



Modern SPA Web Development for Solar Panel Installation: A Survey

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Abstract— Solar Panel installations nowadays are getting more popular and many startup companies are coming into this market. For, growing in this digital era, any new company requires a website, which eventually becomes the face of the company in the internet and in this current web development environment, Single Page Application (SPA) helps the organization to handle the large traffic more efficiently. Single Page Applications (SPAs) use APIs to communicate with the server for dynamically updating the current web page with new data. In this paper, we surveyed the different methods for developing a more secure and efficient web app development method, which loads data faster with minimum server load as compared to the traditional web apps.

Keywords— JavaScript, Single page application, Modular architecture.

I. INTRODUCTION

Single Page Applications is one of the most preferred web apps. SPA uses APIs to communicate with the server for dynamically updating the current web page with new data. For making the SPA more efficient client-server communication is used instead of one-to-one communication. Client and Server communication uses information from multiple servers using RESTful APIs. RESTful APIs are the API that uses a representational state transfer architectural style to communicate with the server. The Single page web applications with the help of RESTful APIs are interactive and easy to use. Single-page applications are more reactive as compared to multi-page websites because they upload at one time, and activities happen on the front end with the help of different versions or flavors of JavaScript. In this, the web page does not reload and mostly might not transfer control to another page.

Researchers and developers have proposed enormous different ways of creating a single-page application. Where developers can create a SPA in a short span of time with minimum resources using framework, libraries, or methods like EmberJS, AngularJS, ReactJS, Vue, Query Service Model, and many more.

The Query Service model[1] provides us with the information required to perform CRUD operations in restful APIs. Query service model method decreases the complexity of the application while using numerous different APIs. It is reserved to use restful APIs and does not entertain to be implemented with other APIs using other protocol standards like SOAP. This model lacks data exchange with other technologies.

AngularJS, Next JS, and Vue are the few frameworks which give the developer the freedom to choose the right technology stack for the project. Which means this framework also gives us the opportunity to integrate with different frameworks like CSS, Database and other frameworks to create suitable technology stack according to the project.

II. RELATED WORK

While surveying, we came across various findings and approaches for developing a SPA website. There were many findings or methodologies that were used for development and after surveying them we have summarized the findings in the following subsections. Section A tells about the secured login ways, Section B deals with Client Server Architecture, which describes the website working,

Section C mainly compares the Multi-Page Application with Single-Page Application and Section D describes the SPA architecture.

A. Login

During login instead of password we can use OTP for secure login. Traditional login method uses user-id and password for login into a system but instead of password, users can directly login to the system using a one time password which is a fast and secure way of signing. There are few methods for securely creating OTP, one is Message Digest Algorithm 5 (MD5) [6] and another is Pseudo Random Number Generator (PNRG) [5]. The MD5 is a one-way cryptographic algorithm that uses 128 bits long hash value to encrypt and generate the otp. MD5 has high usage in situations where long messages are required to be processed quickly. In the PRNG method random bytes are taken from any PRNG and presented as OTP by transformation function. Pseudo random number generator is used for generating the sequence of random numbers. Pseudo random number generator works by taking some input number, which is a seed in sequence generation as output one, then takes this random number for the next iteration and repeats the process for generating a unique sequence of numbers.

B. Multi-tier Client Server Architecture

Multi-layer client-server architecture is also used by single-page applications, in which the client-side is being viewed in the browser, and the communication happens with a server using multiple APIs. Multi-layer client server architecture provides a more secure and scalable model which can be reused without affecting the performance as it is lightweight

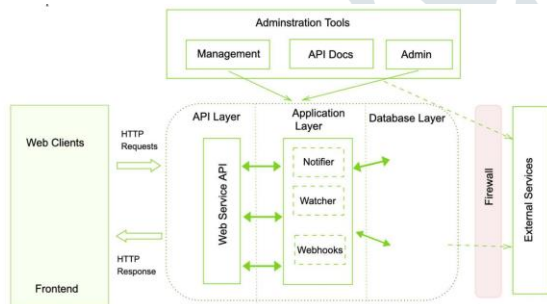


Figure 1. Multi-tier Client-server architecture

as compared to other architectures. The above figure illustrates multiple layers of the web application. Figure 1 shows how the API layer connects with the database by transferring data between different application layers. The end-user is the web client that sends an HTTP request to the server to retrieve data. Administration Tools are used for giving commands and arranging the layer to help them to communicate here, API docs track the API commands and maintain logs. The database layer responds to the SQL queries raised by the APIs to fulfill the user request. To

maintain the linkage between the architecture, the database layer communicates with other external services with the help of a secured firewall.

C. MPA vs SPA

Multi-page application (traditional web application) contains numerous web pages mostly with static content like text or images, which is linked with the other pages of the same type and while changing or refreshing the page the entire content is being fetched again by the server[8]. When the page reloads or moves to a different page, the browser gets refreshed, and the content of the web page changes entirely, which tends to download all the resources once more, even the components(e.g., header, footer) are repeated throughout all pages loading again [3]. For the first time when client initiate requests to the server html page gets rendered and on the same page if client asks for any data the entire html pages gets reloaded

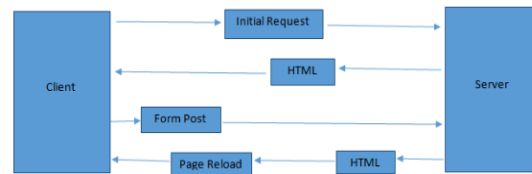


Figure 2. Multi-Page

which means fetching the entire html page from the server instead of loading that particular data in multi page(i.e. traditional website) as shown in figure 2, But in single page only that data gets loaded instead of the entire html page. This approach is suitable or we can say it is best for low traffic websites and for the less complex websites. Multi page applications require the framework for increasing the complexity of the website. Search engine optimization is quite efficient in a multi-page application. Whereas single-page applications lack SEO optimization but as the technology industry is changing rapidly many frameworks are coming into the market which claim their framework or libraries are more efficient in search engines. SPA gives the freedom of handling the heavy traffic with the help of frameworks and libraries, which handle most of the job on its own as this code comes with the framework.

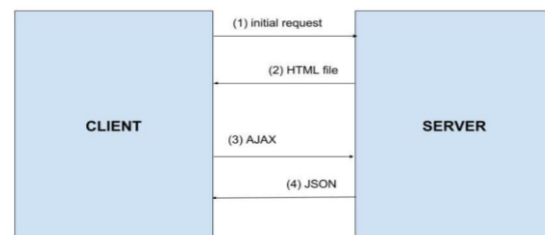


Figure 3. Single Page

A web app made using a single-page concept works on the browser that is user side only, therefore constant reloading of the page is not required, which gives an upper hand to the client regarding facing any problem[3]. Many day-to-day applications use SPA such as Facebook, Gmail, Netflix, etc[8]. Single-page applications reduce the caching issues as compared to the multi-page application. It has a linear content flow which gives the developer an easy debugging root and makes its website responsively fast. Single-page applications lack SEO optimization, as the technology industry evolves, new frameworks emerge that claim to be more search engine friendly. Nowadays there are many frameworks and libraries for developing single-page applications such as Angular by Google, React by Facebook, etc[9].

D. Single-Page Application Architecture

SPA consists of two completely separate applications: client and server (Figure 3). The client application is the front-end or we can say face of the website where majority communication and logic implementation happens. The server application mainly serves as a layer between data layer and security implementation[8].

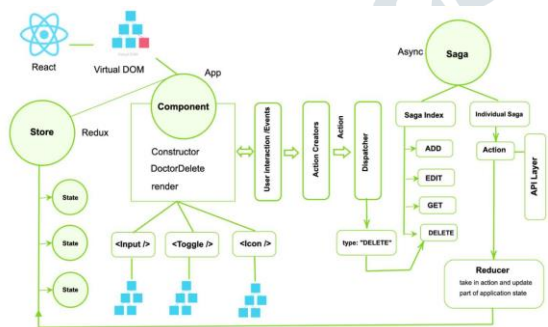


Figure 4. React based single page architecture

The architecture shown above is ReactJS based, and the front end, or the UI, is designed using react XML by adhering to the react lifecycle events and the redux-saga or the hook concept to enhance the performance[2]. The redux helps to maintain the flow of the data unidirectionally and the logical model of the same is depicted above. The diagram depicts an application overview with React, virtual DOM, and the components. Every framework works differently and has its own unique feature. Below are the few frameworks commonly used:

Next JS: Next JS is open-source framework that is used for server side rendering and hybrid static websites, while using the react library functionalities and is built on top of Node js. Search engine optimization is good in this framework as compared to the earlier versions.

AngularJS: It is a web framework written in typescript and developed by Google. Angular is a client-side framework based on javascript to overcome the difficulties faced by the other SPA developers[9]. Angular uses its own decision tree to increase performance and the speed of the application.

Vue JS: VueJS is an open source framework based on javascript, which is used to develop a SPA and it is a very lightweight and easy to learn framework, which also allows the developers to integrate with other frameworks.[10].

III. CONCLUSION

In this paper, we have surveyed and discussed different approaches to develop SPA based websites efficiently. In this paper, we have mainly discussed web application development and focused on the single-page application side of the web app architecture. From the website application architecture perspective, we have surveyed the different possibilities. Either we can say the attribute of the modern single-page architecture components is sufficient enough to handle the large traffic but from the search engine perspective, more refined ways have to be found or the process has to be changed completely. For web application development, we have shown the modern technique for developing a single page application architecture which will help the developers to make their website scalable and to enhance modifiability.

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