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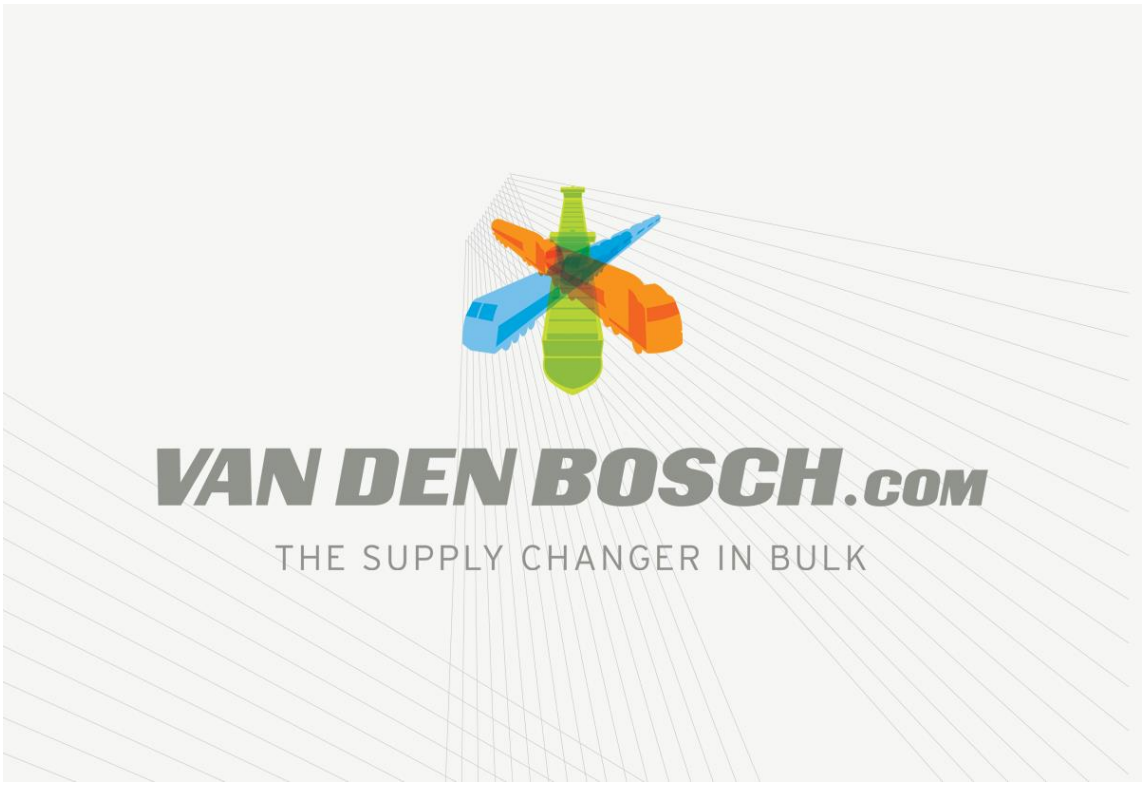

MAPPING TECHNOLOGY RESEARCH

VAN DEN BOSCH AMS RESEARCH DOCUMENT

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Versions

Version	Date	Author(s)	Changes	Status
1.0	06-03-2023	Robin van Hoof	Document setup, Introduction, Methods, Result, Tables and Figures, References	Finalized version 1.0

Distribution

Version	Date	To	Goal
1.0	06-03-2023	Publication to portfolio	Publication

Introduction

One of the major functionalities of the Address Management System being developed is giving the user, an in-house employee, insight and control over certain geological aspects of the system. Doing so requires an interface that mirrors the real world that the user can interact with. This is commonly done through the use of an interactable world map.

However, many platforms exist that offer these interactable world maps with each their own strengths and weaknesses. To implement one of these world maps it needs to be determined what world map would work best in the context of the application that's being made. This is what this research will focus on.

Methods

What does our platform require?

To determine what solutions would be applicable and work for out application we first need to determine what the AMS platform requires of the world map implementation. To determine this I used the requirements set up for the project together with the product owner. Going through sketches the following profile:

Customizability

In terms of customization and theming the application that will be made is an early stage prototype of an AMS system that the company will use in some way to develop their own platform later on. This in turn also means that customizability is in this stage of the project not very important as the main goal of the application is functionality, not aesthetics. Thus, customizability is not a major defining factor in the choice of mapping platform. However, as this research will also function as basis for the development of the second iteration later on, customizability will be analyzed for all the platforms throughout this research, though it will not be taken into account in the conclusion for the development of this prototype.

Level of documentation

In terms of ease of integration availability and level of documentation is an important factor for determine what platforms are fitting. A strong platform is not very useful without the correct quantity and quality of documentation on how to implement and use it to back it up. Especially since the development time and resources for this prototype platform are very limited. However, the time and resource constraint is not to such level that the best of the best documentation is an absolute requirement. Thus availability and level of documentation will play a role, though not major, in the selection of mapping platform.

Functionality

Functionality will play a very big role in the selection on what platform will be used. As the platform requires not only just a map to be shown, but also quite a few additional features, the mapping platforms needs to be able to support these features. The features in question that the platform are *required* to have are as follows:

- The ability to place markers on the map representing both GPS-data-points and geolocations as stated in requirements ‘FR-03’ and ‘FR-06’
- The ability to handle a large amount of these above mentioned markers as stated in requirement ‘FR-07’.
- The ability to use a location search bar to navigate the world map as discussed with the product owner in an undocumented meeting.
- The ability to draw geo-fences (2d areas of arbitrary shapes) on the map.

As mentioned before, the availability of all these features are a requirement for the mapping solution. However, if no mapping solutions are found that offer all of these, a mix of mapping solutions or implementing some of these features in different ways is possible though not desirable.

Field research, user and requirements analysis

What solutions are available?

To determine what mapping solution would fit our needs best we first need to look for available solutions, what defines them and what their advantages and disadvantages would be in our scope. This is mainly done through a library research, investigating a list of different solutions and analyzing them one by one. An overall analysis of with advantages and disadvantages can be found in table 1.

Google Maps API

Google Map API is one very well known and widely used mapping solution by companies and developers around the world. After investigation of the in-house Bulkio platform, this is the platform that was used for the similar implementation on this platform. An interview took place with one of the developers of this platform, 'George Suteu', and the product owner 'Luke van der Doelen'. In this interview the question of *"Why was Google Maps API chosen over other solutions?"* was brought up. The main reason why Google Maps API was used in this similar platform was because of the additional features it offers, mainly location searching and address validation, that most other platforms do not offer.

Field research, interview

Taking this into account a further investigation into the capabilities of Google Maps API was done. The Google Maps solution. Offers a medium level of customization of their maps to developers. However, the documentation the platform provides in both implementation and usage is vast and provides extremely broad coverage. Furthermore, most of the features that are required of the platform are provided natively, with an exception to drawing geo-fences on the map.

Leaflet

Leaflet is another well known and widely used mapping solution. Leaflet is a JavaScript-only platform that is focused on providing developers with easy mapping solutions. As the platform is open-source, a developer has almost full control over the customization and theming of the maps they create with it. Furthermore, as the platform is made for use on JavaScript frameworks, documentation on the usage but more importantly implementation is very in depth and vast. However, Leaflet lacks in terms of additional functionality: placing markers on the map directly is possible, however large amounts of markers are not very well handled. Furthermore the platform does not offer any location-search functionality making world navigation natively near to impossible.

Mapbox

Mapbox is another widely used mapping solution in the industry, though it slightly less popular then the above mentioned two solutions. Mapbox gives developers a huge amount of freedom in terms of customization and theming. Additionally it also provides most additional functionality that is needed, with an exception of natively drawing geo-fences on the map. However, what it offers in terms of aesthetics and functionality, it lacks in terms of documentation: Mapbox provides a large amount of documentation, however this documentation is of such high level that getting started and learning how to use and implement the platform is a very steep learning curve.

OpenLayers

OpenLayers is a mapping platform that makes use of the widely known OpenStreetMap. The platform is very similar to leaflet, matching the extreme customizability in terms of theming and visualization. However, the documentation on the platform is slightly more niche and covers less of the platform. Similar to Leaflet the platform does not cover most of the additional functionality that is required, supporting markers (though working better in larger quantities then Leaflet) but lacking native location search support. However, it does offer the use of plugins that allows for this functionality. Notability, one of the main selling points of OpenLayer is the speed in terms of networking that the mapping solutions runs at.

Here

Here is a slightly less popular but powerful mapping solution. The platform is fairly customizable in terms of theming and visualization. However, Here excels in visualization of data on their maps. In terms of documentation Here is very similar to Mapbox where the quantity is very large, however the level of documentation is so high that there is a steep learning curve for getting started with the platform. The solution offers most of the required functionality with an exception for drawing geo-fences on the map natively. Notably, this solution seemingly focuses more on navigation using world maps than the world maps themselves.

Library research, literature

Result

As result of this research a decision on what mapping solution to use for the development of the prototype AMS platform was made. This decision was made based on the found result in terms of strengths an weaknesses of each mapping solution and comparing these to the requirements and needs analyzed as part of this research.

The conclusion was made that for this prototype project Google Maps API would best fit with the needs of the mapping solution. This conclusion was drawn from two major component:

Available documentation

The Google Maps API solution provides a vast and extensive documentation on all parts of the platform. This documentation is in fact so extensive yet easy to understand and use that implementing the platform in an application takes only a fraction of time, which in the case of a prototype application like this is very desired, as it gives more time to work on other possibly more important features.

Functionality

The Google Maps API provides an enormous amount of functionality besides just the map itself. This functionality includes the required functionality of location searching, but besides that also provides an enormous amount of other functionality in the form of API's ranging from address validation to route planning. These features are in the current scope of the project not needed, nor will be used, but the fact that these are present and can possibly in the future be used to apply a lot more functionality to the application is a very big advantage.

Tables and Figures

Table 1

Mapping Solution	Customiz-ability	Document-ation	Covers functionalities?	Additional advantages	Additional disatvantages
Google Maps API	Medium	Vast, good coverage, good level	Mostly, doesn't offer geo-fence drawing	Already used in Bulkio	
Leaflet	High	Vast, good coverage, extremely good level	Minimal, only offers markers at limited capacity		Pre-existing development experience
Mapbox	Extreme	Vast, good coverage, difficult	Mostly, doesn't offer geo-fence drawing		
OpenLayers	Extreme	Good, good coverage, good level	Minimal, only offers markers	Great performance	
Here	High	Vast, good coverage, difficult	Mostly, doesn't offer geo-fence drawing		Mainly focused on navigation through maps

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