A Mobile Application for Fire Risk Notification based on Edge Computing

Vision document

Authors:
Emilie Hinna Fisketjøn, Abu Tallaha Hussain, Thorbjørn Svendal

Supervisors:
Prof. Lars Michael Kristensen, Ph.D. candidate Ruben Dobler Strand

Department of Computer science, Electrical engineering, and Mathematical sciences
Western Norway University of Applied Sciences

May 23, 2022

REVISION HISTORY

Date	Version	Description	Author
28.01.2022	1.0	First iteration	Emilie, Tallah and Thorbjørn
27.02.2022	2.0	Second iteration	Emilie, Tallah and Thorbjørn
04.05.2022	3.0	Third iteration	Emilie, Tallah and Thorbjørn
20.05.2022	4.0	Final iteration	Emilie, Tallah and Thorbjørn

Table of Contents

Introduction

This document explains the vision behind the project. The goal of the project is to develop an application that can predict fire risk for multiple locations and display this. The system will predict fire risk using the model of Log [1]. It is envisioned that this application will be the first system that makes the model of Log [1] accessible for everyone. A web-based software system has already been developed under the auspices of the DYNAMIC research project, but this system has not been released yet. The idea is to develop a mobile application that can easily be further developed by other developers if it should be relevant.

Summary of Problem and Product

2.1 Problem summary

The problem with	*There is no consumer grade technology to detect and display fire risk for homes based on specified geographical coordinates.*
Affects	*Homeowners, businesses, wildlife, the environment, fire brigade, and the ecosystem.*
As a result of this	*People are heavily dependent on the government and other institutes for information they could easily have access to themselves.*
A successful solution will	*Will be able to predict fire risk for the next 3 days based on the weather forecast and weather observations.*

2.2 Product summary

For	*The user*
Who	*Needs to foresee the risk of fire within a geographical location*
The product named	*is (“Fire Guard”)*
which	*Predicts the risk of fire based on weather data*
Unlike	*Today’s system where people are heavily reliant on announcements from public institutions which only happens when needed.*
Our product has	*The most important benefit of our product is that it is available to anyone who owns a smartphone.*

Description of Stakeholders and Users

3.1 Summary of stakeholders

Name	Description	Role during development
User	*The average user represents this stakeholder, they are stakeholders because they will be using the app*	*The user will test the application during the development.*
Municipality	*They could use the app to find and notify areas of high fire risk.*	*Provide data if needed and test the application.*
Fire Department (emergency services)	*The app could be used to foresee potential fire and therefore prevent it.*	*Evaluate the application during the development.*
Project supervisor	*Teacher (Lars Michael Kristensen)*	*Guide the project group*
Project Owner	*PhD Candidate (Ruben Dobler Strand)*	*Co-guide the project group, provide feedback and ideas based on work. The project owner is also the client.*
DYNAMIC	*Stakeholder*	*Evaluate the application and provide suggestions for improvement*
MET	*Stakeholder*	*Provide weather data*

3.2 Summary of users

Name	Description	Role during development	Represented by
User	*Main role is simply using the application.*	*During the development, the user group will consist of testers. The testers will test the application and provide feedback for improvement.*	*The user group will be represented by everyone who uses the application, it can vary from typically homeowners, tourists, hikers, and businesses*

3.3 Users' environment

The environment can vary based on the user. The product is envisioned to be an application available on both Android and iOS. The users will typically be either homeowners, companies, members of the fire brigade or workers in a municipality.

The application will be developed using Xamarin. An advantage of using a cross-platform framework to develop an application is that the application will be compatible with any mobile phone regardless of the operating system. This implies that certain versions of mobile operating system versions are not supported, in the latest release of Xamarin the following is specified:

- The version of iOS must at least be 9.0 or higher.
- The version of Android must at least be 4.4 or higher.

3.4 Summary of user's requirements

Requirement	Affects	Existing solution	Suggested new solution
Provide MET-ID	*User*	The user can manually find the page themselves.	Provide a link in the application that takes the user to MET's page form where he can request an ID.
Add location	*User*	None	User specifies location through geographical coordinates (longitude and latitude)
Delete location	*User*	None	User choose a location to delete
Navigating the app	*User*	None	A tabbed-menu containing links to different parts of the application
Get tips and help	*User*	None	Tooltips and help page with contact info

3.5 Alternatives to our product

There is no direct alternative to our product in the form of a mobile application on the market to this day. This was concluded after thorough research on Apple's App Store and on Android's app store which is known as Google Play. However, the research was not empty handed. There exist some indirect alternatives to this product, indirect alternative in this context implies that some of the functions provided are similar. Most of the found alternatives are based on voluntary collaboration between the users. The user manually registers the conditions and shares them with other users. This is the opposite of what our product provides, which is based on a completely automated process.

An alternative to our project is a Java-based Cloud- and Microservice-based Software system for Fire Risk Prediction. This software system was implemented by Eivind Dagsland Halderaker and Andreas Evjenth, as their master thesis in 2021 [2]. There are several similarities between the two projects. Both projects seek to implement a solution that uses the model of Log [1]. The model of Log [1] was developed in 2019 and is very central for this project. It has been experimented with and implemented in different projects. A lot of the research around the model of Log [1] includes aspects such as modelling methodology and model input parameters, the model's results, and the strengths and weaknesses of its predictions. The model focuses on the first building involved in a fire, based on the indoor relative humidity and transient drying of wooden wall panels. Log based the model on indoor relative humidity that uses ambient weather data. He further discusses components that contribute to the estimated TTF.

The web-based software system developed by Halderaker and Evjenth has not been released yet. This project seeks to potentially be the first issue of the model of Log [1] that is available for everyone. .

Yr.no [3] offers a service that predicts forest fire and is based on weather parameters such as air temperature, relative humidity, rain, wind, and snow. The mobile application follows the same color scheme for notifying the user of potential risks. The main distinction between these two is that the model of Log predicts fire risks within wooden homes. As for Yr, they focus on fire risk in urban wildlife.

Product Overview

4.1 Prerequisites and dependencies

One of the assumptions made is that the weather data provided by MET is correct. Should the meteorological data be corrupt or inaccurate, the application will no longer be reliable.

The most important data for the application provided by the weather stations are the following: Relative humidity, wind speed, and temperature. Should any of these no longer be available from the relevant weather station, the application will have to look for the closest weather station with the required data. It will extract data from the nearby functioning weather station and specify where the data is from, so that the user is aware.

4.2 Application name and logo

The name of the mobile application is FireGuard. FireGuard resembles the application's main functionality, to act as a fire preventive tool for homes. The logo of FireGuard can be seen in figure 1, figure 2 shows an example page of how the application would look in a home page for iPhone.

Figure 1. App logo

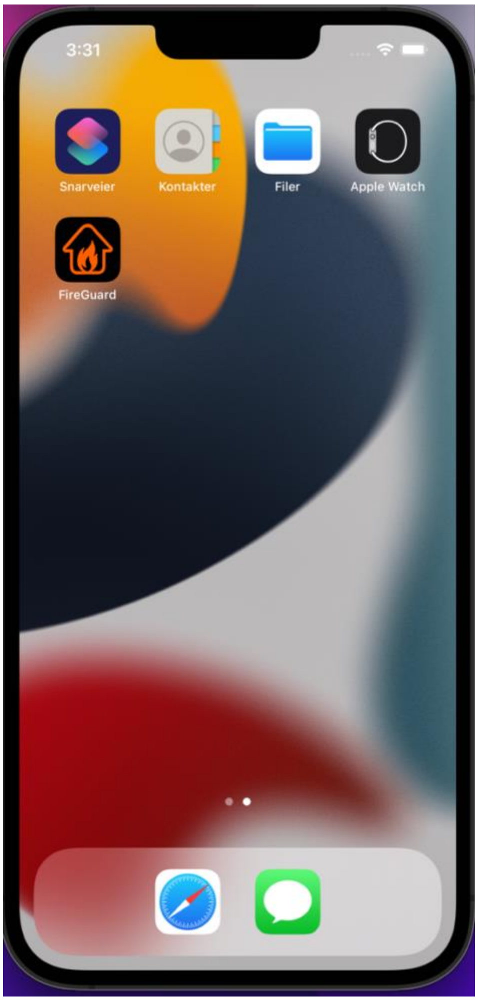

Figure 2. App logo

Product Features

1. A User Interface (UI) design for displaying map and input field
2. A field for data input for user to input location
3. Interface to get data from MET/Frost (Norwegian Meteorological Institute)
4. Function to check if data contains necessary fields
5. Interpolation of meteorological data to fit DYNAMIC model
6. Adapting the DYNAMIC model.
7. Function to use the DYNAMIC model to calculate fire risk
8. UI for output of data
9. UI for tooltips and help
10. A function that notifies users when the risk of fire is high
11. The ability for the model to run in the background while the app is not in use (if automatic updating is chosen by the user)
12. Ability to store data in the app between updates
13. Option to save location(s)
14. Option to have more than one location specified
15. UI for summarized data of several locations
16. A menu for users to navigate the app
17. Settings UI
18. Help UI
19. Submit MET ID to the application
20. Option to monitor several locations
21. Function to get the user’s current position
22. Function to display contact information
23. Option to name locations (e.g., Stavanger, Bergen)

Non-Functional Requirements

1. App symbol and name
2. Implemented on a cross-platform
3. Security
4. Handling GDPR
5. The mobile application needs to be functional for both iOS and Android
6. The mobile application needs to be implemented

Bibliography

1. Log, T., *Modeling Indoor Relative Humidity and Wood Moisture Content as a Proxy for Wooden Home Fire Risk.* Sensors, 2019. **19**(22): p. 5050.
2. Halderaker, E.D., & Evjenth, A, *Development and Evaluation of a Software System for Fire Risk Prediction*. 2021, Western Norway University of Applied Sciences
3. Meterologisk-Institutt. *Skogbrannfare*. Available from: https://skogbrannfare.met.no.

Tables of Figures