

FIREURISK - DEVELOPING A HOLISTIC, RISK-WISE STRATEGY FOR EUROPEAN WILDFIRE MANAGEMENT

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Authors:	Suresh Babu K V and Emilio Chuvieco
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Quality Control

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Executive Summary

The primary goal of the FirEURisk project is to create, evaluate, and disseminate an Integrated and Science-Based Strategy for wildfire risk management throughout Europe. Control strategies are expected to employ the several models, tools, and data that will be defined, developed, and produced within the project to solve the various challenges of wildfire management.

Within the relevance of encouraging public participation in the design and implementation of fire risk assessment methodologies, an android based mobile application "FirEURisk" has been designed, and the beta version is now available for testing. The main purpose of mobile application is distributing information from the project to citizens living in fire-prone areas as well as asking their participation in reducing fire risk. This Mobile App will allow citizens to report real-time forest fire alerts, ground fuel information, and any fire-related damages, in addition to other essential features such as satellite-based fire alerts (MODIS and VIIRS), FirEURisk project outputs such as fuel type map, fire weather index, and so on.

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1 Introduction

1.1 Structure of the Document

The structure of the document has been chosen to meet the main purpose of the deliverable. This document is followed by background of mobile applications, a review of mobile applications from around the globe, and a user guide for the FirEURisk mobile application. This document is separated into two main sections: one providing an overview of mobile applications worldwide and the architecture of FirEURisk mobile app, and one meant to act as a guide for users to learn more about the features supplied by FirEURisk mobile app and how to use them.

1.2 Background

Mobile apps could be used as information sharing tools, and this capability could help to improve the flow of essential data during disasters (Leelawat & Iijima, 2013). A significant need for disaster-related data acquisition via portable devices has been established to address the growing concerns about data availability (Sukhwani & Shaw, 2020). As a result, smartphones have become increasingly vital in disaster management, both for delivering critical information to impacted areas and for coordinating rescue efforts (de Guzman & Ado, 2014). Nowadays, Mobile phones can be used for various applications, including messaging, social networking, navigation, and digital broadcasting, thanks to recent technology development (Banerjee et al., 2019; Sweta, 2014). Mobile phones contain geo-tagging and geocoding features, which allow photos, audio, and video from mobile devices to be shared with geo-location codes; the information gathered from them is especially important for common public and government agencies during disasters (Roche et al., 2013).

Citizen participation in data collecting for environmental monitoring or scientific study is becoming more popular, and it's known as citizen science or crowdsourcing (See, 2019). Citizen science refers to the participation of citizens in the scientific community, which can range from simple data gathering to complete participation in research design, for example: data collection, interpretation, analysis, quality control etc. (Bonney et al., 2009). Citizen science is defined as the practice of including the general public in a scientific project that results in reliable data and information that can be used by scientists, decision-makers, or the general public (McKinley et al., 2017). The advent of citizen science has been aided by recent advances in information science, particularly in the areas of data informatics, user interface, and GPS-based apps, which can now be ported to smartphones and other portable devices (Goodchild, 2007; Dickinson et al., 2012).

Crowdsourcing is a data collection approach used in disaster management that encourages the citizens to voluntarily provide answers to queries or information for consumption using open transmission systems such as mobile phones (Martin-Shields, 2013). Citizens can now participate to geodata collection and obtain a better awareness of their surroundings thanks to advances in spatial information sciences. Citizen science has a long history in the fields of conservation and biodiversity (See et al., 2016), but they are now being employed in many different domains in the geosciences (Zheng et al., 2018) and hydrology studies such as water quality (Jollymore et al., 2017) and river flooding (Assumpço et al., 2018).

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"Disaster-related mobile apps," according to Ridler, are those that are intended to be utilized before, after, or during a disaster (Ridler, 2013). When disaster strikes, warning notifications for some potential or current dangers may be crucial, and disseminating the current location and providing forecasted hazard maps can help users understand the geographic information about the ongoing disaster and potential risks in neighbouring regions (Sung, 2011). In general, when a disaster happens most people's, initial thought is to obtain real-time information in order to monitor their current situation, however, traditional media such as television, radio, and newspapers make this difficult. As a result, mobile phones have become a top priority during disasters, with victims preferring to carry them with them when fleeing to safer areas (Sukhwani & Shaw, 2020).

1.3 Purpose of the Document

The mobile application "FirEURisk" has been designed, and the beta version is now available for testing. The purpose of an Android mobile application is to encourage citizen participation in reducing fire risk. This Mobile App will allow users to report real-time forest fire alerts, ground fuels, and fire damages, in addition to other important features such as satellite-based fire alerts, FirEURisk project outputs such as fuel type map, fire weather index etc.

2 Review of wildfire Apps

Wildfire mobile apps have diverse features and are designed for different purposes, such as fire alert notification, satellite-based alerts, fire risk mapping, educational purposes, and so on. Table 1 summarizes the list of wildfire mobile apps that are available globally along with their main functions.

Table 1: Summary of wildfire mobile apps and their main functionalities

S.No.	Name of the App	Main functionalities
1	Wildfire analyst pocket (WFA)	This app assists fire fighters in evaluating fire behavior in the field based on weather, fuel parameters, and fire spread.
2	EscapeWildFire	This app can help users monitor the progress of a fire and plan an escape route in the event of an emergency.
3	Active Wildfire Map	This app shows active fires, fire perimeters, and wildfire hazard risk levels.
4	Fogos.pt	This app displays MODIS and VIIRS fire alerts, weather parameters as well as fire risk maps.
5	Wildfire map	This app provides users with MODIS and VIIRS global wildfire alerts.
6	AFIS Wildfire map	This app provides users global wildfires based on MODIS and VIIRS sensors, as well as fire risk maps.
7	Fireguard Wildfire Tracker	This app provides VIIRS active fire alerts, NOAA smoke maps as well as wildfire incidents and burned area maps
8	Wildfire Info	This app shows fire perimeters from WFIGS and IRWIN, air quality maps, and MODIS and VIIRS hotspots

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9	BC Wildfire Service	This app provides citizens of British Columbia with real-time fire information.
10	Firemapper	This app will allow users to create wildfire and other incident maps, as well as provide a simple interface for drawing maps with their fingers and sending them.
11	Firesource - Live Wildfires	This app includes satellite fire alerts (MODIS and VIIRS), a live fire feed, and the ability to view national fire incidents and perimeters, report a fire and air quality maps.
12	Cal Fire - Ready for wildfire	Cal fire, a web based mobile app that offer each user with a unique preparedness plan based on their location, property, and age, as well as rapid updates on active fires.
13	Wildfire Safety Evaluator (WiSE)	This app assists wildland firefighters in determining safe separation distances.
14	Watch Duty	This app provides real-time information about fire progress and surrounding firefighting efforts, as well as the ability to monitor the situation and make informed decisions, as well as receive photographs and push notifications of ground conditions.

The wildfire mobile apps are further categorized depending on the features that they have provided to its users. Table 2 categorizes wildfire mobile applications according to the features they provide to users.

Table 2: The list of mobile apps and their features

S.No.	Features	Mobile Apps
1	Satellite fire alerts	Wildfire Map, Active Wildfire Map, AFIS Wildfire Map, Fireguard Wildfire Tracker, Firesource- Live Wildfires, Fogos.pt, Wildfire – Fire map info, Wildfire Info.
2	Fire perimeters	Active Wildfire Map, BC Wildfire Service, Firesource- Live Wildfires, Wildfire – Fire map info, Wildfire Info.
3	Fire risk maps, fire danger index	AFIS Wildfire Map, BC Wildfire Service, Fogos.pt, Wildfire – Fire map info.
4	Active fire alerts and reports	BC Wildfire Service, Fireguard Wildfire Tracker, Firesource-Live Wildfires, Watch Duty, Wildfire – Fire map info
5	Evacuation routs and alerts	Escape WildFire, BC Wildfire Service, Watch Duty
6	Social media	BC Wildfire Service, Wildfire Info
7	Report fires	BC Wildfire Service, Firesource- Live Wildfires
8	Burned area maps	Fireguard Wildfire Tracker
9	Air quality maps	Firesource- Live Wildfires, Fireguard Wildfire Tracker, Wildfire – Fire map info, Wildfire Info
10	Weather data	Fogos.pt, Wildfire – Fire map info, Wildfire Info

The majority of mobile apps are designed to provide users with satellite-based fire alerts, fire risk, fire danger maps, and fire reports, among other things, according to the Table 1. Except for a few apps like Firesource - Live Wildfires and BC Wildfire Service, citizens do not have the opportunity to report a real-time fire alert in their region in any of the

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mobile apps. Therefore, the FirEURisk partners involved in this task suggested a mobile app that would allow citizens to report real-time fire alerts, fuel conditions, and any fire-related damages, as well as other valuable features like satellite-based fire alerts, fire hazard maps, burned area maps, air quality maps, and so on. Figure 1 shows the proposed mobile app with the fire risk components.

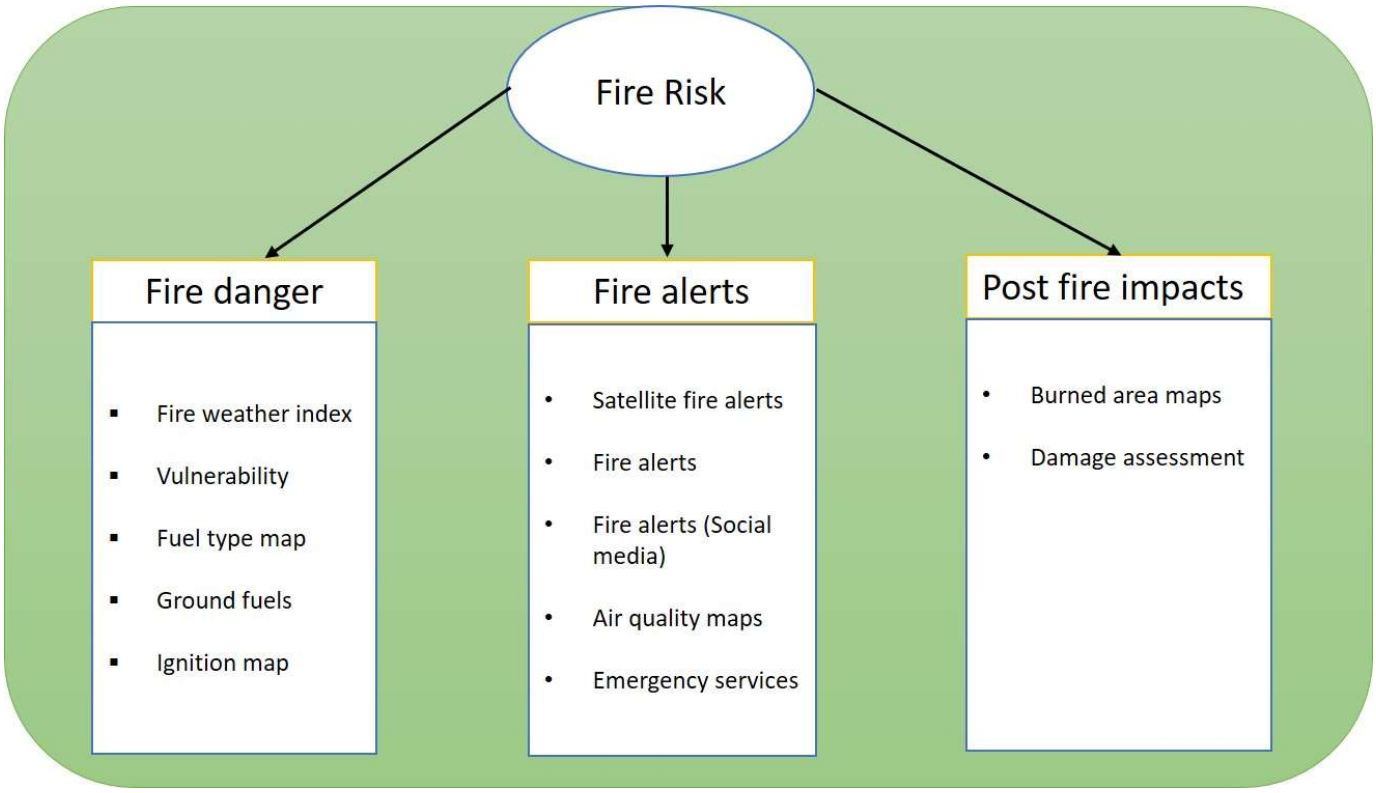


Figure 1: Proposed FirEURisk mobile app and their functionalities

The mobile application that is being proposed is made up of three basic components, all of which are designed to be accessible to users throughout all three seasons of wildfires, namely prior to, during, and at the end of the fire season. Fire risk, fire alerts and post fire impacts are the three basic components of FirEURisk mobile app.

3 Methods

The FirEURisk mobile app is designed and developed in Google Android studio operating system. Android Studio provides a Layout Editor for the purpose of designing an interface for an app. This editor creates XML files that define the layout of an app. Fig 2 shows the overview of system architecture of FirEURisk mobile app.

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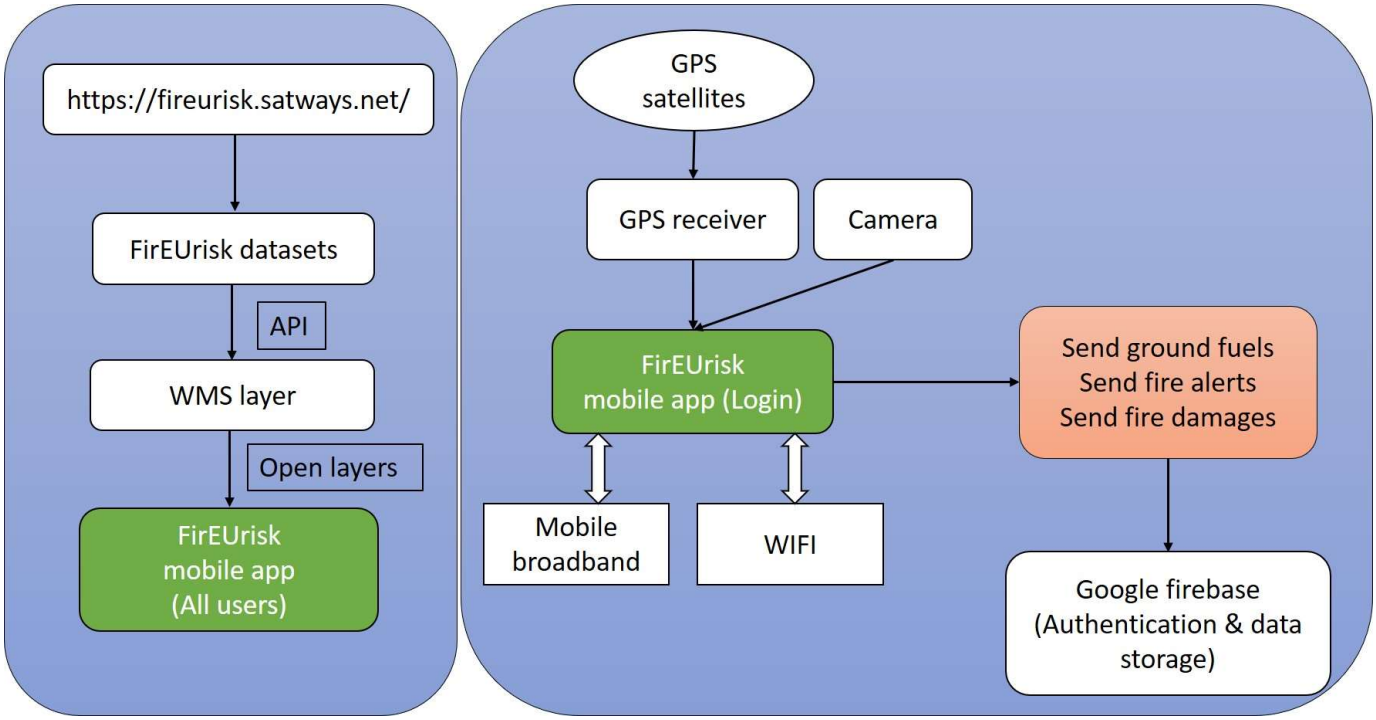


Figure 2: Architecture of FirEURisk mobile app

In order to send data, users must first register with the mobile app, which is a simple and straightforward process requiring only a user name, email address, password, and a re-entry of the password. The user must provide authorization to use the GPS device, camera, and internet connection to send data about ground fuels, fire alerts, and fire damages. Nowadays, mobile phones are equipped with their own GPS receivers, making it possible to access location data directly from a mobile device. The Global Positioning System (GPS) receiver of mobile triangulates its location on Earth based on data it gets from a network of satellites that provide precise timing and range measurements. The mobile app menu is designed to have dedicated photo and get location buttons, making it simple for users to take photos and obtain their location. Additionally, the user has the opportunity to upload a photo from their gallery. User-entered data, including ground fuels, fire alerts, and fire damages, can be saved to Google Firebase servers for subsequent analysis. The user input data can be accessed by selected members of the FirEURisk consortium team, and the analysis will cover the validation of fuels, the complement of fire alerts, and fire damages as part of citizen involvement in fire management.

Users of the FirEURisk mobile app can view the specific project's results without having to sign in and the API Handler is used to retrieve the project datasets from the fireurisk Satways website (https://fireurisk.satways.net/). It is necessary to generate the API key in order to get access to the datasets that are stored on the Satways platform and to retrieve such datasets in Android Studio in the form of a WMS (Web Map Service) layer. The WMS layer will then be published as a map in a mobile app using open layers.

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4 User guide of FirEURisk mobile app

The FirEURisk mobile App is intended to incorporate citizen-based information such as ground fuels and fire alerts, as well as FirEURisk project outputs such as fuel map, propagation, fire weather index, and so on. The home button of the FirEURisk mobile app is shown in Fig 3 (a), and the user may simply access the primary features using the side bar (☰) also (Fig 3 b).

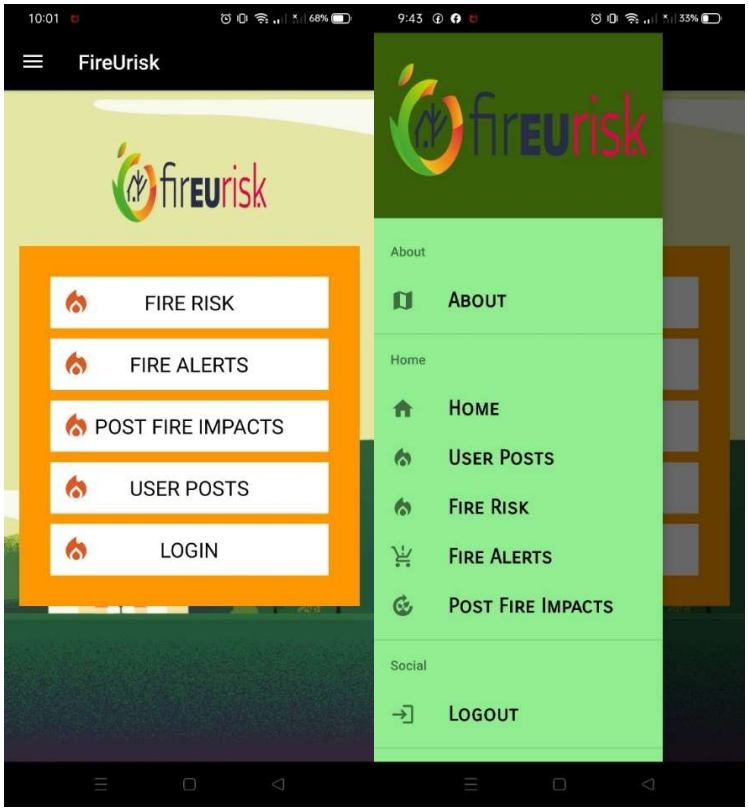


Figure 3: The FirEURisk Home page (a & b)

The mobile app consists of three main buttons i.e., Fire risk, Fire alerts and Post fire impacts.

4.1 Fire risk menu

The "Fire Risk" button gives the user access to a number of features and services, such as the Fire Weather Index, Vulnerability, send ground fuels, fuel type map, and Ignition map, as depicted in Figure 4.

The Fire Risk button contains multiple functionalities such as Fire Weather Index, ignition probability, vulnerability, ground fuels, Fuel type map, and Propagation. The FWI, or Fire Weather Index, is calculated from a variety of meteorological parameters, including air temperature, relative humidity, wind speed, wind direction, and precipitation. The human ignition button shows the results of the model obtained to estimate ignitions from human and biophysical factors. The fuel type map depicts the ground fuels found throughout the European Union region, as generated from high spatial resolution satellite datasets. Once a citizen has signed in for the very first time, they are able to utilize the

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device's built-in camera and mobile GPS to capture ground fuels and send fuel-related information such as geographic position, fuel and understory type, height, and image using the button labelled Send ground fuels. This is possible after the citizens have completed the initial sign-up process. Vulnerability map displays the potential damages that fire would imply on ecological values and ecosystem services. The propagation map brings up a map that was developed by the FirEURisk project that shows the possibility for fire spread within the European Union territory.

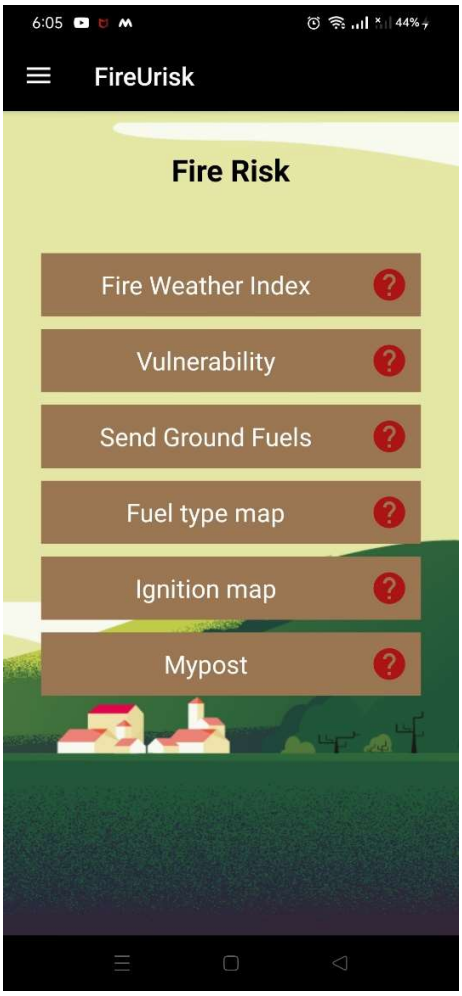


Figure 4: The Fire Risk main functions

4.2 Fire alerts

Fire alerts (Figure 5) menu offers citizens information on active fires that is nearly real time, and this information originates from satellite datasets, forestry agencies, and social media. During the fire season, fire alerts are particularly valuable for citizens because they provide information on active fires that is nearly real time. The Satellite fire alerts button displays fire alerts from MODIS and VIIRS in near real time (MODIS NRT, MODIS SNPP NRT & VIIRS NOAA 20 NRT) as well as conventional standard products including MODIS SP, and VIIRS SNPP SP. The data has taken from the

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NASA Fire Information for Resource Management System (FIRMS) website. If the user selects a specific active fire dataset, the associated active fire points for that day will be displayed (Figure 6). The button 'send fire alerts' allows the user to inform other users as well as forest management officials by sending a picture of the active fire that is located closest to their current location, along with the user's geographic location and observations. The Twitter button brings up a list of the most recent tweets on fire alerts based on the hashtags that have been used. Air quality maps display maps of air quality across the European continent, and the emergency services button enables the user to dial 112 in the event of an emergency.

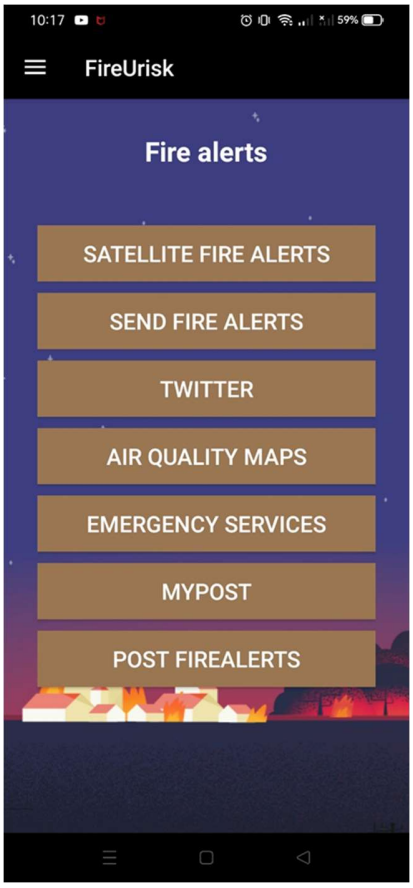


Figure 5: Fire alerts menu

The user's current geographic location is automatically displayed once the icon is clicked. The user can change the background using icons such as Google Maps ( ) and Satellite image ( ). Zoom in and zoom out are denoted by the symbols and respectively.

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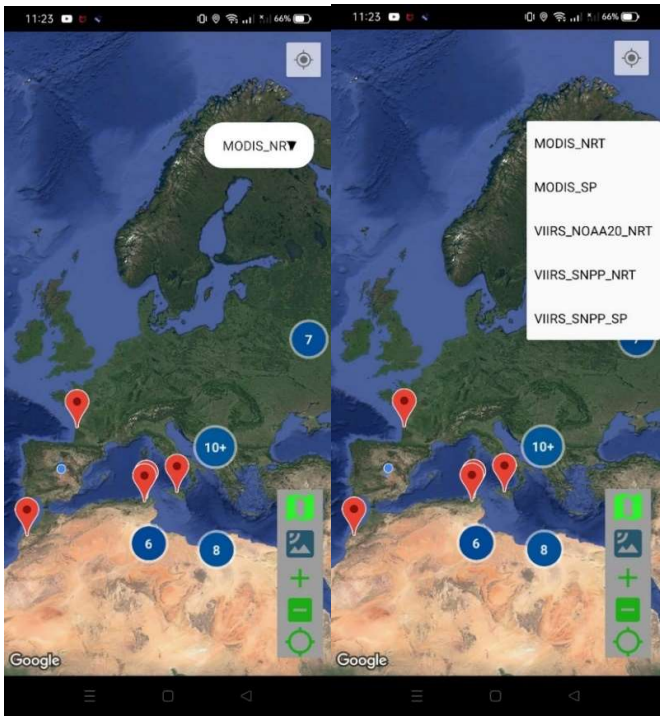


Figure 6: Satellite fire alerts window

The user can also get fire alerts on a particular date by selecting the product, specifying the date, and then clicking the post fire alerts button (Figure 7).



Figure 7: Get satellite fire alerts menu

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The ‘Send fire alerts’ button allows the user to notify other users and forest management officials about a fire by sending a picture of the active fire that is closest to their current location, along with the user's geographic location and observations. This feature is covered in more detail in the following sections. The Twitter button displays a list of the most recent tweets about fire alerts depending on the hashtags used. Air quality maps show maps of the air quality throughout the European continent. When the emergency services button is pressed, the user can directly dial 112 in case of an emergency (Figure 8).

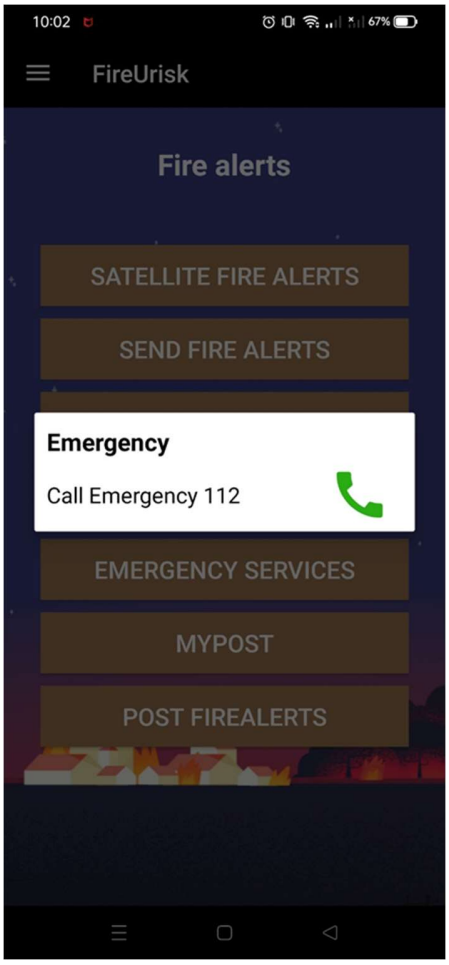


Figure 8: Emergency services window

4.3 Post fire impacts

Post fire impacts provides maps of the burned area derived from satellite datasets and information on fire damages caused by fires (Figure 9).

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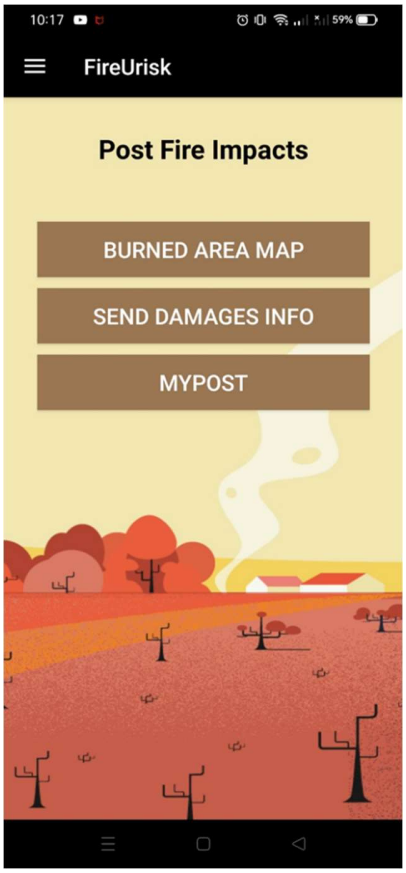


Figure 9: Post fire impacts menu

The current version does not include access to burned area maps, as they will not be generated within FirEURisk. Agreements with the EFFIS service providing this information are foreseen in the near future.

4.4 User sending the data - Instructions

A citizen must register with the mobile app in order to report data on ground fuels, fire alerts, and fire damages; the registration steps involved are outlined below.

4.4.1 Registration

First, the user must input their name, email address, user-defined password, and then they must re-enter the password in order to complete the registration process (Fig 10 b). A simple password is sufficient, and there is no need for any specific criteria that are often necessary for the most registration. The confirmation link will be provided to the user's email address, and the user will be required to click on that link in order to finish the registration process. Once the registration process has been finished, the user will be able to log in to the mobile app by entering their user's name and password. If the registration link is not received in the user's primary mailbox, they must additionally check their spam folder.

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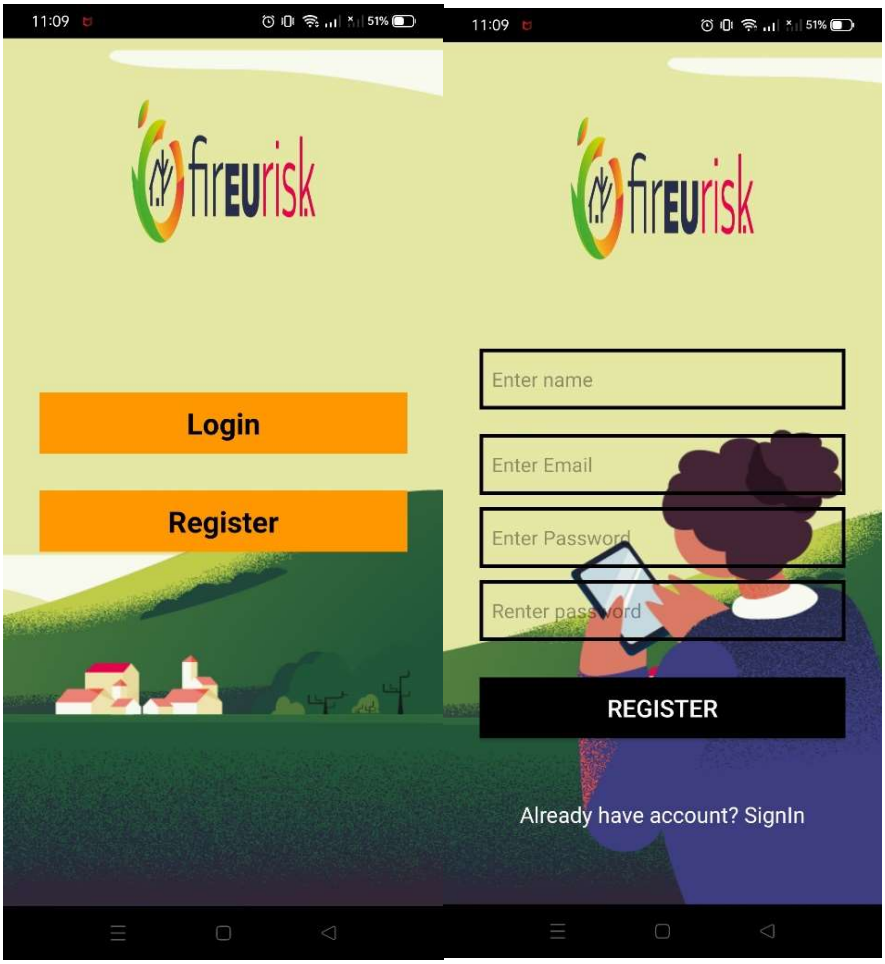


Figure 10: The FirEURisk login (a) and registration (b) windows

4.4.2 Login

Once the user has validated their account by clicking the link provided in the confirmation email, they will be able to input their email address and password in order to access the mobile app and provide information regarding ground fuels, fire alerts, and fire damages. Figure 11 shows the login page, where the user has to enter their email address and password to access the mobile app.

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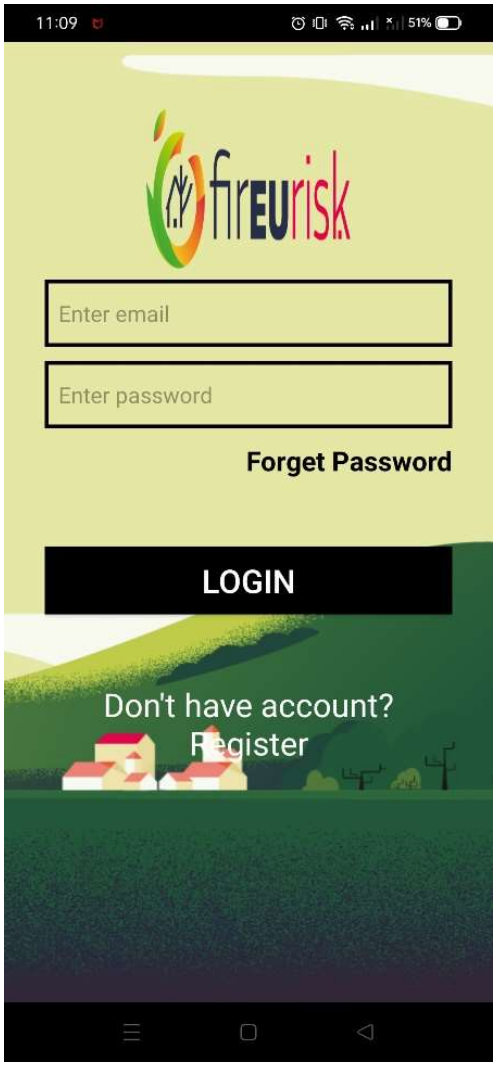


Figure 11: The FirEURisk login window

4.4.3 Reset password

If a user forgets their password, they can use the Forget Password option in the login box to reset it (Figure 12). User has to put their registered email address in the "Reset Password" box, and a link to change the password will be sent to that email address.

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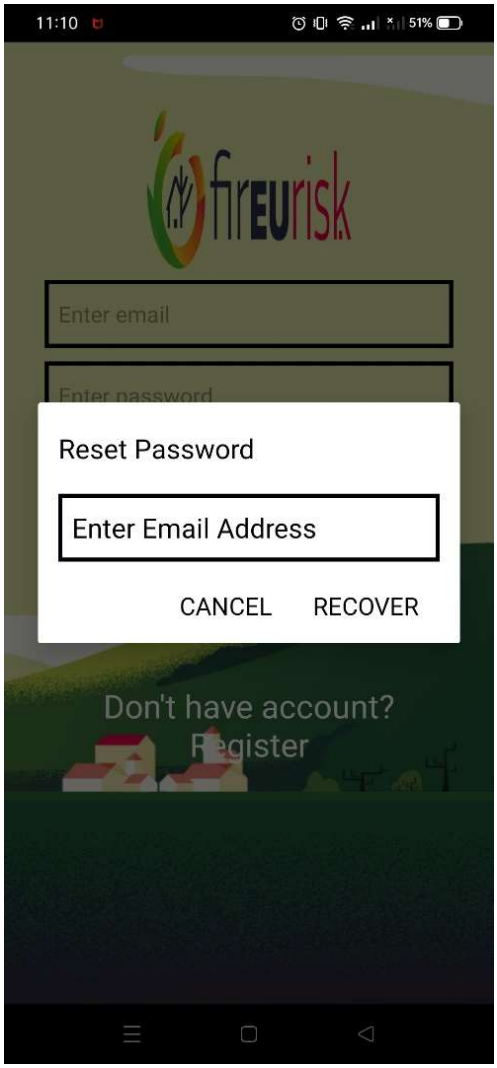


Figure 12: Reset password window

4.4.4 Report the data through mobile app

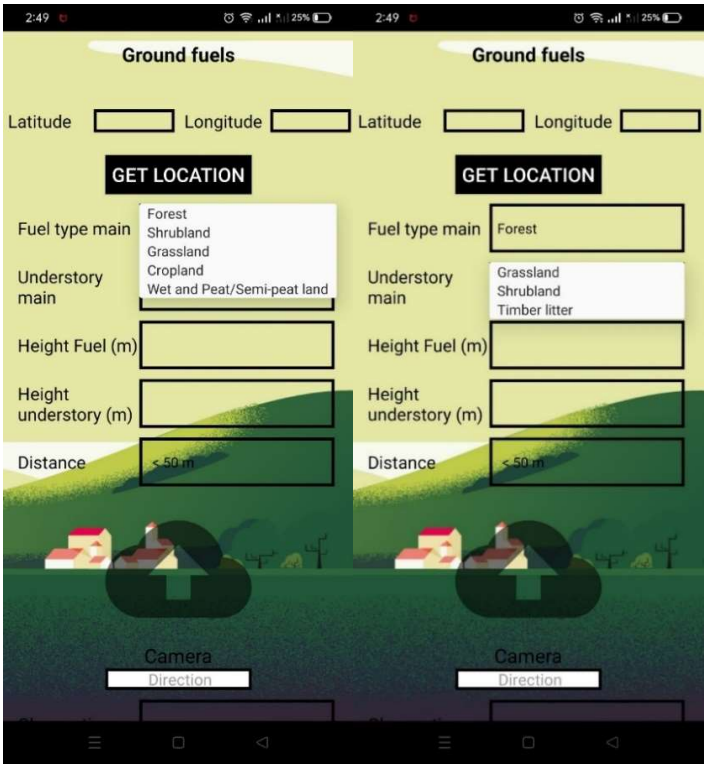
The user must log in to the mobile app in order to provide information on ground fuels, fire alerts, and fire damages, as well as grant the app permission to access location, camera, and storage.

4.4.4.1 Ground fuels

Once a citizen has signed in for the first time, he/she can use the device's camera and mobile GPS to take pictures of ground fuels and send information about them, like their geographical location, type of fuel and understory, height, observations and a picture, by pressing the ground fuels button.

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The user must first select the Get location icon and then provide permission to the mobile app for it to access their location. After the user has done so, the geographic location details will appear in the appropriate boxes. The user has to choose the main type of fuel in their field region, such as forest, scrubland, grassland, cropland, wet and peat/semi-peat land, urban, and then choose the main type of understory from grassland, scrubland, or timber litter. The user is required to specify the height of both the primary fuel type as well as the understory based on their own observations. The user can capture a picture of the ground fuels by tapping the camera button on the mobile app. Further, there is an option for the user to select an image from their gallery and upload it to the mobile app. The user is required to specify the distance from where the photo was shot, with options including 50 meters, 50-150 meters, and 150 meters respectively. Figure 13 shows the send ground fuels window with all of its functions.



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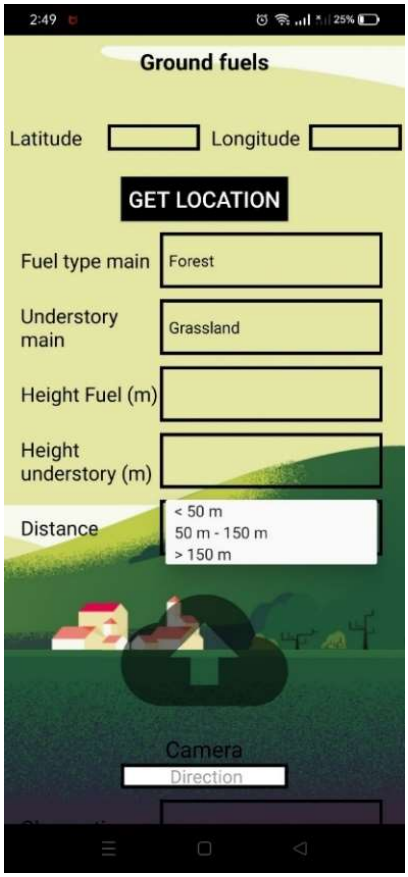


Figure 13: The Send ground fuels window

The user can then review the information they have provided by clicking the submit button, at which point they can either click send if everything is correct or edit if they would like to make any changes (Figure 14).

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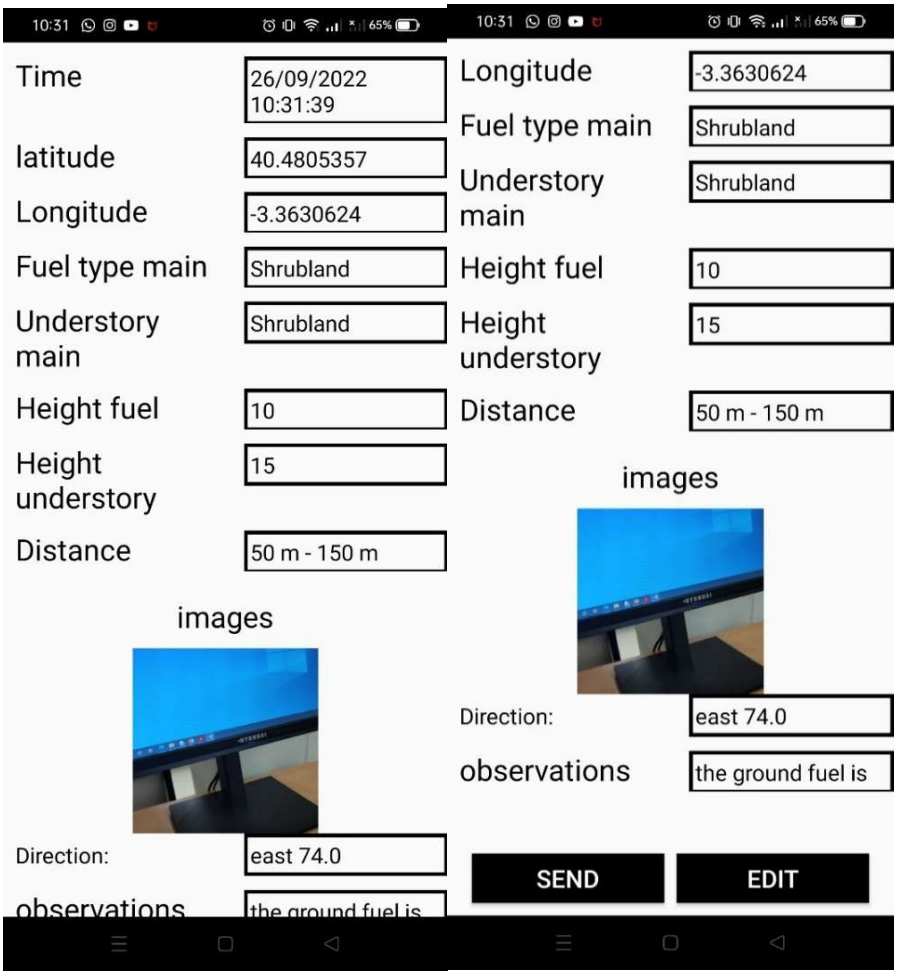


Figure 14: User input data view window

4.4.4.2 Send fire alerts

The user can send fire alerts by clicking the Send fire alerts button from the fire alerts menu. The user must provide access to their geographic location and select the distance and type of vegetation from drop-down menus based on the distance from where the image was captured and the type of vegetation that is burning in the fires. The user can inform other users by sending a picture of the fire and adding observations about it, such as the closest location, its current fire status, and so on. The send fire alerts window is show in Figure 15.

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Figure 15: Send fire alerts menu

4.4.4.3 Send damages information

If the user clicks the Send damages info button that is available in the Post fire impacts menu (Figure 16), they will be able to provide information regarding the damages that were caused by fires. This may include information regarding damaged homes, forest products, and properties, among other things. In the observations field, the user can include whatever information regarding the damages caused by the fire, including the extent of the damage to homes, the value of the property lost, number of animals killed, and among other things.

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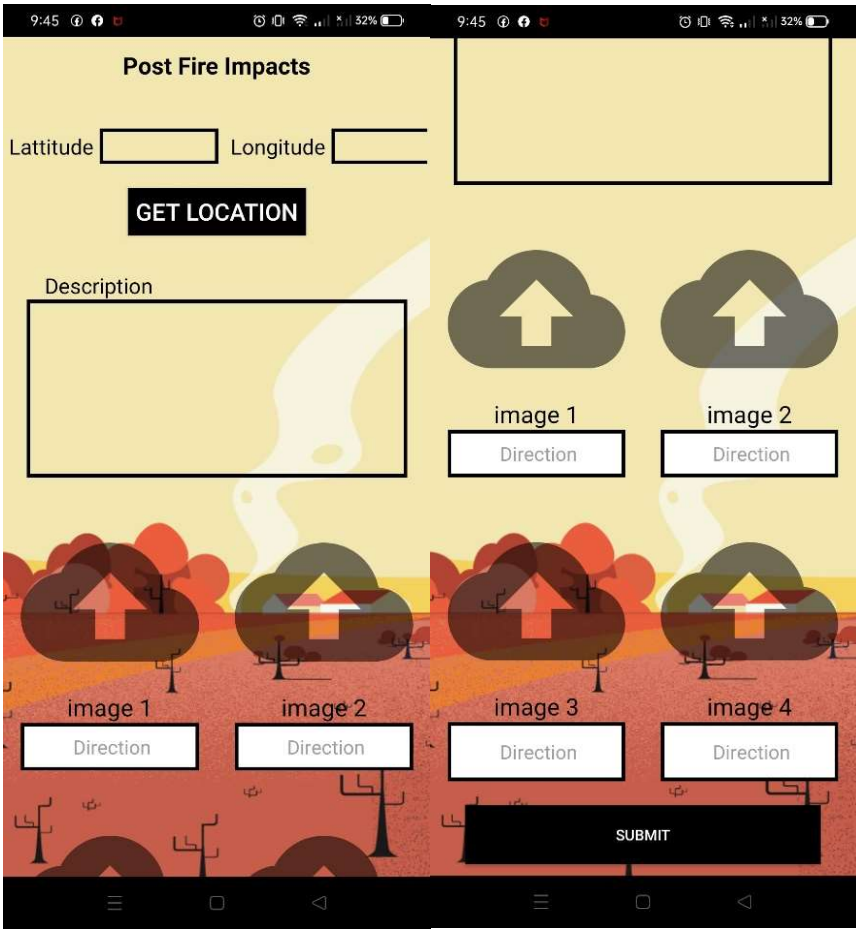


Figure 16: Send fire damages info menu

Furthermore, it was mentioned that the user must double-check the information before sending it and edit it if they wish to make changes.

5 Conclusions

As part of the FirEURisk project, a beta version of the mobile app FirEURisk, which is based on citizen science, has been developed and is presently available for testing. Citizen will be able to utilize the mobile app and report fire alerts, ground fuels, and fire damages caused by wildfires. The mobile app displays near real-time active fire alerts from MODIS and VIIRS (MODIS NRT, MODIS SNPP NRT, and VIIRS NOAA 20 NRT), in addition to regular products such as MODIS SP and VIIRS SNPP SP. The data was retrieved from the NASA Fire Information for Resource Management System (FIRMS). The mobile app can also display FirEURisk project outputs such as fuel type maps, Fire Weather Index, weather parameters, propagation, and so on once they are made accessible by the organization in responsible of those outputs.

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6 Privacy policy

The FirEURisk mobile app does not collect, use, or share any personal information. The application does not make use of any of the user's personal data, contacts, location, pictures, or other media files. However, the user must provide authorization to the camera and location in order to send information such as fire alerts, ground fuels, and fire damages.

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8 Links to download Wildfire mobile apps

[1] Wildfire analyst pocket (WFA):
https://play.google.com/store/apps/details?id=com.technosylva.PocketWFAv3&hl=en&gl=US
https://apps.apple.com/us/app/wildfire-analyst-pocket/id1385350370
[2] EscapeWildFire:
https://play.google.com/store/apps/details?id=com.ewf.escapewildfire&hl=en_US&gl=US
[3] Active Wildfire Map:
https://play.google.com/store/apps/details?id=com.mobincube.active_wildfire_map.sc_EA9DQA&hl=es_MX&gl=US
https://apps.apple.com/us/app/active-wildfire-tracker-map/id1523119825
[4] Fogos.pt:
https://play.google.com/store/apps/details?id=com.tomahock.fogos&hl=pt&gl=US
https://apps.apple.com/es/app/fogos-pt/id1126944255
[5] Wildfire map
https://play.google.com/store/apps/details?id=com.aoe.wildfire&hl=en&gl=US
[6] AFIS Wildfire map:
https://play.google.com/store/apps/details?id=za.co.csir.afis&hl=en&gl=US
https://apps.apple.com/za/app/afis-wildfire-map/id673060823
[7] Fireguard Wildfire Tracker:
https://play.google.com/store/apps/details?id=com.rmtheis.fireguard&hl=en&gl=US
https://apps.apple.com/us/app/fireguard-wildfire-tracker/id1609656462
[8] Wildfire Info:
https://play.google.com/store/apps/details?id=com.davidgrossapps.wildfire&hl=en&gl=US
https://apps.apple.com/us/app/wildfire-info/id1035221813
[9] BC Wildfire Service:
https://apps.apple.com/ca/app/bc-wildfire-service/id1477675008
https://play.google.com/store/apps/details?id=ca.bc.gov.WildfireInformation&hl=en&gl=US
[10] Firemapper:
https://play.google.com/store/apps/details?id=com.firefrontsolutions.firemapper.enterprise&hl=en&gl=US
https://apps.apple.com/us/app/firemapper/id865028094
[11] Firesource - Live Wildfires:
https://apps.apple.com/us/app/firesource-live-wildfires/id1517932241
[12] Cal Fire - Ready for wildfire:
https://www.readyforwildfire.org/more/ready-for-wildfire-app/
[13] Wildfire Safety Evaluator (WiSE):
https://play.google.com/store/apps/details?id=com.technosylva.WiSE&hl=es_SV&gl=US
https://apps.apple.com/us/app/wise-wildfire-safety-evaluator/id996363142
[14] Watch Duty
https://play.google.com/store/apps/details?id=org.watchduty.app&hl=en&gl=US
https://apps.apple.com/us/app/watch-duty-wildfire/id1574452924

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