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Modern and Responsive Mobile-enabled Web Applications

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Abstract

Rapid web technology improvements in the last few years have powered software developers to quickly write responsive mobile-friendly applications. The innovative web frameworks and libraries make it easy to have same software code base for desktop and mobile devices. Single-page applications offer a more-native-app-like experience to the user. This also means a web application can easily be converted to a native mobile application if desired. This allows software products to be evolved continuously at a much faster pace with features added on daily basis. The software companies who can adopt these technologies will most likely see the benefit in the long run as they can offer new and modified products faster than their competitors.

In this paper, we review some of the state-of-the-art web technologies, third-party libraries, and frameworks for quick interactive web development. Finally, we present a simple interactive browser-based, mobile friendly web application which was developed using one of the latest web development framework.

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1. Introduction

In the last few years, several web technology innovations have allowed software designers and engineers to quickly develop responsive mobile-friendly applications. These improvements include web frameworks and libraries which allow quick and user-friendly application development for desktop and mobile devices. In fact, it is quite common to have single code base for an application which functions on the desktop and mobile devices (like smart phones and tablets). The successful software companies will adopt these technologies quickly to stay ahead of their competitors by offering new and modified products at a much faster rate.

The content of a web page are described by HyperText Markup Language (HTML). HTML5 evolves from HTML and includes new attributes and behaviors. Apart from HTML5, the building blocks for most of the modern browser-based applications include JavaScript (JS) and Cascading Style Sheets (CSS3).

Single-Page Applications (SPAs) are web-based applications which load a single HTML page and dynamically update the page content as the user interacts with the application through menus and side bars. These applications offer a more-native-app-like experience to the user. Fluid and responsive web applications are created, without constant

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page reloads, using AJAX (Asynchronous JavaScript and XML) technology, which communicate with server-side scripts to receive as well as send information in a variety of formats (usually from/to a persistent storage like database). The applications that uses basic functions of persistent storage namely Create, Read, Update, Delete (CRUD) are called CRUD applications. CRUD are the basic operations to be done in a data repository.

In one of our previous works¹, we reviewed some state-of-the-art web technologies, third-party libraries and frameworks that can be utilized to fulfill the promise of interactive browser based custom visualization applications. These libraries uses client-based technologies for appending and manipulating Scalable Vector Graphics (SVG) elements, which is supported in almost all modern browsers, smart phones and tablets.

Shaikh et. al.² presented some state-of-the-art web based tools and libraries for client-side browser-based visualization. They introduced a novel web-based network visualizer and simulator application which utilizes HTML, JavaScript and Bootstrap.

Some of the contribution of this work includes brief description of latest tools and frameworks which are backbone of modern web applications and a simple description of the architecture of a modern web application.

The rest of this paper is organized as follow. In section 2, we provide some background related to modern web development and list some latest framework and libraries. We provide modern web application architecture in section 3. We present an example application in section 4. The conclusion of our work is provided in the last section.

2. Latest Web Framework and Libraries

In this section, we review some of the JavaScript libraries which are designed for modern browsers and smart devices. These libraries exploited the advancement in HTML5, CSS3 and JavaScript and provide an Application Programming Interface (API) for developer to create web-based mobile-friendly applications. Lightweight frameworks add structure to a web application and offer a way to handle navigation between different views, and typically split the application into layers implementing the Model-View-Controller (MVC) design pattern. These libraries and frameworks are developed using pure JavaScript, so users get interactivity without requiring round-trips to servers and without any additional plugins.

- **jQuery** is a popular JavaScript library³. jQuery helps in finding and manipulating the Document Object Model (DOM) elements, processing browser events, and dealing with browser incompatibilities. jQuery is an extensible library, and thousands of plugins have been created by developers from around the world.
- **AngularJS** is a toolset for building the framework most suited to application development. It is fully extensible and works well with other libraries. Every feature can be modified or replaced to suit unique development workflow and feature needs⁴. AngularJS is often used for creating single-page applications, where only certain portions of the page (sub-views) are updated as a result of the user's actions or data being sent from the server. Other features include two-way data-binding, reusable components, deep linking, built-in services for backend communication and localization support. Mobile Angular is another User Interface (UI) framework that is built on AngularJS and Bootstrap for mobile-friendly application development.
- **Angular** Angular 2 (or just Angular) is an open source JavaScript framework maintained by Google. It is an evolution of its popular predecessor, AngularJS. Apart from JavaScript, Angular applications can be developed in Dart, or TypeScript⁵. The framework makes it simpler to create custom components that can be added to HTML documents and to implement application logic. Angular uses data binding extensively, includes a dependency injection module, supports modularization, and offers a routing mechanism. Whereas AngularJS was MVC-based, Angular is not. This framework doesn't include UI components.
- **Bootstrap** is the most popular HTML, CSS, and JS framework for developing responsive, mobile first projects on the web⁶. It is an open source library of UI components developed by Twitter. The components are built using the responsive web design principles, which makes this library extremely valuable for web applications that needs to automatically adjust its layout depending on the screen resolution.
- **Google's Material Design libraries** is a new library of UI components called Material Design, which may become an alternative to Bootstrap. Material Design is optimized for cross-device use and comes with a set of nice-looking UI components⁷. Material Design is a unified system that combines theory, resources, and tools for crafting digital experiences.

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