IOS MOBILE APP

IOS GEOTHERMAL APP: UPDATING THE WORLD'S FIRST PRE-DESIGN TOOL FOR GEOTHERMAL SYSTEMS

TEAM IO-REDBACK

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CLIENT

Guillermo Narsilio Ferrero

SUPERVISOR

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Project detail

Background Description:

Nowadays, the construction industry is increasingly focused on sustainable development and environmental protection. Geothermal systems, as an effective renewable energy technology, have been widely used worldwide. They can provide efficient heating and cooling for residential and commercial buildings while reducing energy costs and carbon emissions. By utilizing geothermal applications, engineers and architects can optimize the design and performance of geothermal systems and improve heating and cooling efficiency. At the same time, this approach meets the demands of sustainable development and environmental protection and promotes the development of the construction industry towards a more energy-efficient and environmentally friendly direction.

Fourth Element Energy Pty Ltd is an Australian company that is devoted to developing and commercializing clean energy solutions, particularly in the area of shallow geothermal, which is efficient heating and cooling using thermal energy from the ground. With the continuous development of the market and technology, the current iOS Geothermal app which was published in 2016 is laggard to the latest App Store version. Further, some functions that are out of date bring some inconvenience to the users and can not help with user stickiness. To meet the mass-market demand, the company has decided to update this iOS App.

Motivation:

Geothermal systems, as a clean, sustainable, and reliable energy source, have numerous benefits:

- Significantly reducing carbon emissions: Geothermal energy is a renewable resource with minimal greenhouse gas emissions.
- Lowering energy costs: Geothermal systems have lower operation and maintenance costs, which can lead to long-term energy savings.
- Improving energy efficiency: Geothermal systems are highly efficient, utilizing constant underground temperatures to convert energy, and can convert low-temperature heat into high-temperature heat through heat pump technology.

Geothermal applications can also provide engineers, architects, and property owners with more efficient, accurate, and cost-effective geothermal system design and implementation solutions, driving the industry towards further advancement. The development of geothermal applications is of paramount importance.

Project Overview:

Our team, IO-Redback, will collaborate with client Guillermo Narsilio Ferrero to implement this app's updated version with the help of our supervisor Luke. The estimated duration of this project is 3 months and we will use the Agile management method to ensure the successful completion of this project.

Client goals(Objectives and Scopes):

With the continuous development of the market and technology, users' requirements for the design and performance of geothermal systems are also continuously improving. Therefore, geothermal applications need to be updated in a timely manner to adapt to market changes and technological development, improve heating and cooling efficiency, reduce costs, and lower carbon emissions. Specifically, updating geothermal applications may include the following scopes:

- Fix known vulnerabilities and issues
- Update the iOS version to maintain compatibility with the latest operating system version.
- Enhance the user experience, such as customizing colors, optimizing the user interface, and improving interaction. Improve user satisfaction and experience, making it easier for users to find the tools and information they need.
- Provide multiple language options to attract more users and promote the market expansion of geothermal applications.
- Add a new input unit method. Update the front-end to obtain inputs in different formats, which can be converted in the back-end and then calculated.

Challenges

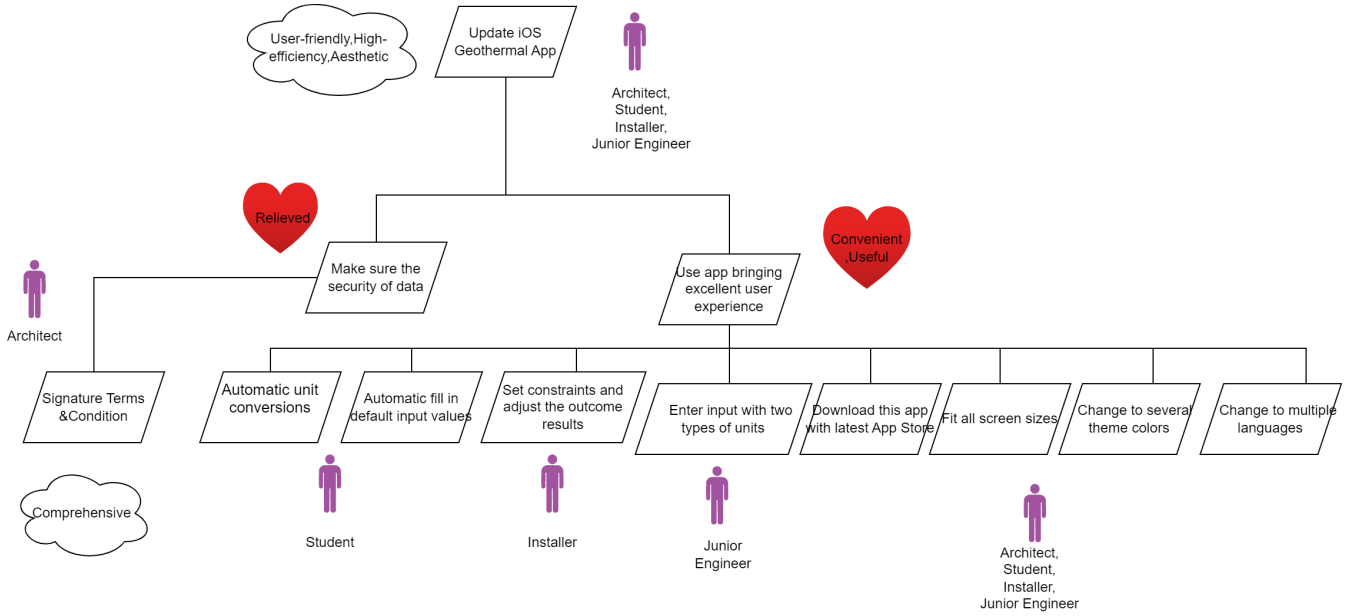
For this project, we also faced several challenges:

- Neither of us has a lot of experience in iOS programming, and the project updates require a deep understanding of swift
- We need to meet frequently with clients, supervisors and team members, and communication issues are also a challenge
- We have not used software such as Confluence before, we need to adapt and learn

DO-BE-FEEL List

WHO	DO		BE	FEEL
Architect	Make sure the security of data	Signature Terms &Condition	Comprehensive	Relieved
Student	Use app bringing excellent user experience	Automatic unit conversions	User-friendly,High-efficiency,Aesthetic	Convenient,Useful
		Automatic fill in default input values		
Installer		Set constraints and adjust the outcome results		
Architect,Student,Installer,Junior Engineer		Change to multiple languages		
		Change to several theme colors		
		Fit all screen sizes		
		Download this app with latest App Store		
Junior Engineer		Enter input with two types of units		

Goal Model



Persona

After further discussions with our clients, we have finally identified four different types of personas:

- Junior Engineer

The primary target user of this app is the junior geothermal engineer. This app aims to provide guidance for the engineers with limited work experience who are not yet familiar with geothermal system design, simplifying their workflow and enabling them to complete system designs more efficiently.

- Architect

Architects are also among the target users of this app. They often lack technical knowledge about geothermal systems and may face difficulties in practice. Using this app will help them understand the structure and cost of geothermal systems more easily, making it convenient for them to incorporate geothermal systems into their building designs.

- Student

This app can assist students in infrastructure engineering and other related majors in learning the structure and design methods of geothermal systems. It can help them gain a better insight of geothermal systems.

- Installers

This app enables installers to better understand the design specifications of geothermal systems, assisting them in completing the installation of geothermal systems.

The specific persona information is shown in the chart below.

Type	Bio	Goals	Frustration
Junior Engineer	Ethan Jackson is a 25-year-old entry-level geothermal system engineer. He recently graduated with a degree in infrastructure engineering and has been working in a company that specialises in geothermal systems for 6 months. He has a basic understanding of geothermal systems and is able to complete the geothermal system design under the guidance of senior professionals. He is eager to learn more and gain practical experience in designing efficient and cost-effective geothermal systems for buildings.	• Use the app to design geothermal systems individually and improve his business skills. • Quickly gain a solid understanding in geothermal systems and their components. • Stay up-to-date with the latest industry trends and guidelines.	• It would be time consuming to complete the entire system design independently at his current level. • He finds it challenging to understand some technical abbreviations and calculations. • He needs to use multiple tools for the designing and calculating of geothermal systems.
Architect	Rachel Williams is a 35-year-old architect who works for a large architecture firm. She has ten years of experience in designing sustainable buildings. She works for a large architecture firm. She is interested in collaborating with engineers to incorporate geothermal systems into her building designs. She wants to use the app to get accurate estimates of feasibility and cost of a geothermal system.	• Integrate geothermal systems into energy-efficient building designs. • Use the app to get the accurate estimates of feasibility and cost of a geothermal system. • Collaborate with geothermal engineers on system design.	• She doesn't have much background knowledge in geothermal systems. • She is struggling to find some reliable and and up-to-date resources of geothermal information. • It can be difficult to communicate effectively with geothermal engineers sometimes.
Student	Samantha Lee is a 21-year-old infrastructure engineering student who has developed an interest in sustainable energy solutions. She aims to become a geothermal engineer after graduation and is seeking a comprehensive resource to learn more about it. She wants to use the app to gain a better understanding of how geothermal systems work.	• Gain a thorough understanding of geothermal systems and their components. • Learn more about the topic without affecting her coursework. • Stay updated on industry trends to help her make future career choices.	• She has limited access to user-friendly and comprehensive educational resources on geothermal systems. • It is difficult to balance heavy course load while trying to learn about a new and complex topic. • She has some difficulty in finding real-world examples and case studies to supplement her learning.
Installer	Robert Davis is a 45-year-old experienced installer who has been working in the HVAC industry for 15 years. In recent years, with more and more buildings adopting geothermal systems, he has also received more work orders for installing geothermal systems. He is keen to expand his expertise in this area.	• Install geothermal systems efficiently according to design specifications. • Ensure the systems are functioning optimally after installation. • Stay updated on the latest installation techniques and best practices.	• He has some difficulty in interpreting complex design specifications due to lack of technical knowledge. • He is struggling to find accurate and up-to-date information on system components and installation techniques.

NAME

Ethan Jackson

MARKET SIZE

45 %

TYPE

Junior Engineer

Demographic

♂ Male | 25 years

Australia

Geothermal system engineer

Bio

Ethan Jackson is a 25-year-old entry-level geothermal system engineer. He recently graduated with a degree in infrastructure engineering and has been working in a company that specialises in geothermal systems for 6 months. He has a basic understanding of geothermal systems and is able to complete the geothermal system design under the guidance of senior professionals. He is eager to learn more and gain practical experience in designing efficient and cost-effective geothermal systems for buildings.

Quote

“Empower me to design a greener tomorrow.”

Goals

- Use the app to design geothermal systems individually and improve his business skills.
- Quickly gain a solid understanding in geothermal systems and their components.
- Stay up-to-date with the latest industry trends and guidelines.

Frustrations

- It would be time consuming to complete the entire system design independently at his current level.
- He finds it challenging to understand some technical abbreviations and calculations.
- He needs to use multiple tools for the designing and calculating of geothermal systems.

NAME

Rachel Williams

MARKET SIZE

25 %

TYPE

Architect

Bio

Rachel Williams is a 35-year-old architect who works for a large architecture firm. She has ten years of experience in designing sustainable buildings. She works for a large architecture firm. She is interested in collaborating with engineers to incorporate geothermal systems into her building designs. She wants to use the app to get accurate estimates of feasibility and cost of a geothermal system.

Quote

Blending architecture with sustainability.

Demographic

Female 35 years

Australia

Architect

Goals

- Integrate geothermal systems into energy-efficient building designs.
- Use the app to get the accurate estimates of feasibility and cost of a geothermal system.
- Collaborate with geothermal engineers on system design.

Frustrations

- She doesn't have much background knowledge in geothermal systems.
- She is struggling to find some reliable and and up-to-date resources of geothermal information.
- It can be difficult to communicate effectively with geothermal engineers sometimes.

NAME

Samantha Lee

MARKET SIZE

16 %

TYPE

Student

Bio

Samantha Lee is a 21-year-old infrastructure engineering student who has developed an interest in sustainable energy solutions. She aims to become a geothermal engineer after graduation and is seeking a comprehensive resource to learn more about it. She wants to use the app to gain a better understanding of how geothermal systems work.

Quote

Unlocking the potential of geothermal energy.

Demographic

Female 21 years

Australia

Student

Goals

- Gain a thorough understanding of geothermal systems and their components.
- Learn more about the topic without affecting her coursework.
- Stay updated on industry trends to help her make future career choices.

Frustrations

- She has limited access to user-friendly and comprehensive educational resources on geothermal systems.
- It is difficult to balance heavy course load while trying to learn about a new and complex topic.
- She has some difficulty in finding real-world examples and case studies to supplement her learning.

NAME

Robert Davis

MARKET SIZE

13 %

TYPE

Installer

Bio

Robert Davis is a 45-year-old experienced installer who has been working in the HVAC industry for 15 years. In recent years, with more and more buildings adopting geothermal systems, he has also received more work orders for installing geothermal systems. He is keen to expand his expertise in this area.

Quote

Efficiency and expertise in every installation.

Demographic

Gender 45 years

Australia

HVAC installer

Goals

- Install geothermal systems efficiently according to design specifications.
- Ensure the systems are functioning optimally after installation.
- Stay updated on the latest installation techniques and best practices.

Frustrations

- He has some difficulty in interpreting complex design specifications due to lack of technical knowledge.
- He is struggling to find accurate and up-to-date information on system components and installation techniques.

Technical details

1.Programming languages :

SWIFT is an open source programming language that can run on multiple platforms (including operating systems such as Linux, Windows, and Android) and is specifically used to develop iOS, iPadOS, watchOS, tvOS, and macOS applications.

2. IDE :

Xcode is the main IDE for iOS application development, providing many functions:

- Source Code Editor: The editor supports functions such as automatic code completion, syntax highlighting, intelligent prompts, and error checking, which can help developers write and debug code more quickly;
- Debugger: Support breakpoint debugging, variable monitoring, console output, and memory monitoring functions, which can help developers debug and optimize applications;
- Automated build tools: Developers can use Xcode's build system to create and manage build configurations, including compilation options, code signatures, and application versions;
- Version control: Developers can use Xcode to manage code versions, view history, compare different versions of code, and more;
- User interface design tools: Developers can use Xcode's interface designer to drag and drop controls, layout the interface, set properties, and create connections.

3. IOS SDK:

The iOS SDK is the foundation for iOS application development, providing developers with the necessary tools, frameworks, and APs, including:

- Xcode IDE :used to create, debug, and deploy iOS applications;
- The iOS Simulator :used to test the performance of iOS applications on different devices;
- The iOS SDK Frameworks : includes multiple frameworks, including UIKit, Core Data, Core Location, MapKit, and others, can help developers create user interfaces for applications, process data, and manage location information;
- Instruments: Help developers analyze application performance issues and optimize application performance;
- iOS Dev Center: Provide development documentation, sample code, tools, and resources to help developers develop iOS applications more quickly.

By using these components, developers can develop and test iOS applications more efficiently, and achieve better performance and user experience.

4. Application programming interface (API) :

APIs are commonly utilized in the development of iOS apps, as they offer a vast array of features that can enhance app functionality. In our scenario, UIKit could be employed to construct a user interface that meets the client's expectations for a positive user experience. Specifically, the built-in tool named Interface Builder, which is available in Xcode, can assist developers in designing and previewing the interface.

5. App store guidelines and deployment :

The client's ultimate objective is to have the application published on the App Store. As a result, the app must meet the requirement with Apple's App Store guidelines. Additionally, developers must register for the Apple Developer Program and have an account linked to the App Store. Fortunately, the client already has an Apple developer account and can grant us access to it.

6. Test and debug :

Before being released, all programming projects must undergo testing and debugging to guarantee a satisfactory user experience and meet Apple's App Store guidelines.

- Xcode incorporates several built-in debugging tools;
- Apple offers automated testing tools like XCTest;
- The client will supply us with some test cases.

User stories

We measure our workload by using low, medium and high to describe our workload, we think the workload for low generally takes 1 to 2 days, medium takes about 2 to 3 days, high takes 3 to 5 days to complete, and at the same time the priority is also divided according to low, medium and high, low we think is low is not urgent and unimportant, the medium is not urgent but important, high is urgent and important. We will arrange for the next work to be determined by a combination of workload and priority assessment.
Although we are asked to use chatGPT for some of the user stories, we have analysed the current requirements to produce user stories that the client is happy with, so we don't think we need its help at this stage.

- As an engineer, I want to enter my measurements in international units so that I can check the accuracy of the data

workload: low Priority: medium

- As a student, I would like to enter the data units based on my existing measurements, so that I don't need to spend extra time on unit conversions

workload: low Priority: medium

- As an engineer, I want to fix one of the outcome values, so that I can find the most logical way to build a pipe.

workload: low Priority: medium

- As an installer, I want to get results based on the constraints of the house so that I can offer the most cost-effective installation solution to my clients.

workload: low Priority: medium

- As a student/engineer/installer/architect, I want to use my own language to navigate the application so that I can understand the content faster.

workload: medium Priority: high

- As a student/engineer/installer/architect , I want to have access to the terms and conditions so that I can have a clear understanding of my rights, responsibilities, and privacy policies that are applicable to the application.

Workload: low Priority: high

- As a student/engineer/installer/architect, I want to change the theme color, so that I can choose the theme that I like and that makes me feel comfortable using this application.

Workload: low Priority: medium

- As a student/engineer/installer/architect, I want the application to be able to fit different screen sizes so that it can provide the same experience and information on different hardware.

Workload: high Priority: high

- As a student, I want the application to be able to provide default input values so that when I have some unknown value I can have a default number to avoid inputting some invalid value.

Workload: medium Priority: high

Sprint Plans

Project Name: IO-Redback

Project Objective: To develop a user-friendly iOS application that allows users to design geothermal systems effectively.

Sprint 2: Implementation of Basic Features (Duration: 4 weeks)

1. Task Breakdown:
    a. Conversion between metric and imperial units
    b. Allow users to set constrains or fix one of the outcome calculations
    c. Multi-language support
    d. Provide a link to terms and conditions
    e. Change theme color
    f. Adapt to different devices and system versions
    g. Provide default input values
2. Task Estimation:
    a. Units conversion: 1 to 2 days
    b. Set constrains: 1 to 2 days
    c. Multi-language: 2 to 3 days
    d. Link of terms: 1 to 2 days
    e. Theme: 1 to 2 days
    f. Device adaption: 3 to 5 days
    g. Default values: 2 to 3 days
3. Task Assignment:
    a. Units conversion: Yichen Liu
    b. Set constrains: Yuwei Gu
    c. Multi-language: Yuntian Wan
    d. Link of terms: Haoyuan He
    e. Theme: Ruiqi Pang
    f. Device adaption: Haoyuan He, Yuntian Wan
    g. Default values: Ruiqi Pang
4. Weekly meetings:
    a. Client meetings: Once per week, depending on client's availability.
    b. Supervisor meetings: 30 minutes per week, every Thursday at 12:30 PM.
    c. Team member meetings: 2-3 times per week.
5. Code Reviews: Weekly on Fridays, 2 hours per session.
6. Testing: Ongoing unit testing and integration testing throughout the sprint.

Sprint 3: Optimization and Extension of Features (Duration: 4 weeks)

1. User Experience Improvements: Based on client feedback and testing results, make necessary adjustments to enhance the user experience.
2. Code Refactoring: Review and optimize the code to improve performance, readability, and maintainability.
3. Documentation: Write detailed development documents, including architecture design and user manuals.
4. Integration and System Testing: Ensure all modules and functionalities work correctly within the entire system and meet performance and stability requirements.
5. Bug Fixes: Fix all issues and defects discovered during testing.
6. Deployment and Release Preparation: Perform pre-deployment tasks, including configuration management, data migration, and version control.
7. Retrospective Meeting: At the end of the sprint, organize a retrospective meeting to summarize the lessons learned from this sprint and continuously improve in subsequent sprints.