NASA Europa Project
Project Specification

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The Europa challenge aims to find urban management solutions that can be shared worldwide. The goal is to “build a great application that serves some aspect of the OpenCitySmart design and uses NASA's open source virtual globe technology, WebWorldWind.”

We noticed that the vast majority of past winners of the competition have engaged in predicting something, most recently earthquakes. We liked the idea and thought through multiple natural disasters that could theoretically be predicted with currently available data and APIs. We eventually agreed upon the following idea.

Description of Idea

Prediction of wildfires using well known precursors. Generally speaking, lack of rain for some time, high temperatures, low humidity are the main precursors. By tracking all this information, we can provide a realtime map providing likelihood of a wildfire within the next few days in locations worldwide.

Following this, by tracking wind speeds and wind directions in an area, we can predict how extensive the wildfire will be should it occur and how fast it will spread.

The application will utilise WebWorldWind, a 3D virtual globe API for HTML5 and JavaScript, to display the locations where we predict wildfires are to occur.

Reasoning

Wildfires are an issue that many countries, particularly those with hot, dry climates, suffer with. Even in highly developed countries, it can take days if not weeks to put a large forest fire out. It also takes a considerable amount of money and resources to put one out. Due to global warming, this is likely to get worse in the near future.

If wildfires can be accurately predicted, residents in nearby towns and cities that could be affected can prepare evacuation plans and the authorities can take preventative measures to reduce the likelihood of a wildfire starting.

This application serves the OpenCitySmart design detailed in the competition brief as it will improve the quality of urban life, enable the cities of tomorrow to be more resilient to potential wildfires, and thus make our way of life more sustainable.

Implementation Details

In essence, our application will collect weather data, use it in an algorithm, and then return locations where wildfires are likely to occur in the near future (next 6 days).

Our algorithm will use a number of different parameters. The data required includes temperature levels, humidity levels, historical rainfall, forest locations, wildfire history in area, wind levels, potentially lightning and ozone levels in stratosphere above area.

The realtime data will be retrieved through Dark Sky APIs, which provides realtime and future weather data for cities around the world in JSON format. Unfortunately, this API doesn't provide historical data unless you purchase a paid subscription, so will not be our sole source of data for this project, the same can be said for all other weather related APIs. Also, the API only provides a limited number of free requests hence the project will only function in California for now.

There exist multiple free websites that provide historical data, so it is possible to use web scraping to obtain the required historical training data. Since no other method could be found of obtaining historical data, we had to resort to using this method.

The data we collect will need to be stored in a self updating database so that it doesn't have to be retrieved using the API or a website each time the data is required. Dark Sky only allows us to obtain the past 48 hours of weather data, since we need the past 14 days of data for our model to work, the self updating database is essential.

We've created a SVM (Support Vector Machine) that takes data for each forest location from the database and returns a wildfire likelihood rating. A focus has been placed on areas with large forests.

The wildfire likelihood rating for an area will finally need to be displayed on the virtual globe provided by WebWorldWind. Under 30% likelihood shows green, 30%-60% shows orange and 60%+ shows red.

Project Deliverables

We will create a fully functioning application to predict wildfires, as previously detailed.

We will create a website associated to the project that will provide a professional-looking page for users to download the application and learn more about the project.

We must create a 3 minute video showing off our application and how it can be used to help people around the world.

We will need to perform some degree of outreach. Potentially get in touch with local governments and see if they would be willing to try the application. For this we will need to have a prototype complete at least 2 weeks before the deadline. We will contact summer camps around the world to see if they'd be interested in using our application to help plan future activities.

Project Timeline

The dates provided are subject to change. However we are very confident that come the 7th August we will have all the deliverables required to submit.

10th June: Finish determining what resources and programming languages to use.
12th June: Divide the project in several smaller subtasks and assign them to each other.
26th June: Create a basic prototype of the algorithm using data from one city or region.
28th June: Test the prototype and look at ways to optimise the algorithm.
5th July: Export the data produced by the algorithm to WebWorldWind, and work on creating an effective user interface within the WebWorldWind framework.
20th July: Finish expanding the prototype to as much of the rest of the world as possible whilst maintaining accuracy.
1st August: Finish contacting local governments and other agencies to see if they'd be willing to try our app.
3rd August: Finish the video and improve the website.
7th August: Submission deadline.
29th-31st August: Finals in Finland.