

Design Manual

Wildfire Location & Information App

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Abstract

The purpose of the Wildfire project is to develop a mobile application for the General public and professional firefighters. This application should help people who fight fires as well as protect people who don't. The application should be used as a tool to report fires, search for fires and notify people of nearby fires. It also should be able to provide the general public and the firefighters with useful information about fires and how to keep safe around them.

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1. Introduction

The following documentation will document the design of the Wildfire Application. This documentation will describe the design of the Wildfire Application in great detail. The design manual comes after the research manual and the requirements specification and is aimed at providing a greater understanding of the design of the application in conjunction with the functional specification.

The following sections will first cover the technology toolchain, this will include a flowchart of how all of the interlocking parts come together to create this application. This section will also describe each of the technologies used in brief detail.

The next section will discuss the database Schema from the implemented database. This section will display a JSON formatted diagram of the database structure as well as an overview of the column names and what they stand for in the database.

The section following the database schema is the Class & Sequence Diagram section, this section will include the relevant diagrams that make up the systems structure.

Lastly, the final section that will be covered is the UI/ UX design, this section will display the first iteration of design screens of the application, these screens will more likely change as the application develops. This section will also include the colour palette of the application.

2. Technology Toolchain

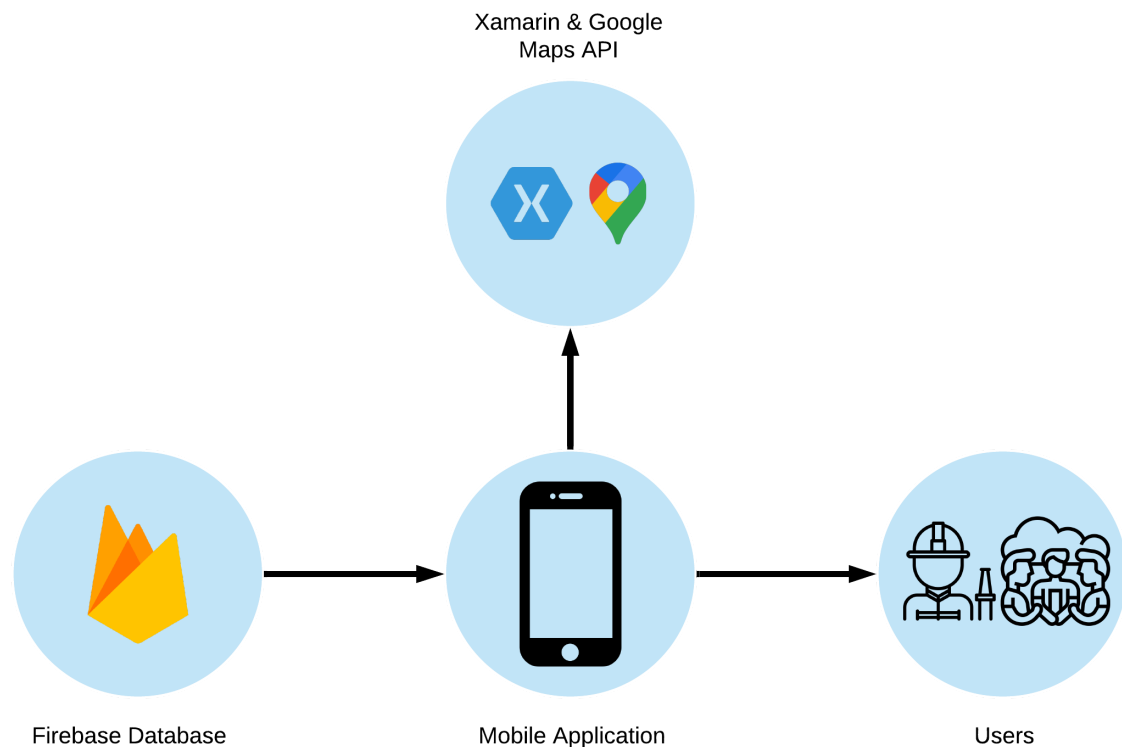


Figure 1 - Technology Toolchain.

In **Figure 1** above the technology toolchain is shown. The technology toolchain describes how all of the chosen technologies come together to create the Wildfire application. This section will discuss why all of the technologies were chosen and how they will be implemented together.

Firestore Database - The Firestore database was chosen for its ease of use and simplicity. The Firestore database is a NoSQL database and displays all of the data in a clean JSON format. Firestore will house all of the data that is entered by the users, the database will also house the accounts of the users and credentials that are used to access the accounts. Firestore offers a very safe and secure authentication tool that allows for passwords and other credentials to be encrypted. Firestore offers a free account with up to 1GB of free storage which should be more than enough for this application.

Another service that Firestore offers is Firestore storage, this is a tool included with the original account. Firestore storage is a great tool to have at my disposal as now I have a safe and secure place to store all of the images that users upload to the application.

Xamarin & Google Maps API - Xamarin forms was chosen because of its wide variety of features from the views and layouts it offers and to the ease of adding API's on the backend. Xamarin forms proved to be the best option for Wildfire.

The decision to choose the Google Maps API over the other available options proved well, the Google Maps API does not only offer a clean and crisp map but also offers additional APIs such as the Places API which made the search function easier to implement.

Xamarin Forms and the Google Maps API, alongside the firebase database allowed the application to come to life. When all of these key technologies come together they create a clean and secure fully functioning application.

Mobile Application - Now that the application has a database and a main framework the application is functional and now requires users. All of the key parts come together to give the user a clean and slick experience.

3. Database Schema + Authentication

This section will display the database schema that is used by the wildfire application as well as the authentication system that is in place that stores the users of the wildfire application.

3.1. Firebase Realtime Database Schema

The firebase realtime database that was used for the Wildfire application uses a JSON format. Therefore the following diagram will show the layout in a similar style.

```
WildfireApplication
  -Fire
    <UID>
      - Description
      - DeviceID
      - FireID
      - Latitude
      - Longitude
      - Placename
      - Time
      - WindDirection

  -ResolvedFire
    <UID>
      - Description
      - FireID
      - PlaceName
      - ResolvedDescription
      - Time
```

The schema shown above is the main structure that is used to store the Reported fire and the Resolved fires. All of the information that is stored in the database is the adequate amount of information needed for the professional users.

This section will contain an explanation of all of the elements needed to report a fire, all of the elements are type string.

- **Description** - This may contain information such as what type of fire is being reported? Or how the fire started?.
- **DeviceID** - This ID is used to uniquely identify the device reporting the fire, the main use of this is if a malicious user reported fake fires from the same device. The device ID can be blocked.
- **FireID** - This ID is used to uniquely identify every fire reported on the application.
- **Latitude** - Holds the fires North-South positions on the earth's surface.
- **Longitude** - Holds the fires East-West position on the earth's surface.
- **Placename** - This contains the name of the place where the fire was reported.
- **Time** - Time the fire was reported.
- **WindDirection** - This contains the wind direction of the fire.

This section will contain an explanation of all of the elements needed to resolve a fire, all of the elements are type string.

- **Description** - This may contain information such as what type of fire is being reported? Or how the fire started?.
- **FireID** - This ID is used to uniquely identify every fire reported on the application.
- **Placename** - This contains the name of the place where the fire was reported.
- **ResolvedDescription** - This may contain information such as how the fire was resolved? Or how bad the fire was?.
- **Time** - Time the fire was resolved.

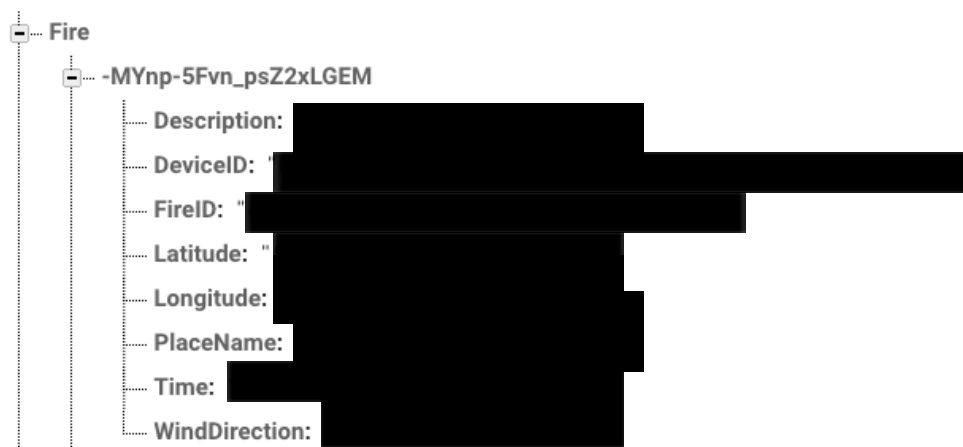


Figure 2 - Database Fire structure.

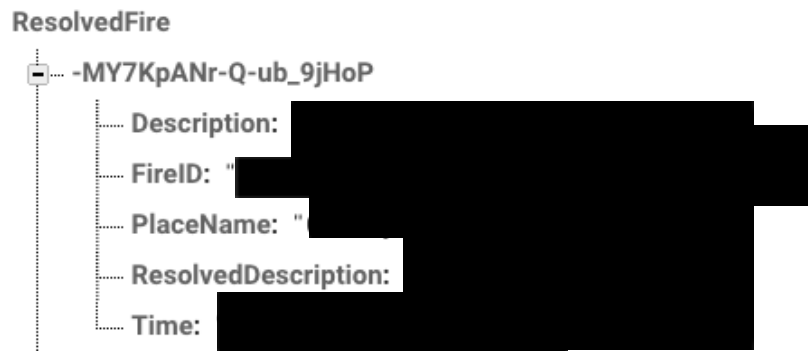
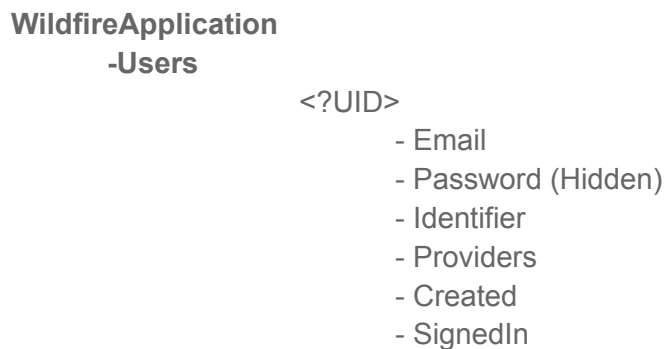


Figure 3 - Database ResolvedFire structure.

3.2. Authentication

The authentication system that was also implemented using firebase, this provides a safe and strong system to store the systems users.

The authentication does not have a specific structure but based on the information that is required to register a user and the location where the users are stored. This diagram has been constructed to visualise the authentication storage system.



Search by email address, phone number or user UID					Add user	↻	⋮
Identifier	Providers	Created	Signed in	User UID ↑			
c00226160@itcarlow.ie	✉	20 Apr 2021	[REDACTED]	02U3UQKX9QdwdPlhVIWilo5RzFD3			📄 ⋮

Figure 4- Database Account structure.

3.3. Firebase Storage

The storage system was also implemented using firebase. This storage system is safe and secure and will be utilized to store the images of the reported fires and the resolved fires.

Currently the images are not being removed from the system, but in a future version of the application the idea would be to remove the photos 30 days after the fire has been resolved. This time frame will ensure that if access is needed to these images they will be retained for 30 days before deletion.

There is no specific structure to image storage, the following diagram will be the general structure of what's stored with an image.

WildfireApplication -Fires

- Name.
- Size.
- Type.
- Last Modified.


<input type="checkbox"/>	Name	Size	Type	Last modified
<input type="checkbox"/>	 [REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Figure 5 - Database Storage structure.

4. Sequence Diagrams

This section will contain the main sequence diagrams for the wildfire application. The class diagram will be a high level overview of the structure of the whole application.

While the sequence diagrams will focus on the main algorithms that have been used to bring the wildfire application to life. The main algorithms that will be shown are :

- Load Fires
- Current location + fire radius
- Report Fire.
- Notifications.

4.1. Sequence Diagrams

4.1.1. Load fires

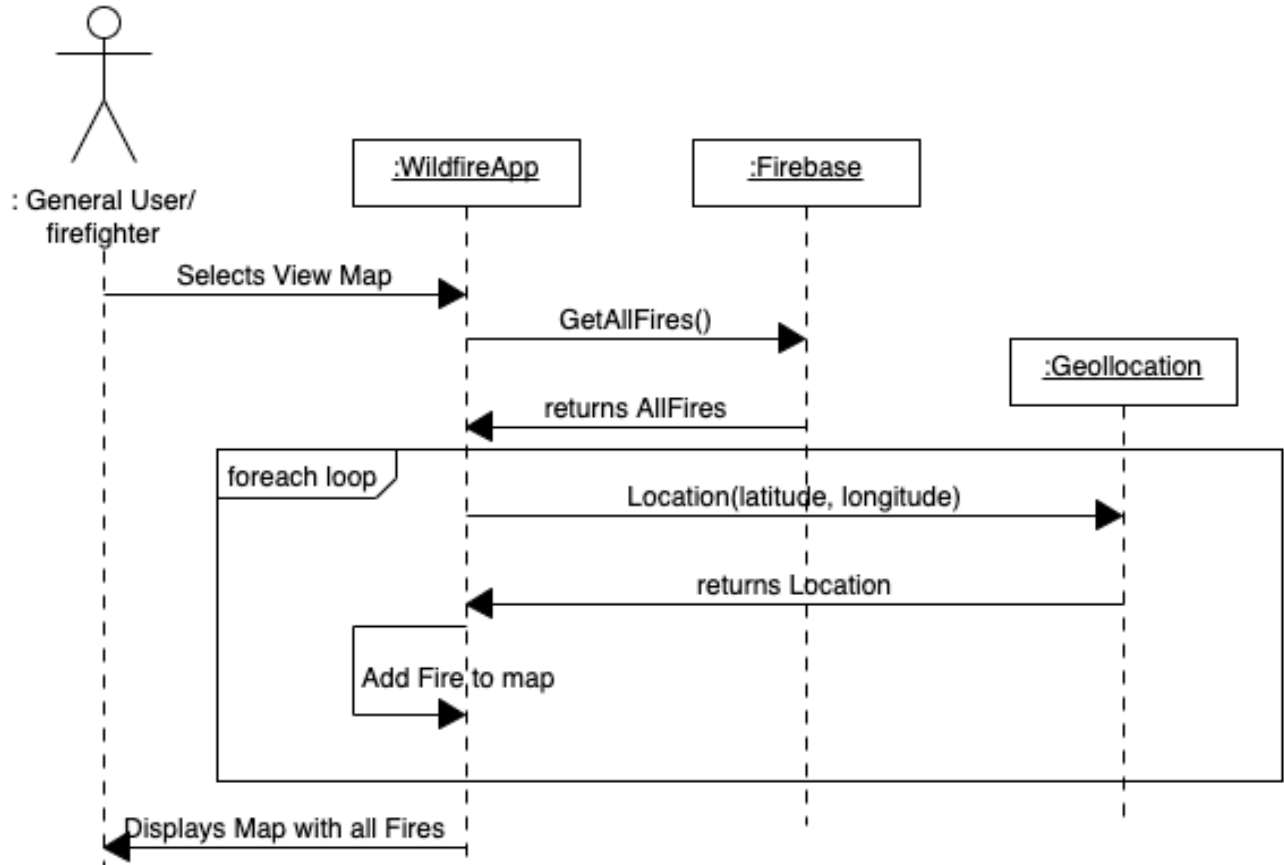
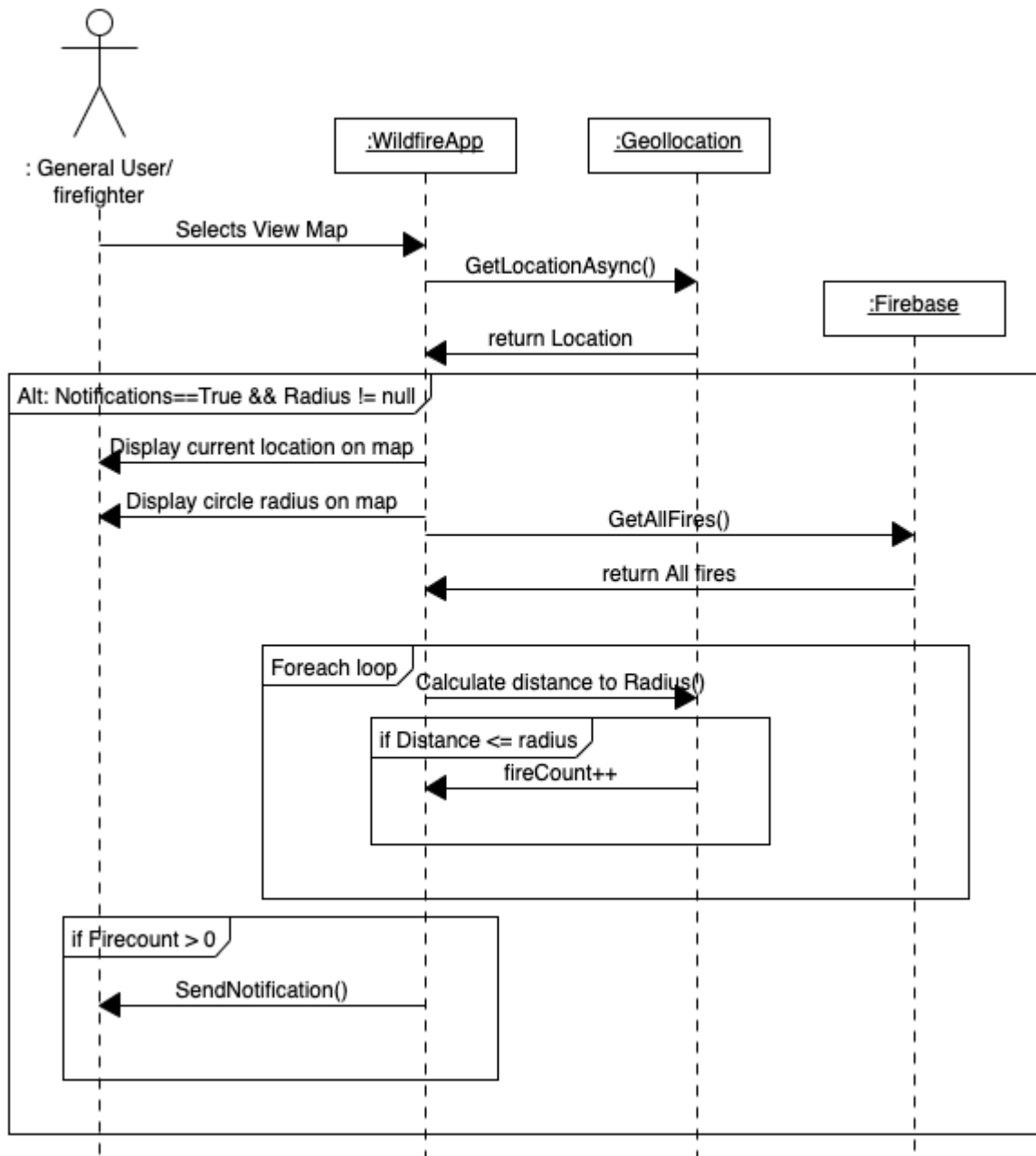


Figure 6 - Load Fires Sequence diagram.

This sequence diagram displays the load fires algorithm. This algorithm was a key algorithm to implement when creating the wildfire application. The main scenario of this algorithm is to display all of the fires that are stored in the database on the map.

This algorithm is triggered when a user wishes to view the map screen. The application first sends a request to the database for all of the current fires, once retrieved each fire location is requested and is mapped on the map via geolocation. This happens for each fire until all fires have been added to the map.

4.1.2. Current Location, Fire Radius and Notifications



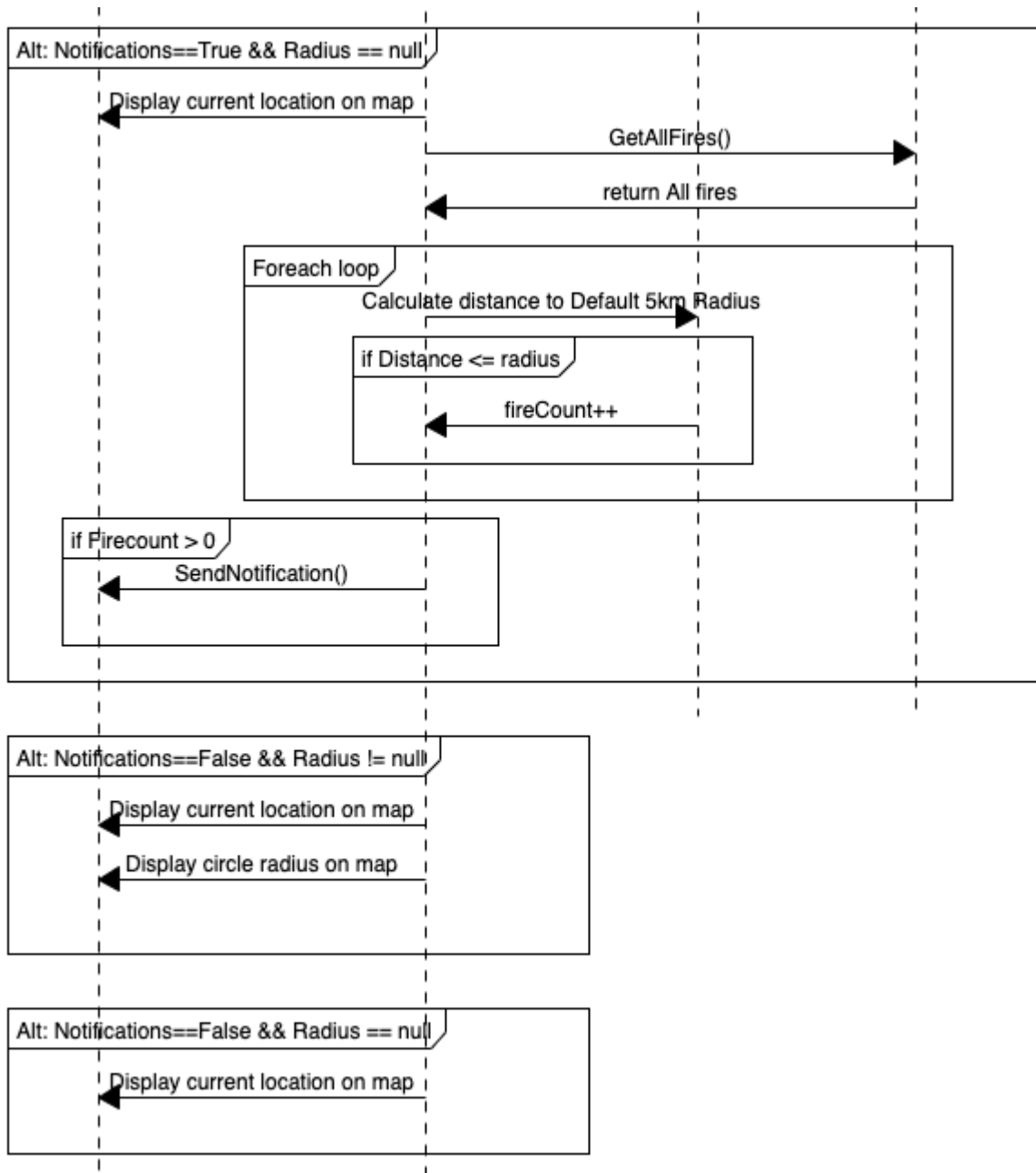


Figure 7 - Current Location, Fire Radius and notifications.

This sequence diagram explains the algorithm that displays the user's current location, notifications (if checked) and fire radius (if set). This diagram has 4 alternatives;

- If (Notifications equals true and Radius is not Null).
- If (Notifications equals true and Radius is Null).
- If (Notifications equal false and Radius is not Null).
- If (Notification equal false and Radius is Null).

4.1.3. Report Fire

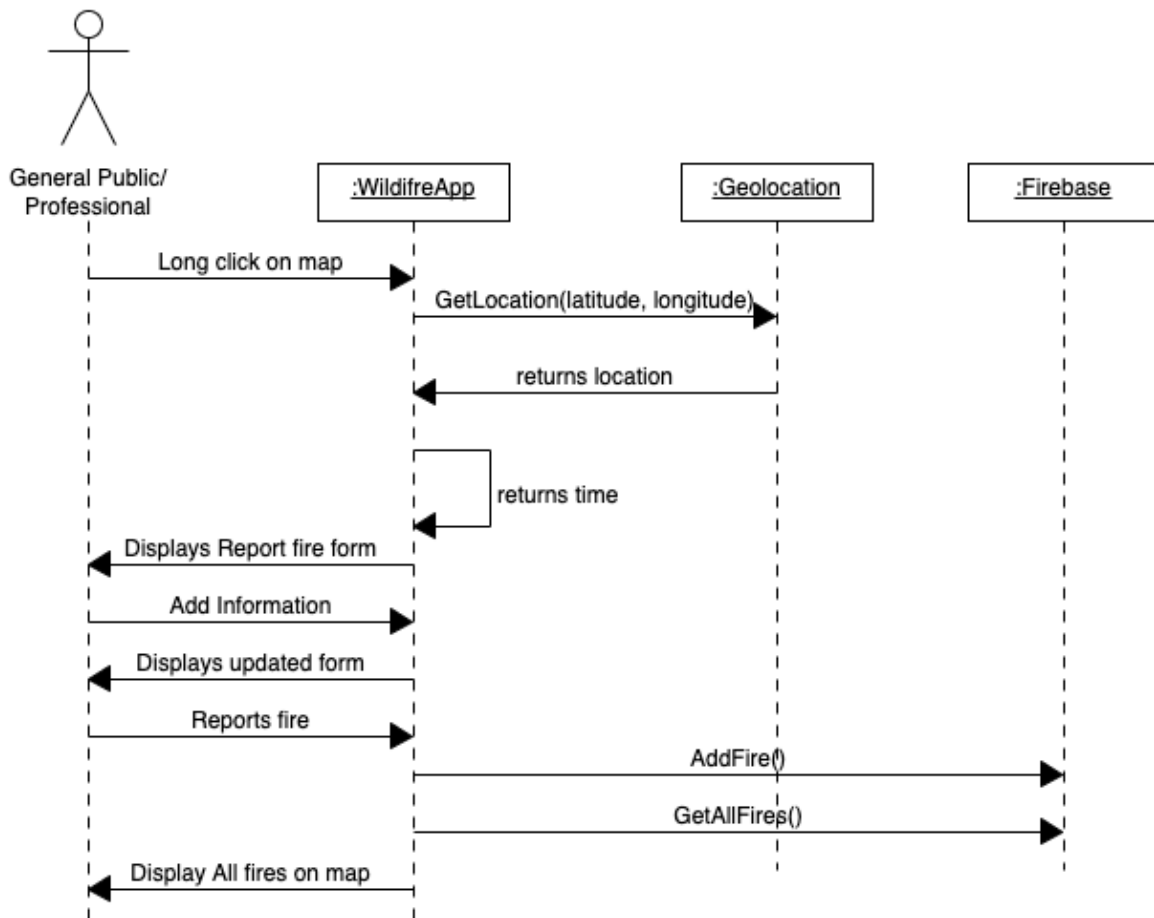


Figure 8 - Report fire sequence diagram.

This sequence diagram describes the report fire process. Once the map has been clicked. The application gets the location clicked using the geolocation. Once the location is returned the form is displayed to the user.

The user can then add information to the form, once the form is complete the user selects the report fire option. The application then adds a fire to the database, the system now requests all fires and displays all the fires on the map.

4.1.4. Resolve Fire

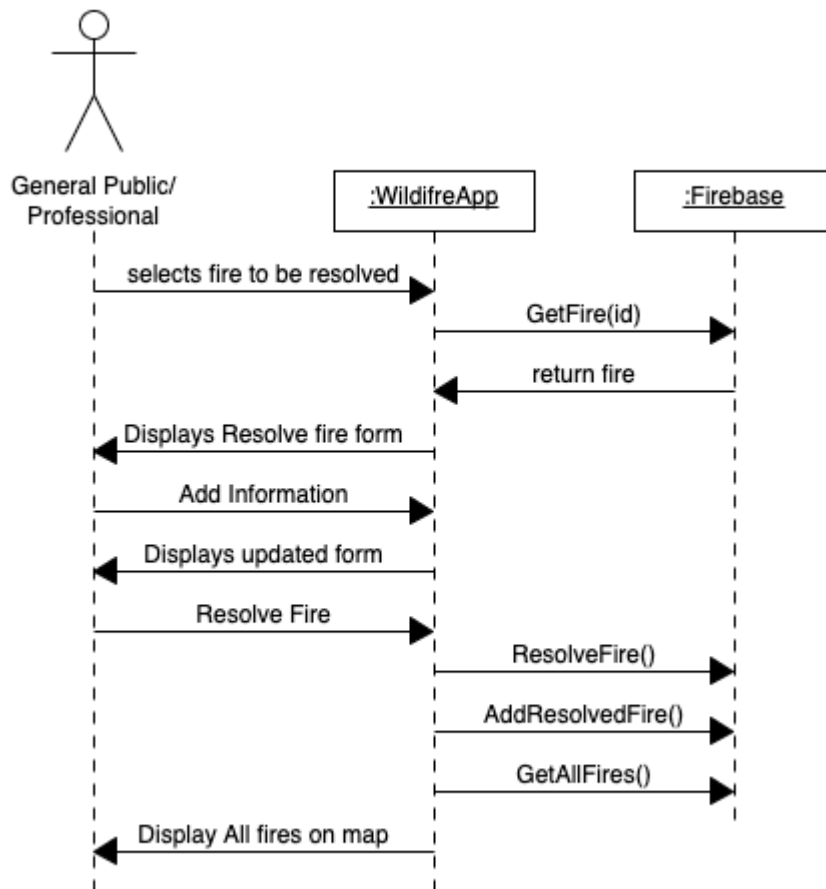


Figure 9 - Resolve Fire sequence diagram.

This sequence diagram displays the resolve fire process, once the fire has been selected it is retrieved from the firebase database. Once the form has been filled the user selects the Resolve fire option.

The fire is removed for the fires list and is added to the resolved fire list. Finally the system requests all fires and displays them on the map.

5. UI / UX Design

5.1 - Colour Palette

The colour scheme of every application is a very important decision. According to a study carried out by ColorBlindAwareness.org [1], 4.5% of the entire population of the world is colour blind. This decision doesn't only affect those that are color blind but those that have difficulties viewing small smartphone screens and trying to differentiate between the different features on the screen. For this application it was very important to make the color scheme color blindness friendly and compliant to the guidelines.

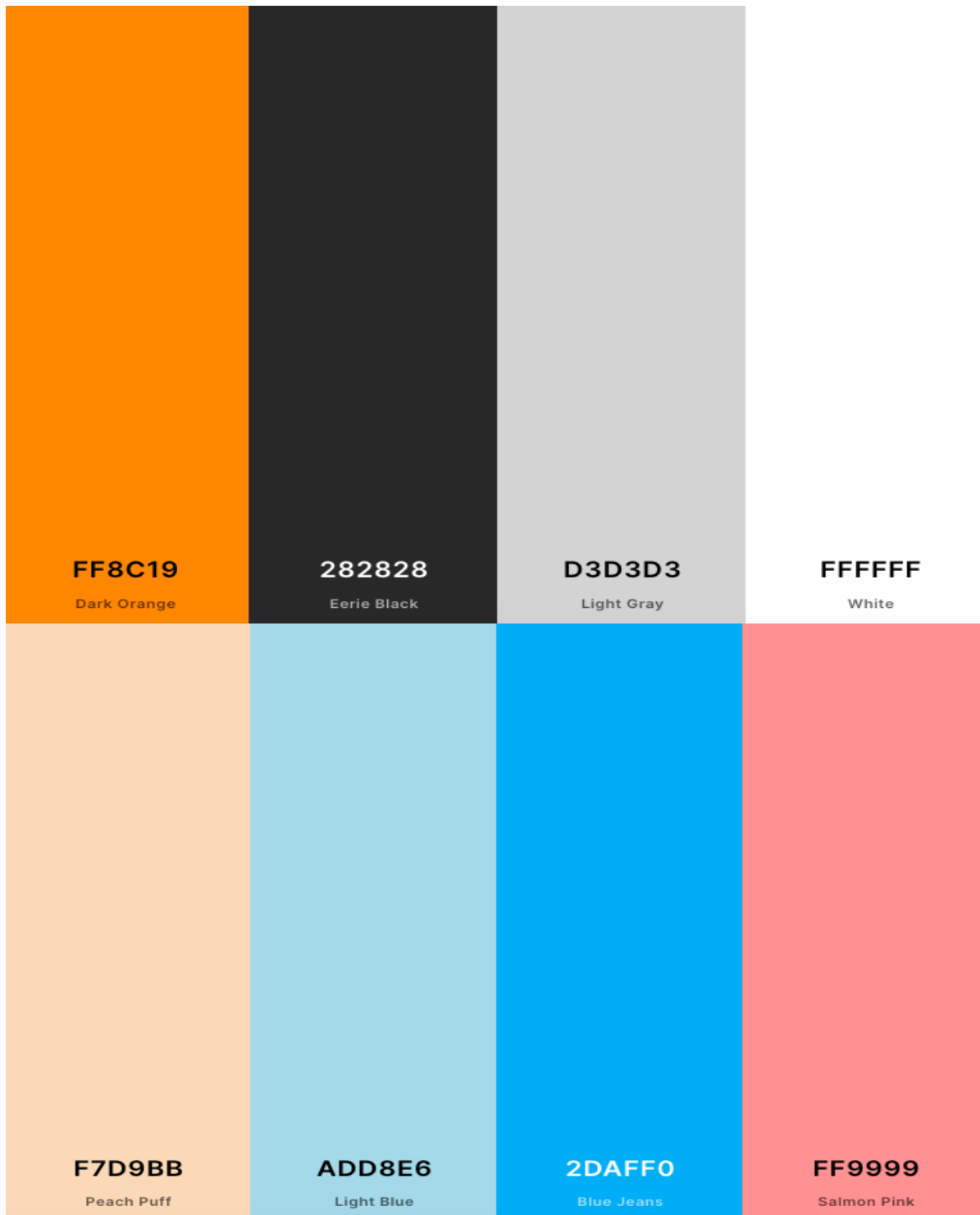
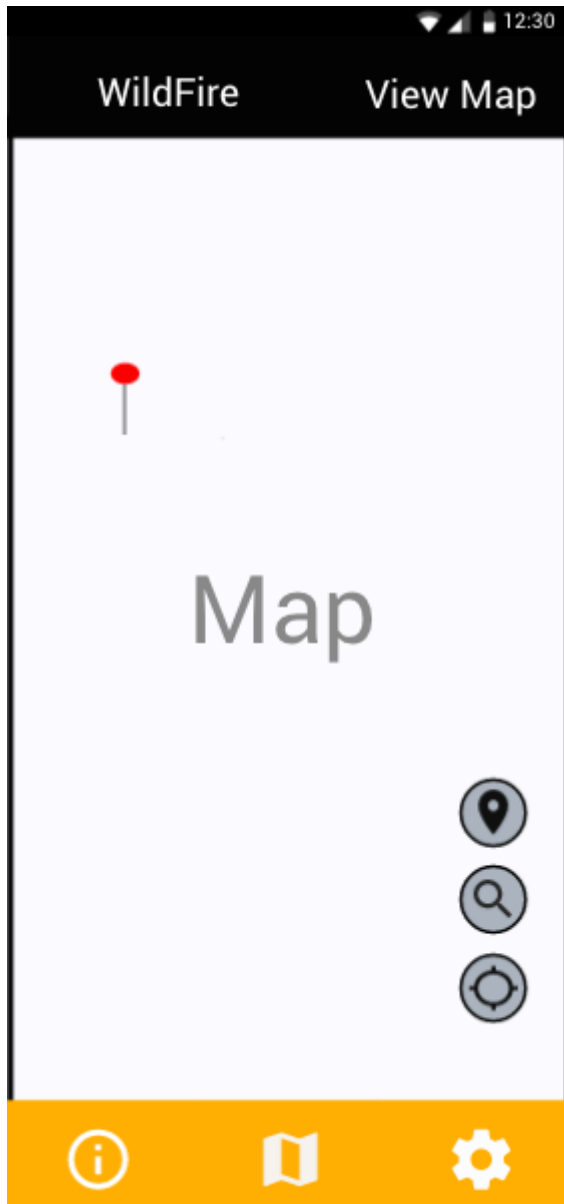


Figure 10 - Colour Palette [2].

Figure 7 above shows the colour palette that has been decided for the wildfire application. These colours were chosen using the colors.co website with colour blindness in mind. It was important that these colours were easily comparable for someone with colorblindness.

5.2 - Basic Screen Prototypes

5.2.1 - View Map



The View Map Screen is the main screen that the General Public or Professional Firefighters will interact with. This Screen will allow the users to view the applications map. Here the users can Zoom in & Zoom Out as one way to view the map.

The users will also be able to report and resolve fires from this screen by selecting the option available. Another feature that the users will be able to use is the search feature accessible through the search option the user will have the ability to search a location.

The user will be able to report a fire by dragging the pin or clicking the map in the exact location, from here the user will be redirected to the Report Fire Screen.

Lastly the user will users both General and Professional will have the option to change screens from this screen using the on screen options.

Figure 11 - View Map Screen.

5.2.2 - Report Fire Screen

12:30

WildFire Report Fire

Report Fire

Time Found @

Text input

Is this the correct Location?

Location

Text input

Wind Direction(if known)?

Text input

Photos

From Device +

Report Cancel

The Report Fire Screen is undoubtedly one of the most important screens of the application.

On this screen it is very important to walk the user through this process step by step. Firstly the user will be asked what time they found the fire, from here the user either general or professional will enter the time the fire was found.

Next the user will be asked if the location in which they have selected is correct if the answer is Yes, the user will be allowed to move on and if the answer is no they will be allowed to change the location.

Next the user will be asked some additional questions such as wind direction or if they would like to add photos of the fire to aid those that wish to fight it.

If all of the information is correct and the user wishes to report the fire they must now select the report option, from here the user will be redirected to the Report Fire Overview Screen.

Figure 12 - Report Fire Screen.

5.2.3 - View Fire Screen



The View Fire Screen is available from the View Map screen. This screen is accessible by selecting a fire on the map, once a fire is selected the Fire View will display and contain a screen similar to the Report fire overview screen.

The aim of this screen is to give the users a quick and brief overview of the fire that has been reported. This screen will contain information such as where the fire is, what time it was found and additional information such as the wind direction and photos of the fire.

When viewing this screen the “Resolve” option will appear for the professional firefighters. The professional firefighter will then select the resolve option if they wish to resolve the fire.

If the professional firefighter selects the resolve option the user will be redirected to the Resolve Fire Screen.

Figure 13 - View Fire Screen.

5.2.4 - Resolve Fire Screen

12:30

WildFire Resolve Fire

Resolve Fire

Time Resolved @

Text input

Is this the correct Location?

Location

Text input

Photos

From Device +

Resolve Cancel

The Resolve Fire Screen is the screen in which the professional firefighters can resolve a fire in which they have extinguished or fought.

The reason this screen is only accessible to professional firefighters is to prevent malicious users from falsely resolving fires.

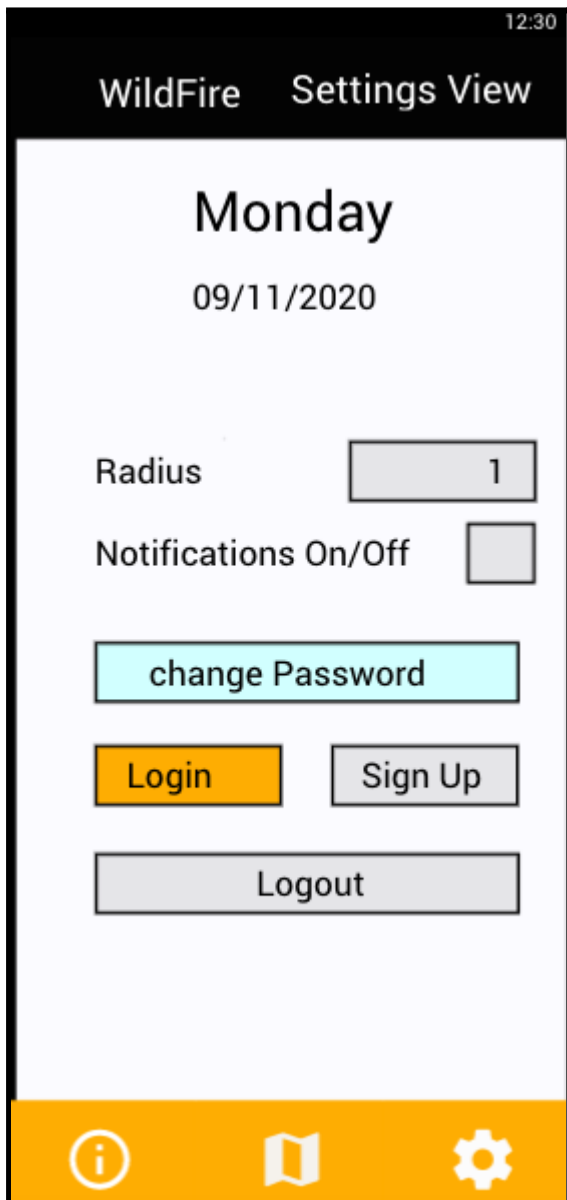
The Resolve fire page allows the professional firefighters to input the time in which they resolve the fire, the location, if it was the correct location and also to add photos to show the fire was dealt with correctly.

Once the professional firefighter is happy with the information in which they have added they will select the “Resolve” option, here the user will be redirected to the Resolve overview screen.

If the professional firefighters wish to cancel the Resolving or a fire the professional firefighter will select the “Cancel” option.

Figure 14 - Resolve Fire Screen.

5.2.5 - Settings Screen



The settings view page is the page that the users of the application will interact with if they wish to turn on their notifications or set their fire radius.

This screen also allows the professional firefighters to change their password, login, logout and sign up if they have not.

Finally this page displays the time and day just for the ease of the users.

Figure 15 - Settings Screen.

5.2.6 - Infoview Screen



The info view pages allows all users to view the provided information that aims to keep the user safe from wildfires. This page is split up into 4 sections.

Home fire safety - This contains information accessible by all users and aims to help you prepare and fight against fires if one arises in the home setting.

Wildland fire safety - This contains information accessible by all users and aims to help you prepare and fight against fires if one arises in a wildland setting.

Local Information - This contains information accessible by all users and aims to aid you when you need quick local information about the area you are in.

Firefighters - This contains information only accessible to professional firefighters and contains a list to all current and resolved fires.

Figure 16 - Infoview Screen.

6. Declaration

- I declare that all material in this submission e.g. thesis/essay/project/assignment is entirely my own work except where duly acknowledged.
- I have cited the sources of all quotations, paraphrases, summaries of information, tables, diagrams, or other material; including software and other electronic media in which intellectual property rights may reside.
- I have provided a complete bibliography of all works and sources used in the preparation of this submission.
- I understand that failure to comply with the Institute's regulations governing plagiarism constitutes a serious offense.

Student Name : Jack McNally

Student Number : C00228768

Student Signature :



Date: 30 | 04 | 21

7. References

- [1] Colour Blind Awareness. 2020. *Colour Blind Awareness - The Colour Blind Awareness organisation has been founded to raise awareness of colour blindness (colour vision deficiency) and aims to be the first point of reference for in the UK for people seeking information on colour blindness..* [online] Available at: <[https://www.colourblindawareness.org/#:~:text=is%20Colour%20Blindness%3F-,Wh at%20is%20colour%20blindness%3F,m%20of%20whom%20are%20male](https://www.colourblindawareness.org/#:~:text=is%20Colour%20Blindness%3F-,Wh%20is%20colour%20blindness%3F,m%20of%20whom%20are%20male)> [Accessed 26 November 2020].
- [2] Coolors.co. 2020. *Create a palette - Coolors.* [online] Available at: <<https://coolors.co/generate>> [Accessed 26 November 2020].