

# **“Trailly”: An application for mapping, safe exploration and navigation on hiking trails.**

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ΠΑΝΕΠΙΣΤΗΜΙΟ ΙΩΑΝΝΙΝΩΝ**

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Wednesday, 4<sup>th</sup> of April.

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# Περίληψη

Η διπλωματική αυτή εργασία έχει ως στόχο την δημιουργία μίας εφαρμογής που θα ασχολείται με την καταγραφή, μεταφόρτωση, ασφαλή εξερεύνηση και περιήγηση ορειβατικών μονοπατιών στον ελλαδικό χώρο. Σημαντικό είναι να αναφερθεί πως η εφαρμογή αυτή αναπτύχθηκε με σκοπό τη διατήρηση της ασφάλειας των περιηγητών κατά τις ορειβατικές τους εξορμήσεις, καθώς και την επέκταση των ήδη υπαρχόντων υπηρεσιών για την ενημέρωση κατά την περιήγηση τους. Στόχος ήταν η προσπάθεια για τη δημιουργία μίας πλατφόρμας όπου οι χρήστες θα μπορούν να ανατρέχουν για βοήθεια σε περίπτωση ανάγκης και για ενημέρωση. Έχοντας όμως ως προτεραιότητα την ασφάλεια, οι χρήστες θα μπορούν να λαμβάνουν καθώς και να στέλνουν ειδοποιήσεις για έκτακτα γεγονότα που συμβαίνουν γύρω τους όπως φωτιές, σήματα SOS, προβλήματα στα μονοπάτια τους καθώς και για αναπάντεχα καιρικά φαινόμενα. Ακόμα, θα μπορούν να ενημερώνονται για το τι να κάνουν εάν βρεθούν σε έκτακτη ανάγκη, να μπορούν να καλούν τα αντίστοιχα τριψήφια νούμερα των πλησιέστερων αρμόδιων φορέων και να οργανώνονται σε ομάδες εθελοντών σε περίπτωση που υπάρχει τρόπος ανθρώπινης παρέμβασης για την αντιμετώπιση των προαναφερθέντων γεγονότων. Τέλος, πρέπει να τονιστεί πως η εφαρμογή αυτή σε καμία περίπτωση δεν προσπαθεί να αντικαταστήσει κανένα φορέα ενημέρωσης και παροχής βοήθειας, παρά προσπαθεί να προσφέρει μία επέκταση στις ήδη υπάρχοντες δομές για να εξασφαλίσει περισσότερη ασφάλεια στους λάτρεις της ορειβασίας.

**Λέξεις Κλειδιά:** εφαρμογή, ορειβατικά μονοπάτια, ενημέρωση, ασφάλεια, πλατφόρμα, καταγραφή μονοπατιών, μεταφόρτωση μονοπατιών, ασφαλή περιήγηση, βοήθεια, ειδοποιήσεις, σήματα S.O.S, φωτιές, αναπάντεχα καιρικά φαινόμενα, προβλήματα στα μονοπάτια, έκτακτη ανάγκη, τριψήφια νούμερα, ομάδες εθελοντών, πλησιέστεροι αρμόδιοι φορείς

# Abstract

This diploma thesis aims to develop an application capable of recording, uploading and safe exploring hiking trails in Greece. It is important to note that the project's primary focus lies on enhancing the safety aspects of an explorer's hiking experience while also complementing already existing services responsible for updating them during their hiking journeys. The application is designed as a platform for users to receive safety updates, as well as, assistance in case of emergency during their hikes. It allows users to receive and send reports and alerts regarding unexpected events that may occur during their hike; such events may be fires, SOS signals, unexpected weather and trail issues. Additionally, the users will be able to access three-digit numbers of the agencies responsible for acting on such events and receive guidance and help. Moreover, they will be able to access safety tips and information provided from trustworthy guides on what actions to take in those situations. Furthermore, the application facilitates the creation of volunteer teams to assist fellow hikers in need when human intervention is possible. To conclude, crucial to note is that this application does not aim to replace existing services but rather to complement and enhance them, providing yet another way for people to reach out and enjoy hiking as safely as possible in the trails of Greece.

**Keywords:** hiking trails, application development, Greece, safety, recording, uploading, emergency assistance, safety updates, reporting system, alerts, volunteer teams, fires, S.O.S. signals, unexpected weather, trail issues, three-digit numbers, agencies responsible, safety tips

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# **Introduction**

This is a thesis project about "Trailly", a mobile application that is developed for hiking enthusiasts, offering a digital companion to their journeys. With a focus on hiker's safety, the goal of "Trailly" is to enhance the hiking experience by using mobile technology to promote community engagement, and a safer way of exploration of the great outdoors. What makes "Trailly" differ from other applications is that it provides a comprehensive solution for hikers, addressing not only navigation and trail recording but also real-time safety alerts and a community-driven approach to emergency response. The app leverages GPS technology to track hikers' locations, allowing them to share their routes and receive notifications about potential hazards, such as weather phenomena or trail issues. Moreover, "Trailly" enables hikers to connect with a network of volunteers who can provide assistance in case of emergencies, fostering a sense of community and mutual support among them. The application's focus on community engagement and emergency response sets it apart from traditional hiking apps, making it a valuable tool for both seasoned and those new to the hiking experience.

In the following chapters of this thesis, we will be discussing the creation of "Trailly" in greater detail, exploring the design process, as well as, the technical implementation, and viewing screenshots of the application's usage.

# Related Works

The baseline applications for the development of “Trailly” are the following:

- a. **Wikiloc** [WL1], a website and mobile application that contains trails and waypoints that hikers upload and showcases them in Google Maps and Google Earth. The premium version also allows trail suggestions, aids like heading indicators, compass and audio clues that alert the hiker when wandering off the trail. Wikiloc is community based, thus, the members of the community can rank, comment and upload photos of trails. For each trail the application showcases the weather forecast for the area, the photos and comments of the community, the ranking it has, driving directions and makes it available for download and GPS navigation.
- b. **AllTrails** [AT1], a fitness and travel mobile application and website that is commonly used for a variety of outdoor activities. It allows its users access to a database of trail maps which includes community sourced reviews and images for each trail.
- c. **Gaia GPS** [GG1], a website and mobile application for minimally tracking routes, finding waypoints and looking through topographical maps. The premium version unlocks features such as offline navigation and speciality maps for many countries. Some of the speciality maps include cell-phone coverage, snow forecasting, skiing, colors suitable for those with color vision deficiencies and many more.
- d. **Komoot** [KM1], a website and mobile application for navigation and route planning. This application is suggested as a great option for hikers, trekkers and backpackers since it allows to easily import a GPS track via the Komoot website (also contains voice navigation).

# **Chapter 1.**

## **Brand Identity and Visual Design: Creating the Look and Feel of “Trailly”.**

### **1.1 Project Name Selection**

Naming appropriately an application is very important. A brand as well as every project is distinctly characterized by its color scheme and name, making them key identifiers and contributing to the perceptions of it. “Trailly” is a name that very well embodies the aspects of the application’s usage. It encapsulates the essence of the application’s purpose: exploring hiking trails safely. Moreover, “Trailly” is a both descriptive and memorable name for such a purpose. The short and catchy sound it conveys makes it easy to remember and the use of the word “trail” reinforces its association with hiking and trail exploration. Thus, it makes up a perfect name for a mobile application.

### **1.2 Color Palette**

Colors are not merely decorative elements but powerful tools and a very important aspect of the application’s design. They are used to shape the user experience and perception, evoke emotions, influence decisions and interactions and set the overall aesthetic aspect of the project. The consistency of colors throughout a project is also very important since it gives the user a sense of familiarity. Bearing these factors in mind, the color palette for “Trailly” was carefully selected from early on, in order to keep consistency throughout the whole application.

The following figure (Figure 1.1) is a color palette containing all the colors used in “Trailly” along with their respective hexadecimal numbers and names.

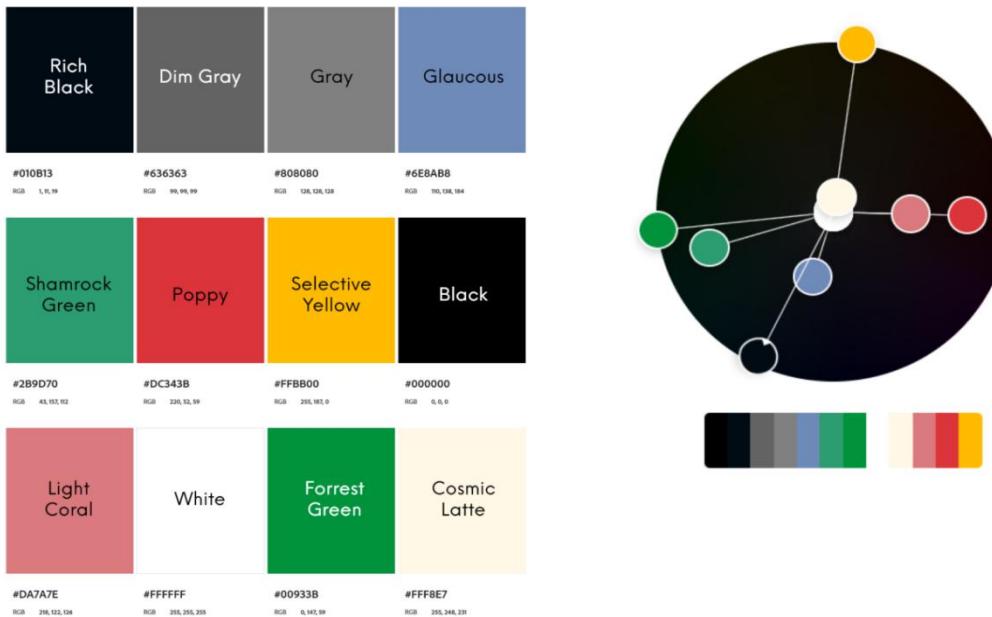


Figure 1.1. Color Palette

## 1.3 Application's Logo Design

The application's logo was designed to resemble a pin adorned with topographic map lines. The colors were selected for the logo to be distinct and unique while staying true to the pre-selected color palette. The following figure (Figure 1.2) showcases the logo and the colors that were used.

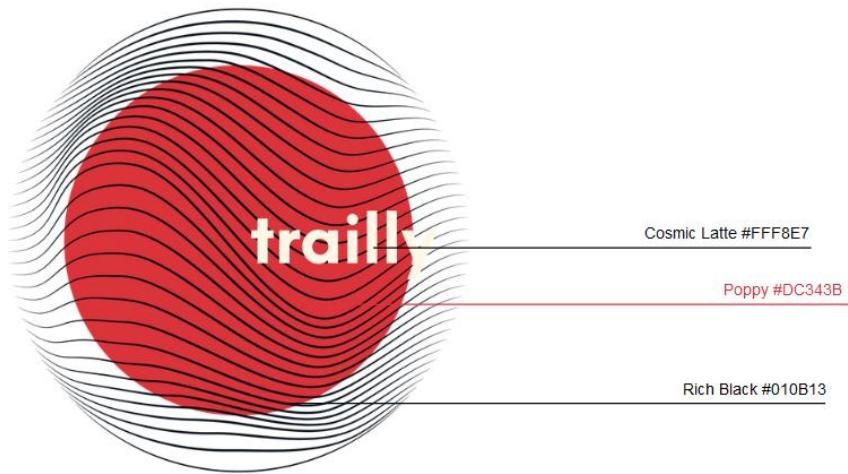


Figure 1.2. Trailly Logo Design

## 1.4 “Trailly” Symbols Showcase

### 1.4.1 Map Symbols

For the project to work as intended, there was a need to create some symbols for buttons on the map the application provides. The following figure (Figure 1.3) showcases those symbols and the colors that were used from the pre-selected palette.

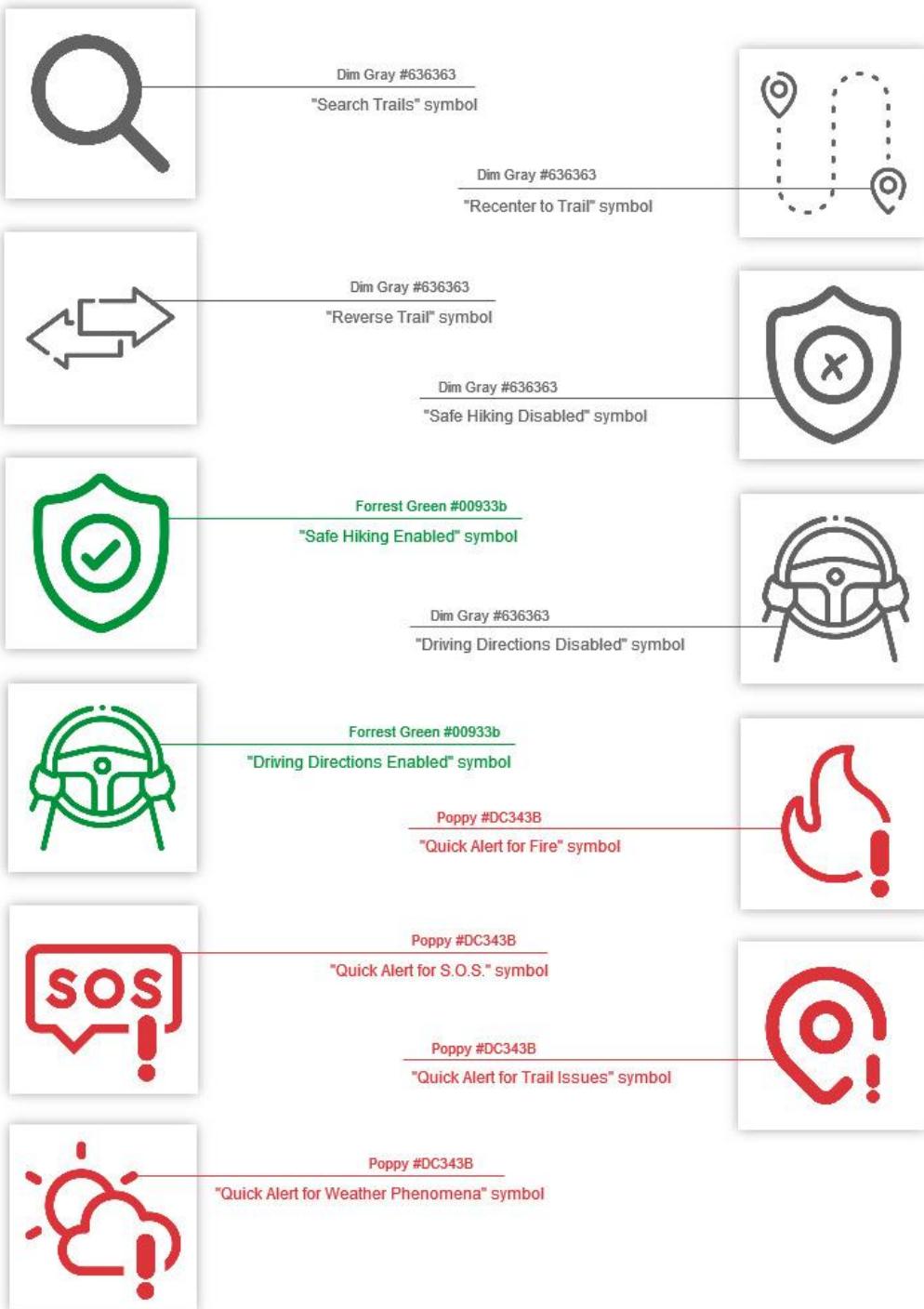


Figure 1.3. Map Symbols Design

## 1.4.2 Menu Symbols

There was also a need to create some symbols for the menu buttons of the application. The following figure (Figure 1.4) showcases them along with the colors that were used from the pre-selected palette.



Figure 1.4. Menu Symbols Design

# Chapter 2.

## User Stories and Use Cases: Designing

"Trailly" for User-Centricity.

### 2.1 User Stories

#### 2.1.1 Project's User Stories

The following table (Table 1.1) consists of user stories that played a pivotal role in the project's visualization. These user stories are categorized and grouped together (by colors red, blue, green and purple) based on their respective thematic.

Name	As a <User Type>	I want to <An Action>	So that I can <A Benefit>
US1	User	register for the application	access the features of the application
US2	User	login to my account	use the features of the application
US3	Admin	login to my account	manage the data and features of the application
US4	User	logout from my account	cease using the features of the application
US5	Admin	logout of my account	cease managing the data and features of the application
US6	Guest	be able to enter the application with a guest login	utilize some of the application's features without creating an account
US7	User, Guest	be able to see the map of the area I am in along with my location	navigate and find my way correctly
US8	User, Guest	make a report/alert for an incident (fire, SOS,	notify users and seek assistance without

		trail issue or unexpected weather) on the go, while I am navigating on the map	interrupting the navigation
US9	User, Guest	search and visualize hiking trails on the map while I am navigating	view trail locations and formations without interrupting the navigation
US10	User, Guest	get driving directions to my selected hiking trail on the map	reach the trailhead by car (if not nearby)
US11	User, Guest	recenter the map to my location	view my current location
US12	User, Guest	recenter the map to my selected hiking trail	focus on my chosen trail
US13	User, Guest	reverse my selected trail	change directions
US14	User, Guest	control if I can receive notifications for the trail I am currently navigating	manage notification preferences to avoid overload
US15	User, Guest	explore/search available trails	plan future hiking excursions
US16	User	save hiking trails available for later to a list	organize trails for future visits or planning
US17	User	remove hiking trails from my list	maintain a clean list of trails
US18	User	see my list of hiking trails	keep track of uploaded trails and planned visits
US19	User	record my own hiking trails	preserve custom hiking trails for future navigation
US20	User	upload my own trails and have the ability to share them publicly	preserve my hiking trails for future navigation and share them with other users

US21	User, Guest	view in more detail the notifications I receive and take action	assist fellow hikers and inform the responsible agencies
US22	User, Guest	access the three-digit numbers of agencies responsible for corresponding to emergencies	call for help
US23	User, Guest	get information about safety tips and what to do in emergency situations	prevent injuries and prepare accordingly
US24	User	join volunteer teams	assist fellow hikers
US25	User, Guest	in case of emergency, see alternative trails to switch to	find safer routes
US26	User who made an alert	get notified about the creation of volunteer team that will come to my rescue	know if help is on its way

Table 1.1. Project's User Stories

## 2.1.2 User Stories for Future Versions

Since there is always space for improvement and expansion, the following table (Table 1.2) provides additional user stories that explore an outline of ideas that were not integrated into the initial version of the application presented. These ideas hold potential for future versions of “Trailly”, aiming to expand its practicality. These user stories are categorized and grouped together (by colors gray, red, blue) based on their respective thematic.

Name	As a <User Type>	I want to <An Action>	So that I can <A Benefit>
FUS1	User, Admin	personalize my account with my name and photo	enhance my user experience with personalized details
FUS2	User	participate in a live chat with other users	socialize with fellow hikers

FUS3	Admin	restrict users from their chatting rights permanently or for some fixed time periods	monitor the live chat for malicious behavior and apply restrictions if necessary
FUS4	User with an account who was muted from the live chat	see the live chat despite my inability to write in it	stay informed about important matters, updates or discussions in the chat
FUS5	User, Guest	have GPS instructions while I am navigating a hiking trail	improve navigation experience
FUS6	User	rate a trail	provide feedback to the community
FUS7	User	see the average rating of a trail	access community feedback
FUS8	Admin	monitor the hiking trails uploaded by the community	maintain the application's database manageable
FUS9	User	upload photos of a hiking trail	assist fellow users in visualizing the trail features and locations

Table 1.2. User Stories for Future Versions

## 2.2 Use Cases

This section presents and specifies concrete use cases that describe the interaction of the user with the application. These use cases are derived from the abstract user stories that were presented in the previous sections. The use case UML will also be provided in the end of this section.

### 2.2.1 Project's Use Cases

#### *Use Case 1: Register*

Use Case ID	UC1
Actors	User
Preconditions	The user must open the application.

Main flow of events	<p>1. Navigate to “Registration” screen.</p> <ul style="list-style-type: none"> <li>✓ The user navigates from the starting screen of the application to the “Registration” screen by selecting the “Register” option from the menu.</li> </ul> <p>2. Fill the form.</p> <ul style="list-style-type: none"> <li>✓ The user enters the following information:</li> <ol style="list-style-type: none"> <li>a. The username</li> <li>b. The password</li> <li>c. The password’s confirmation</li> </ol> <p>3. Submit the form.</p> <ul style="list-style-type: none"> <li>✓ The user submits the information by pressing the submit button.</li> <li>✓ If the chosen username is already taken, the application notifies the user and prompts them to enter another username upon submission.</li> </ul> </ul>
Alternative flow of events	The user can cancel this activity anytime they want and go back to the starting menu screen.
Post Conditions	The user is successfully registered in the applications database.

### ***Use Case 2: Login***

Use Case ID	UC2
Actors	User, Admin
Preconditions	User/Admin must open the application and register.  <b><i>Admins cannot register themselves.</i></b>
Main flow of events	<p>1. Navigate to “Login” screen.</p> <ul style="list-style-type: none"> <li>✓ The user/admin navigates from the starting screen of the application to the “Login” screen by selecting the “Login” option from the menu.</li> </ul> <p>2. Fill the form.</p> <ul style="list-style-type: none"> <li>✓ The user/admin enters the following information:</li> </ul>

	<p>a. The username</p> <p>b. The password</p> <p>3. Submit the form.</p> <ul style="list-style-type: none"> <li>✓ The user/admin submits the information by pressing the submit button.</li> <li>✓ If the entered username and password don't match or are invalid, the application notifies the user/admin and prompts them to enter another valid combination of the two upon submission.</li> </ul>
Alternative flow of events	The user/admin can cancel this activity anytime they want and go back to the starting menu screen.
Alternative flow of events	If the user/admin does not want to login, they can choose the "Continue as a Guest" option from the starting menu screen, if they still want to use the applications features.
Post Conditions	<ol style="list-style-type: none"> <li>1. The user/admin is successfully logged in to the application.</li> <li>2. The user/admin is redirected to a home menu screen with various features.</li> </ol>

### ***Use Case 3: Logout***

Use Case ID	UC3
Actors	User/Admin
Preconditions	The user/admin must open the application and log in.
Main flow of events	The user/admin selects the "Logout" option from their home screen menu. If something goes wrong with logging the user/admin out, the user/admin will be informed with an according pop-up message and no redirection will take place.
Post Conditions	<ol style="list-style-type: none"> <li>1. The user/admin is now logged out.</li> <li>2. The user/admin gets informed for the successful logout with a pop-up message.</li> <li>3. The user/admin is now prompted to the starting screen of the application.</li> </ol>

### ***Use Case 4: See Safety Tips***

Use Case ID	UC4
Actors	User/Guest
Preconditions	The user/guest must open the application and login.
Main flow of events	<p>1. Navigate to “Safety Tips” screen.</p> <ul style="list-style-type: none"> <li>✓ The user/guest selects the option “Safety Tips” from the respective menu and gets navigated to the “Safety Tips” screen.</li> </ul> <p>2. Access information.</p> <ul style="list-style-type: none"> <li>✓ The user/guest has now access to safety tips for:</li> <ol style="list-style-type: none"> <li>a. Preparation for wildfires, campfires and encounters with wildfires (all fall under the option “Fire”).</li> <li>b. First aid kit contents, water, hydration, dehydration and filtering tips for water (all fall under the option “S.O.S”).</li> <li>c. Weather phenomena such as rain, hot weather, cold weather, lightning (all fall under the option “Weather”).</li> <li>d. Trail issues</li> </ol> </ul>
Alternative flow of events	The user/guest can cancel this activity anytime they want and they can logout.
Post Conditions	The user/guest sees the according information for each of the subjects above.

### ***Use Case 5: Report/Alert when in Unexpected Situations***

Use Case ID	UC5
Actors	User/Guest
Preconditions	The user/guest must open the application and login.
Main flow of events	<p>1. Navigation to the “Alert for Unexpected Situation” screen.</p> <ul style="list-style-type: none"> <li>✓ The user/guest selects the “Alert for Unexpected Situation” option from the menu and gets navigated to the “Alert for Unexpected Situation” screen.</li> </ul> <p>2. Select option.</p>

- ✓ The user/guest chooses one of the following options:
- a. SOS
  - b. Fire
  - c. Weather Conditions, an option that unlocks a more specific menu for the user to chose between with the following options:
    - i. Storm
    - ii. Heavy Rainfall
    - iii. Extreme Heat
    - iv. Extreme Cold
    - v. Snowstorm
    - vi. Blizzard
    - vii. Ice Storm
    - viii. High Winds
    - ix. Fog
    - x. Hailstorm
  - d. Trail Issues, an option that unlocks a more specific menu for the user to chose between with the following options:
    - i. Broken Bridge
    - ii. Landslide
    - iii. Wrong Signage
    - iv. Flood

### 3. Enter information.

- ✓ The user/guest chooses can enter, optionally, more information for their situation in a text box that is provided.

### 4. Submit the form.

- ✓ The user/guest submits the information by pressing the submit button.
- ✓ If the user has not chose a category for the report, the application notifies them upon submit and prompts them to pick one.

Alternative

The user/guest can cancel this activity anytime they want and they can

flow of events	logout.
Post Conditions	The user/guest has successfully submitted a report to alert fellow hikers about the situation they are experiencing or have observed.

### ***Use Case 6: Handle Fire Notifications***

Use Case ID	UC6
Actors	User/Guest
Preconditions	<p>1. The user/guest must open the application.</p> <p>2. The user/guest must select a trail to display on the map.</p> <p>3. The user/guest must press the “Safe Hiking” button on the map and activate its notification features.</p> <p>4. The user/guest must give the according location permissions for the notifications else the application won’t work.</p>
Main flow of events	<p>1. Get the notification.</p> <ul style="list-style-type: none"> <li>✓ The user/guest gets a notification concerning a fire nearby (30km range).</li> </ul> <p>2. Interact with the notification.</p> <ul style="list-style-type: none"> <li>✓ The user/guest taps the notification in order to interact with it.</li> <li>✓ The user/guest is presented with the notification title, contents and exact location. They get to chose whether to take action, by pressing the “TAKE ACTION” option, or to skip this notification and continue their navigation, by pressing the “CLOSE” option.</li> <li>✓ If the user/guest doesn’t want to interact anymore with the notification, they press “CLOSE” and get back to where they left off their navigation and the use case ends.</li> </ul> <p>3. Take action.</p> <ul style="list-style-type: none"> <li>✓ The user/guest selects the “TAKE ACTION” option as previously explained, from the notification pane.</li> <li>✓ The user/guest gets redirected to a page with the following menu for taking action: <ul style="list-style-type: none"> <li>a. “ALERT NEAREST AGENCIES RESPONSIBLE”, a button that navigates to a page with all the three-digit numbers</li> </ul> </li> </ul>

	<p>to call for help that correspond to the according situation.</p> <ul style="list-style-type: none"> <li>b. “JOIN FIRE FIGHTING VOLUNTEERS”, an option for the user to join a volunteer team. If the user joins, an alert will notify them if the team was indeed in the end created. For a team to be created there must be at least 5 users who were willing to join it. The user who made the alert will also be notified that help is on its way once the volunteer team is created successfully.</li> <li>c. “SEE WHAT TO DO IN CASE OF FIRE HERE”, a button that navigates the user to the safety tips for fire section of the application.</li> </ul>
Alternative flow of events	The user/guest can cancel this activity anytime they want and they can logout.
Post Conditions	<ol style="list-style-type: none"> <li>1. The users/guests are informed.</li> <li>2. Volunteer teams are created or at least tried to be created.</li> <li>3. Agencies are alerted if possible.</li> </ol>

### ***Use Case 7: Handle SOS Notifications***

Use Case ID	UC7
Actors	User/Guest
Preconditions	<ol style="list-style-type: none"> <li>1. The user/guest must open the application.</li> <li>2. The user/guest must select a trail to display on the map.</li> <li>3. The user/guest must press the “Safe Hiking” button on the map and activate its notification features.</li> <li>4. The user/guest must give the according location permissions for the notifications else the application won’t work.</li> </ol>
Main flow of events	<ol style="list-style-type: none"> <li>1. Get the notification. <ul style="list-style-type: none"> <li>✓ The user/guest gets a notification concerning a SOS call nearby (30km range).</li> </ul> </li> <li>2. Interact with the notification. <ul style="list-style-type: none"> <li>✓ The user/guest taps the notification in order to interact with it.</li> <li>✓ The user/guest is presented with the notification title, contents</li> </ul> </li> </ol>

	<p>and exact location. They get to choose whether to take action, by pressing the “TAKE ACTION” option, or to skip this notification and continue their navigation, by pressing the “CLOSE” option.</p> <ul style="list-style-type: none"> <li>✓ If the user/guest doesn’t want to interact anymore with the notification, they press “CLOSE” and get back to where they left off their navigation and the use case ends.</li> </ul> <p>3. Take action.</p> <ul style="list-style-type: none"> <li>✓ The user/guest selects the “TAKE ACTION” option as previously explained, from the notification pane.</li> <li>✓ The user/guest gets redirected to a page with the following menu for taking action:           <ol style="list-style-type: none"> <li>a. “ALERT NEAREST AGENCIES RESPONSIBLE”, a button that navigates to a page with all the three-digit numbers to call for help that correspond to the according situation.</li> <li>b. “JOIN MEDICAL HELP VOLUNTEERS”, an option for the user to join a volunteer team. If the user joins, an alert will notify them if the team was indeed in the end created. For a team to be created there must be at least 5 users who were willing to join it. The user who made the alert will also be notified that help is on its way once the volunteer team is created successfully.</li> <li>c. “SEE WHAT TO DO IN CASE OF S.O.S. HERE”, a button that navigates the user to the safety tips for S.O.S. section of the application.</li> </ol> </li> </ul>
Alternative flow of events	The user/guest can cancel this activity anytime they want and they can logout.
Post Conditions	<ol style="list-style-type: none"> <li>1. The users/guests are informed.</li> <li>2. Volunteer teams are created or at least tried to be created.</li> <li>3. Agencies are alerted if possible.</li> </ol>

### ***Use Case 8: Handle Weather Notifications***

Use Case ID	UC8
Actors	User/Guest

Preconditions	<ol style="list-style-type: none"> <li>1. The user/guest must open the application.</li> <li>2. The user/guest must select a trail to display on the map.</li> <li>3. The user/guest must press the “Safe Hiking” button on the map and activate its notification features.</li> <li>4. The user/guest must give the according location permissions for the notifications else the application won’t work.</li> </ol>
Main flow of events	<ol style="list-style-type: none"> <li>1. Get the notification. <ul style="list-style-type: none"> <li>✓ The user/guest gets a notification concerning a weather alert nearby (30km range).</li> </ul> </li> <li>2. Interact with the notification. <ul style="list-style-type: none"> <li>✓ The user/guest taps the notification in order to interact with it.</li> <li>✓ The user/guest is presented with the notification title, contents and exact location. They get to chose weather to take action, by pressing the “TAKE ACTION” option, or to skip this notification and continue their navigation, by pressing the “CLOSE” option.</li> <li>✓ If the user/guest doesn’t want to interact anymore with the notification, they press “CLOSE” and get back to where they left off their navigation and the use case ends.</li> </ul> </li> <li>3. Take action. <ul style="list-style-type: none"> <li>✓ The user/guest selects the “TAKE ACTION” option as previously explained, from the notification pane.</li> <li>✓ The user/guest gets redirected to a page with the following menu for taking action: <ul style="list-style-type: none"> <li>a. “SEE WHAT TO DO IN CASE OF UNEXPECTED WEATHER HERE”, a button that navigates the user to the safety tips for unexpected weather section of the application.</li> <li>b. “SEE OTHER TRAILS CLOSE TO YOU HERE”, a button that showcases a list of trails near the user’s location in case the user wants to find shelter or switch trails due to issues they might encounter. After the user chooses a trail, a map centered to the trail appears, helping the user navigate.</li> </ul> </li> </ul> </li> </ol>
Alternative	The user/guest can cancel this activity anytime they want and they can

flow of events	logout.
Post Conditions	The users/guests are informed.

### ***Use Case 9: Handle Trail Issue Notifications***

Use Case ID	UC9
Actors	User/Guest
Preconditions	<p>1. The user/guest must open the application.</p> <p>2. The user/guest must select a trail to display on the map.</p> <p>3. The user/guest must press the “Safe Hiking” button on the map and activate its notification features.</p> <p>4. The user/guest must give the according location permissions for the notifications else the application won’t work.</p>
Main flow of events	<p>1. Get the notification.</p> <ul style="list-style-type: none"> <li>✓ The user/guest gets a notification concerning a faulty trail nearby (30km range).</li> </ul> <p>2. Interact with the notification.</p> <ul style="list-style-type: none"> <li>✓ The user/guest taps the notification in order to interact with it.</li> <li>✓ The user/guest is presented with the notification title, contents and exact location. They get to chose whether to take action, by pressing the “TAKE ACTION” option, or to skip this notification and continue their navigation, by pressing the “CLOSE” option.</li> <li>✓ If the user/guest doesn’t want to interact anymore with the notification, they press “CLOSE” and get back to where they left off their navigation and the use case ends.</li> </ul> <p>3. Take action.</p> <ul style="list-style-type: none"> <li>✓ The user/guest selects the “TAKE ACTION” option as previously explained, from the notification pane.</li> <li>✓ The user/guest gets redirected to a page with the following menu for taking action: <ul style="list-style-type: none"> <li>a. “SEE OTHER TRAILS CLOSE TO YOU HERE”, a button that showcases a list of trails near the user’s location in case</li> </ul> </li> </ul>

	the user wants to find shelter or switch trails due to issues they might encounter. After the user chooses a trail, a map centered to the trail appears, helping the user navigate.
Alternative flow of events	The user/guest can cancel this activity anytime they want and they can logout.
Post Conditions	The users/guests are informed.

### ***Use Case 10: Upload a Trail***

Use Case ID	UC10
Actors	User
Preconditions	The user must open the application and login.
Main flow of events	<p>1. Navigation to the “Upload a New Trail” screen.</p> <ul style="list-style-type: none"> <li>✓ The user selects the “Upload/Record/Manage Trails” option from the menu and gets redirected to a second menu screen.</li> <li>✓ The user selects the option “Upload a New Trail”.</li> </ul> <p>2. Enter information.</p> <ul style="list-style-type: none"> <li>✓ The user enters the following information:           <ol style="list-style-type: none"> <li>a. The name of the trail.</li> <li>b. Optionally a description of the trail, or more information about the trail in general.</li> <li>c. The trail file in .gpx or .tcx format.</li> </ol> </li> <li>✓ The user selects if the trail is for personal or public use.</li> </ul> <p>3. Submit the form.</p> <ul style="list-style-type: none"> <li>✓ The user submits the trail.</li> <li>✓ If the user hasn’t named the trail, the application notifies and prompts them to pick one upon the submission.</li> <li>✓ If the user hasn’t uploaded a trail file, the application notifies and prompts them to input one upon the submission.</li> <li>✓ If the user uploads a trail with wrong format, the application cannot read the file given, or for some reason the trail could not be</li> </ul>

	uploaded, the user gets notified.
Alternative flow of events	The user can cancel this activity anytime they want and they can logout.
Post Conditions	The trail has been added to the application's database and can be seen and managed by the user in their trail list.

### ***Use Case 11: Record a Trail***

Use Case ID	UC11
Actors	User
Preconditions	The user must open the application and login.
Main flow of events	<p>1. Navigation to the “Upload a New Trail” screen.</p> <ul style="list-style-type: none"> <li>✓ The user selects the “Upload/Record/Manage Trails” option from the menu and gets redirected to a second menu screen.</li> <li>✓ The user selects the option “Record a Trail” and gets redirected to a screen with two buttons:           <ul style="list-style-type: none"> <li>a. “Start Recording”, an option to initiate continuous trail recording.</li> <li>b. “Stop Recording”, an option to pause continuous trail recording.</li> </ul> </li> </ul> <p>2. Record trail.</p> <ul style="list-style-type: none"> <li>✓ The user selects the “Start Recording” option.</li> <li>✓ Once a trail has started been recorded, another button will appear “Save Recorded Trail”.</li> <li>✓ If the user wants to pause recording the trail for some time, they can select the “Stop Recording” option.</li> </ul> <p>3. Save recorded trail.</p> <ul style="list-style-type: none"> <li>✓ Once the user wants to stop recording and save the trail they recorded, they will select the “Save Recorded Trail” option from the menu.</li> <li>✓ The user gets redirected to a new screen for saving the trail.</li> <li>✓ The user enters the following information:           <ul style="list-style-type: none"> <li>a. The name of the trail.</li> </ul> </li> </ul>

	<p>b. Optionally a description of the trail, or more information about the trail in general.</p> <ul style="list-style-type: none"> <li>✓ User selects if the trail is for personal or public use.</li> </ul> <p>4. Submit trail.</p> <ul style="list-style-type: none"> <li>✓ The user submits the trail by pressing the submit button.</li> <li>✓ If the user hasn't named the trail, the application notifies and prompts them to pick one upon submission.</li> <li>✓ If for some reason the trail could not be uploaded, the user gets notified upon submission.</li> </ul>
Alternative flow of events	The user can cancel this activity anytime they want and they can logout.
Post Conditions	The trail has been added to the application's database and can be seen and managed by the user in their trail list.

### ***Use Case 12: Remove a Trail***

Use Case ID	UC12
Actors	User
Preconditions	The user must open the application and login.
Main flow of events	<p>1. Navigation to the “Trail Details” screen.</p> <ul style="list-style-type: none"> <li>✓ The user selects the “Upload/Record/Manage Trails” option from the menu. The user gets redirected to a second menu screen and from the new menu screen, the user selects the option “My Trail List” and gets redirected to a page with all his saved and uploaded trails listed. The trails can be selected to view further details.</li> <li>✓ Or, the user selects the “View Map and Search Trails” option from the menu and gets redirected to a second menu screen and from the new menu screen, the user selects the option “My Trail List” and gets redirected to a page with all his saved and uploaded trails listed. The trails can be selected to view further details.</li> <li>✓ Or, the user selects the “View Map and Search Trails” option from the menu and gets redirected to a second menu screen and from the new menu screen, the user selects the option “Explore Available Trails” and gets to browse trails. The trails are</li> </ul>

	<p>interactive and can be selected to view further details.</p> <p>2. Remove trail.</p> <ul style="list-style-type: none"> <li>✓ If the user wants to delete a trail, all they have to do is to select it and from its details page either chose:</li> </ul> <ol style="list-style-type: none"> <li>a. “Delete Trail” (if they are the one that uploaded it) and remove it from the application’s database completely for all users, or</li> <li>b. “Remove Trail” (if they are not the one that uploaded it) and remove it from their trail list. The trail still remains public for all users to see, just not in the list of the said user.</li> </ol>
Alternative flow of events	The user can cancel this activity anytime they want and they can logout.
Post Conditions	The trail is either removed from the database (if the user is the one that uploaded it) or is just removed from the user’s respective trail list (if the user is not the one that uploaded it).

#### ***Use Case 13: Add a Trail to Trail List***

Use Case ID	UC13
Actors	User
Preconditions	The user must open the application and login.
Main flow of events	<p>If the user uploads (see UC10) or records and saves (see UC11) a new trail, then the trail gets automatically added to their respective trail list.</p> <p>If that is not the case, then the user can add a trail to their trail list by doing the following:</p> <ol style="list-style-type: none"> <li>1. Navigation to the “View Map and Search Trails” menu. <ul style="list-style-type: none"> <li>✓ The user selects the “View Map and Search Trails” option from their home menu.</li> <li>✓ The user gets redirected to a second menu screen.</li> </ul> </li> <li>2. Add the trail to the trail list. <ul style="list-style-type: none"> <li>✓ The user selects the option “Explore Available Trails” and gets to browse trails. The trails can be selected to view further details.</li> <li>The user selects the trail and selects the “Add to my Trails” option</li> </ul> </li> </ol>

	<p>it provides in its details page.</p> <ul style="list-style-type: none"> <li>✓ The user selects the option “View Map” and gets to browse trails by selecting the button that looks like a magnifying glass on the top right side of the map. The user searches a destination and can see the available trails that are provided in a list. The user selects the trail and adds it by selecting the “Add to Trail List” option. If no such option appears, it means that the trail is already added to the user’s respective trail list.</li> </ul>
Alternative flow of events	The user can cancel this activity anytime they want and they can logout.
Post Conditions	The trail is successfully added to the user’s trail list.s

#### ***Use Case 14: Search Trails on Map***

Use Case ID	UC14
Actors	User/Guest
Preconditions	<ol style="list-style-type: none"> <li>1. The user/guest must open the application and login.</li> <li>2. The user/guest must be navigating on the map.</li> </ol>
Main flow of events	<ol style="list-style-type: none"> <li>1. Open search. <ul style="list-style-type: none"> <li>✓ The user selects the “search trails” that is a button that allows them to browse trails. The button looks like a magnifying glass and is situated on the top right side of the map.</li> </ul> </li> <li>2. Search the trail. <ul style="list-style-type: none"> <li>✓ The user writes key words in the search bar.</li> <li>✓ The user presses the “Search” button.</li> </ul> </li> <li>3. See results and select trail. <ul style="list-style-type: none"> <li>✓ The results appear in the form of a drop-down list.</li> <li>✓ The user selects the trail of their liking.</li> <li>✓ From then on the user has the following options: <ol style="list-style-type: none"> <li>a. Reverse the trail.</li> <li>b. Add the trail to their list (if they are not a guest)</li> <li>c. See more details for the trail - an option that redirects to</li> </ol> </li> </ul> </li> </ol>

	<p>the trail's detail page.</p> <ul style="list-style-type: none"> <li>d. See the trail on the map.</li> <li>e. There is also a button that prompts the user to explore more trails and if pressed, it navigates to the "Explore Available Trails" screen of the application.</li> </ul>
Alternative flow of events	The user can cancel this activity anytime they want and they can logout.
Post Conditions	The user can search, find and view trails while navigating on the map.

### ***Use Case 15: View the Map and Trails***

Use Case ID	UC15
Actors	User/Guest
Preconditions	The user/guest must open the application and login.
Main flow of events	<p>1. Navigation to the map screen.</p> <p>✓ The user/guest selects the "View Map and Search Trails" option from the menu and gets redirected to a second menu screen. From there, the user/guest selects the option "View Map". The user/guest gets redirected to a map that is centered to their current location.</p> <p>✓ Or, the user/guest selects the "View Map and Search Trails" option from the menu and gets redirected to the second menu screen. Then, the user/guest selects the "Explore Available Trails" and gets to browse trails. The trails can be further selected to view details. From the details page of a trail, the user/guest selects the "Directions" option and gets redirected to a map that is centered to the selected trail. The map also contains the current location of the user.</p> <p>✓ Or, the user (not a guest option) selects the "View Map and Search Trails" option from the menu and gets redirected to a second menu screen. From there, the user selects the "My Trail List" option and gets to see their saved trails. The trails can be further selected to view details. The user selects a trail and from its details</p>

page, selects the “Directions” option and gets redirected to a map that is centered to the selected trail. The map also contains the current location of the user.

✓ Or, the user (not a guest option) selects the “Upload/Record/Manage Trails” option from the menu and gets redirected to another menu screen. From there, the user selects the “My Trail List” and gets to see their saved trails. The trails can be further selected to view details. From the details page of a selected trail, the user selects the “Directions” option and gets redirected to a map that is centered to the selected trail. The map also contains the current location of the user.

## 2. View of the map.

✓ User/Guest sees a map centered to their current location and some buttons on the top right corner. Those buttons are:

- a. The “recenter to user’s current location” button, a button that recenters the map to the user’s/guest’s current location.
- b. The “search trails” button, a button that once pressed, gives the option to the user to search trails and showcase them on the map.
- c. The “quick alert for issue in the trail path” button, a button that gives the option to the user/guest to make a quick alert (an alert that contains only their location and general issue) in case of a problematic situation during their navigation.
- d. The “quick alert for fire” button that has similar usage with the “quick alert for issue in the trail path button”.
- e. The “quick alert for unexpected weather phenomenon” button that has similar usage with the “quick alert for issue in the trail path button”.
- f. The “quick alert for SOS” button that has similar usage with the “quick alert for issue in the trail path button”.
- g. The “safe hiking” button, a button that when is pressed and its feature becomes active, the user/guest will receive notifications from trails and users in the range of 30km

	<p>from the user's current location. (only appears when a trail is selected)</p> <ul style="list-style-type: none"> <li>h. The “driving directions” button, a button that when is pressed and its feature becomes active, displays driving directions to the selected trail’s trailhead. The driving directions are displayed only if the user/guest is more than 1km away from the trailhead. (only appears when a trail is selected)</li> <li>i. The “reverse trail” button, a button that reverses the trailhead with the trail’s end and vice versa. (only appears when a trail is selected)</li> </ul>
Alternative flow of events	The user can cancel this activity anytime they want and they can logout.
Post Conditions	The user can search, find and view trails while navigating on the map.

## 2.2.2 Project's Use Case UML

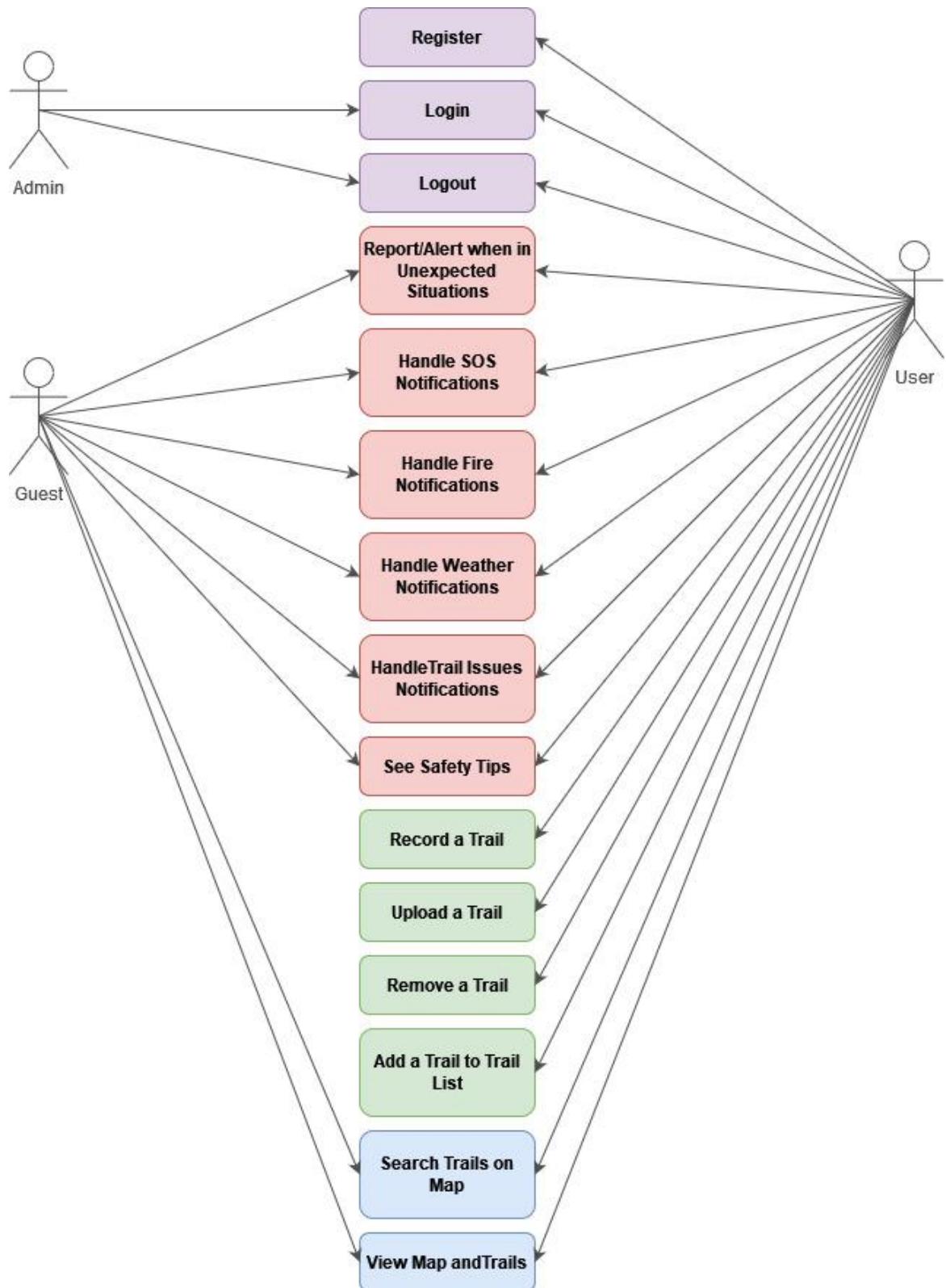


Figure 1.1 Use Case UML

# **Chapter 3.**

## **Choosing the Path: Decisions for the Project's Development and Data Schema.**

### **3.1 Introduction to the Application's structure**

Embarking on this project as the first of many in creating a mobile application, entailed making numerous decisions and learning countless lessons along the way in regards to it. From the initial choice of development platform to the detailed implementation of core features, each step presented unique challenges that required thoughtful consideration and creative problem-solving. The following is a list of decisions that had to be made in regards to the project's initialization and further development.

- a. **The selection of programming language:** JavaScript was chosen as the main programming language due to its various advantages in versatility (can be used for developing both back-end and front-end), in cross-platform compatibility (allows to build cross-platformed applications), speed and as well as performance.
- b. **The selection of framework:** React-Native and Express.js were chosen for the project's development.
- c. **The choice of NGROK** as a supporting tool for creating a static domain for server requests, thereby bypassing the need for "local-host", and managing port forwards. This was a strategic decision with several benefits such as:
  - i. Easy external access for testers without having to deploy the application to a live server.
  - ii. Testing the application in real-world conditions, simulating its performance when deployed to a production environment.
  - iii. Avoiding port forwarding configuration.
- d. **The decision to use MySQL as the database management system (DBMS).**
- e. **The use of MapBox web service API (*in its free version*)** in order to retrieve driving directions for the map's waypoints. Here we have to note that APIs with

subscriptions such as the one Google owns could later on be more suitable the application's development.

- f. **Jest** was decided to be used for testing since it is a popular choice for testing JavaScript applications, particularly those built with frameworks like React. However even though the testing was successful, there have been issues with babel and jest configuration files causing the application to crash. That is why, the testers were delivered in the form of a zip file without being included in the project directly.

## 3.2 Data Schema

The following figure (Figure 3.1) showcases the structure of the project's MySQL database with an ER (Entity- Relationship) SQL diagram.

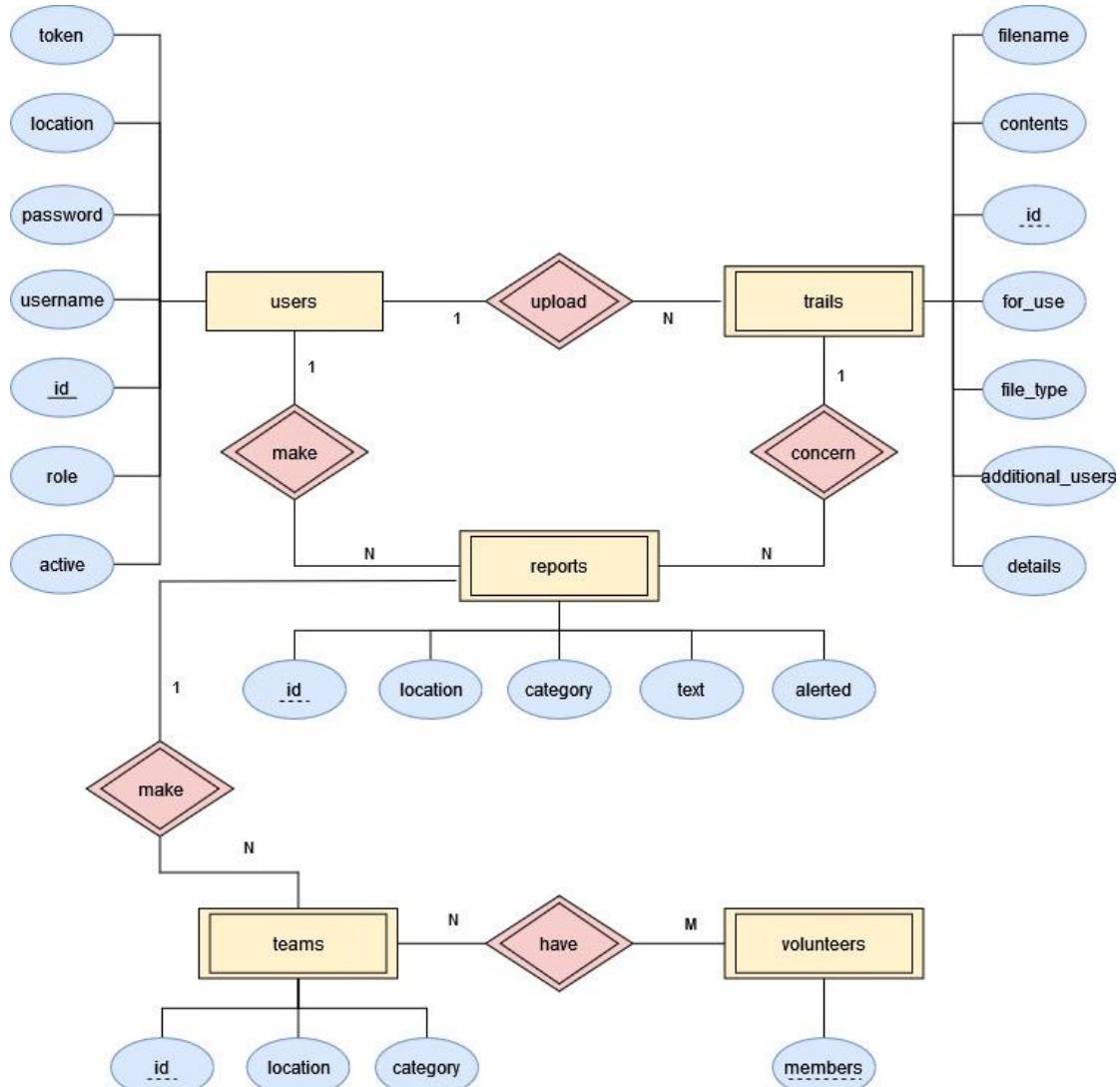


Figure 3.1. MySQL database structure (ER (Entity- Relationship) SQL diagram)

To further explain the diagram above, the following notations were gathered.

- a. The table “users” represents all the users of the application. Guest users fall under one table entry that was manually added to the table. Administrators (admins) also require manual addition to the database since the application does not yet provide a registration mechanism for them. Moreover, the application in its current state does not support the removal of either users or admins from the database.

Each entry of the table has:

- i. A unique id (primary key) that makes each user also unique.
- ii. A username that is also unique for each user.
- iii. A password. Guests have an empty string for password since it is not really ever used and was just included for the table entry to be complete.
- iv. A role that is either “guest”, “admin” or “user”. This is how the users of the application get categorized and get different screens and features with their respective login.
- v. A binary [0,1] field that shows if each user is currently logged in (active = 1) or not (active = 0).
- vi. The users current location, a field that is not yet used by the application but should be built-in the database since it could be beneficial for the application’s further development.
- vii. A token for the user to receive notifications. Each token is unique and is made for expo to send notifications separately.

The following figure (Figure 3.2) displays the table with some example entries, including the manually added guest and administrator entries (guest entry must have this specific format).

<b>id</b>	<b>username</b>	<b>password</b>	<b>role</b>	<b>active</b>	<b>location</b>	<b>token</b>
0	guest		guest	0	NULL	
2	admin	123	admin	0	NULL	
3476195a-d53c-4a3e-b888-295556d5ec7d	Pam	123	user	0	NULL	
b7cf4aaaf-deb3-4aa8-9a3a-7f74cba2c8b7	User2	123	user	0	NULL	
NULL						

*Figure 3.2. “users” table example*

- b. The table “trails” represents all the recorded and uploaded trails that exist in the application. This table has a manually inserted entry with filename being “unknown” with no contents or file type and the user owning it being the guest user.

This specific entry was created for reports/alerts regarding unexpected situations users encounter that do not include in which trail they happen in but only in which location.

Each entry of the table has:

- i. A unique id (primary key) that makes each trail also unique.
- ii. A filename that is a name given to the trail by the user when uploading the trail to the database.
- iii. The contents that consist of a matrix containing latitude and longitude entries that collectively represent the trail coordinates.
- iv. A for\_use field that will either be “public” or “personal” and will categorize the trail as available to all users (public) or only to the user that uploaded it (personal).
- v. The details that consist of a text written by the user containing additional information for the trail when uploading it to the database.
- vi. An additional\_users field that keeps a record of users that saved the trail to their respective lists without them being the one who shared the specific trail.
- vii. A user\_id field that shows who added the trail to the database (foreign key).

The following figure (Figure 3.3) displays the table with some example entries, including the manually added dummy entry.

filename	contents	id	for_use	user_id	file_type	additional_users	details
unknown		0	0				
Vikos voidomatis springs	{"tracks": [{"latitude": "39.952729", "longitude": "22.309713", "order": 1}, {"latitude": "39.952729", "longitude": "22.309713", "order": 2}, {"latitude": "39.952729", "longitude": "22.309713", "order": 3}, {"latitude": "39.952729", "longitude": "22.309713", "order": 4}, {"latitude": "39.952729", "longitude": "22.309713", "order": 5}, {"latitude": "39.952729", "longitude": "22.309713", "order": 6}, {"latitude": "39.952729", "longitude": "22.309713", "order": 7}, {"latitude": "39.952729", "longitude": "22.309713", "order": 8}, {"latitude": "39.952729", "longitude": "22.309713", "order": 9}, {"latitude": "39.952729", "longitude": "22.309713", "order": 10}, {"latitude": "39.952729", "longitude": "22.309713", "order": 11}, {"latitude": "39.952729", "longitude": "22.309713", "order": 12}, {"latitude": "39.952729", "longitude": "22.309713", "order": 13}, {"latitude": "39.952729", "longitude": "22.309713", "order": 14}, {"latitude": "39.952729", "longitude": 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Figure 3.3. “trails” table example

- c. The table “reports” represents all the reports/alerts that the users have made for unexpected situations they encountered (quick alerts from the map included).

Each entry of the table has:

- i. A unique id (primary key) that makes each report also unique.
- ii. The location the report was made at.
- iii. The category the report befalls under.

- iv. A text input if the user who made the report wanted to elaborate on more details about the event.
- v. The trail's id (foreign key) that the event happen. If the trail was not specified the manually-added-entry's id from the "trails" table is used.
- vi. A binary [0,1] field "alerted" which specifies if each report/alert has been passed on to users in notification form (alerted = 1) or is yet to be passed on (alerted = 0). It is important to also note that 24 hours after each report/alert is made, it becomes alerted (1) from not alerted (0) that is was. This happens because the report/alert is then considered expired.

The following figure (Figure 3.4) displays the table with some example entries.

<u>id</u>	<u>location</u>	<u>category</u>	<u>text</u>	<u>alerted</u>	<u>trail_id</u>	<u>user_id</u>
9b9228d2-6687-48f9-ad96-107e6dae004d	{"speed":0.0017697212751954794,"altitudeAccur...}	sos	0	3a081879-6bfb-42a3-bf58-8e02853d8b7b	0	
9c355784-60d6-4358-9435-d19931ce3833	{"speed":0.0004520144429989159,"altitudeAc...}	weather	0	3a081879-6bfb-42a3-bf58-8e02853d8b7b	0	
aea3e003-cad7-4df7-a1be-bc587e9dd114	{"speed":0.014030302874743938,"altitudeAcc...}	sos	0	3a081879-6bfb-42a3-bf58-8e02853d8b7b	0	
c1b2c893-9ad3-4bbb-a723-1f3c9650ba5c	{"speed":0.0042111496441066265,"altitudeAc...}	sos	0	3a081879-6bfb-42a3-bf58-8e02853d8b7b	0	
da6165c3-97b1-4550-844a-59f76b25e0d3	{"speed":0.03334924578666687,"altitudeAccur...}	sos	0	3a081879-6bfb-42a3-bf58-8e02853d8b7b	0	
e2525fd2-7d56-4d4b-9baa-2762a5a45a97	{"speed":0.00027423963183537126,"altitudeA...}	fire	0	3a081879-6bfb-42a3-bf58-8e02853d8b7b	0	
f6009fb3-bb1b-4592-9d0c-a8b93199d74c	{"speed":2.331533432006836,"altitudeAccurac...}	trail	0	3a081879-6bfb-42a3-bf58-8e02853d8b7b	1	
NULL	HULL	HULL	HULL	HULL	HULL	HULL

Figure 3.4. "reports" table example

- d. The table "teams" represents the volunteer teams that the application attempts to establish for responding to the emergency situations the users encounter.

Each entry of the table has:

- i. A unique id (primary key) that makes each report also unique.
- ii. The category the volunteer team befalls under (SOS or fire).
- iii. The report's id (foreign key) the team corresponds to.
- iv. The report's location.

The following figure (Figure 3.5) displays the table with some example entries.

<u>id</u>	<u>category</u>	<u>report_id</u>	<u>location</u>
0a91ce5c-5c5f-4473-a179-5bc5d1a77dbb	sos	78fcfbe4-a375-4da4-ae18-0ad7b14efdb5	{"speed":0.016786379739642143,"altitudeAccur...}
0d36de68-09c2-42d2-bac0-3b4e99f0cdc1	fire	45f8eb1-a59b-4caa-bd57-c83b318931de	{"speed":0.005400172434747219,"altitudeAccur...}
1c8e060d-269f-408a-91b8-0453b02c643	fire	45d7c284-764a-495f-948f-6fd5033094da	{"speed":0.04107064753770828,"altitudeAccur...}
39cb4621-4fd8-4217-bf56-caa245419b0	sos	53e2f425-e951-4c53-887c-39e7b44bb8cd	{"speed":0.0035377703607082367,"altitudeAccur...}
486c3085-e3f9-4a87-bc1c-19ab57bf94ec	fire	e2525fd2-7d56-4d4b-9baa-2762a5a45a97	{"speed":0.00027423963183537126,"altitudeA...}
4ea370ee-808a-4375-be78-7494728962fe	sos	aea3e003-cad7-4df7-a1be-bc587e9dd114	{"speed":0.014030302874743938,"altitudeAccur...}
53bf0c09-9690-408c-ab04-be280a171031	sos	46d89bb6-b7ca-436b-a6f4-88cb807843c2	{"speed":0.011914663948118687,"altitudeAccur...}

Figure 3.5. "teams" table example

- e. The table "volunteers" represents the volunteers in the teams that the application attempts to establish for responding to the emergency situations the users encounter.

Each entry of the table has:

- i. The team's id (foreign key).
- ii. The member's id (foreign key).

The following figure (Figure 3.6) displays the table with some example entries.

team_id	members
a62a9864-0691-48f9-a23d-7aeb743fb56	0
cb2f34a2-2381-4c50-8099-8460fd9ba1b	0
d2eda0cb-4926-4cea-8ad8-ca74100c78ac	0
d2eda0cb-4926-4cea-8ad8-ca74100c78ac	1
e5add8b5-2438-41e2-b4e5-1de3373c36dc	0
f27742c5-4580-4f8d-bb4c-b6da18eb79d8	0
f7b6b00f-b0ad-4764-ac84-2d10112c1021	0
NULL	NULL

Figure 3.6. "volunteers" table example

# Chapter 4.

## Blueprints and Breakdowns: In-depth Design of “Trailly”.

### 4.1 “Trailly” Package Architecture

The following figure (Figure 4.1) showcases the project’s package architecture (packages for testing and resources not included).

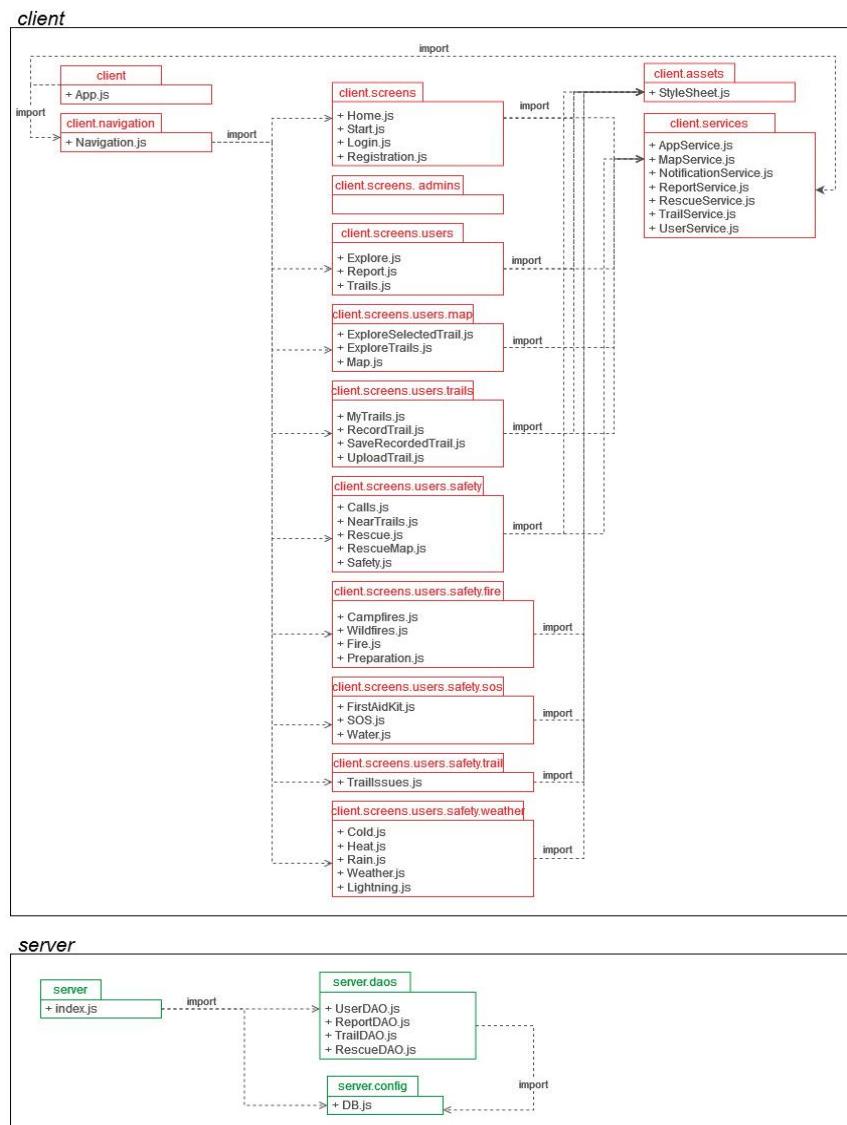


Figure 4.1. “Trailly” package architecture UML

## 4.2 Client package

In this section, the discussion will focus on the client package of the application.

### 4.2.1 “client.navigation” package

This package contains a stack navigator created for switching and navigating between different screens within the “Trailly” application. The code creates a stack navigator using React Navigation’s `createStackNavigator()` function.

Name: Navigation	
Responsibilities:	Collaborations:
✓ Responsible for the creation of the stack navigator of the application.	✓ All the screens of the application (the screens are located inside the “client.screens” package)

Table 4.1.”client.navigation” package

### 4.2.2 “client.assets” package

This package contains all the assets used (logos, designs and images) for the application. Along with those, the assets package contains a JavaScript file that contains Styles-Sheet choices for styling screens and their respective components using React Native’s `StyleSheet.create()` function. Each style rule is defined as a key-value pair within the styles object.

Name: StyleSheet	
Responsibilities:	Collaborations:
✓ Responsible for the keepsake of each style used for styling the screens and their respective components.	None

Table 4.2.”client.assets” package

### 4.2.3 “client.screens” package

This package contains screens (UI elements) available for all the users of the application just before they log in and just after they take their respective roles (guest, admin or logged in user).

<b>Name:</b> Start	
<p><b>Responsibilities:</b></p> <ul style="list-style-type: none"> <li>✓ Responsible for showing the starting screen of the application to the user.</li> <li>✓ Responsible for navigating to the "Login" screen.</li> <li>✓ Responsible for navigating to the "Registration" screen.</li> <li>✓ Responsible for navigating to the "Guest Menu" screen.</li> </ul>	<p><b>Collaborations:</b></p> <ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> Login	
<p><b>Responsibilities:</b></p> <ul style="list-style-type: none"> <li>✓ Responsible for the user login UI.</li> <li>✓ Responsible for navigating the user to the a new menu screen after a successful login attempt.</li> </ul>	<p><b>Collaborations:</b></p> <ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ UserService</li> </ul>
<b>Name:</b> Registration	
<p><b>Responsibilities:</b></p> <ul style="list-style-type: none"> <li>✓ Responsible for the user registration UI.</li> </ul>	<p><b>Collaborations:</b></p> <ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ UserService</li> </ul>
<b>Name:</b> Home	
<p><b>Responsibilities:</b></p> <ul style="list-style-type: none"> <li>✓ Responsible for showing the according menu to each user (logged in user, guest user or admin).</li> <li>✓ Responsible for navigating to the "Explore Map Menu" screen.</li> <li>✓ Responsible for navigating to the "Report/Alert for Unexpected Situations form" screen.</li> <li>✓ Responsible for navigating to the "Safety Tips Menu" screen.</li> </ul>	<p><b>Collaborations:</b></p> <ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ UserService</li> </ul>

<ul style="list-style-type: none"> <li>✓ Responsible for navigating to the “User Trails Menu” screen.</li> <li>✓ Responsible for navigating to the “Login” screen.</li> <li>✓ Responsible for navigating to the “Registration” screen.</li> <li>✓ Responsible for logging out the user and navigating back to the starting screen.</li> </ul>	
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*Table 4.3. "client.screens" package*

#### **4.2.4 “client.screens.admins” package**

This is an empty package created for the sole purpose of further development of the application in the future. This package will contain all screens (UI elements) available only to administrators of the application (admins).

#### **4.2.5 “client.screens.users” package**

This package contains screens (UI elements) available to only the users (logged in users and guest users) of the application and not the administrators (admins).

<b>Name:</b> Explore	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing a menu with choices for user to select for where to navigate to next.</li> <li>✓ Responsible for navigating to the “Map” screen.</li> <li>✓ Responsible for navigating to the “Explore Available Trails” screen.</li> <li>✓ Responsible for navigating to the “Trail List” of each user (only available for logged in users , not guests).</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> Trails	

<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing a menu with choices for user to select for where to navigate to next.</li> <li>✓ Responsible for navigating to the “Record a Trail” screen (only available for logged in users , not guests).</li> <li>✓ Responsible for navigating to the “Upload a Trail” screen (only available for logged in users , not guests).</li> <li>✓ Responsible for navigating to the “Trail List” of each user (only available for logged in users , not guests).</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> Report	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for allowing users to make reports/alerts through a form that is showing on the screen.</li> <li>✓ Responsible for managing the database by calling services for queries that have to do with adding reports to it.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ ReportService</li> </ul>

Table 4.4. "client.screens.users" package

#### 4.2.6 “client.screens.users.trails” package

This package contains screens (UI elements) of the application related to the management of trails. Trails can be uploaded, recorded, saved to a list and removed from it or the database. The screens (UI elements) of this package are only available to logged in users. Guests have no access to those specific features the application provides.

<b>Name:</b> MyTrails	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showing to the user all the trails they have uploaded and</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ TrailService</li> </ul>

<p>saved to their list.</p> <ul style="list-style-type: none"> <li>✓ Responsible for navigating to the “Selected Trail” screen when a trail is selected for preview by the user.</li> </ul>	
<b>Name:</b> RecordTrail	
<b>Responsibilities:</b> <ul style="list-style-type: none"> <li>✓ Responsible for recording the coordinates of the trail a user is walking.</li> <li>✓ Responsible for navigating to the “Save Recorded Trail” screen.</li> </ul>	<b>Collaborations:</b> <ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> UploadTrail	
<b>Responsibilities:</b> <ul style="list-style-type: none"> <li>✓ Responsible for receiving a trail in the form of a .gpx or .tcx file.</li> <li>✓ Responsible for showcasing the user a form to complete of information about the trail they want to add to the database.</li> <li>✓ Responsible for managing the database by calling services for queries that have to do with adding trails to it (only available for logged in users , not guests).</li> </ul>	<b>Collaborations:</b> <ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ TrailService</li> </ul>
<b>Name:</b> SaveRecordedTrail	
<b>Responsibilities:</b> <ul style="list-style-type: none"> <li>✓ Responsible for showcasing the user a form to complete of information about the trail they want to add to the database.</li> <li>✓ Responsible for managing the database by calling services for queries that have to do with adding</li> </ul>	<b>Collaborations:</b> <ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ TrailService</li> </ul>

trails to it.	
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*Table 4.6. "client.screens.users.trails" package*

#### 4.2.7 “client.screens.users.safety” package

This package contains screens (UI elements) regarding the rescue features that notifications for unexpected events provide to the users. Those screens are available to all users (logged in users and guests) that have chosen to take action for a specific alert/notification. Administrators of this application (admins) do not have access to those features.

<b>Name:</b> Calls	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showing the user the three-digit phone numbers available for calling for according help.</li> <li>✓ Responsible for navigating the user to the calling application of their phone with the three-digit number of their choice dialed in already.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> Safety	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for navigating the user to the “Fire Safety Tips Menu”.</li> <li>✓ Responsible for navigating the user to the “S.O.S. Safety Tips Menu”.</li> <li>✓ Responsible for navigating the user to the “Weather Safety Tips Menu”.</li> <li>✓ Responsible for navigating the user to the “Trail Issues Safety Tips Menu”.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> NearTrails	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showing the user a list of trails situated near his current location.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ RescueService</li> </ul>

<ul style="list-style-type: none"> <li>✓ Responsible for navigating to the “Rescue Map” screen when a trail is selected for preview by the user.</li> </ul>	
<b>Name:</b> Rescue	
<b>Responsibilities:</b> <ul style="list-style-type: none"> <li>✓ Responsible for navigating to the “List of Near Trails” screen.</li> <li>✓ Responsible for navigating to the “Three-Digit Number List” screen.</li> <li>✓ Responsible for managing the database by calling services for queries that have to do with adding volunteer teams to it (possible only in specific scenarios).</li> </ul>	<b>Collaborations:</b> <ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ RescueService</li> </ul>
<b>Name:</b> RescueMap	
<b>Responsibilities:</b> <ul style="list-style-type: none"> <li>✓ Responsible for displaying to the user a map with the selected trail’s coordinates and directions on how to get to it along with their current location.</li> </ul>	<b>Collaborations:</b> <ul style="list-style-type: none"> <li>✓ StylesSheet</li> <li>✓ RescueService</li> <li>✓ MapService</li> </ul>

Table 4.7. "client.screens.users.safety" package

#### 4.2.8 “client.screens.users.safety.fire” package

This package contains screens (UI elements) accessible to all users of the application (logged in users and guests), providing safety tips and information regarding fire-related situations. Admins do not have access to those features.

The application aims to provide both users and guests with essential knowledge to enhance safety awareness and preparedness in the event of fire-related emergencies. All safety tips in our application (not only about fire but also about weather and SOS situations) were developed with the assistance of reputable hiking websites such as:

- a. **Australian Hiker** [AH1], a website with tips and tricks from fanatical hikers with the aim of becoming the go-to source for Australian hiking.

- b. **Hiking Guy** [HG1], a website owned by a professional hiking guide and author based in Southern California, Cris Hazzard.
- c. **REI Shop's Experts' Advice** [RSEA1], a hiking shop's page with expert advice.
- d. **American Hiking Society** [AHS1]
- e. **Washington's Trails Association** [WTA1]
- f. **NHS inform** [NHSI1], the National Health Service publicly funded health care system in England, and one of the four National Health Service systems in the United Kingdom.
- g. **The Hiking Life** [THL1], a website created by Cam "Swami" Honan, who is described as "The most traveled hiker on earth" by the "Backpacker Magazine" in January 2015.

Thus, the sections 4.2.9 and 4.2.10 will be relating to this list as well for their respective bodies of safety tips that can be found in the appendix.

<b>Name:</b> Fire	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing a menu with choices for user to select for where to navigate to next.</li> <li>✓ Responsible for navigating to the "Preparation for Wildfires" screen.</li> <li>✓ Responsible for navigating to the "Encountering Wildfires" screen.</li> <li>✓ Responsible for navigating to the "Campfires and Tips" screen.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> Preparation	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing tips for preparation for wildfires.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> Campfires	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing tips concerning campfires.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>

<b>Name:</b> Wildfires	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing tips for encounters with wildfires.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>

*Table 4.8. "client.screens.users.safety.fire" package*

#### 4.2.9 "client.screens.users.safety.sos" package

This package contains screens (UI elements) accessible to all users of the application (logged in and guests users), providing safety tips and information regarding emergency situations concerning SOS signals. Admins do not have access to those features.

<b>Name:</b> SOS	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing a menu with choices for user to select for where to navigate to next.</li> <li>✓ Responsible for navigating to the "First Aid Kit Contents" screen.</li> <li>✓ Responsible for navigating to the "Water, Hydration and Filtering Tips" screen.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> FirstAidKit	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing tips about the contents that a first aid kit should have.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>
<b>Name:</b> Water	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing tips concerning water, hydration and filtration.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>

*Table 4.9. "client.screens.users.safety.sos" package*

#### **4.2.10 “client.screens.users.safety.weather” package**

This package contains screens accessible to all users of the application (logged in and guest users), providing safety tips and information regarding unexpected weather situations. Admins do not have access to those features.

<b>Name:</b>	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"><li>✓ Responsible for showcasing a menu with choices for user to select for where to navigate to next.</li><li>✓ Responsible for navigating to the “Hiking with Cold Weather” screen.</li><li>✓ Responsible for navigating to the “Hiking with Hot Weather” screen.</li><li>✓ Responsible for navigating to the “Hiking with Lightning” screen.</li><li>✓ Responsible for navigating to the “Hiking with Rain” screen.</li></ul>	<ul style="list-style-type: none"><li>✓ StylesSheet</li></ul>
<b>Name:</b> Rain	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"><li>✓ Responsible for showcasing tips concerning hiking with rainy weather conditions.</li></ul>	<ul style="list-style-type: none"><li>✓ StylesSheet</li></ul>
<b>Name:</b> Lightning	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"><li>✓ Responsible for showcasing tips concerning hiking with lightning.</li></ul>	<ul style="list-style-type: none"><li>✓ StylesSheet</li></ul>
<b>Name:</b> Heat	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"><li>✓ Responsible for showcasing tips concerning hiking with hot weather conditions.</li></ul>	<ul style="list-style-type: none"><li>✓ StylesSheet</li></ul>
<b>Name:</b> Cold	

<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for showcasing tips concerning hiking with cold weather conditions.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>

Table 4.10. "client.screens.users.safety.weather" package

#### 4.2.11 "client.screens.users.safety.trail" package

This package contains screens (UI elements) accessible to all users of the application (logged in and guest users), that provide safety tips and information regarding unexpected trail issues they might encounter throughout their journeys. Admins do not have access to those features. It has not yet been completed and as of now contains only a screen informing about its incompleteness.

<b>Name:</b> TrailIssues	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for informing the user about the incompleteness of the to-be menu page filled with safety tips about unexpected trail issues.</li> </ul>	<ul style="list-style-type: none"> <li>✓ StylesSheet</li> </ul>

Table 4.11. "client.screens.users.safety.trail" package

#### 4.2.12 "client.screens.users.map" package

This package contains screens (UI elements) available to only the users (logged in users and guests) and not the administrators (admins).

<b>Name:</b> Map	
<b>Responsibilities:</b>	<b>Collaborations:</b>
<ul style="list-style-type: none"> <li>✓ Responsible for displaying a map of the world to the user, with their current location marked on it.</li> <li>✓ Responsible for displaying trails on the map and driving directions to them.</li> <li>✓ Responsible for searching, displaying and reversing paths of trails.</li> <li>✓ Responsible for making quick</li> </ul>	<ul style="list-style-type: none"> <li>✓ StyleSheet</li> <li>✓ MapService</li> <li>✓ TrailService</li> <li>✓ ReportService</li> <li>✓ AppService</li> <li>✓ NotificationService</li> </ul>

<p>alerts/reports for incidents and adding them to the database.</p> <ul style="list-style-type: none"> <li>✓ Responsible, with the “Safe Hiking” option active, for notifying the user with alerts/reports from other users and enabling them to interact with said notifications. Through this interaction the user can be navigated to the “Rescue Menu” screen.</li> </ul>	
<b>Name:</b> ExploreTrails	
<b>Responsibilities:</b> <ul style="list-style-type: none"> <li>✓ Responsible for showcasing the trails that are uploaded for public use in the database.</li> </ul>	<b>Collaborations:</b> <ul style="list-style-type: none"> <li>✓ StyleSheet</li> <li>✓ TrailService</li> </ul>
<b>Name:</b> ExploreSelectedTrail	
<b>Responsibilities:</b> <ul style="list-style-type: none"> <li>✓ Responsible for showcasing a specific trail on a mini map.</li> <li>✓ Responsible for adding the trail to the user’s trail list.</li> <li>✓ Responsible for removing a trail from the user’s trail list and/or the database.</li> <li>✓ Responsible for navigating to the “Map” screen with the trail’s directions.</li> </ul>	<b>Collaborations:</b> <ul style="list-style-type: none"> <li>✓ StyleSheet</li> <li>✓ TrailService</li> <li>✓ MapService</li> </ul>

Table 4.12. "client.screens.users.map" package

### About Map and Notifications.

It is of importance to note that a user can receive notifications only when they are navigating a trail on the map and have “safe hiking” activated. Otherwise they can only send notifications regarding their position and situation. This decision was made to prioritize user safety and prevent unnecessary alerts that could be disruptive or cause anxiety when the user is not actively participating in a hiking activity.

#### 4.2.13 “client.services” package

This package contains all services used in the application. Services communicate with the application’s database and provide the necessary functionality to the front-end components, ensuring a seamless user experience.

All services are responsible for providing methods that the screens (UI elements) can use to interact with the database. The methods communicate with the server side of the application by passing on requests and information for the MySQL queries.

<b>Name:</b> AppService	
<b>Responsibilities:</b> <ul style="list-style-type: none"><li>✓ Responsible for providing services that locate the current geographical location of the user.</li></ul>	<b>Collaborations:</b> None.
<b>Name:</b> UserService	
<b>Responsibilities:</b> <ul style="list-style-type: none"><li>✓ Responsible for user registration.</li><li>✓ Responsible for user login.</li><li>✓ Responsible for user logout.</li></ul>	<b>Collaborations:</b> None.
<b>Name:</b> TrailService	
<b>Responsibilities:</b> <ul style="list-style-type: none"><li>✓ Responsible for retrieving all the “public” trails of the database.</li><li>✓ Responsible for retrieving all the trails a specific user has saved to the database.</li><li>✓ Responsible for retrieving information about a specific trail from the database.</li><li>✓ Responsible for removing a specific trail either from the database or from the user’s list. This depends on who is making the request for removal. If the user has added the trail to the</li></ul>	<b>Collaborations:</b> None.

<p>database, the trail is removed from it. Else, the trail is just getting removed from the user's list of saved trails.</p> <ul style="list-style-type: none"> <li>✓ Responsible for adding trails to the database.</li> <li>✓ Responsible for managing the .gpx and .tcx files that the user can upload to the application.</li> <li>✓ Responsible for converting .gpx and .tcx files to a JSON format with only the information concerning the trail's coordinates.</li> <li>✓ Responsible for a search of trails to the database according to the key words provided by the user.</li> <li>✓ Responsible for adding additional users (users who save the trail to their list) to a specific trail. This is a request for altering the already existing trail entry inside the database.</li> </ul>	
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#### Name: ReportService

Responsibilities:	Collaborations:
<ul style="list-style-type: none"> <li>✓ Responsible for retrieving a specific report/alert from the database.</li> <li>✓ Responsible for retrieving all "active" reports/alerts from the database.</li> <li>✓ Responsible for converting an "active" report/alerts to "non-active".</li> <li>✓ Responsible for adding reports/alerts to the database.</li> </ul>	<ul style="list-style-type: none"> <li>✓ AppService</li> </ul>

#### Name: MapService

Responsibilities:	Collaborations:
<ul style="list-style-type: none"> <li>✓ Responsible for getting the</li> </ul>	<ul style="list-style-type: none"> <li>✓ AppService</li> </ul>

<p>appropriate permissions for the user in order to be able to retrieve their location.</p> <ul style="list-style-type: none"> <li>✓ Responsible for altering a specific trail and its details in order to convert them to the according format for the map to utilize.</li> <li>✓ Responsible for fetching driving directions from MapBox starting from the user's current location and ending to the trailhead.</li> <li>✓ Responsible for counting distances in kilometers using the haversine formula, which calculates the great-circle distance between two points on a sphere given their longitudes and latitudes (will be furthered analyzed later on).</li> <li>✓ Responsible for finding the center of the trail of a specific trail through its coordinates (calling it initial region since this will only be used by maps to center the trail).</li> <li>✓ Responsible for finding the average center of a trail given by its coordinates.</li> </ul>	
<b>Name:</b> NotificationService	
<b>Responsibilities:</b> <ul style="list-style-type: none"> <li>✓ Responsible for getting according permissions and registering the user for getting push notifications.</li> <li>✓ Responsible for fetching reports/alerts to notify the user.</li> <li>✓ Responsible for clearing the</li> </ul>	<b>Collaborations:</b> <ul style="list-style-type: none"> <li>✓ AppService</li> <li>✓ MapService</li> </ul>

<p>notifications history (for saving on data load).</p> <ul style="list-style-type: none"> <li>✓ Responsible for managing the content each notification will have according to the category, details and location it has.</li> <li>✓ Responsible for sending notifications in general or user specific. Notifications will be sent only if user is no more than 30km away from the report/alert's location.</li> </ul>	
<b>Name:</b> RescueService	
<p><b>Responsibilities:</b></p> <ul style="list-style-type: none"> <li>✓ Responsible for adding warnings to trails based on user's alerts/reports.</li> <li>✓ Responsible for fetching trails near or with the user's location.</li> <li>✓ Responsible for calculating if a trail is close enough (less than 10lm from user's current location).</li> <li>✓ Responsible for making volunteer teams for reports/alerts and saving them to the application's database.</li> <li>✓ Responsible for retrieving the volunteer teams from the database.</li> <li>✓ Responsible for adding volunteers to the volunteer teams.</li> <li>✓ Responsible for counting the team size of volunteer teams.</li> <li>✓ Responsible for checking if a team is in valid size to be considered valid in order to notify the users for its existence. A valid team is consisted of</li> </ul>	<p><b>Collaborations:</b></p> <ul style="list-style-type: none"> <li>✓ TrailService</li> <li>✓ MapService</li> <li>✓ AppService</li> <li>✓ ReportService</li> <li>✓ NotificationService</li> </ul>

<p>five or more people.</p> <ul style="list-style-type: none"> <li>✓ Responsible for fetching a specific team's members from the database.</li> <li>✓ Responsible for checking if a user has already joined a volunteer team.</li> </ul>	
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*Table 4.13."client.screens.users.map" package*

#### **4.2.14 App.js**

This is a file, located inside the client package, that serves as the entry point for the client side of the application and is used as the central hub for managing application-wide tasks and rendering the primary navigation interface. This file also contains a function, crucial to the application, that executes every 24 hours and sets all the notifications as non-active since they are now considered expired. This feature for clearing expired notifications enhances the application's usability and ensures users are presented with up-to-date information.

## 4.3 Server package

In this section, the discussion will focus on the server package of the application.

### 4.3.1 “server” package

This package contains files that make of the skeleton of the server and handle the rerouting of the server-client requests.

#### **index.js**

This file is acting as the entry point for the server-side application. It has a pivotal role in initializing the server, accessing the application’s MySQL database, setting up routes for several DAOs and handling incoming requests. It acts as the backbone of the server, establishing smooth communication between the client and the server side components of the “Trailly” application.

#### **.env**

This file contains static values concerning information about the application’s database. The values contained in the .env file are essential for establishing connections with the MySQL database and defining the server’s port number. We use the .env file in order to keep our environment clean and organized as well as be able to make quick and easy changes.

### 4.3.2 “server.daos” package

This package contains files that send and receive requests to and from the application’s MySQL database.

<b>Name:</b> UserDao	
<b>Responsibilities:</b> ✓ Responsible for providing queries that communicate with the database in regards to the “users” table.	<b>Collaborations:</b> ✓ .env ✓ DB.js from “server.config” package
<b>Name:</b> TrailDAO	
<b>Responsibilities:</b> ✓ Responsible for providing queries that communicate with the database in regards to the “trails” table.	<b>Collaborations:</b> ✓ .env ✓ DB.js from “server.config” package

<b>Name:</b> ReportDAO	
<b>Responsibilities:</b>	<b>Collaborations:</b>
✓ Responsible for providing queries that communicate with the database in regards to the “reports” table.	✓ .env ✓ DB.js from “server.config” package
<b>Name:</b> RescueDAO	
<b>Responsibilities:</b>	<b>Collaborations:</b>
✓ Responsible for providing queries that communicate with the database in regards to the “volunteers”, “teams”, “members” and “trails” (only for updating the “trails” table with information) tables.	✓ .env ✓ DB.js from “server.config” package

Table 4.14. “server.daos” package

### 4.3.3 “server.config” package

This package contains files that play an important role in configurations for the database.

#### DB.js

This file creates a connection pool to the application’s MySQL database using the .env file (mentioned in section 4.3.1) to get needed information for the database. The choice of establishing a pool connection in comparison to an immediate one with the database allows us efficiency and performance in scenarios with high traffic or multiple requests. Finally, the file exports the pool for user throughout the application minimizing the creation of connections.

# Chapter 5.

## Screenshots: A preview of “Trailly”.

In this chapter a user’s guide for the “Trailly” application will take its form.

### Starting the application, User Login and Registration.

With the opening of the application, the user faces a starting screen (“Start” as seen in Figure 5.1) with a menu of three options. The user is then called to either login, register or continue as a guest in order to use the application.

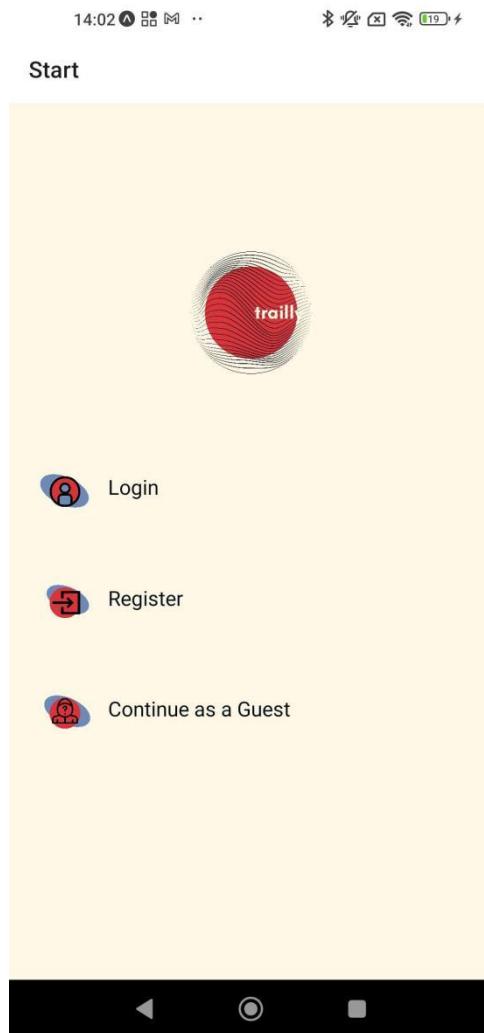


Figure 5.1. "Start" screen

- ✓ If the user chooses to login then, they will be redirected to the according screen (“Login” as seen in Figure 5.2) and try to do so.

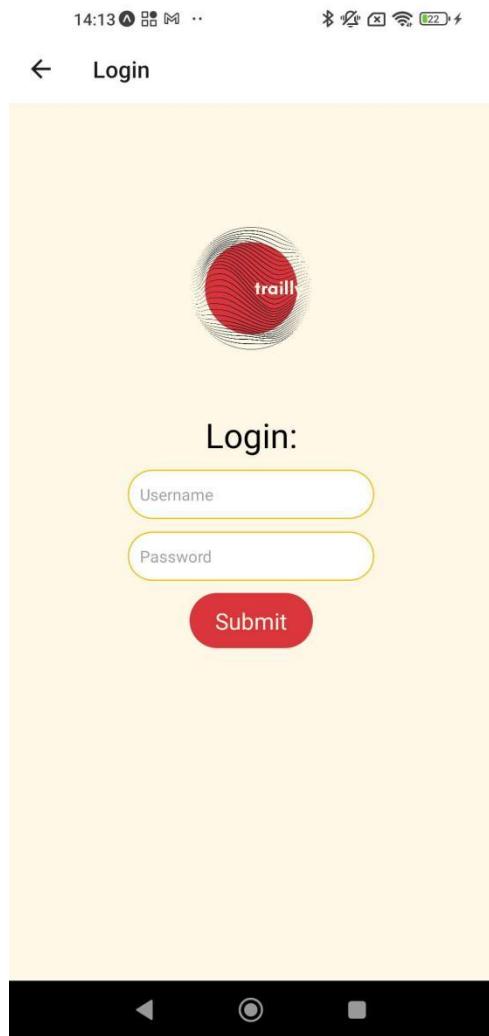


Figure 5.2. "Login" screen

If the login is successful, the user will be redirected to a new menu with features the application provides (“Home” as seen in Figure 5.3) that will be discussed later on.

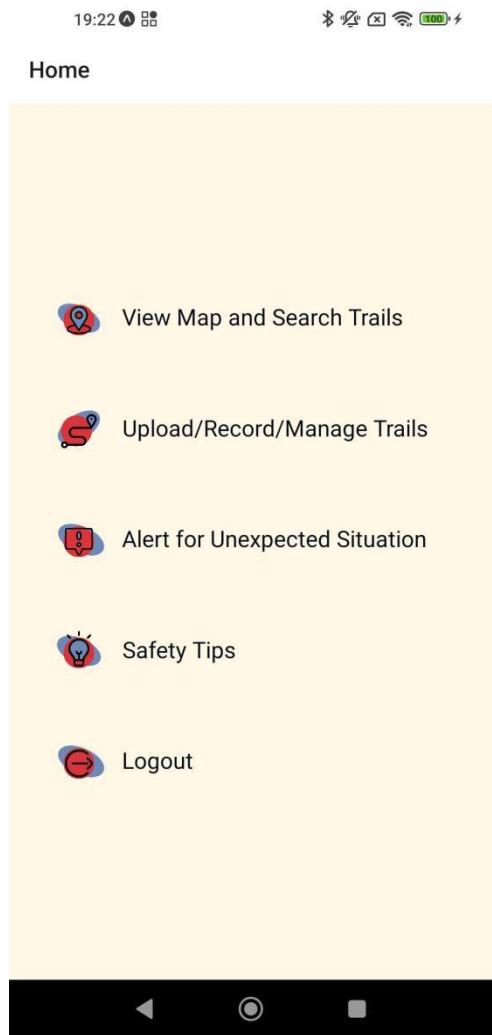


Figure 5.3."Home" screen of user

Else, if the credentials the user has entered are incorrect or invalid, the following message will appear (as seen in Figure 5.4) and the user will be prompted to try again.

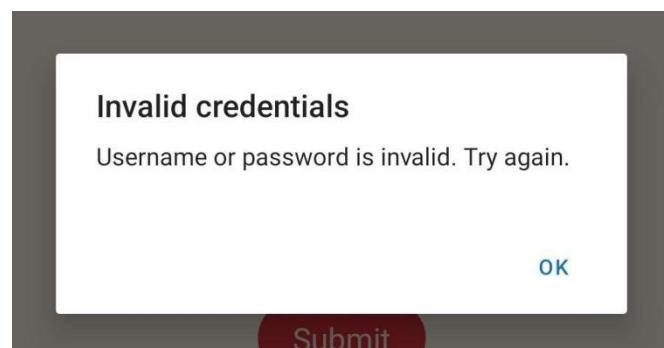


Figure 5.4."Login error " message

- ✓ If the users chooses to register, then they will be redirected to the according screen (“Registration” as seen in Figure 5.5) and try to do so.

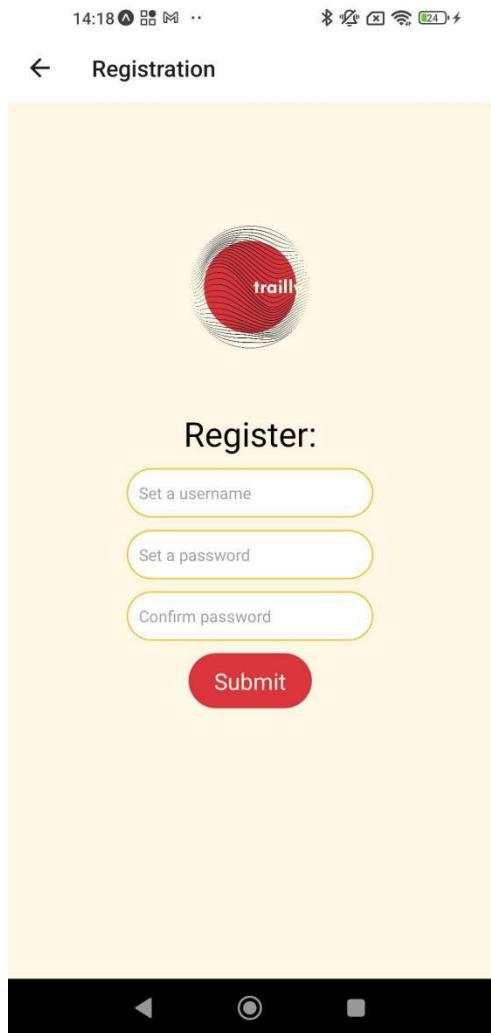


Figure 5.5. “Registration” screen

If the registration is successful, the user will be informed with an according message (as seen in Figure 5.6) and will be redirected to the starting screen again (“Start” as seen on Figure 5.1).

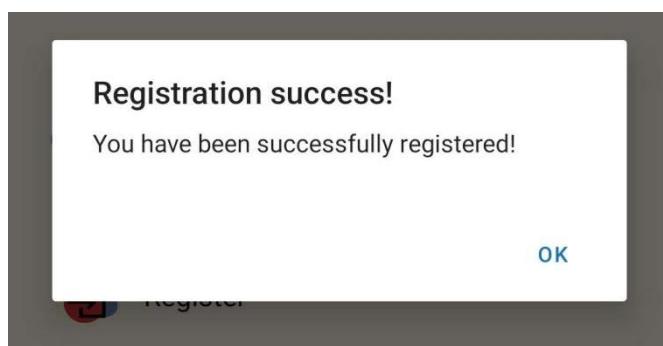


Figure 5.6. “Registration success” message

If the password confirmation is incorrect and there is a password mismatch, the user will be informed with an according message (as seen in Figure 5.7) and will be prompted to change that.

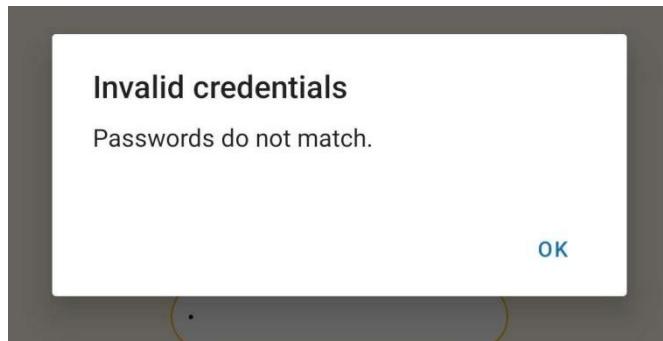


Figure 5.7."Registration password mismatch" message

Or, if the username the user chose is already taken, the user will be informed about that with an according message (as seen in Figure 5.8) and will be prompted to change their username.

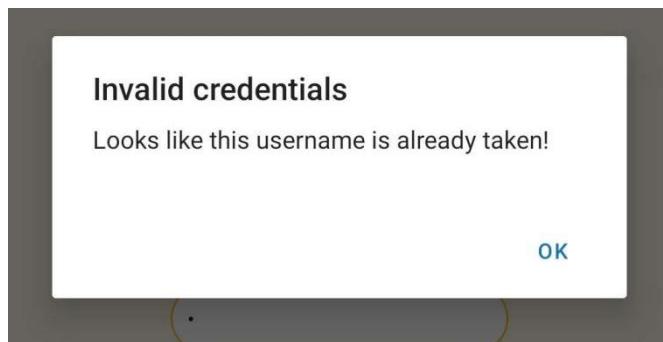


Figure 5.8."Registration taken username" message

Or even, if the user has empty or filled with only white-space characters either one or both username and password, the user will be informed about the missing of information with an according message (as seen in Figure 5.9) and will be prompted to change that.

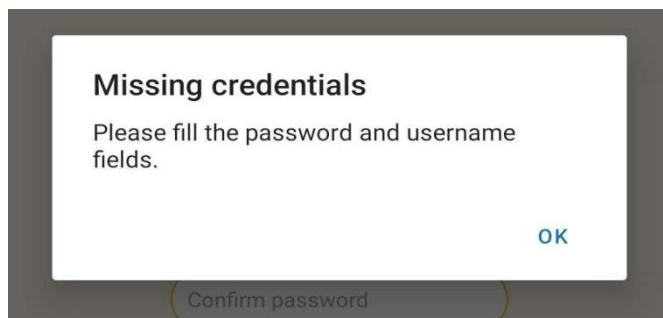
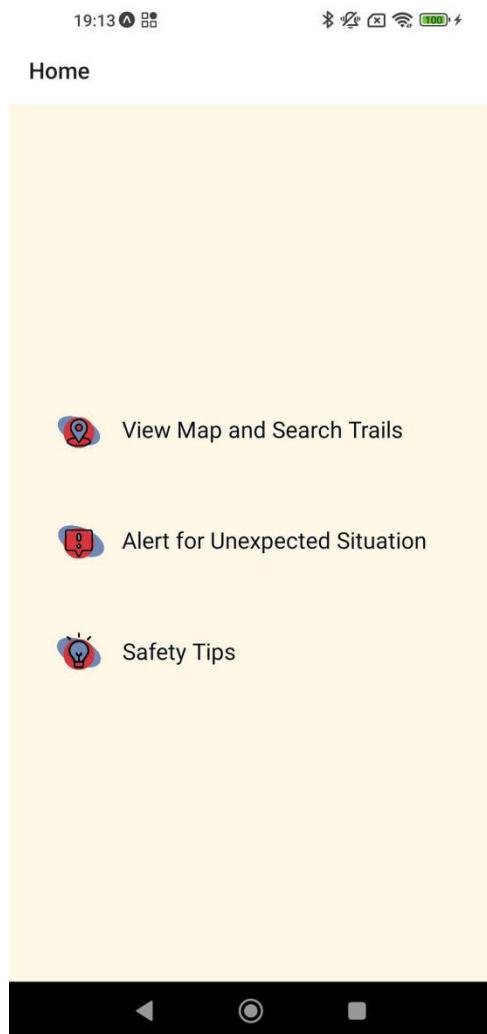


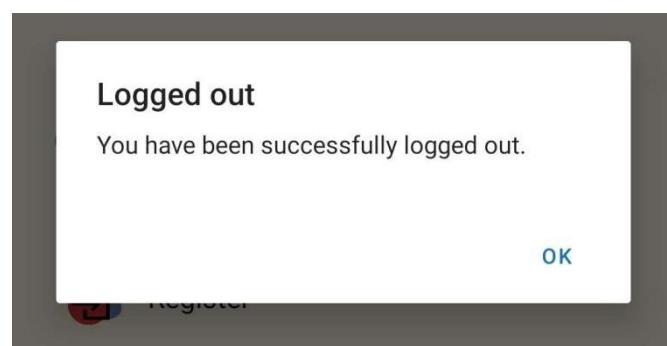
Figure 5.9."Registration missing credentials" message

- ✓ If the user chooses to continue as a guest, then they will be redirected to another menu screen (“Home” as seen in Figure 5.10) with features that will be discussed later on.



*Figure 5.10. "Home" screen of guest user*

- ✓ When a user logs out, the following message appears and they get redirected to the starting screen of the application.



## **View Map and Search Trails.**

As seen in both user and guest home menus (Figures 5.3 and 5.10), there is an option called “View Map and Search Trails”. When this option is selected, the user/guest gets redirected to a second menu screen (“Explore” as seen in Figures 5.11 and 5.12). The only difference is that the option to view a list of saved trails (“My Trail List”) is only available in logged in users.

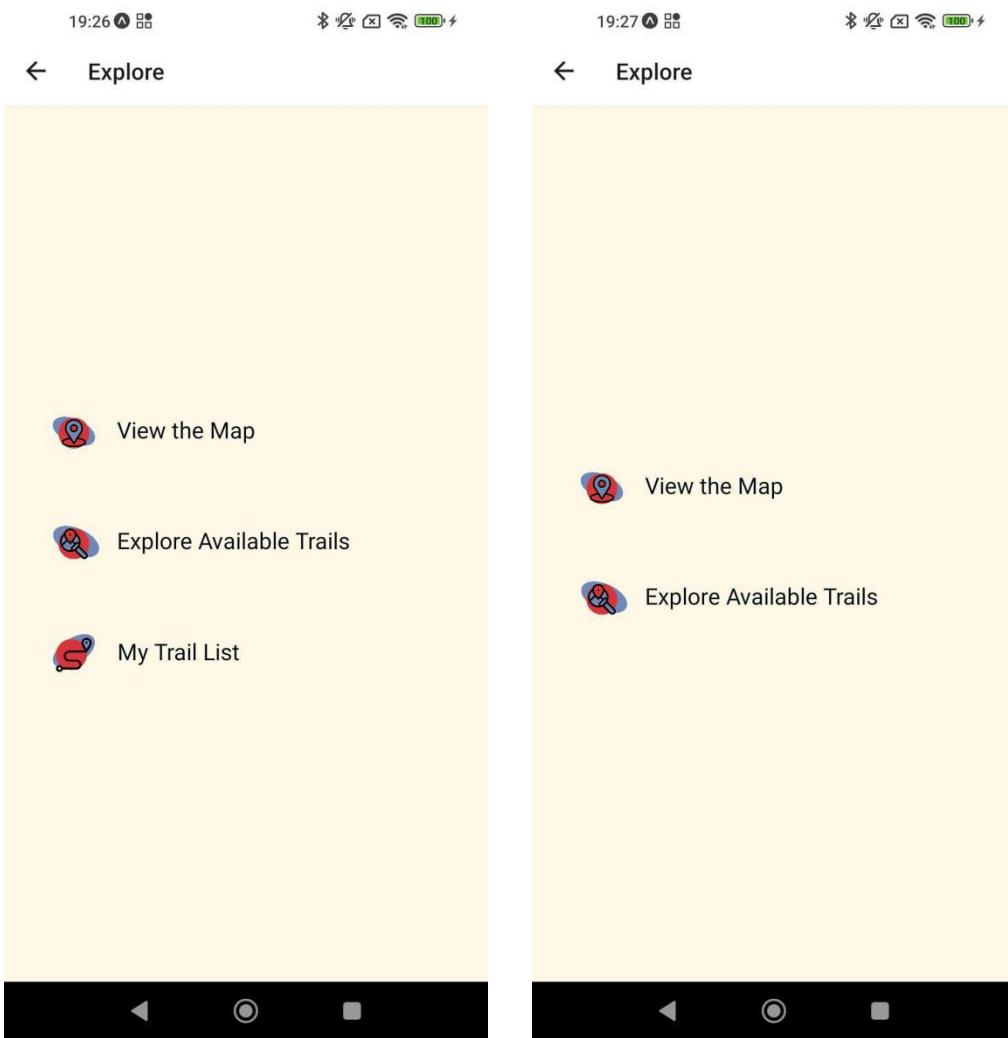


Figure 5.11. "Explore" user menu screen

Figure 5.12. "Explore" guest menu screen

- ✓ If the user/guest chooses to view the map, then they get redirected to a screen that shows a map centered to their current location (“Map” as seen in Figure 5.13). The map is provided by Google.

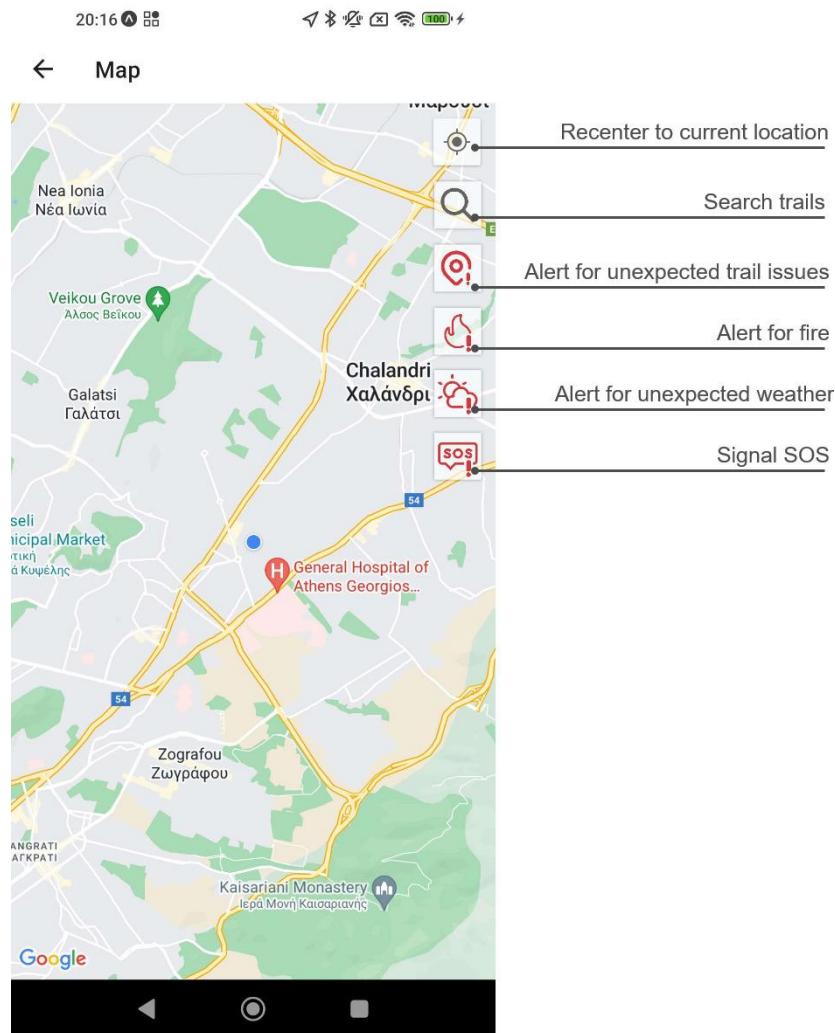


Figure 5.13."Map" screen

From then on, the user/guest can select from the following actions:

- a) **Recenter the map to their location**, an action that recenters the map view.
- b) **Search trails**. If the user/guest wants to search for trails, then a modal window appears (as seen in Figure 5.14) and they can search key words of the trails they want in the search bar. If they do not wish to search but rather see all available trails, they can select the "Explore More Trails Here" option that navigates them to the "Explore Available Trails" page (as seen later on in Figure 5.24).

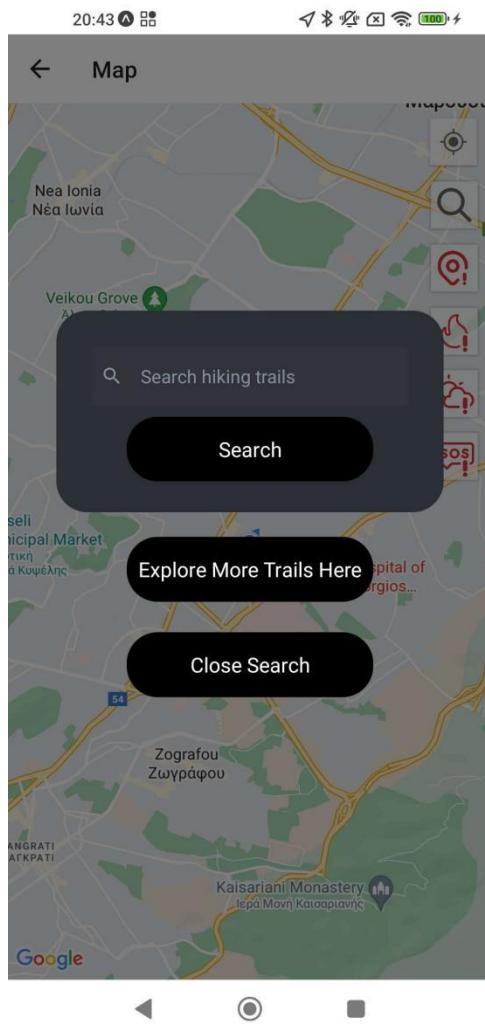


Figure 5.14."Map search trails" modal window

When the search is done, if unsuccessful, a message that informs the user/guest about it appears under the search bar (as seen in Figure 5.15). If thought the search is successful, the results appear in a list for the user to select (if the result list only contains one entry, the application informs the user/guest as seen in Figure 5.16).

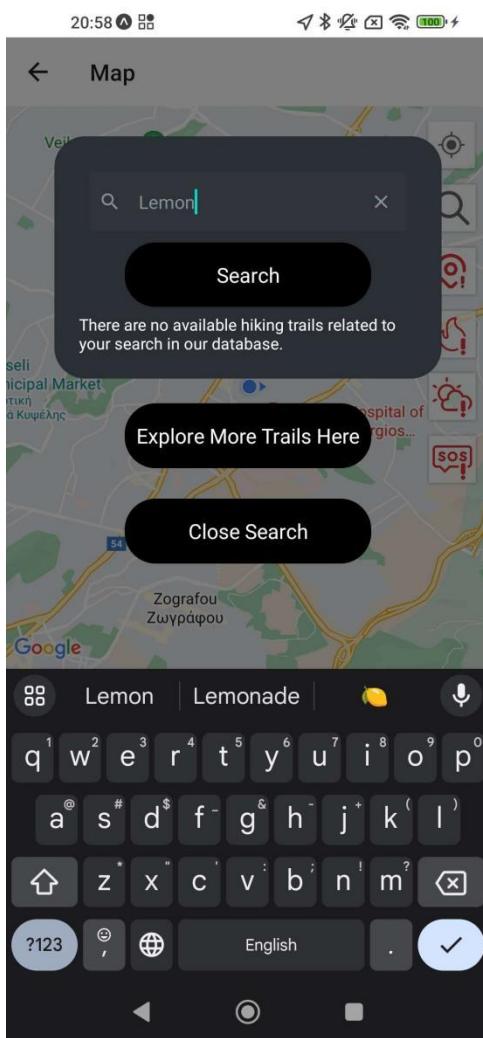


Figure 5.15."Unsuccessful search" message

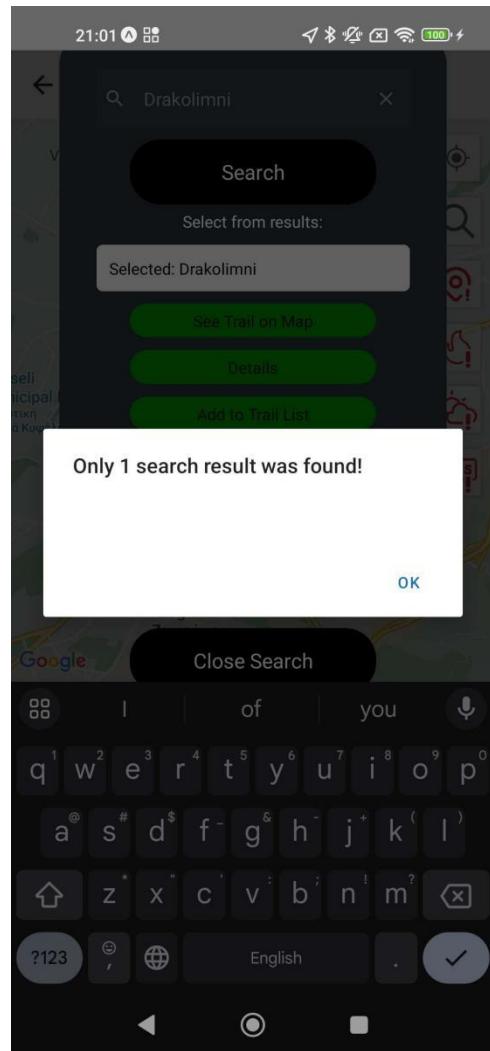


Figure 5.16."Only one search result" message

Once the user/guest selects a trail (as seen on Figure 5.17), they can do the following:

- i) **See the selected trail on the map** (as seen in Figure 5.20). Where the map unlocks new options for the user/guest to select (will be discussed later on). Before the trail gets displayed, the user/guest will be asked if they want to have driving directions on display (as seen in Figure 5.19).
- ii) **See the trail's details** and get redirected to a screen with the trail's details ("ExploreSelectedTrail" as seen later on in Figures 5.25, 5.26 and 5.27).
- iii) **Add the trail to their list of trails** (if already added, the option just does not show in the menu). Once done, the user gets a success message as feedback (as seen in Figure 5.21).

iv) **Reverse the trail's directions.** The trailhead becomes the trail's end and vise versa.

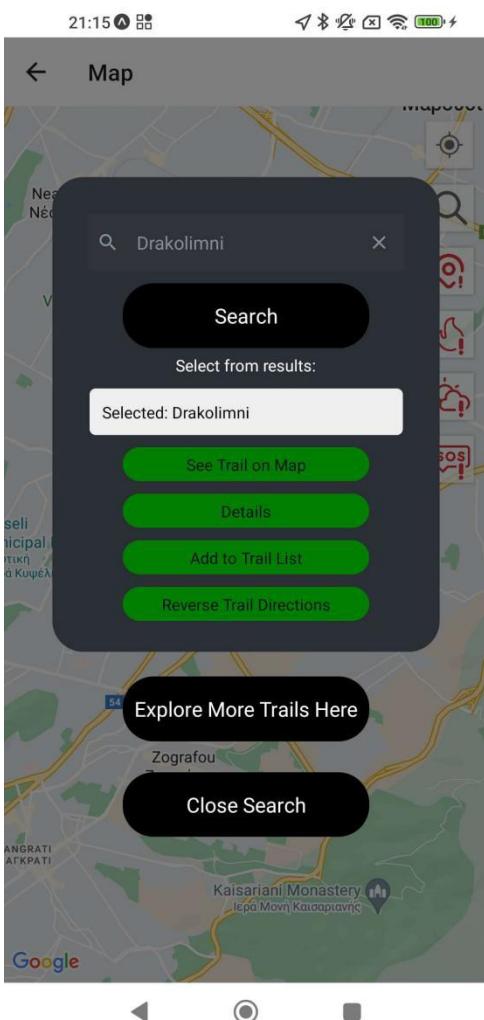


Figure 5.17. "Successful search" screen

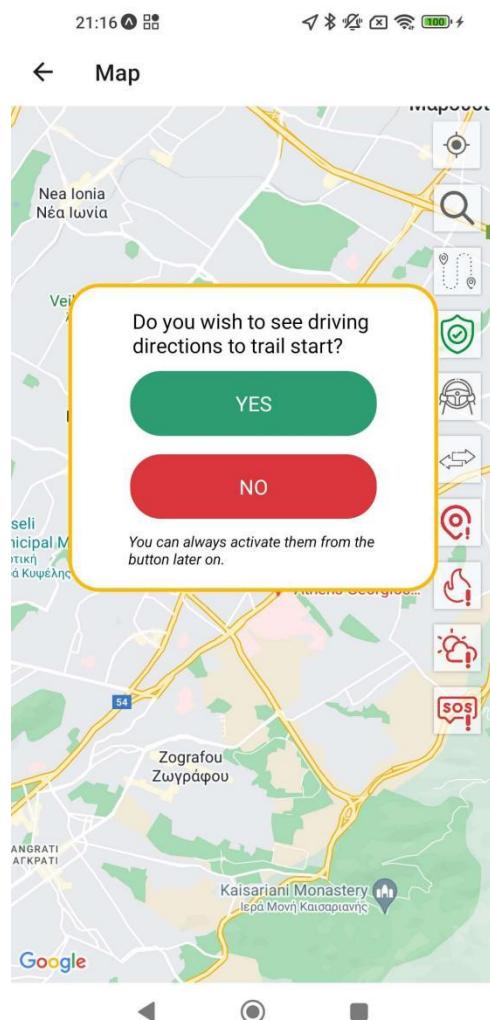


Figure 5.16. "Driving directions" pop-up



Figure 5.20. "Selected trail on the map" screen

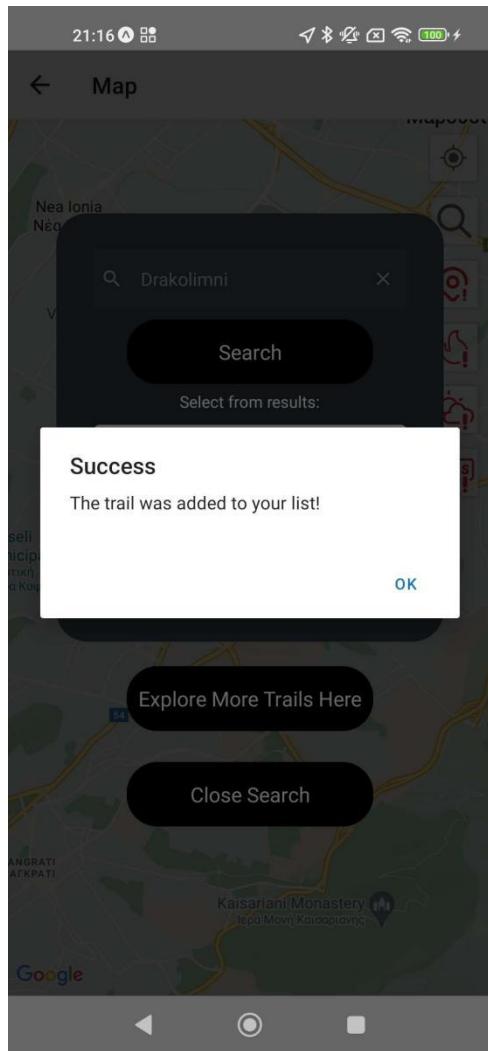


Figure 5.21."Successfully added trail to list" message

- c) Alert for unexpected trail issues.
- d) Alert for fire.
- e) Alert for unexpected weather phenomena.
- f) Signal SOS.

If any of the (c-f) alerts is pressed, then the user/guest is asked for confirmation through a pop-up window that appears (as seen in Figure 5.22). If the user/guest confirms their action, a success message will show them that their alert has been registered (as seen in Figure 5.23). Else, another similar message will inform them for the failure of registering the alert.

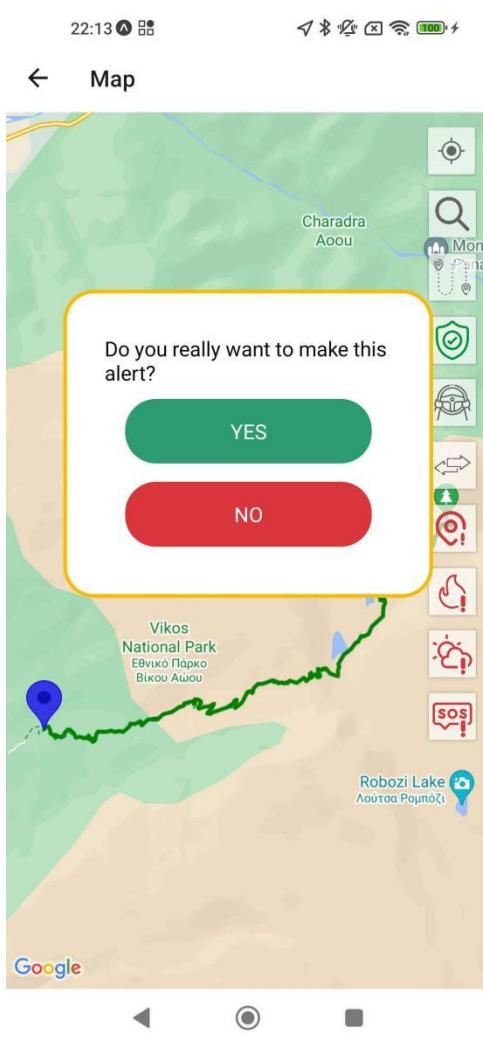


Figure 5.22."Confirmation" pop-up

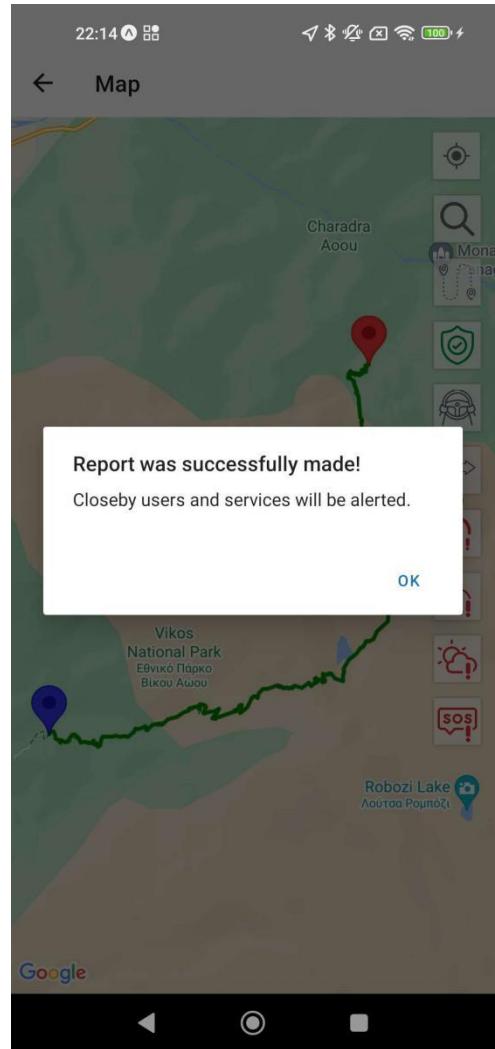


Figure 5.23."Successful registration of report" message

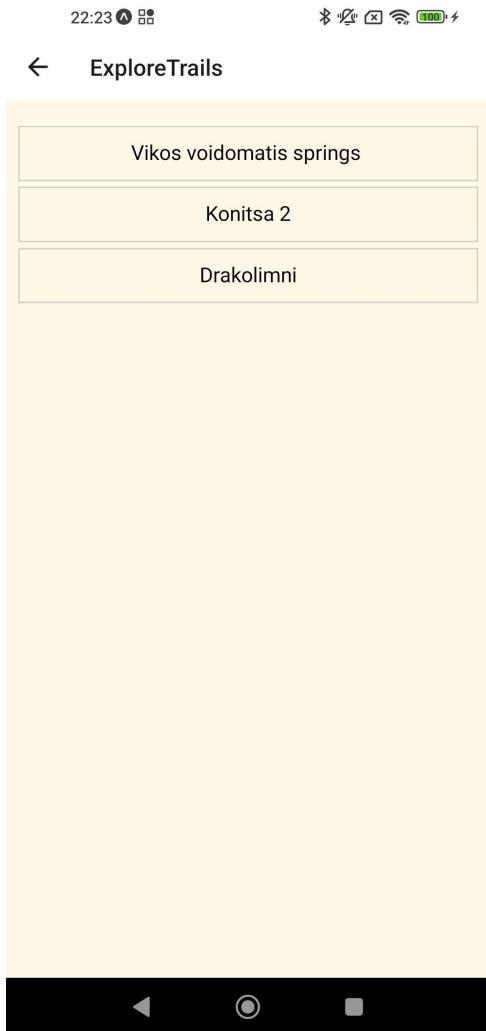
g) **Recenter to trail** (available only when navigating trail on map), an action that recenters the map view.

h) **Activate or deactivate "Safe Hiking"** (available only when navigating trail on map), activation allows notifications to come through to user's/guest's phone while hiking.

i) **Activate or deactivate driving directions** (available only when navigating trail on map), activation shows driving directions on map.

j) **Reverse trail's coordinates** (available only when navigating trail on map), an action that turns the trailhead to the trail's end and vice versa.

- ✓ If the user/guest chooses to explore all the available trails of the application from the “View Map and Search Trails” menu (“Explore” as seen in Figures 5.11 and 5.12), then they get redirected to a list that has all the trails (“ExploreTrails” as seen in Figure 5.24).



*Figure 5.24. "ExploreTrails" screen*

Each trail is interactive and can be further selected to view its details (“ExploreSelectedTrail” as seen in Figures 5.25, 5.26 and 5.27). Inside the details page, the user/guest can do the following actions:

- a) **See the directions of the trail on the map** (and basically navigate to Figure 5.20)

- b) **Add the trail to their list** (only for users).
- c) **Remove the trail from their list** (only for users who have not uploaded the said trail). In this case, a success message will appear and redirect the user to the home menu (as seen in Figure 5.28). If anything goes wrong, another similar message will appear that will inform the user accordingly. The trail will still exist in the database (as seen in Figure 5.29).
- d) **Delete the trail from the application's database** (only for users who have uploaded the trail). In this case, a success message will appear and redirect the user to the home menu (as seen in Figure 5.30). If anything goes wrong, another similar message will appear that will inform the user accordingly. The trail will not exist anymore in the database (as seen in Figure 5.31).

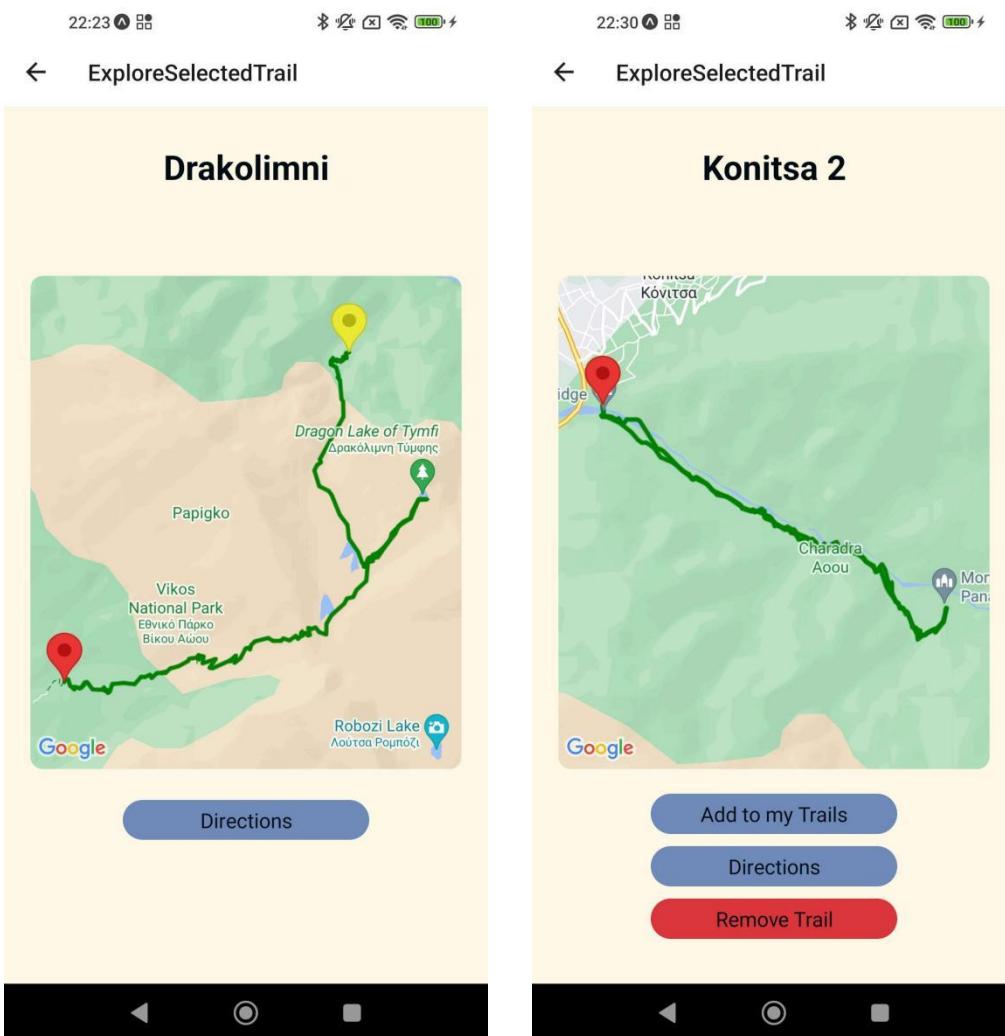


Figure 5.25."ExploreSelectedTrail" screen for guest

Figure 5.26."ExploreSelectedTrail" screen for user 1

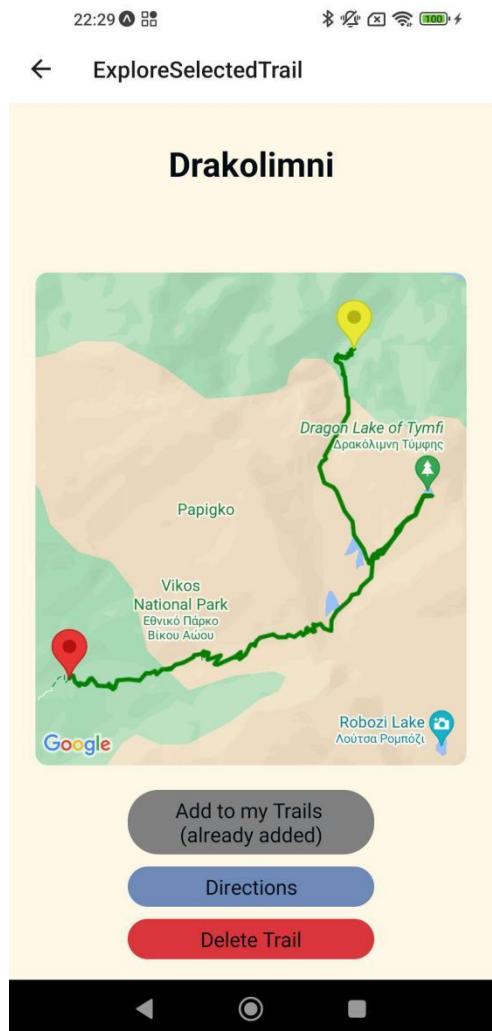


Figure 5.27. "ExploreSelectedTrail" screen for user 2

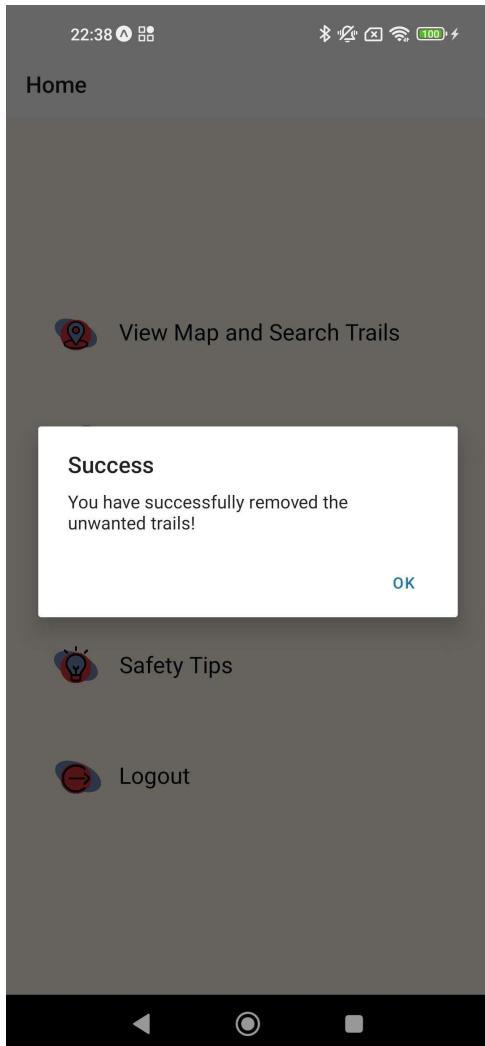


Figure 5.28."Successful Trail Removal" message

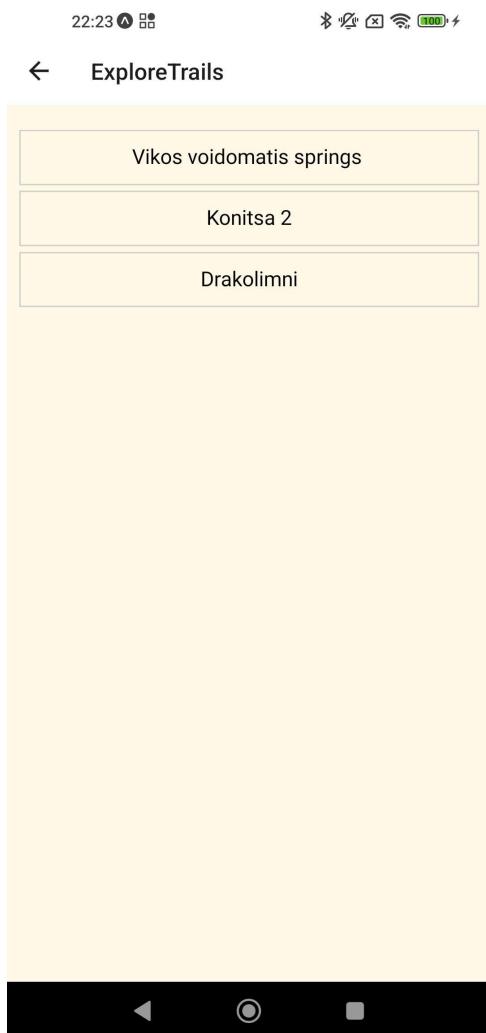


Figure 5.29.Trails after Removal

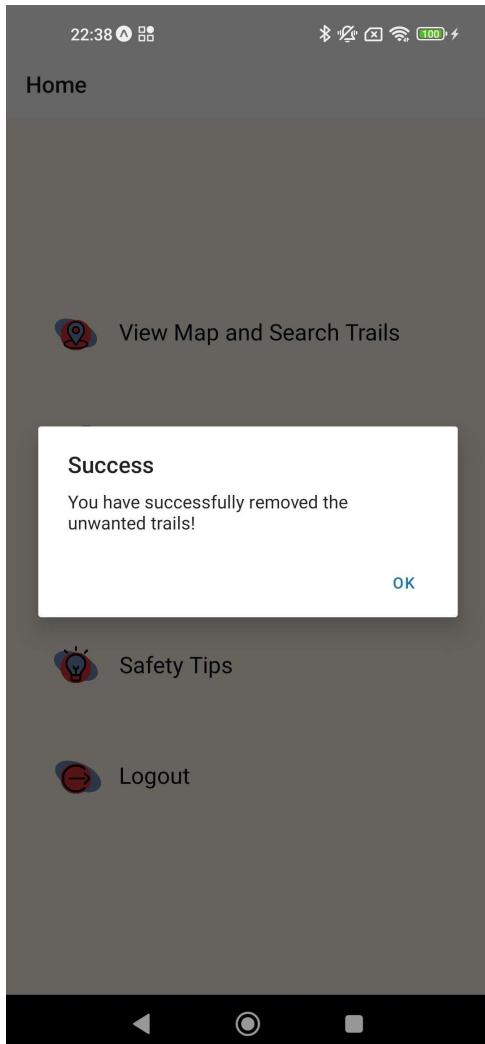


Figure 5.30."Successful Trail Deletion" message



Figure 5.31.Trails after Deletion

- ✓ If the user wants to see their trail list, then, from the “View Map and Search Trails” menu (“Explore” as seen in Figures 5.11 and 5.12), they get redirected to a list of the trails they have uploaded and saved (“MyTrails” as seen in Figure 5.32). Each trail is interactive and can be further selected to view its details (“ExploreSelectedTrail” as seen in Figures 5.26 and 5.27).



Figure 5.32. “MyTrails” screen

## **Upload/Record/Manage Trails.**

As seen in user home menu (Figure 5.3), there is an option called “Upload/Record/Manage Trails”. When this option is selected, the user/guest gets redirected to a second menu screen (“Trails” as seen in Figure 5.33).

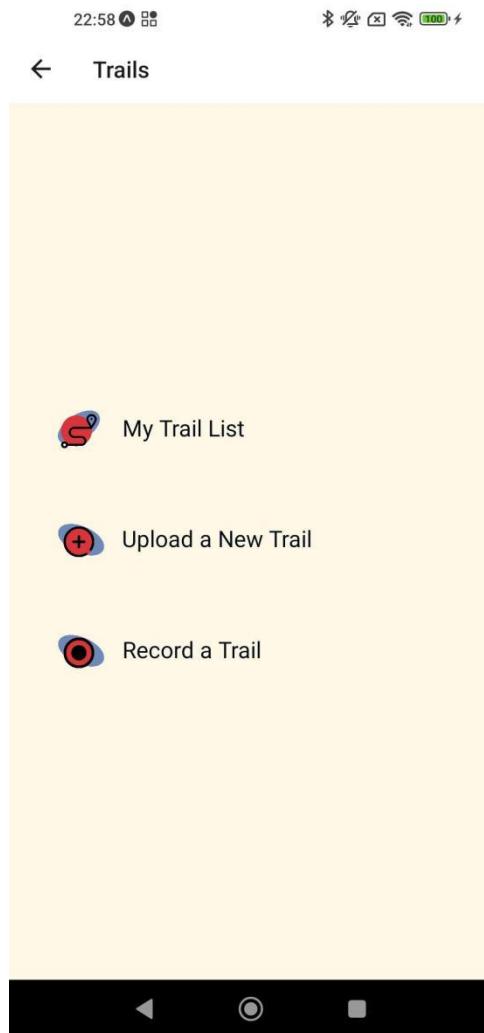


Figure 5.33. “Trails” screen

- ✓ If the user wants to see their trail list, then, they get redirected to a list of the trails they have uploaded and saved (“MyTrails” as seen in Figure 5.32). Each trail is interactive and can be further selected to view its details (“ExploreSelectedTrail” as seen in Figures 5.26 and 5.27).
- ✓ If the user wants to upload a trail, then they get redirected to a new screen that contains a form for the user to fill and upload the new trail file (“UploadTrail” as seen in Figure 5.34)

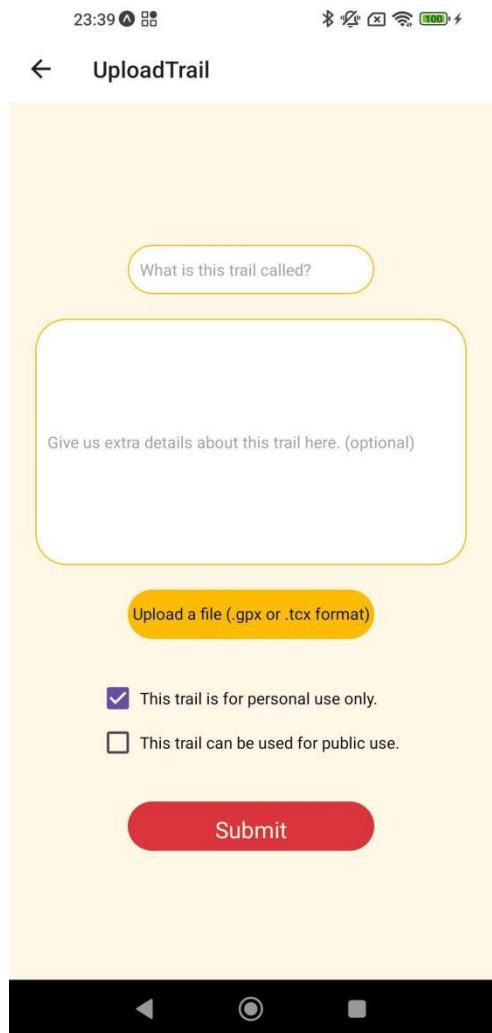


Figure 5.34. "UploadTrail" screen

If the user submits the form without a trail name, they will be informed about the missing of information with an according message (as seen in Figure 5.35) and will be prompted to change that.

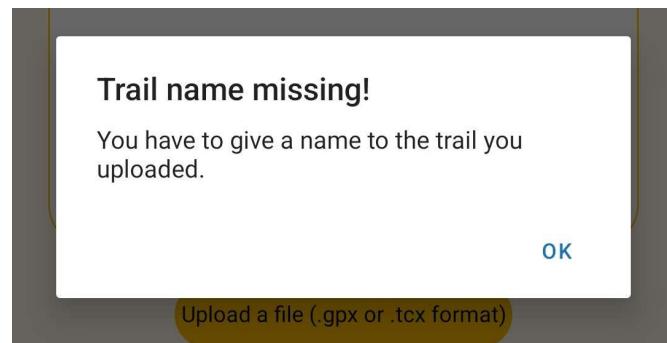


Figure 5.35. "Trail name missing" message

If the user does not submit a file, the user will be informed about the missing of information with an according message (as seen in Figure 5.36) and will be prompted to add that file.

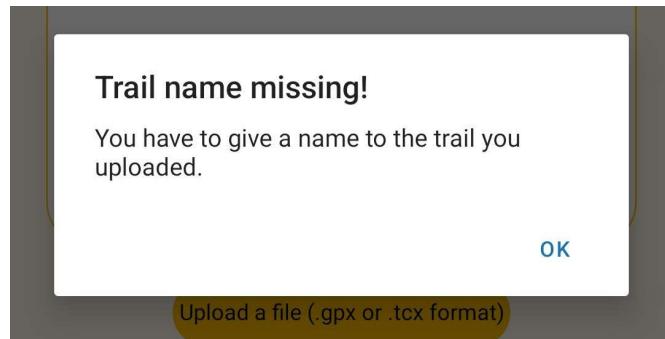


Figure 5.35. "Trail name missing" message

If the user's file is of incorrect format or anything else goes wrong, there will be an according message (as seen in Figure 5.37).

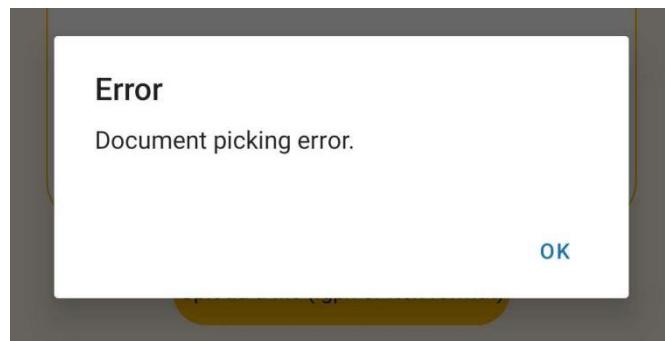


Figure 5.37. "Document picking error" message

In the happy day scenario that the form gets filled correctly, the new trail will be uploaded to the application's database, the user will be informed about the success of their actions (as seen in Figure 5.38) and they will be redirected back to the menu.

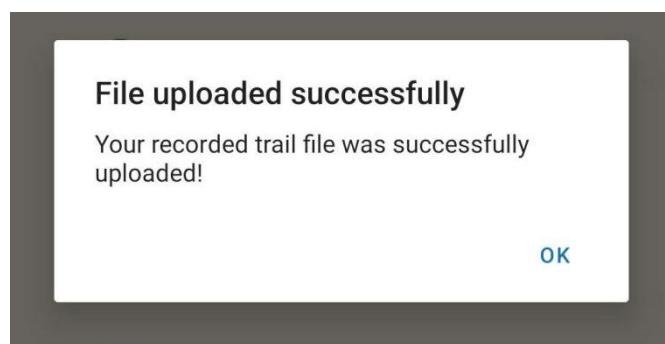
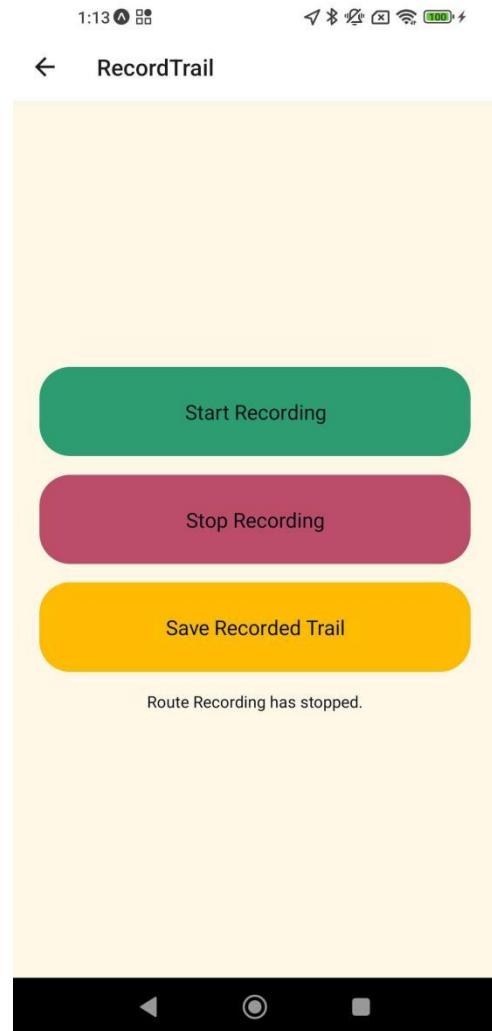


Figure 5.38. "File uploaded with success" message

- ✓ If the user wants to record a new trail, then they get redirected to a new screen that contains two buttons in the beginning (“RecordTrail” as seen in Figure 5.39). Then, when the user starts the recording, another button will appear that will offer the user a chance to save the recorded trail (“RecordTrail” as seen in Figure 5.40).



*Figure 5.39. "RecordTrail" screen start*



*Figure 5.40. "RecordTrail" screen after a while*

When the user wants to save the recorded trail, then by pressing the button for saving, they get redirected to a screen (“SaveRecordedTrail” as seen in Figure 5.41) that looks like and acts like the “UploadTrail” screen (Figure 5.34).

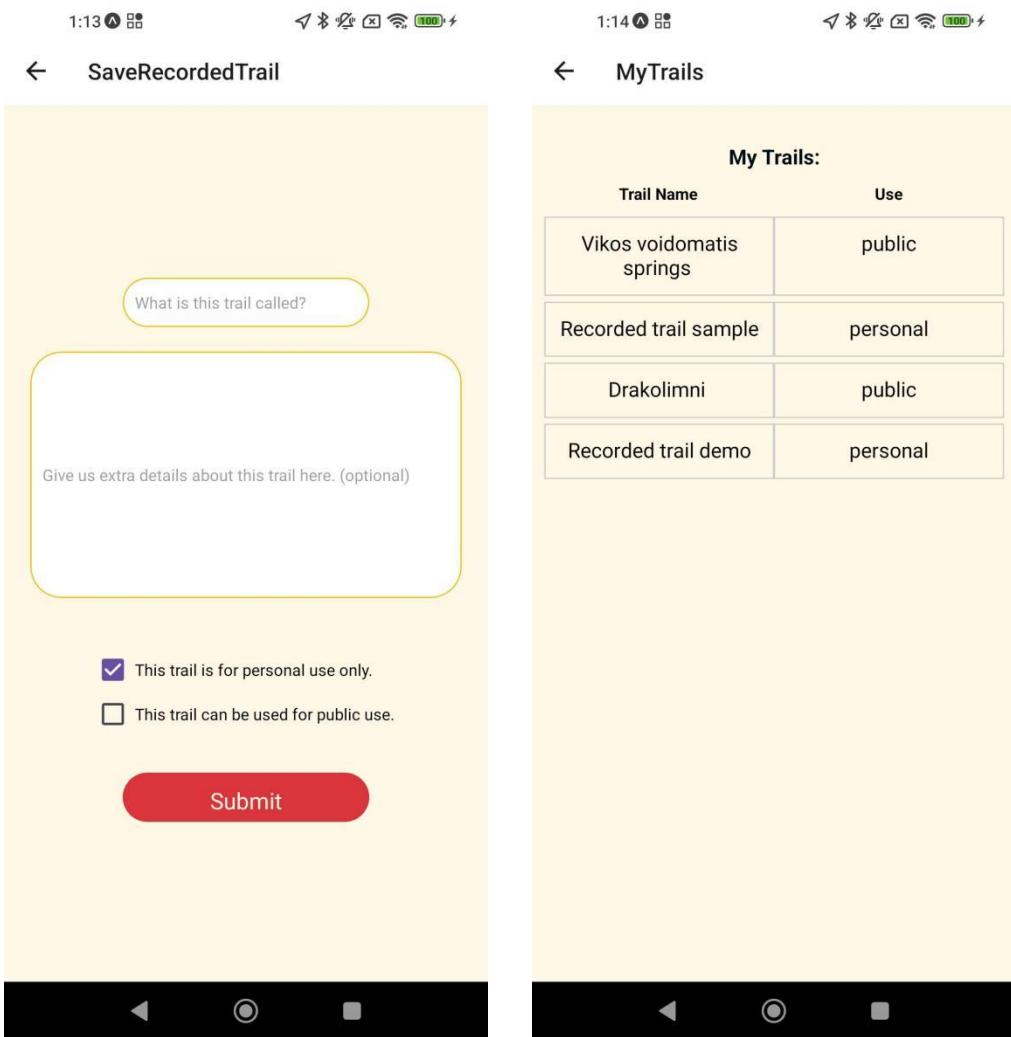


Figure 5.41. "SaveRecordedTrail" screen

Figure 5.42. User's trail list with recorded trail

## **Alert for Unexpected Situation.**

As seen in both user and guest home menus (Figures 5.3 and 5.10), there is an option called “Alert for Unexpected Situation”. When this option is selected, the user/guest gets redirected to a form to fill about a situation they are currently facing. The following figures showcase the screen (“Report”).

1:22 ⓘ 🔋

← Report

**Report an event here:**

Select the category that your report befalls under and explain briefly what happened:

SOS Fire Weather Conditions Trail Issues

What happened? Explain here briefly.

Submit

◀ ⌂ ⌂

Figure 5.43. "Report" screen

1:22 ⓘ 🔋

← Report

**Report an event here:**

Select the category that your report befalls under and explain briefly:

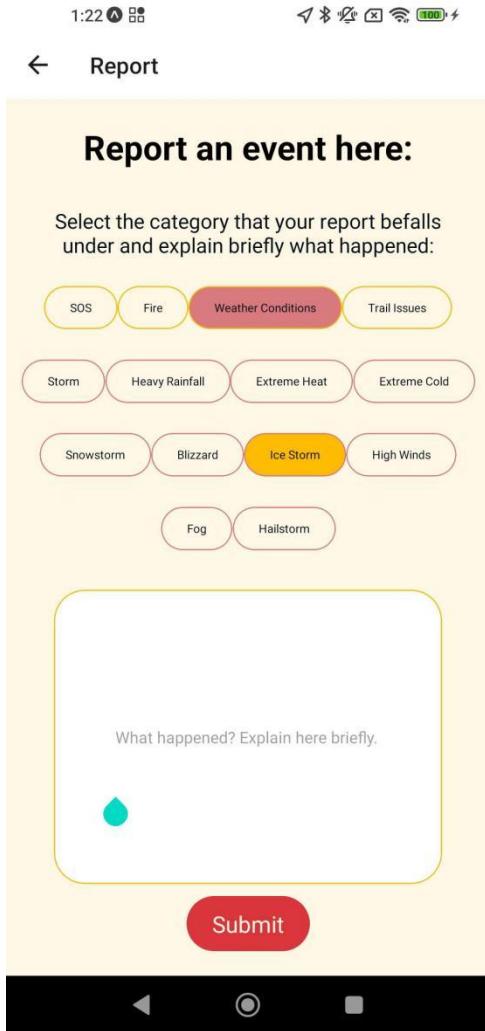
SOS Fire Weather Conditions Trail Issues

What happened? Explain here briefly.

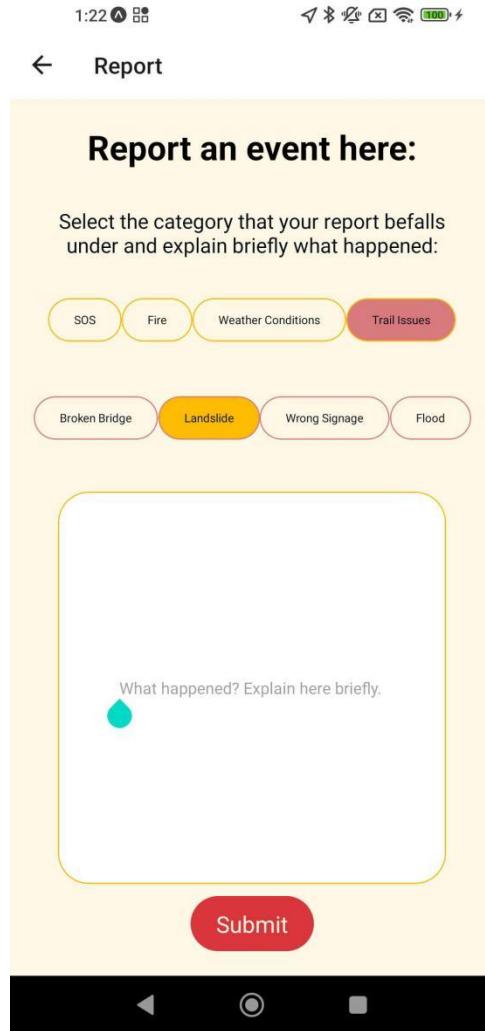
Submit

◀ ⌂ ⌂

Figure 5.44. "Report" screen

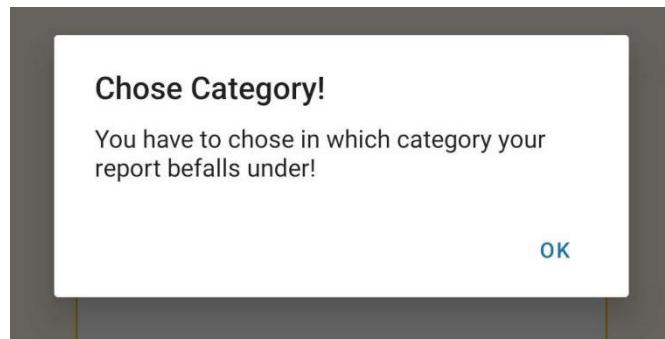


*Figure 5.45."Report" screen*



*Figure 5.46. "Report" screen*

If the user hasn't chose a category, the application informs them with a message and prompts them to do so (as seen in Figure 5.47).



*Figure 5.47. "Chose category" message*

## Safety Tips.

As seen in both user and guest home menus (Figures 5.3 and 5.10), there is an option called “Safety Tips”. When this option is selected, the user/guest gets redirected a second menu (“Safety” as seen in Figure 5.48) that contains categories of dangerous situations. Each category contains another menu with tips that the user/guest can choose to read about. The respective bodies of the safety tips can be found in the appendix.

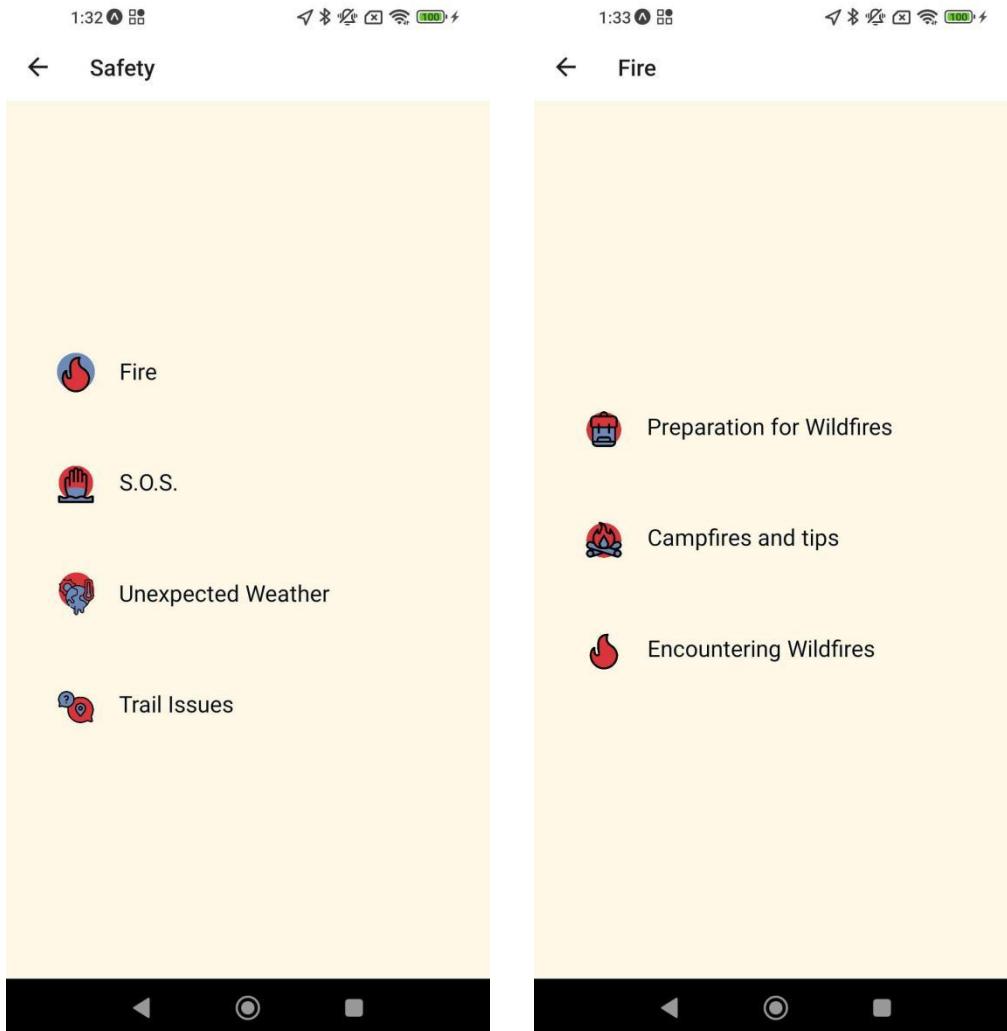


Figure 5.48. "Safety" screen

Figure 5.49. "Fire" screen

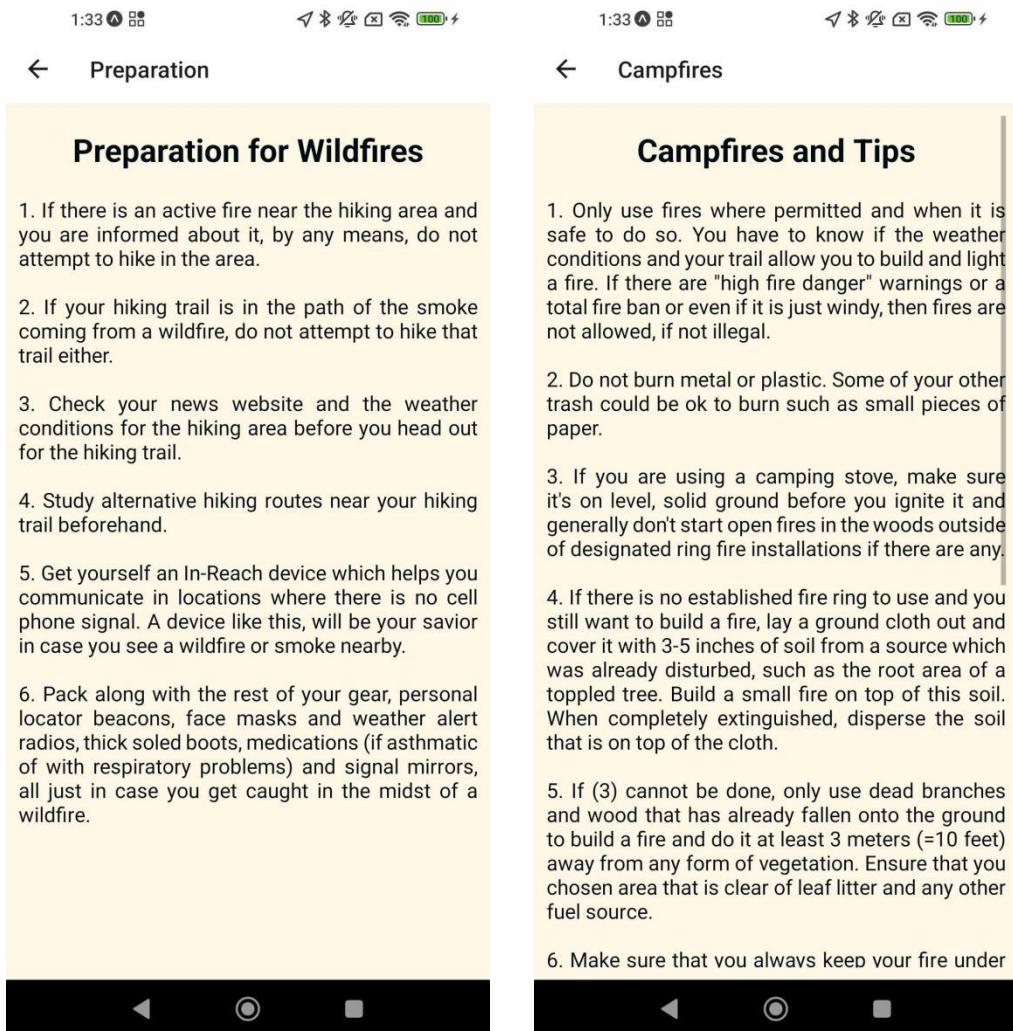


Figure 5.50. "Preparation" screen

Figure 5.51. "Campfires" screen

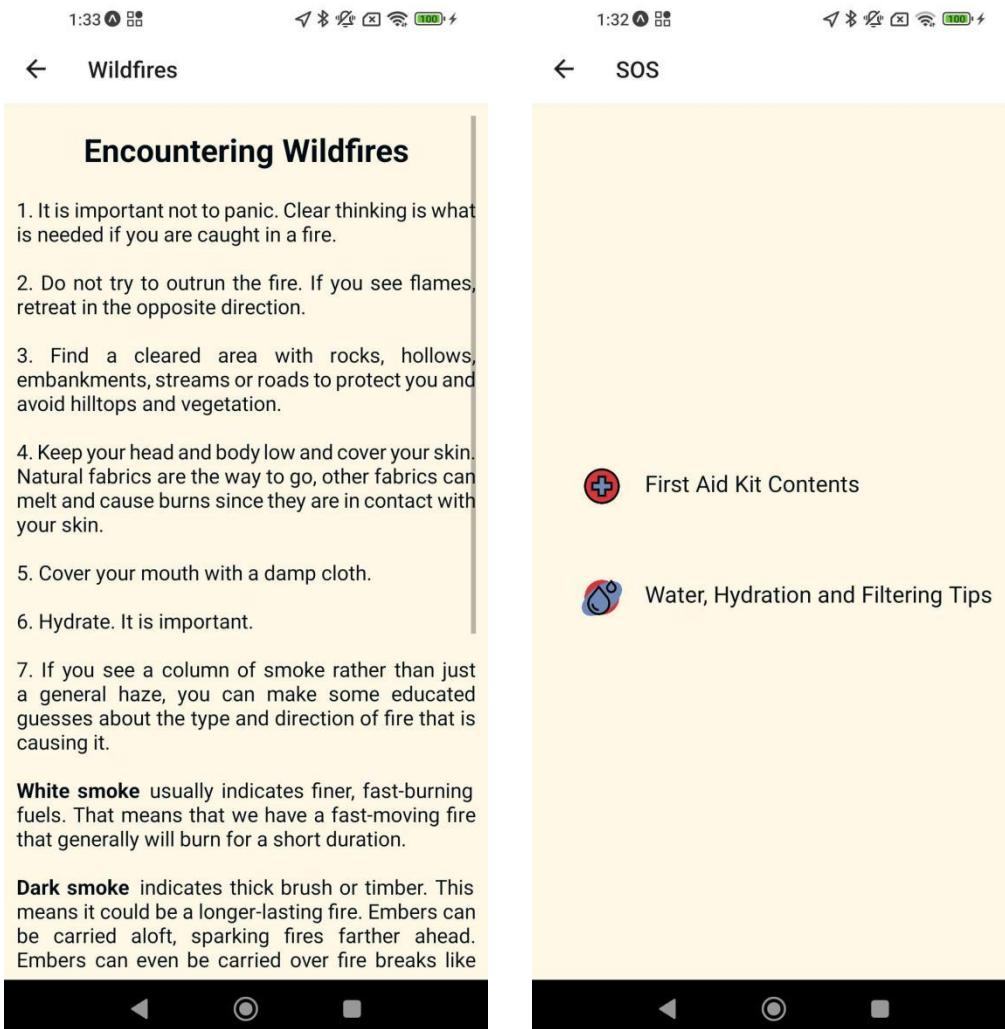


Figure 5.52. "Wildfires" screen

Figure 5.53. "SOS" screen

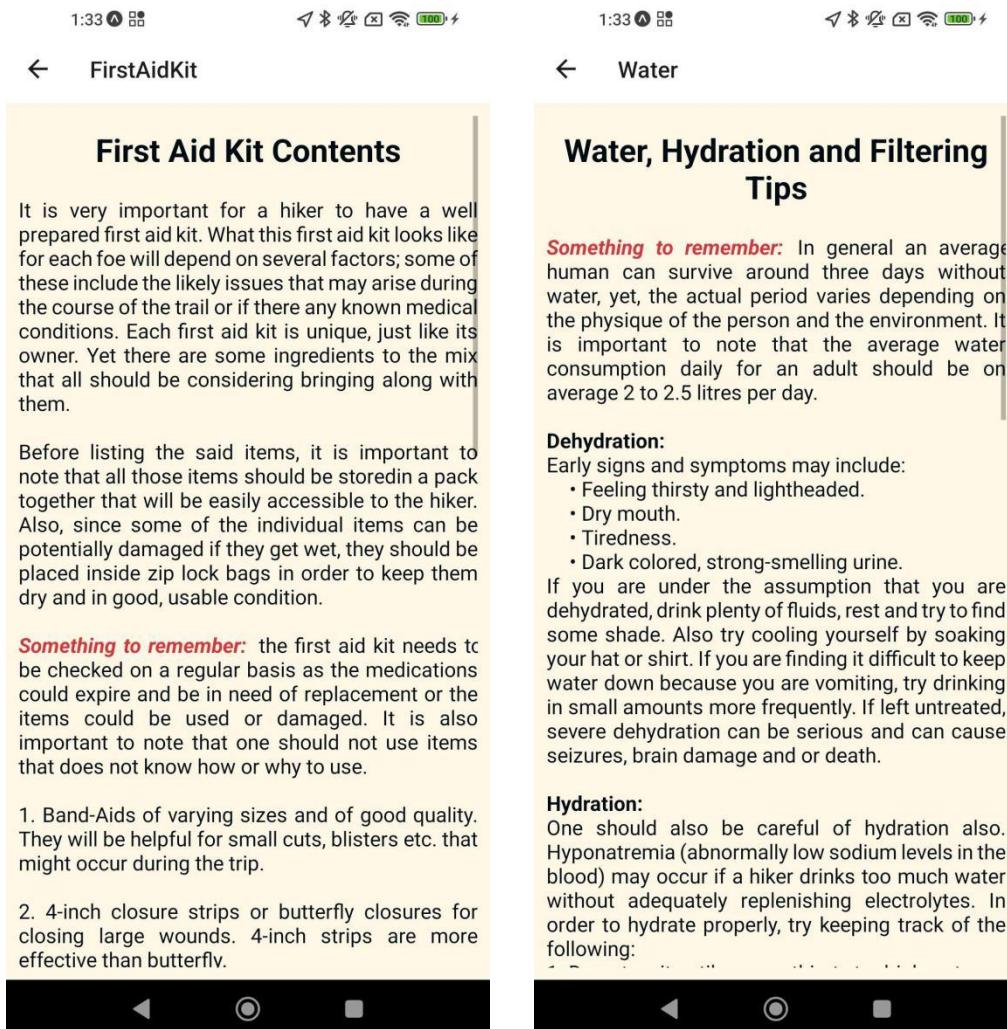
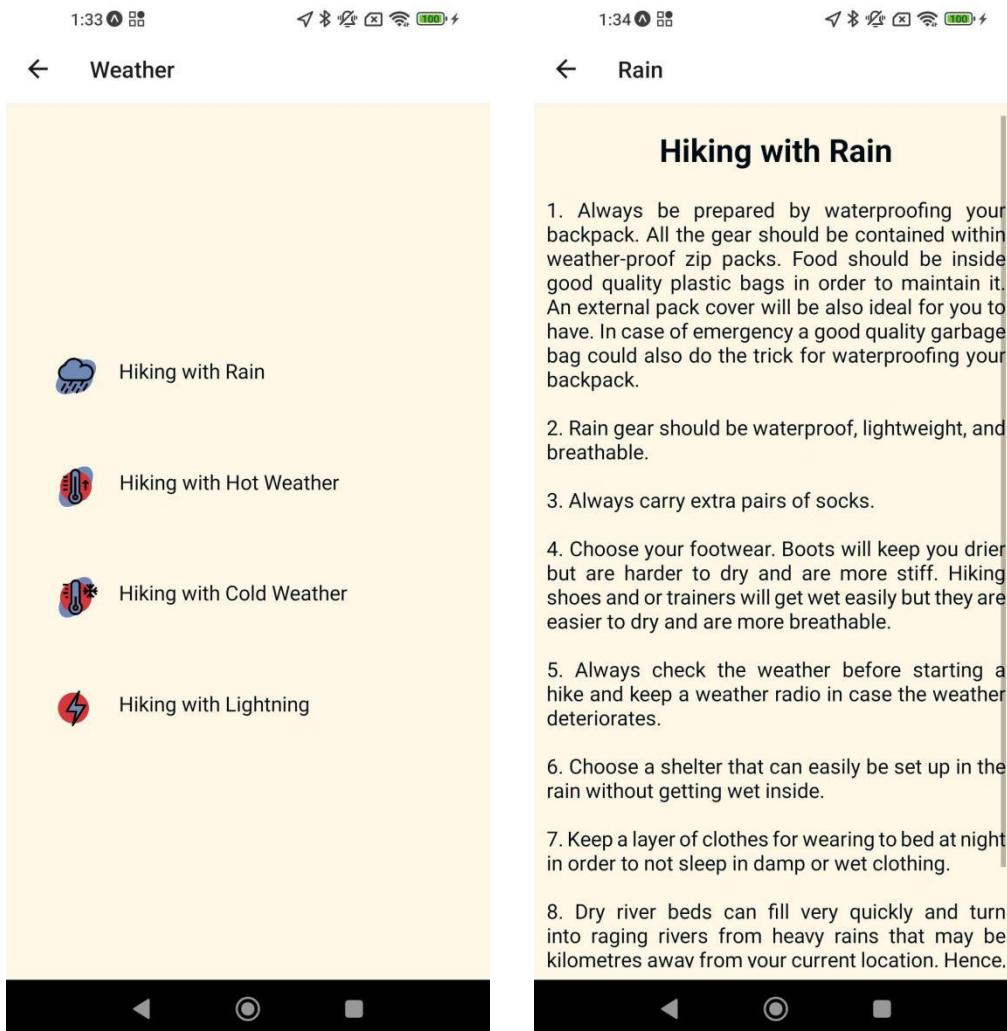


Figure 5.54. "FirstAidKit" screen

Figure 5.55. "Water" screen



The image displays two side-by-side screenshots from a mobile application. Both screens have a top status bar showing the time (1:34), signal strength, battery level (100%), and a navigation arrow icon.

**Left Screen (Heat):**

- Hiking with Hot Weather**
- Dehydration:**  
Early signs and symptoms may include:
  - Feeling thirsty and lightheaded.
  - Dry mouth.
  - Tiredness.
  - Dark colored, strong-smelling urine.If you are under the assumption that you are dehydrated, drink plenty of fluids, rest and try to find some shade. Also try cooling yourself by soaking your hat or shirt. If you are finding it difficult to keep water down because you are vomiting, try drinking in small amounts more frequently. If left untreated, severe dehydration can be serious and can cause seizures, brain damage and or death.
- Hydration:**  
One should also be careful of hydration also. Hyponatremia (abnormally low sodium levels in the blood) may occur if a hiker drinks too much water without adequately replenishing electrolytes. In order to hydrate properly, try keeping track of the following:
  1. Do not wait until you are thirsty to drink water.
  2. Use sunscreen, hats and stay in the shade. In general, try to keep cool. A warm environment always brings the thirst levels up.
  3. During hot and largely shadeless conditions where water sources are scarce, do the bulk of your hiking while the temperatures are cooler (e.g. early morning, late afternoon and early evening).
- Heat Exhaustion:**

**Right Screen (Cold):**

- Hiking with Cold Weather**
- Getting cold:**  
Signs and symptoms may include:
  - Feeling cold.
  - Uncontrollable shivering.
  - Exhaustion.
  - Cool and pale skin.
  - Shivering.If getting cold progresses, the person could develop hypothermia.
- Hypothermia:**  
Signs and symptoms may include:
  - Feeling cold.
  - Pale, cold and dry skin.
  - Blue or gray skin and lips.
  - Slurred speech.
  - Slow breathing.
  - Tiredness.
  - Confusion.If the person is suspected to have hypothermia, then he has to be moved to a shelter immediately. Wet clothes should be removed and they should be wrapped in a blanket, sleeping bag or dry towel (the head should be also covered). They need to be kept awake and given something warm, non-alcoholic to drink and sugary foods.  
Do not rub the person in order to warm them up and also do not try to warm them up with heat lamps, hot water bottles or hot baths.  
It is important to note that if the person progresses into severe hypothermia, shivering usually stops. Symptoms of severe hypothermia include slowing

Figure 5.58. "Heat" screen

Figure 5.59. "Cold" screen

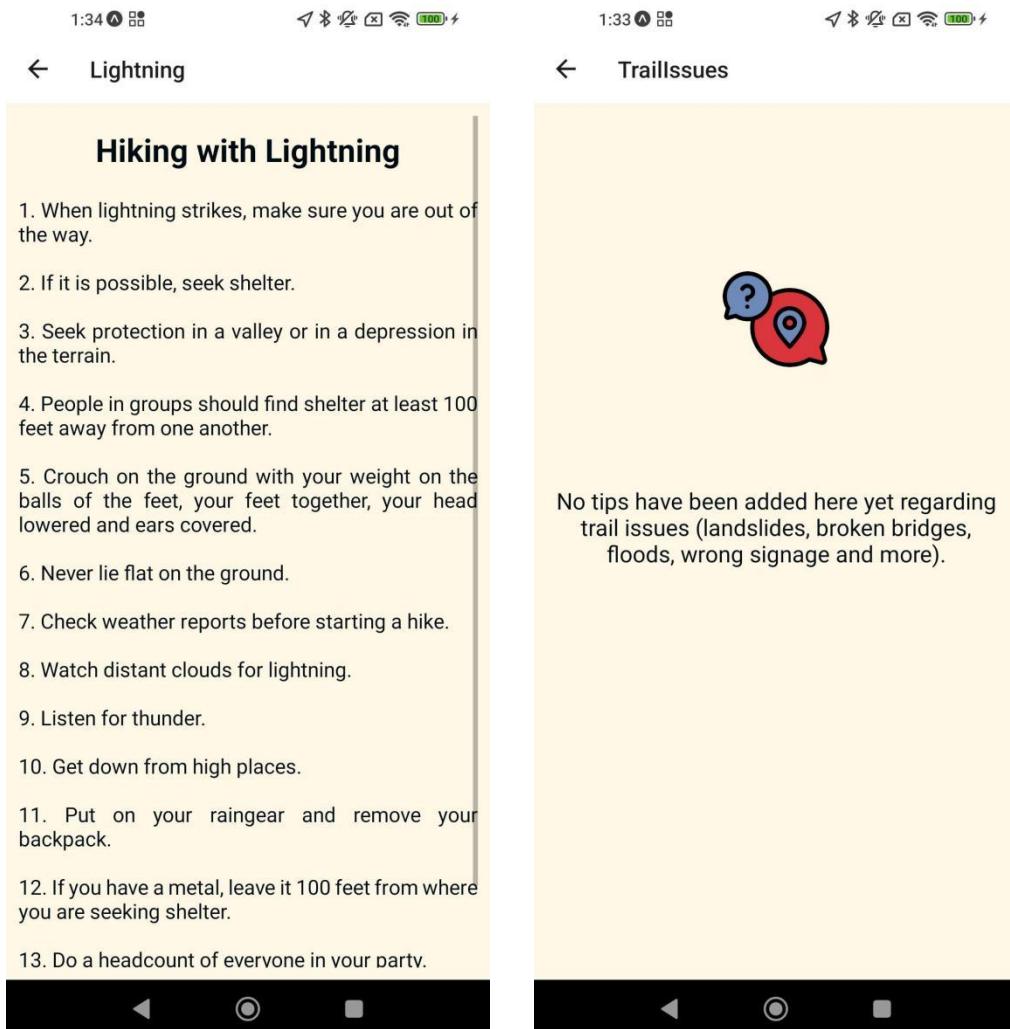


Figure 5.60. "Lightning" screen

Figure 5.61. "TrailIssues" screen

## “Safe Hiking” and Notifications.

The starring point of the application is the “Safe Hiking” feature that the map provides. The “Safe Hiking” activation allows notifications to come through to user’s/guest’s phone while hiking. Notifications and alerts go through in a range on 30km from the user and are constantly getting refreshed in case something new arises. The following figures showcase the handling of the notifications.

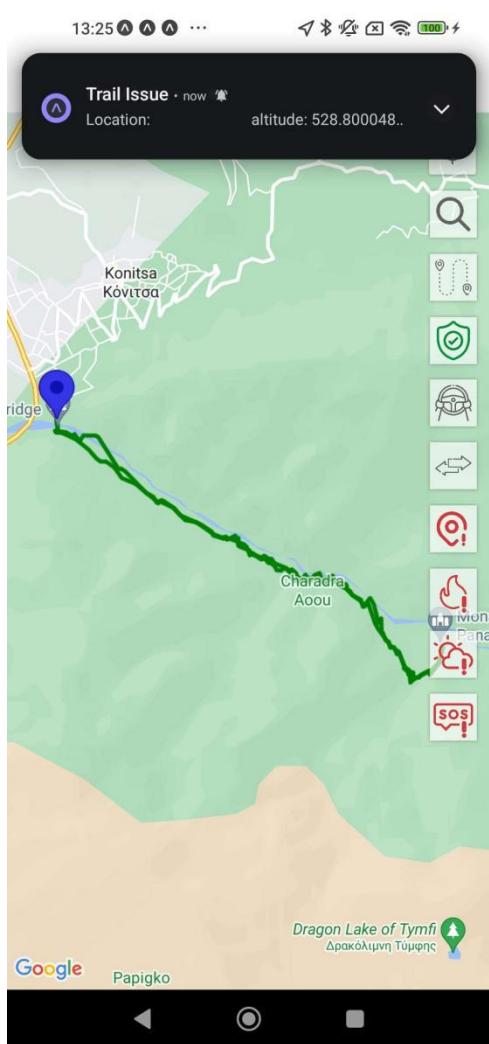


Figure 5.62. Getting a notification 1

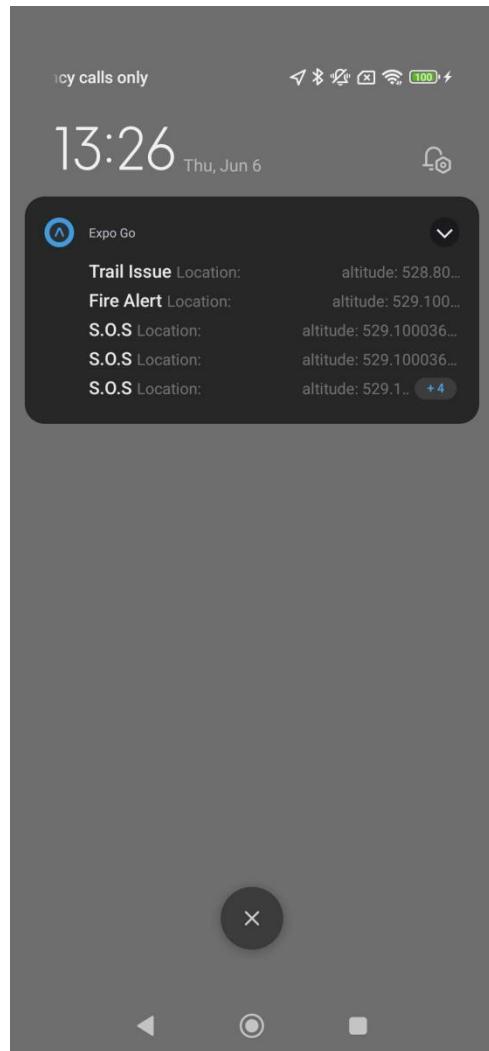


Figure 5.63. Getting a notification 2

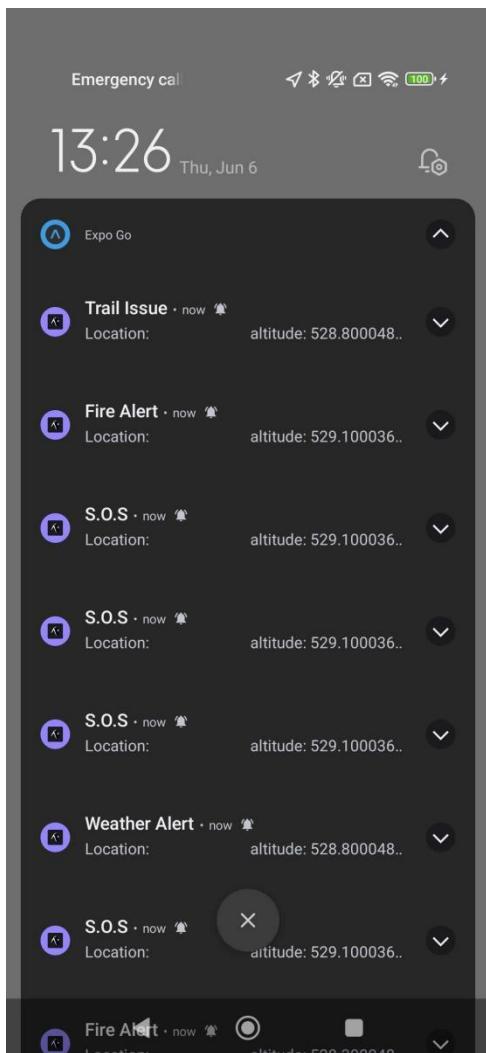


Figure 5.64. Getting a notification 3

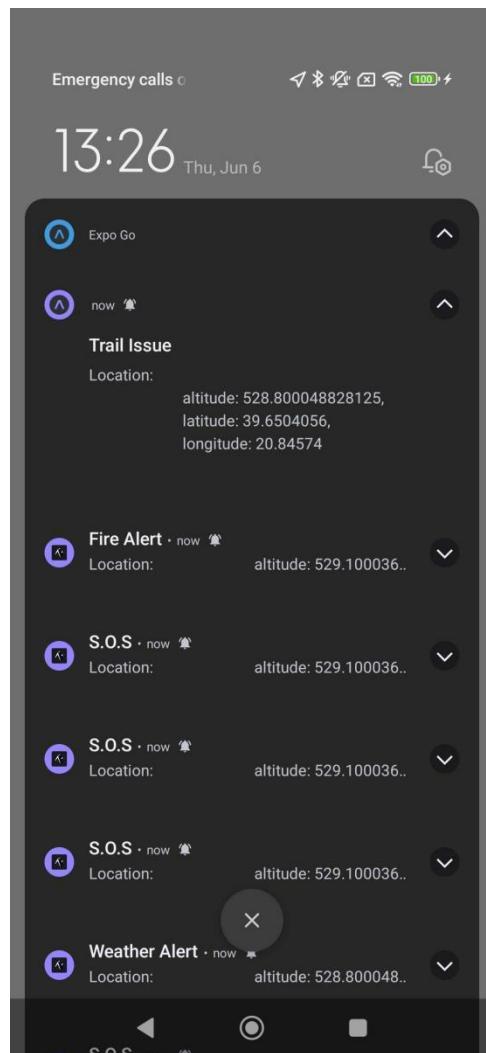


Figure 5.65. Getting a notification 4

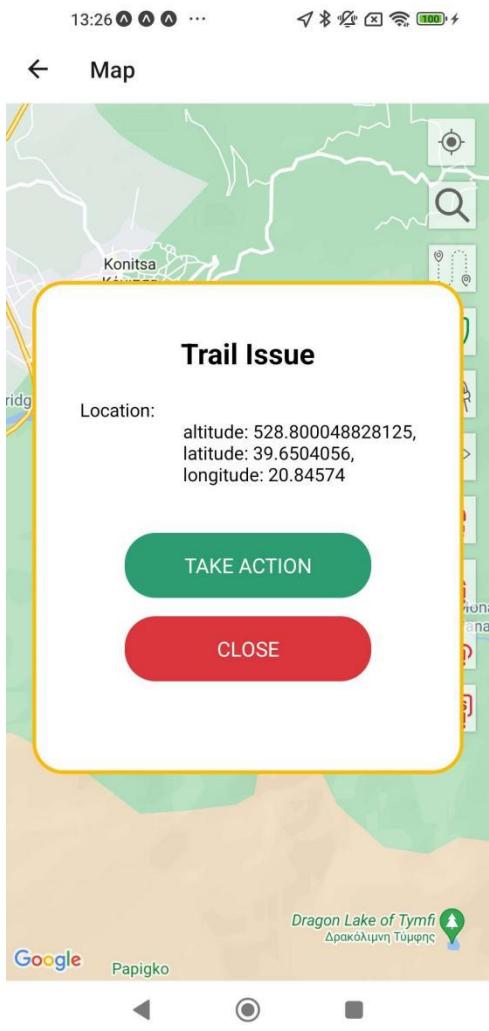


Figure 5.66. "Trail Issue" notification

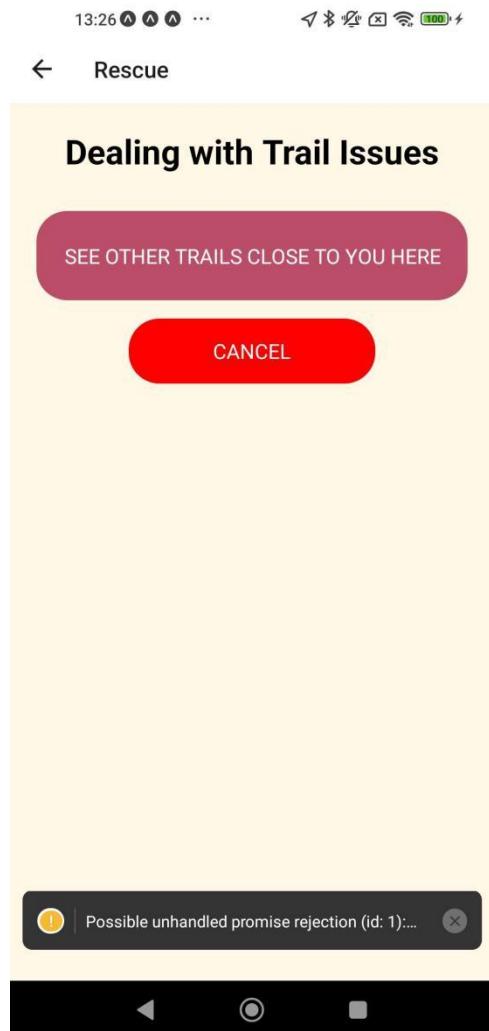


Figure 5.67. "Trail Issue" notification action menu

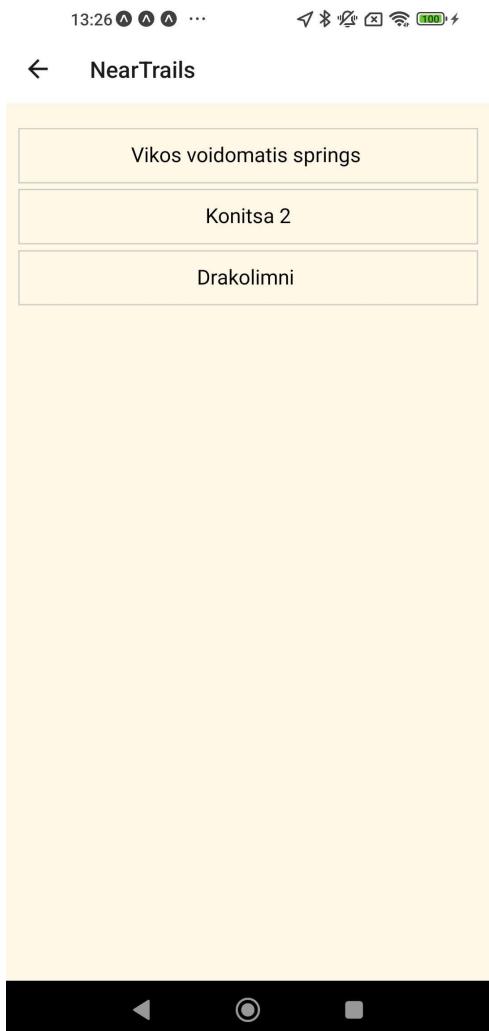


Figure 5.68. "NearTrails" screen

(trails near user's location) the application was altered in order to show results in the list.

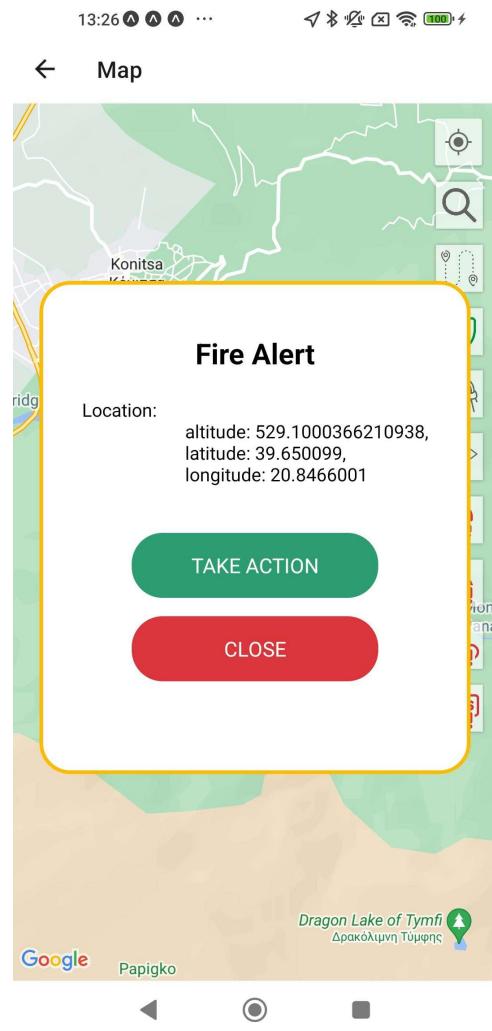
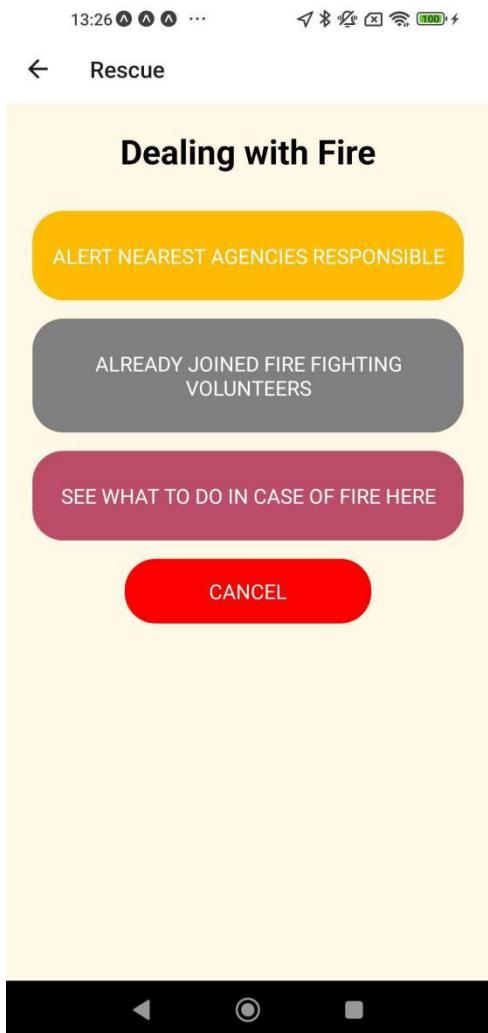
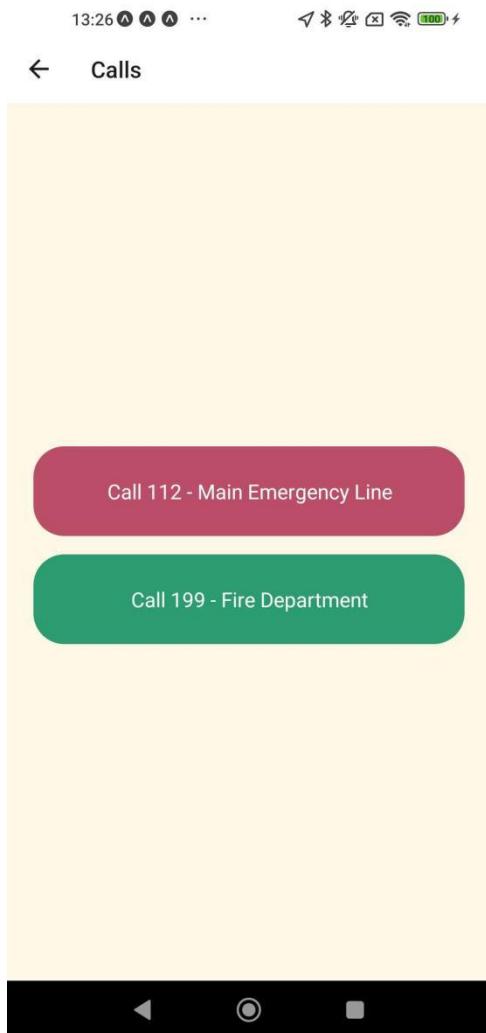


Figure 5.69. "Fire" notification



*Figure 5.70. "Fire" notification action menu*



*Figure 5.71. "Alert nearest agencies" menu*

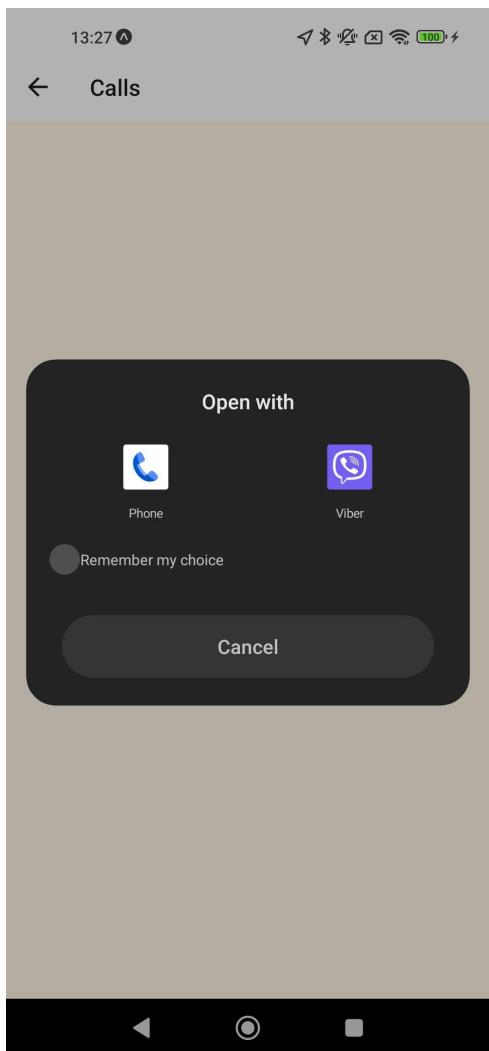


Figure 5.72. Redirection for calling 3-digits 1

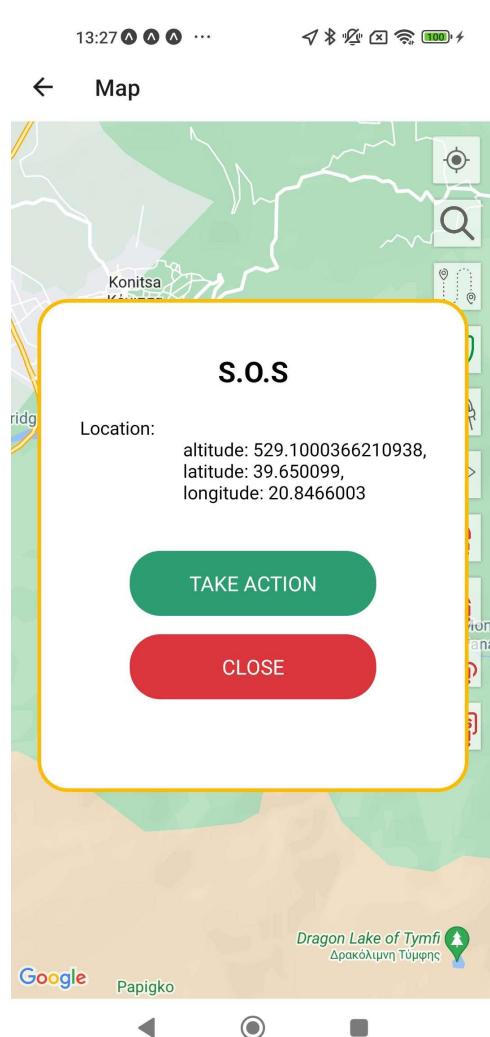


Figure 5.73. "S.O.S" notification

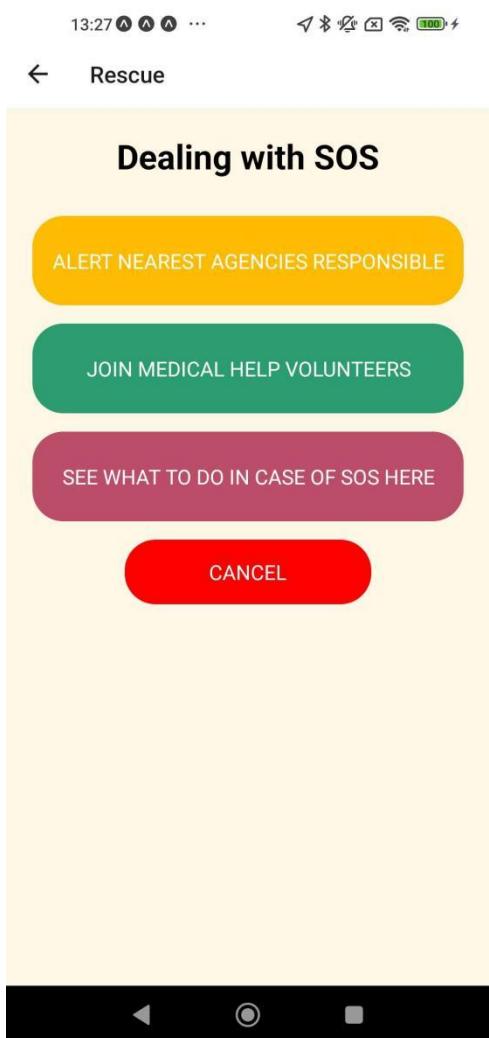


Figure 5.74. "SOS" notification action menu

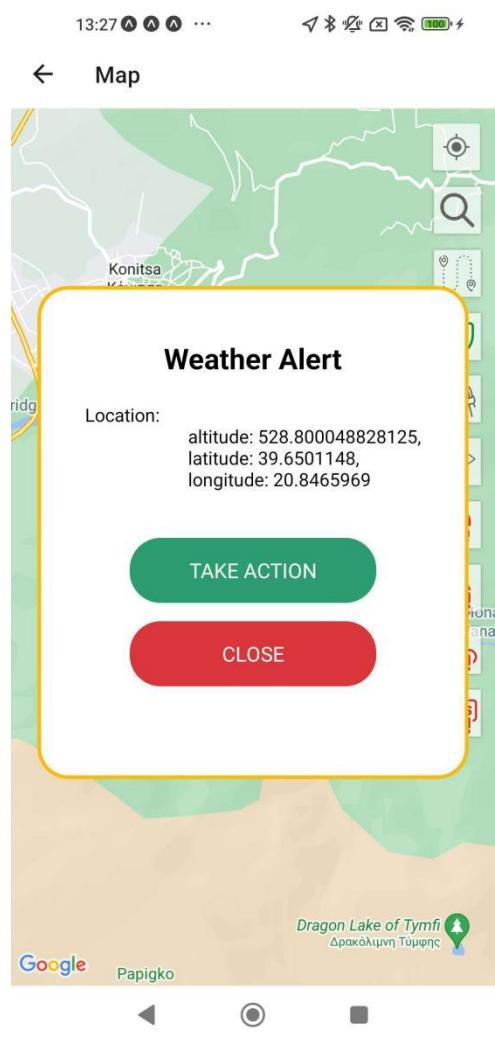


Figure 5.75. "Weather alert" notification

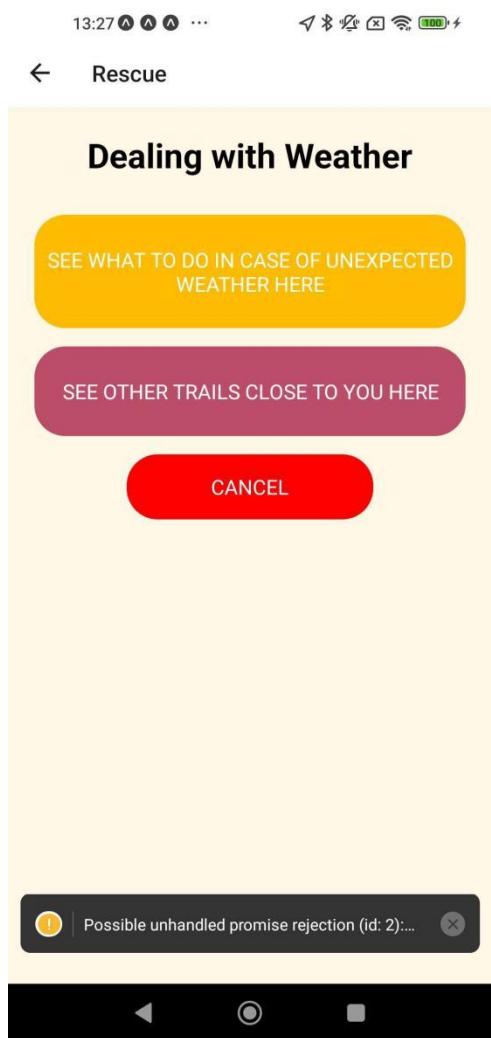


Figure 5.76. "Weather alert" notification action menu

# Conclusion

As we reach the conclusion of this thesis, we reflect on the journey that brought “Trailly” from a concept to a real life application that acts as a companion to people, enhancing their hiking experience. The creation of “Trailly” represents a significant advancement in hiking technology, offering a unique blend of navigation, safety, and community engagement. This thesis has documented the journey from concept to implementation, providing insights into the design and technical challenges that arose along the way.

As we look to the future of this project, there are numerous possibilities for expanding and improving “Trailly” since no such project could be perfect from the get-go. The following is a list of such potential improvements and expansions. The foundation that has been built provides a solid platform for these future developments, ensuring that this application will continue to evolve and meet the needs of the hiking community as promised.

- i. Fixes on the applications database with focus on data management and data load. The database in some cases is used for keeping big data and this could cause many issues as it gets crowded. For example the table of “trails” holds the contents of each file that is uploaded in the application.
- ii. Fixes on the way browsing trails is done. This is also an issue concerning data management and data load. As the database gets more and more entries, the current loading technique could suffer and cause big loading times and trail management issues.
- iii. GPS live navigation is a priority in future versions.
- iv. A password encryption would be a nice addition for user’s safety.
- v. Chatting features could also be added along with user profile personalisation.
- vi. Integration of weather forecasting will be useful for creating alerts for all users and warnings about trails. It could also benefit the planning of trail hiking.

I hope that “Trailly” will inspire and empower hikers, keeping them safe while they connect with nature and with each other.

# Appendix

## Counting distances of points on map in kilometers

The distances between points on the map, in this application, are calculated with the use of the ***haversine formula*** [HF1], which calculates the great-circle distance between two points on a sphere given their longitudes and latitudes.

The simplified formula (that is used in the application) is the following:

$$d = 2 \cdot r \cdot \arcsin \left( \sqrt{\frac{\sin^2(\frac{\varphi_2 - \varphi_1}{2}) + \cos(\varphi_1) \cdot \cos(\varphi_2) \cdot \sin^2(\frac{\lambda_2 - \lambda_1}{2})}{2}} \right)$$

Where:

- ✓ **d** is the distance
- ✓ **r** is the radius of the Earth that is on average 6371km .
- ✓  **$\varphi_1$**  is the latitude of the fist point.
- ✓  **$\lambda_1$**  is the longitude of first point.
- ✓  **$\varphi_2$**  is the latitude of the second point.
- ✓  **$\lambda_2$**  is the longitude of second point.

## Safety Tips

### Body of safety tips about encountering wildfires.

1. It is important not to panic. Clear thinking is what is needed if you are caught in a fire.
2. Do not try to outrun the fire. If you see flames, retreat in the opposite direction.
3. Find a cleared area with rocks, hollows, embankments, streams or roads to protect you and avoid hilltops and vegetation.
4. Keep your head and body low and cover your skin. Natural fabrics are the way to go, other fabrics can melt and cause burns since they are in contact with your skin.
5. Cover your mouth with a damp cloth.
6. Hydrate. It is important.

7. If you see a column of smoke rather than just a general haze, you can make some educated guesses about the type and direction of fire that is causing it.

- a) White smoke usually indicates finer, fast-burning fuels. That means that we have a fast-moving fire that generally will burn for a short duration.
- b) Dark smoke indicates thick brush or timber. This means it could be a longer-lasting fire. Embers can be carried aloft, sparking fires farther ahead. Embers can even be carried over fire breaks like rivers or highway.

8. The larger the column of smoke, the greater the fire. If you see the smoke column growing bigger, get out of the area. The direction that a smoke column bends indicates the direction the fire is moving, so head the other way if possible.

9. If the atmosphere has a yellow or orange or red hue around you, breathing will be unhealthy and it might be time to leave. Wear a damp cloth in front of your mouth or a mask.

10. Fires go uphill faster than downhill.

11. If you can safely travel over already-blackened earth, it can be a good way to go because the fire will likely be headed away from you and there will be little to no fuel to attract it back to your way. If you do so, watch out for possible falling trees and be careful not to step in hot ash pockets as ground heat can melt your soles.

### **Body of safety tips about preparing for wildfires.**

1. If there is an active fire near the hiking area and you are informed about it, by any means, do not attempt to hike in the area.

2. If your hiking trail is in the path of the smoke coming from a wildfire, do not attempt to hike that trail either.

3. Check your news website and the weather conditions for the hiking area before you head out for the hiking trail.

4. Study alternative hiking routes near your hiking trail beforehand.

5. Get yourself an In-Reach device which helps you communicate in locations where there is no cell phone signal. A device like this, will be your savior in case you see a wildfire or smoke nearby.

6. Pack along with the rest of your gear, personal locator beacons, face masks and weather alert radios, thick soled boots, medications (if asthmatic or with respiratory problems) and signal mirrors, all just in case you get caught in the midst of a wildfire.

## **Body of safety tips about campfires.**

1. Only use fires where permitted and when it is safe to do so. You have to know if the weather conditions and your trail allow you to build and light a fire. If there are "high fire danger" warnings or a total fire ban or even if it is just windy, then fires are not allowed, if not illegal.
2. Do not burn metal or plastic. Some of your other trash could be ok to burn such as small pieces of paper.
3. If you are using a camping stove, make sure it's on level, solid ground before you ignite it and generally don't start open fires in the woods outside of designated ring fire installations if there are any.
4. If there is no established fire ring to use and you still want to build a fire, lay a ground cloth out and cover it with 3-5 inches of soil from a source which was already disturbed, such as the root area of a toppled tree. Build a small fire on top of this soil. When completely extinguished, disperse the soil that is on top of the cloth.
5. If (3) cannot be done, only use dead branches and wood that has already fallen onto the ground to build a fire and do it at least 3 meters (=10 feet) away from any form of vegetation. Ensure that you chosen area that is clear of leaf litter and any other fuel source.
6. Make sure that you always keep your fire under constant watch and control.
7. When you are done with the lit fire, carefully douse the fire with water and stand where the steam won't burn you as you pour, stir the ashes and apply more water. Keep dousing, stirring and breaking apart embers until all remnants of the fire are cool to human touch.
8. Do not light fires under low hanging trees. Fires must be positioned to open spaces.
9. Keep your fire to a reasonable size. There is no need for grandeur, you need just enough of a fire in order to cook something small or create a bit of warmth.
10. Rocks help create a contained area for your fire but only if building a fire ring does not destroy the natural habitat. Do not use rocks that have been taken from waterways or were very close to water sources. The water content in them can cause them to explode when they come in contact with flames.
11. Do not use liquid fuel to light up a fire such as kerosene or petrol.

## **Body of safety tips about water, hydration and filtration.**

*Something to remember:* In general an average human can survive around three days without water, yet, the actual period varies depending on the physique of the person and the environment. It is important to note that the average water consumption daily for an adult should be on average 2 to 2.5 liters per day.

### **Dehydration:**

Early signs and symptoms may include:

- a) Feeling thirsty and lightheaded.
- b) Dry mouth.
- c) Tiredness.
- d) Dark colored, strong-smelling urine.

If you are under the assumption that you are dehydrated, drink plenty of fluids, rest and try to find some shade. Also try cooling yourself by soaking your hat or shirt.

If you are finding it difficult to keep water down because you are vomiting, try drinking in small amounts more frequently. If left untreated, severe dehydration can be serious and can cause seizures, brain damage and or death.

### **Hydration:**

One should also be careful of hydration also. Hyponatremia (abnormally low sodium levels in the blood) may occur if a hiker drinks too much water without adequately replenishing electrolytes. In order to hydrate properly, try keeping track of the following:

1. Do not wait until you are thirsty to drink water.
2. Use sunscreen, hats and stay in the shade. In general, try to keep cool. A warm environment always brings the thirst levels up.
3. During hot and largely shadeless conditions where water sources are scarce, do the bulk of your hiking while the temperatures are cooler (e.g. early morning, late afternoon and early evening).

### **Finding water:**

Trails will not always have a water bubblers or taps which provide water on a regular basis. Thus, one must always bring his own water bottle. In big hikes, the amount of water needed cannot be carried by the hiker due to its weight. Thus, one must know how to find and make water drinkable. The water you find during a hike is important to remember that no matter how clean it looks, it could always contain germs and or parasites that are undiscoverable with naked human eyes.

### **Always filter water no matter how clean it looks.**

Natural water sources are a way to go for getting water. Dams, creeks and rivers are a good way to get your resupply of water. That is why, you should always study your map well before going on a hike; one must know the where such sources can be reached from the trail. However, natural water sources can be seasonal and not always be reliable.

You should - if possible - avoid drinking water from sources that run through farms as they may contain animal or chemical contamination. Try also to avoid water sources that are stagnant, foamy or have animal faeces.

In case there is a patch of green or a damp spot in an otherwise dry creek bed, that means that water lies close to its surface. You should dig a hole and if it fills up with water, scoop it out with your cooking pot or place a shirt into the hole, soak it up and wring it to get the water out filtered.

### **Filtering:**

The most common forms of water purification are:

- a) UV Lights.
- b) Gravity Filters.
- c) Straw Filters.
- d) Pumps.
- e) Chemicals that can be added to the water.

Water with lots of particles will generally take longer to filter than clean water.

Filtering is good, but not always enough, thus we need to consider pre-filtering.

If you are desperate and have no choice, use a bandanna, a coffee filter or a stocking to pre-filter the big chunks out of your dirty water source and if you are carrying extra fuel, it would probably be to boil the water in order to sterilize it.

### **Body of safety tips about the first aid kit's contents.**

It is very important for a hiker to have a well prepared first aid kit. What this first aid kit looks like for each foe will depend on several factors; some of these include the likely issues that may arise during the course of the trail or if there any known medical conditions. Each first aid kit is unique, just like its owner. Yet there are some ingredients to the mix that all should be considering bringing along with them.

Before listing the said items, it is important to note that all those items should be stored in a pack together that will be easily accessible to the hiker. Also, since some of the

individual items can be potentially damaged if they get wet, they should be placed inside zip lock bags in order to keep them dry and in good, usable condition.

*Something to remember:* the first aid kit needs to be checked on a regular basis as the medications could expire and be in need of replacement or the items could be used or damaged. It is also important to note that one should not use items that does not know how or why to use.

1. Band-Aids of varying sizes and of good quality. They will be helpful for small cuts, blisters etc. that might occur during the trip.
2. 4-inch closure strips or butterfly closures for closing large wounds. 4-inch strips are more effective than butterfly.
3. 4 inch by 4 inch sterile dressing pads (5 to 10) for applying pressure to a wound and stop the bleeding.
4. Non-adherent sterile dressing (2 inch by 2 inch) to cover blisters, burns or lacerations.
5. Gauze roll.
6. Antiseptic cream (e.g. Betadine) for cuts and wounds that could be potentially infected.
7. Multi-use tool or knife and or scissors.
8. Forceps or tweezers for removing splinters, ticks and dirt from wounds.
9. Thermometer.
10. Safety pins.
11. Lip balm and sunscreen.
12. Insect repeler.
13. A note pad and pencil.
14. A small roll of duct tape.
15. A pair of sterile gloves.
16. Antiseptic wipes.
17. Medication for pain relief and inflammation. (e.g. Ibuprofen)
18. Aloe Vera gel that can be found in packets or small bottles for relief of minor burns.
19. Masks.
20. Space bag/blanket that can consist a lightweight emergency shelter. For treating hypothermia victims.
21. A first aid booklet.

Of course more items can be added or some of those recommended could be excluded. This is just a list with commonly used important first aid items for you to reference.

### **Body for safety tips about hiking with rainy weather.**

1. Always be prepared by waterproofing your backpack. All the gear should be contained within weather-proof zip packs. Food should be inside good quality plastic bags in order to maintain it. An external pack cover will be also ideal for you to have. In case of emergency a good quality garbage bag could also do the trick for waterproofing your backpack.
2. Rain gear should be waterproof, lightweight, and breathable.
3. Always carry extra pairs of socks.
4. Choose your footwear. Boots will keep you drier but are harder to dry and are more stiff. Hiking shoes and or trainers will get wet easily but they are easier to dry and are more breathable.
5. Always check the weather before starting a hike and keep a weather radio in case the weather deteriorates.
6. Choose a shelter that can easily be set up in the rain without getting wet inside.
7. Keep a layer of clothes for wearing to bed at night in order to not sleep in damp or wet clothing.
8. Dry river beds can fill very quickly and turn into raging rivers from heavy rains that may be kilometers away from your current location. Hence, do not camp there.
9. Pack your shelter in an easy to get position in your bag.

### **Body for safety tips about hiking with lightning.**

1. When lightning strikes, make sure you are out of the way.
2. If it is possible, seek shelter.
3. Seek protection in a valley or in a depression in the terrain.
4. People in groups should find shelter at least 100 feet away from one another.
5. Crouch on the ground with your weight on the balls of the feet, your feet together, your head lowered and ears covered.
6. Never lie flat on the ground.
7. Check weather reports before starting a hike.

8. Watch distant clouds for lightning.
9. Listen for thunder.
10. Get down from high places.
11. Put on your rain gear and remove your backpack.
12. If you have a metal, leave it 100 feet from where you are seeking shelter.
13. Do a headcount of everyone in your party.
14. It is safe to touch someone that has been struck by lightning.

## **Body for safety tips about hiking with hot weather.**

### **Dehydration:**

Early signs and symptoms may include:

- a) Feeling thirsty and lightheaded.
- b) Dry mouth.
- c) Tiredness.
- d) Dark colored, strong-smelling urine.

If you are under the assumption that you are dehydrated, drink plenty of fluids, rest and try to find some shade. Also try cooling yourself by soaking your hat or shirt. If you are finding it difficult to keep water down because you are vomiting, try drinking in small amounts more frequently. If left untreated, severe dehydration can be serious and can cause seizures, brain damage and or death.

### **Hydration:**

One should also be careful of hydration also. Hyponatremia (abnormally low sodium levels in the blood) may occur if a hiker drinks too much water without adequately replenishing electrolytes. In order to hydrate properly, try keeping track of the following:

1. Do not wait until you are thirsty to drink water.
2. Use sunscreen, hats and stay in the shade. In general, try to keep cool. A warm environment always brings the thirst levels up.
3. During hot and largely shadeless conditions where water sources are scarce, do the bulk of your hiking while the temperatures are cooler (e.g. early morning, late afternoon and early evening).

### **Heat Exhaustion:**

Signs and symptoms may include:

- a) Dizziness.
- b) Tiredness.
- c) Headaches.
- d) Weakness.
- e) Fever.
- f) Fast breathing or heartbeat.
- g) Feeling thirsty and lightheaded.
- h) Excessive sweating.
- i) Skin becoming pale and clammy.
- j) A heat rash.
- k) Cramps in the arms, legs and stomach.

If someone is showing signs of heat exhaustion they need to be cooled down and given fluids.

**Tips:**

- 1. During hot and largely shadeless conditions where water sources are scarce, do the bulk of your hiking while the temperatures are cooler (e.g. early morning, late afternoon and early evening).
- 2. Cover your head
- 3. Use sunscreen.
- 4. Wear sunglasses.
- 5. Cover up, there is no need to get sunburned. Instead, just wear light and breathable, cooling clothes.
- 6. Wear breathable shoes and socks.
- 7. Wear light colored clothing as darker clothes tend to attract heat.
- 8. Hydrate with caution.
- 9. Learn to recognize how your body is reacting to the additional heat and make sure you know what to do.
- 10. Take breaks often.
- 11. Be prepared with the according gear for fires.

## **Body for safety tips about hiking with cold weather.**

### **Getting cold:**

Signs and symptoms may include:

- a) Feeling cold.
- b) Uncontrollable shivering.
- c) Exhaustion.
- d) Cool and pale skin.
- e) Shivering.

If getting cold progresses, the person could develop hypothermia.

### **Hypothermia:**

Signs and symptoms may include:

- a) Feeling cold.
- b) Pale, cold and dry skin.
- c) Blue or gray skin and lips.
- d) Slurred speech.
- e) Slow breathing.
- f) Tiredness.
- g) Confusion.

If the person is suspected to have hypothermia, then he has to be moved to a shelter immediately. Wet clothes should be removed and they should be wrapped in a blanket, sleeping bag or dry towel (the head should be also covered). They need to be kept awake and given something warm, non-alcoholic to drink and sugary foods. Do not rub the person in order to warm them up and also do not try to warm them up with heat lamps, hot water bottles or hot baths. It is important to note that if the person progresses into severe hypothermia, shivering usually stops. Symptoms of severe hypothermia include slowing of the heart rate and breathing, dilated pupils and coma. Without treatment the condition is likely to lead to death.

### **Frostbite:**

Fingers, nose, ears and toes, are most commonly affected by it.

During the early stage of frostbite (frost-nip), you may experience:

- a) Pins and needles.
- b) Throbbing in the affected area.

- c) Aching in the affected area.
- d) Cold, numb and white skin.
- e) A tingling sensation.

After the frost-nip, prolonged exposure to cold will cause:

- a) More tissue damage.
- b) The affected area will feel hard and frozen.

If the frostbite turns severe the symptoms are:

- a) White, blue or blotchy skin.
- b) The tissue feels hard and cold to touch.
- c) Further damage beneath the skin.
- d) Thick black scabs in the area.

At this stage, it's likely that some tissue will die (necrosis).

Long-term effects of frostbite:

- a) Increased sensitivity to cold.
- b) Numbness.
- c) Reduced sense of touch.
- d) Persistent pain.

### **Tips:**

1. Avoid alcohol.
2. Remove any wet clothing.
3. Manage your clothes layering system. Your base layer should be thin, breathable and made out of fabrics like merino wool or synthetics. Do not use cotton for a base layer. Your middle layers should keep your body heat, so a good choice is to wear something like a puffy jacket. Your top layer should be ideally made from a waterproof fabric with seam-sealed construction.
4. Do not sweat. Strip down or layer up as needed to maintain maximum warmth without sweating.
5. Set up a tent and lay inside your sleeping bag.
6. Have something warm and sweet to drink or eat.
7. Always check the weather forecast and trail conditions before hiking.
8. Invest in quality winter clothing.
9. Stay hydrated & snack frequently.

10. Always pack micro-spikes just in case.
11. Keep moving.
12. Hiking in the sun will keep you warmer than hiking in the shade.
13. Get yourself some winter boots.
14. Choose socks that are not made from cotton but still are warm.
15. If you are hiking in snow, wear a pair of gaiters.
16. Sun protection is still important.
17. A fully charged headlamp could be very useful.



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