

research report

Front-end Technologies



May 9, 2022

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# Introduction

This report is a research document detailing the research made per subject based of the internet. This report will cover all the front-end technology that was considered by the team. It is meant to provide proof for conclusions made on why a specific front-end technology was chosen for the development of the FindYourWayIn web application.

# Front-End technology considerations

The following front-end technologies were considered by the team members for use in the development of FindYourWayIn:

* React
* Vue
* Angular
* Svelte

These four technologies will be compared and thus will provide a reason as to why a final one was chosen. The criteria, as agreed by the team, considered when comparing these technologies are:

* **Usability** - The degree as to which something fits for use on a certain scenario
* **Performance** – The speed of the framework’s performance on a specific platform.
* **Popularity and resources** – The number of resources and community support the framework has.
* **Learning** **curve** – How long and how easy it is to be able to build a web application using the framework.
* **Maintenance** – How easy it is to continue upgrading the web application based on this framework.

# Front-End technology comparison

The facts mentioned here are from an online source (Boisdequin, 2020), that mainly compares React, Vue, Angular and Svelte.

## React

This is a JavaScript library for building user interfaces. It was developed by Facebook and released in 2013. This library in this project will work with a framework called NextJS so we can enable server-side rendering and generating static websites which will boost performance in the web application.

### Usability

The library is component based so it can produce reusable code so this can reduce maintenance and development costs and complexity. Since this web application is mostly dealing with the visual aspect then it is a very good tool for building the user interface. This library is easy to work with when implementing a map library such as google maps as shown by Google maps platform (Google, 2022). However, JSX is required to work with React.

### Performance

JavaScript is extremely fast but updating the DOM can reduce this speed greatly. However, React minimizes DOM changes and has realized an efficient and intelligent way to update the DOM. React monitors the values of each component's state with the Virtual DOM. When a component's state changes, React compares the existing DOM state with what the new DOM should look like. After that, it finds the least expensive way to update the DOM. (Surve, 2021)

To understand more about [DOM](#_DOM_and_Virtual) you can read articles in the [appendix](#_Appendix) of this report.

### Popularity and resources

React has a massive number of resources and community members behind it. This can easily compensate for the lack of documentation for the library. Many tutorials are available online and this can affect the learning curve, or a web developer greatly as explained in the next criteria.

### Learning curve

For this project this may be the most important criteria for the team because of the amount of hours we have to make a mobile web application that has to perform well for multiple users connected simultaneously. React is very easy to learn and can almost take no time to learn if you are already experienced with JavaScript and HTML. This factor can also be a bonus when wanting to build a very large web program in components.

### Maintenance

In the long run, a web application built using React can easily be modified by any other web developer because of how easy it is to learn the library. Since this library has the highest popularity then it can be very cheap to keep the source code up to date with the latest problems as a solution.

## Vue

This is a progressive and adoptable JavaScript framework that can be used for building UI on the web. It was developed by Evan You in February 2014.

### Usability

Just like React, this framework is component based so it can produce reusable code and can reduce maintenance and development costs and complexity. It is also easy to implement a map library such as google maps as shown in community websites such as (Miller, 2021). Vue is a very good tool when developing visual web applications.

### Performance

Vue, just like React, utilizes VDOM technology thus reducing DOM updating times and makes the overall program very fast and performant.

### Popularity and resources

Vue also has a large community and number of resources but not as much as React. Many tutorials can still be found online but this may affect the learning curve negatively when compared to React.

### Learning curve

Vue takes a bit more time than React to build a real project. With a bit of work, you could learn the Vue fundamentals in less than 3 days. Although Vue takes longer to learn, it is one of the fastest popular JavaScript frameworks to learn. This may indicate complications soon when more complex features are being implemented in a project.

### Maintenance

A project built using Vue can still be very easy to cheaper to maintain because of the large community it is supported by as well as the tutorials that can assist any programmer. However, it can be more expensive to maintain or upgrade as it is not as easy to master as React.

## Angular

Angular is a development platform for building mobile and desktop web applications using Typescript / JavaScript and other languages. It was developed by Google and released in September 2016.

### Usability

Just like React and Vue this is also component based hence the code is reusable. It is also a suitable candidate to develop large web applications and can easily implement map libraries such as google maps. (Keung, 2019). Angular uses an MVC architecture implementation which is a pattern in software design commonly used to implement user interfaces, data, and controlling logic. This can affect the maintenance of the program in a positive way.

### Performance

In general, Angular is slower than both Vue and React and may even be the slowest when it comes to starting up the project built on this platform and memory allocation. Angular does not use VDOM but it uses its own mechanism for Change Detection combined with Zones, which helps Angular going through the Change Detection tree from its root to its leaves. It is almost just as fast as when using a VDOM but not fast enough.

### Popularity and resources

Just like the other technologies, Angular has a massive community and tutorials can be found online. However, the only drawback is that most of the tutorials are over 2 years old, but later tutorials can still be found.

### Learning curve

Angular is a massive framework and is the largest when compared to all the other technologies in this document. Hence its performance is significantly slower than all the other technologies but when it comes to learning there is quite a lot to get a grasp on before building your first project. The time an individual can take to learn the basics can take a week which is much longer than when studying Vue and React. Since this project is large this may take a considerable amount of time to get the project flow smoothly going.

### Maintenance

As mentioned earlier on, Angular uses an MVC architectural pattern which helps emphasize a separation between the software's business logic and display. This "separation of concerns" provides for a better division of labor and improved maintenance. Thus, reducing costs in multiple factors significantly by making it easier to update the program in a shorter space of time.

## Svelte

Svelte is a new way to build web applications. It is a compiler that takes your declarative components and converts them into efficient JavaScript that surgically updates the DOM. It was developed by Rich Harris in November 2016.

### Usability

Just like all the other before mentioned technologies this is also component based hence the code is reusable. It is also a suitable candidate to develop large web applications and can easily implement map libraries such as google maps. (Delaney, 2019)

### Performance

Svelte is the fastest framework among the group because it does not use a VDOM but instead being a compiler, compiles the components itself rather than relying upon 'virtual DOM' to update the browser DOM. This course improves the performance of the code and makes it fully 'reactive'.

### Popularity and resources

Svelte has a smaller community as compared to all the other frameworks. Quality tutorials can still be found online and since Svelte is easy to learn and use the learning curve on this framework is still very good. Svelte is the least popular framework in use these days though so finding a solution for a specific problem when coding may be very difficult to find. Although Svelte is increasing in popularity because of its ability to create larger web applications that result in a small file size as when compared to the same project files built using other frameworks. (Twardowska, 2022).

### Learning curve

Because Svelte is not popular but still has good quality tutorials online and has a syntax like that of HTML then it is possible to learn the basics in one day. That is the quickest one when compared to the other frameworks and libraries.

### Maintenance

Svelte being the easiest to learn, component based and small in memory size for whatever file puts a huge impact on the maintenance of a project built on this framework. It is relatively easy to maintain like Vue and React but may be cheaper in the long run when considering storage use or development time since it is the fastest being that it is ‘reactive’.

# Comparison summary

All frameworks can put a good debate when it comes to choosing which is best for a large web application such a FindYourWayIn. Below is a multiple criteria table that shows the score between each framework criteria. This is also reflected in the system design document.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Front-End Tech** | **Usability**  **/10** | **Performance**  **/10** | **Popularity and resources**  **/10** | **Learning curve**  **/10** | **Maintenance**  **/10** | **Total**  **/50** |
| **React** | 8 | 8 | 10 | 10 | 8 | **44** |
| **Vue** | 8 | 9 | 8 | 8 | 7 | **40** |
| **Angular** | 9 | 6 | 8 | 7 | 10 | **40** |
| **Svelte** | 9 | 10 | 7 | 10 | 9 | **45** |

Based on the multiple criteria matrix above, it would be a generally good idea to go with Svelte to create the FindYourWayIn web application as it has the highest score of **45**. Although, as a team we agreed on two sets of criteria regarded as the most important and those are, as marked GREEN in the matrix, **Popularity, and resources, learning curve.**

This is because as we continue to develop the project we will surely face difficulties that may need online assistance and since react has the best rating for **Popularity and resources** it will certainly be easier to seek online help for whatever fixable problem we might run into. Also, the fact that we can study and master the basics in literally a very short time when already well knowledge about JavaScript and HTML then it can be a very good candidate to tackle this 8 weeklong project that is large and complex in some areas such as map multi location routing features.

# Conclusion

Based on the discussion in the previous chapter it was agreed by the team, supported by this research report, that the front-end technology we are going to use to build the FindYourWayIn web application UI will be **React**.

# Appendix

The following content are brief definitions of some of the complex key words used in the report. All are supported by online documentation.

## JSX

JSX stands for JavaScript XML and allows us to write HTML in React. JSX makes it easier to write and add HTML in React. (W3 Schools, 2022).

## DOM and Virtual DOM

This covers explanation on how JavaScript works with data known as DOM.

### DOM

The Document Object Model (DOM) is a programming interface for web documents. It represents the page so that programs can change the document structure, style, and content. The DOM represents the document as nodes and objects; that way, programming languages can interact with the page. (MDN Contributors, 2022)

### Virtual DOM (VDOM)

This is a programming concept where an ideal, or “virtual”, representation of a UI is kept in memory and synced with the “real” DOM by a library such as ReactDOM. This approach enables the declarative API of React: You tell React what state you want the UI to be in, and it makes sure the DOM matches that state. This abstracts out the attribute manipulation, event handling, and manual DOM updating that you would otherwise have to use to build your app. (React, 2022)

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