Wildfire Prevention and Fighting Dashboard Design

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November 9, 2024

Contents

Introduction

As time goes by, we come to the conclusion that wildfires are some of the most fierce and dangerous threats to human and wildlife safety.

As reported by the Institute for Nature Conservation and Forests (ICNF), the number of fire incidents in rural areas has exceeded 6,000 since the beginning of this year (2024), with a total area of over 137,000 hectares affected by fire.

Figure 1.1: ICNF rural fire indicators

One of the ways to prevent wildfires is by using technological tools that can detect and combat them more effectively.

The project is comprised of several stages, which have been classified into the following four sections:

- Section 1: from the problem description to the definition of stakeholders;

- Section 2: from the designed sketches to the iteration process;

- Section 3: from the description of the sketches in low fidelity to a description of the constituent parts of the requested system for this project;

- Section 4: from aspects of human interaction with the system to the overall improvements made.

This report will focus on the initial two sections, which have been the primary focus of the project thus far.

Section 1

2.1 Problem Description

For this work, we were given the task to create a dashboard that could simulate a real-time, real-world system for wildfire prevention.

In order to fulfil the above-mentioned objective, we were required to select one of two districts, namely Aveiro or Viseu. Our task was to analyse both districts, with a particular focus on the forest area in each. This area was considered crucial, since that it would be the location of the deployment of cameras and sensors, which would be used to collect data essential for preventing forest fires. To achieve that goal, Silvanet Wildfire Sensors and Mesh Gateways are necessary to survey and detect wildfires effectively.

2.2 Biggest Challenges

One of the biggest challenges we faced was keeping a complex system, with multiple functionalities, simple and intuitive to use without the need for prior knowledge on this specialized tech, such as the sensors and gateways.

2.3 Identification of Stakeholders

In the context of this project, "stakeholders" can be defined as follows:

- Dryad (Sensor Manufacturer)

- Firefighters

- SIRESP - Portuguese National Emergency and Security Networks Operator

- ANEPC - National Emergency and Civil Protection Authority

- City Council

- System Operators (from Civil Protection)

All of these entities play a crucial role in the process of fire monitoring and firefighting. Civil Protection agencies and firefighters rely on this interface to facilitate effective emergency responses and ensure public safety. Sensor and camera manufacturers contribute valuable

technology that is essential for accurate data capture, enabling timely and precise detection. Local authorities have a vested interest in protecting their local areas and resources, and benefit from a tool that enhances their preparedness and risk management strategies. Finally, system operators are integral to ensure smooth operations, maintenance, and real-time monitoring capabilities which, in turn, make it possible for all stakeholders to rely on accurate and up-to-date information.

2.4 Personas as Potential Users

In order to come up with some of the sketches shown in Chapter 3, we created two fictional personas, in this case, two fictional potential users of the system. In the end, we came up with the following:

Persona 1:

- Joaquim Soares (35 years old):

  - Civil Protection agent;
  - Lives with his wife and kids in Aveiro;
  - Joined GNR and received police training at the age of 20;
  - Worked as GNR in Aveiro's district during the wildfires of Summer of 2024. After this catastrophic experience, he volunteered to become a Civil Protection Agent in this new program to prevent and fight forest wildfires.

Persona 2:

- João Rodrigues (24 years old):

  - Has a degree in Management of Safety, Emergency, and Civil Protection;
  - Lives with his parents and sister in Aveiro;
  - Currently undertaking a post-graduation degree in Civil Protection, through online classes;
  - Works as an operations assistant for Civil Protection;
  - Has ambitions to climb the ranks in ANEPC by gathering experience in various fields.

Section 2

3.1 Outline of Implemented Features

3.2 Metrics Used for Evaluation

In order to evaluate the preliminary sketches that were produced, it was collectively determined that each sketch would be assessed according to four distinct criteria.

The criteria were defined as follows:

1. Functionality;

2. Intuitiveness or clarity;

3. Organization;

4. Attractiveness/Design.

Once all members of the group had evaluated the sketches, we proceeded to construct a matrix based on the above-mentioned four criteria. In this manner, a ranking was established, thereby facilitating discussion and progression in the process with regard to the most promising sketches.

3.3 Evaluation and Results

Cameras Panel

- Functionality:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8	Sketch 9
Helena	2	4	2	4	4	4	4	4	4
Tomás	3	3	3	4	4	4	4	3	3
Rui	2	3	2	3	3	2	3	3	3
Sérgio	2	3	2	3	3	2	3	3	3
Total	10	14	9	14	14	14	15	14	13

- Intuitiveness:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8	Sketch 9
Helena	3	4	2	4	3	3	4	4	4
Tomás	2	3	2	4	3	3	4	3	3
Rui	4	4	2	2	3	3	4	4	3
Sérgio	2	3	2	4	3	2	2	3	3
Total	11	14	8	14	12	11	14	14	13

- Organization:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8	Sketch 9
Helena	3	4	3	3	4	4	4	4	4
Tomás	2	3	2	4	3	3	4	3	3
Rui	4	4	2	2	3	3	4	4	3
Sérgio	2	4	2	4	3	4	4	4	3
Total	11	15	9	13	13	14	16	15	13

- Attractiveness:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8	Sketch 9
Helena	2	4	1	3	4	3	3	3	4
Tomás	2	3	1	3	4	3	4	3	3
Rui	4	4	1	2	4	3	3	4	3
Sérgio	2	3	1	4	3	2	3	3	3
Total	10	14	4	12	15	11	13	13	13

- Final Results:

	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8
Functionality	10	14	9	14	14	14	15	14
Intuitiveness	11	14	8	14	12	11	14	14
Organization	11	15	9	13	13	14	16	15
Attractiveness	10	14	4	12	15	11	13	13
Total	42	57	30	53	54	50	58	56

Here, we come to the conlusion that the top 3 sketeches are sketches 7, 2 and 8.

Log Panel

- Functionality:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5
Helena	4	4	4	4	4
Tomás	4	3	3	3	3
Rui	4	4	3	4	3
Sérgio	2	3	3	3	3
Total	14	14	13	14	13

- Intuitiveness:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5
Helena	4	4	4	4	4
Tomás	4	3	3	3	3
Rui	4	4	3	4	3
Sérgio	2	3	3	3	3
Total	14	14	13	14	13

- Organization:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5
Helena	4	4	3	3	4
Tomás	3	4	4	3	3
Rui	4	4	4	3	3
Sérgio	2	3	3	3	3
Total	13	15	14	12	13

- Attractiveness:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5
Helena	4	4	4	4	4
Tomás	4	3	3	3	3
Rui	4	4	3	4	3
Sérgio	2	3	3	3	3
Total	14	14	13	14	13

- Final Results:

	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5
Functionality	14	14	13	14	13
Intuitiveness	12	14	13	14	12
Organization	13	15	14	12	13
Attractiveness	11	16	14	12	13
Total	50	59	54	52	51

Here, we come to the conlusion that the top 3 sketeches are sketches 2, 3 and 4.

Rescources Panel

- Functionality:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8
Helena	4	4	4	4	4	4	4	4
Tomás	3	4	3	2	3	4	4	3
Rui	3	3	3	4	4	4	4	3
Sérgio	2	3	3	3	3	3	3	4
Total	12	14	13	13	14	15	15	14

- Intuitiveness:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8
Helena	4	4	4	4	4	4	4	4
Tomás	3	4	2	3	3	4	4	2
Rui	3	4	2	3	2	4	4	4
Sérgio	2	3	3	3	2	3	3	4
Total	12	15	11	13	11	15	15	14

- Organization:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8
Helena	4	4	4	4	4	4	4	4
Tomás	3	4	3	3	4	4	4	3
Rui	4	4	4	2	4	4	4	3
Sérgio	2	3	3	3	2	3	4	3
Total	13	15	14	12	15	15	16	15

- Attractiveness:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8
Helena	4	4	3	4	3	4	4	3
Tomás	3	4	2	2	3	4	4	2
Rui	3	4	2	2	3	4	4	2
Sérgio	2	3	3	2	3	3	3	3
Total	12	15	10	10	12	15	15	10

- Final Results:

	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8
Functionality	12	14	13	13	14	15	15	14
Intuitiveness	12	15	11	13	11	15	15	14
Organization	13	15	14	12	15	15	16	13
Attractiveness	12	15	10	10	12	15	15	10
Total	49	59	48	48	52	60	61	51

Here, we come to the conlusion that the top 3 sketeches are sketches 2, 6 and 7.

Situation Panel

- Single:

    - Functionality:

Table 3.1: Functionality Results Table

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8	Sketch 9
Helena	2	3	3	3	3	4	3	3	3
Tomás	2	3	4	4	4	4	3	3	3
Rui	2	3	3	4	4	4	3	3	2
Sérgio	2	3	4	3	4	3	4	3	3
Total	8	12	14	14	15	15	13	12	10

    - Intuitiveness:

Table 3.2: Functionality Results Table

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8	Sketch 9
Helena	2	2	4	3	4	4	3	3	2
Tomás	2	2	3	3	4	4	2	3	2
Rui	2	2	3	4	4	4	2	3	2
Sérgio	3	2	4	2	4	4	4	2	4
Total	9	8	14	12	16	16	11	11	10

    - Organization:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8	Sketch 9
Helena	1	2	3	3	4	4	4	3	3
Tomás	1	2	4	3	4	4	3	3	2
Rui	1	2	2	3	4	4	3	3	3
Sérgio	2	2	4	3	4	4	4	2	3
Total	5	8	13	12	16	16	14	11	11

    - Attractiveness:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8	Sketch 9
Helena	1	3	3	3	3	4	4	4	4
Tomás	1	2	2	3	4	4	3	3	2
Rui	1	2	2	2	3	4	4	4	3
Sérgio	1	3	3	3	2	3	3	4	2
Total	4	10	10	11	12	15	14	15	12

	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6	Sketch 7	Sketch 8
Functionality	8	12	14	14	15	15	13	12
Intuitiveness	9	8	14	12	16	16	11	11
Organization	5	8	13	12	16	16	14	11
Attractiveness	4	10	10	11	12	15	14	15
Total	26	38	51	49	59	62	52	49

Here, we come to the conlusion that the top 3 sketeches are sketches 5, 6 and 7.

- Multiple:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6
Helena	4	4	4	4	4	4
Tomás	2	3	3	3	3	4
Rui	2	3	4	4	3	4
Sérgio	4	3	3	3	2	3
Total	12	13	14	14	12	15

- Intuitiveness:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6
Helena	4	4	4	3	3	4
Tomás	1	3	4	2	4	4
Rui	2	2	4	4	3	4
Sérgio	3	2	3	2	2	3
Total	10	11	15	11	12	15

- Organization:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6
Helena	4	3	4	4	3	4
Tomás	1	2	4	3	2	3
Rui	1	2	4	3	2	4
Sérgio	3	2	3	2	2	3
Total	9	9	15	12	9	14

- Attractiveness:

Name	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6
Helena	3	3	4	3	3	4
Tomás	1	2	3	3	2	3
Rui	1	1	4	3	2	4
Sérgio	4	3	3	2	2	2
Total	9	9	14	11	9	13

- Final Scores:

	Sketch 1	Sketch 2	Sketch 3	Sketch 4	Sketch 5	Sketch 6
Functionality	12	13	14	14	12	15
Intuitiveness	10	11	15	11	12	15
Organization	9	9	15	12	9	14
Attractiveness	9	9	14	11	9	13
Total	40	42	58	48	42	57

Here, we come to the conlusion that the top 3 sketeches are sketches 3, 4 and 6.

3.4   Iteration Process

3.5   How to Interact with the Graphical Interfaces Created

Conclusion

Appendices

A.1 A - Information about fire vehicles and procedures during wildfires

To better understand how a firefighter operates, who is the first line of defence, vehicles and people, we collected information from volunteer firefighters.

Firefighters utilise a range of forest firefighting vehicles, which are categorised according to their specific function and capacity. To illustrate, the VTTUs are tank vehicles with a capacity of 12,000, 15,000 or 16,000 litres. These vehicles supply the smaller vehicles that combat fires, such as the VFCI (with a capacity of 3,000 litres) or VLCI. The VOPE is a reconnaissance vehicle that is used to observe and analyse the situation in order to establish or adjust the firefighting strategy. VECI vehicles are all-terrain vehicles and are the first to leave to fight the fire.

Upon reaching the ground, the firefighters establish communication with SIRESP, providing the coordinates of the location to the Operational Coordination Centre (OCC). The OCC is responsible for overseeing the entire situation and coordinating the deployment of additional resources or reallocation of existing ground, air, and human resources.

The information in question proved invaluable in the construction of the resource and log panels, as it enabled us to develop a comprehensive understanding of the subject matter.

Table A.1: Forest firefighting vehicles

Type	Description	Brand	Model
VECI	VECI02	Man(SEC)	T19F 19343 4x4
VECI	VECI04	Mercedes	BARIBI-1217-4X4
VFCI	VFCI01	Iveco	ML150E28WS
VLCI	VLCI05	Mercedes (SEC)	UNIMOG U5000
VLCI	VLCI07	Mitsubishi (SEC)	L200
VOPE	VOPE08	Toyota	Hilux
VOPE	VOPE01	Suzuki (Moto4)	LT-F250
VTTU	VTTU04	Volvo	FH12
VTTU	VTTU06	Volvo (SEC)	FL 10 4x2