guideline Template

Test Planning

Test planning is a phase in the testing process where you gather scope, decide what you are testing, define test scenarios, and come up with a work plan. It encompasses any activities that decide and manage the overall direction of your testing effort.

Benefits

- A clear roadmap of objective, scope, requirements, and strategy for the testing process. This allows stakeholders to see the progress of your project.
- A consistent testing process that is reusable and reliable.
- Prevention of unnecessary tests by having a clear scope of what is needed to be tested.
- Identifying risks that could potentially delay or stop your testing process.
- Having a test process that is open for continuous improvement. When your test plan is documented, your team will have an easier time finding out areas for improvements.

Guidelines

There are seven guidelines that are best utilized in test planning. These guidelines include answers to the following questions:

1. What is the feature being tested:

   Ex. Accessibility features such as screen reader compatibility, keyboard navigation, and alternative text for images.

2. Who will be the consumer of the feature?

   Ex. Visually impaired users relying on assistive technologies to navigate and interact with the application.

3. What is the main scope of the item you're testing, why is it relevant?

   Ex. Ensuring all aspects of the travel web application are accessible and usable for individuals with visual impairments.

4. Are there any external dependencies?

Ex. Compatibility with external API's and adherence to accessibility standards (WCAG)

5. What testing tools will be used?

Ex. Screen Reader, Selenium, Manual Testing, Etc.

6. How to define the test scenario?

Ex. Impersonate one of the prebuilt user personas and navigate the web application catering to their attributes.

7. How to define the work plans. This is where you include all the activities and tasks related to your test plan.

Ex. Test Scheduling document and test case document.

Process

The process of creating your test plan consists of eight steps. These eight steps are as follows.

1. Analyze the product: The first step to developing a test plan begins with a thorough analysis of the product.
2. Design the Test Strategy: Once the product is fully analyzed you will need to develop a test strategy for different levels. These levels include but are not limited to: Unit testing, Integration testing, System testing, Acceptance testing, Performance testing, Regression testing.
3. Define the Test Objectives: Test objectives are the main goals for testing.
4. Define Test Criteria: Test criteria are specific requirements or conditions that must be met to determine if the test passed or failed.
5. Complete Resource Planning: Everything that is required for the testing team to complete testing should be included in the test plan. Resources include human resource, tools, as well as material needed to complete a project.
6. Plan Test Environment: This is the setup required for the team to run the tests. Include both hardware and software requirements like servers, user interface, and even required users.

7. Schedule & Estimation Report: A strategy for scheduling and estimation should be included in the test plan.
8. Determine Test Deliverables: Test deliverables are artifacts like test strategy report, defect management plan, and test schedule produced during the test planning process.

Best Practices

- Define and identify requirements, objective, and what is in scope and out of scope for testing.
- Take and document notes during the planning discussion. You might not need to document your notes with the intention of communicating it to others. Writing down what you plan to do can assist you in organizing your thoughts and can help you identify what is missing from the plan.
- Figure out the audience of who will be using your test plan. You should cater the test plan to them and write it in a way that is easy for them to read.

Unit Testing Guideline Document

Benefits

- Cheaper maintenance and development cost in the long run. It costs less to write a test and have it forever in your stack than to wait for an unexpected defect to show up during critical time. On the other hand, having to manually re-test a feature for every change is a continuous-time and resource investment.
- Document the behavior of your code. Maintaining a system for a long period is costly because technology gets outdated and technical debt grows. Comments are not always reliable, but your test cases always say what it is exactly going to do.
- Allows you to verify code even if the overall feature isn't complete.
- Unit testing improves the quality of your code base and makes it less prone to errors.

Guidelines

- Write simple and readable tests using the AAA pattern.
- Test one scenario per test.
- Write Isolated tests.
- Avoid API calls in your tests.
- Make sure that tests are repeatable and scalable.

Processes

- Set Up the Environment
- Write the Test Cases
- Run the Test Cases
- Analyze the Results

Best Practices

- Unit tests should avoid having side effects. This means there should be no Input/Output access. This includes reading or writing to the console or reading/writing files. This is because unit tests should be isolated and independent. Depending on external factors can lead to unpredictable and unreliable test results. If external factors are needed consider using mocks, stubs, or dependency injection.
- Unit tests should have a minimal scope. Each test has a single purpose and should test one specific behavior. A benefit of this is easier maintenance in the future if/when changes occur.
- Write minimally passing tests. This allows for tests to become more resilient to future changes.
- Test should test all possible inputs and potential failure cases. Your test should consider all possible edge cases.

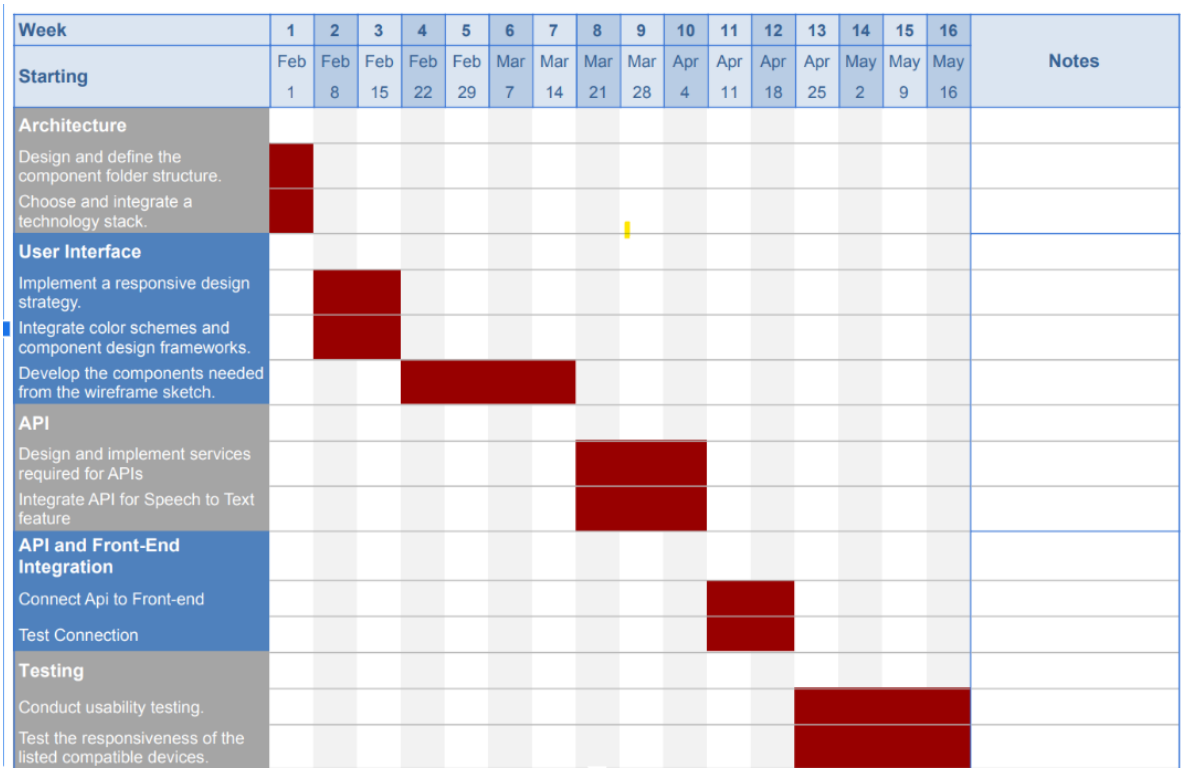
Folder Structure:

```
src/module/class
src/module/class_test
```

Method Naming Convention

- isVerified_False_EmailAccepted
- passedClass_True_IfGradeAboveD

Project Timeline



Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Notes
Starting	Feb 1	Feb 8	Feb 15	Feb 22	Feb 29	Mar 7	Mar 14	Mar 21	Mar 28	Apr 4	Apr 11	Apr 18	Apr 25	May 2	May 9	May 16	
Architecture																	
Design and define the component folder structure.																	
Choose and integrate a technology stack.																	
User Interface																	
Implement a responsive design strategy.																	
Integrate color schemes and component design frameworks.																	
Develop the components needed from the wireframe sketch.																	
API																	
Design and implement services required for APIs																	
Integrate API for Speech to Text feature																	
API and Front-End Integration																	
Connect Api to Front-end																	
Test Connection																	
Testing																	
Conduct usability testing.																	
Test the responsiveness of the listed compatible devices.																	

Repository and Specification Pattern Guideline

```
1.  public interface ISpecification<T>
2. {
3.    //Linq expression
4.    Expression<Func<T, bool>>? Criteria { get; }
5.    List<Expression<Func<T, object>>> IncludeExpressions { get; }
6.    void AddInclude(Expression<Func<T, object>> includeExpression);
7.    Expression<Func<T, object>>? OrderByExpression {get;}
8.    Expression<Func<T, object>>? OrderByExpressionDesc {get;}
9.    bool IsSatisfiedBy(T entity);
10. }
11.
12. public class BaseSpecification<T> : ISpecification<T>
13. {
14.    public Expression<Func<T, bool>> Criteria { get; private set; } = x => true;

15.    public List<Expression<Func<T, object>>> IncludeExpressions { get; } =
16.    new List<Expression<Func<T, object>>>();

17.    public Expression<Func<T, object>> OrderByExpression { get; private set; } = x => null;

18.    public Expression<Func<T, object>> OrderByExpressionDesc { get; private set; } = x => null;
19.
20.    public void AddInclude(Expression<Func<T, object>> includeExpression)
21.    {
22.       IncludeExpressions.Add(includeExpression);
23.    }
24.
25.    protected virtual void AddCriteria(Expression<Func<T, bool>> criteria)
26.    {
27.       Criteria = criteria;
28.    }
29.
30.    protected virtual void AddOrderBy(Expression<Func<T, object>> orderByExpression)
31.    {
32.       OrderByExpression = orderByExpression;
33.    }
34.
35.    protected virtual void AddOrderByDesc(Expression<Func<T, object>> orderByDescExpression)
36.    {
37.       OrderByExpressionDesc = orderByDescExpression;
38.    }
39.
40.    public bool IsSatisfiedBy(T entity)
41.    {
42.       return Criteria.Compile().Invoke(entity);
43.    }
44.
45. }
46.
47. // You will make a different specification file for each specification
48. public class CategorySpecification : BaseSpecification<Post>
```

```
49. {
50.     public CategorySpecification(string categoryName)
51.     {
52.         AddCriteria(p => p.Category.Name == categoryName);
53.         AddInclude(p => p.Category);
54.         AddOrderBy(p => p.ID);
55.     }
56. }
57.
58. public interface IRepository<T>
59. {
60. //Returns an IEnumerable of type T: IEnumerable<T>
61. //Takes in a generic of type T: GetBySpecification<T>
62.             async IEnumerable<IQueryable<T>> GetBySpecification<T>(ISpecification<T> specification);
63.
64.             // Other repository methods...
65. }
66.
67. public class BlogPostRepository : IRepository<BlogPost>
68. {
69.
70.   public override async IEnumerable<IQueryable<BlogPost>>    GetBySpecification(ISpecification<Product>
specification)
71.   {
72.         IQueryable<BlogPost> query = context.BlogPost;
73.         if (includes != null)
74.         {
75.             foreach (var include in specification.IncludeExpressions)
76.             {
77.                 query = query.Include(include);
78.             }
79.         }
80.
81.         if(specification.OrderByExpression is not null)
82.         {
83.             query = query.OrderBy(specification.OrderByExpression)
84.         }
85.
86.         if(specification.OrderByDescExpression is not null)
87.         {
88.             query = query.OrderByDescending(specification.OrderByDescExpression)
89.         }
90.         return await query.Where(specification.IsSatisfiedBy).toListAsync();
91.   }
92. }
93.
94.     // How you would call this in your controller
95.     var specification = new CategorySpecification('Travel Ideas');
96.     var filteredProducts = blogPostRepository.GetBySpecification(specification);
97.
```

References

- Fernandes, H., Costa, P., Filipe, V., Paredes, H., & Barroso, J. "A Review of Assistive Spatial Orientation and Navigation Technologies for the Visually Impaired." *Universal Access in the Information Society*, vol. 18, 2019, pp. 155-168.

- "WCAG - Key to Your Website's Accessibility - useWeb - Sklepy, Strony Internetowe, Aplikacje Webowe." *useWeb*, https://useweb.pl/en/websites/wcag-key-to-your-websites-accessibility/.

- Milbergs, Kaspars. "30 Key Web Accessibility Statistics." *Accessiblyapp.com*, accessiblyapp.com/blog/web-accessibility-statistics/.

- Looti, Mohammad. “Keirsey Temperament Sorter in Psychology.” *PSYCHOLOGICAL SCALES*, 30 Aug. 2023, scales.arabpsychology.com/2022/11/19/keirsey-temperament-sorter/.

- "Social Media Marketing: What It Is and How to Build Your Strategy." *Sprout Social*, 28 Feb. 2024, sproutsocial.com/insights/social-media-marketing-strategy/.