Comparison of Web Development Using Framework over Library

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Abstract—Over recent years, web development has changed significantly. Driven largely by the rise of trends like mobiles, the world of development is rapidly evolving. The rise of the Internet makes web applications crucial nowadays. The web application has been an interface for a company and one of the ways they present their portfolio to the client. On the other hand, the web has become part of the file management system which takes over the role of paper. Due to high demand in web applications, developers are required to develop a web application that are cost-effective, secure and well coded. A framework has been proposed to develop an application rather than using library style development. The framework is helping the developer in creating the structure of a web automatically. This paper will compare the advantages and disadvantages of web development using framework against library-style development. This comparison is based on a previous research paper focusing on two main indicators, which are the impact to management and impact to the developer.

Keywords—Framework, library Style development, web application development, traditional web, static web, dynamic web.

I. INTRODUCTION

TEN years ago, the web was completely different. With the absence of smartphones and the domination of Internet Explorer in the browser market, development methods were far and away very different [1]. Initially, websites were created manually, one page after another, starting from the homepage screen to other screens and connecting all of them together with the use of links. This development style required developers to manually develop the system from scratch. This manual style of development includes the page by page development, and manually linking to each page [2]. Fig. 1 shows the client-server architecture in a traditional web application. Hypertext Markup Language (HTML) is the dominant mark-up language used in creating web pages. It describes the structure of the document and how to render it for the client. The process starts when users submit a request through the client browser. The server interprets the request and accesses the persistence storage of a server to fulfill the request. The result is rendered in an HTML document and returned to the client using the HTTP protocol. The client renders the HTML and displays the request. The traditional client-server is known as synchronous; a user makes a request and waits for a response from the server [3].

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II. THE SHIFT TOWARDS FRAMEWORK

With the emergence of smartphones and tablets, mobile browser usage surpassed the desktop and web development changed dramatically to keep up with the trends [4]. One of the major changes is user expectation; users want a responsive website, both fast to respond and robust [5]. To develop such a web application requires a very complicated skill-set, since web applications must achieve certain characteristics such as high reliability, high usability, be more secured and require continuous maintenance [6]. The client-server model is no longer reliable to support user demand. As a result, developers have shifted towards client-side development. Features such as ASP, JSP, and others, are provided by the client-side framework such as AngularJS and many more. Fig. 2 shows the client-side architecture. Compared to a static webpage, the dynamic webpage moved processing from the server side to the client side [1]. The server only sends data upon a client request, while a client can create a dynamic page without waiting for the server to refresh. In other words, a user can make multiple requests at one time due to less load on the server.
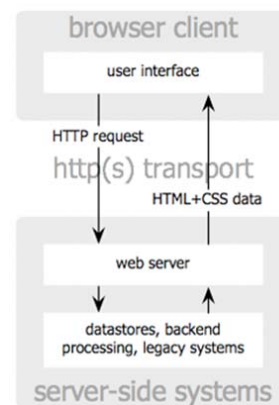

Fig. 1 Client-Server Architecture [1]

III. CURRENT IMPLEMENTATION

The web application has been very crucial in the business process. It has changed the way people complete their daily tasks which involve electronic business, computerized libraries and distance learning, as an example [7]. In simple words, the modern web application is a system that can be accessed through any browser regardless of the device which helps workers to complete their tasks [5]. The way software has been developing is crucial to determine the quality of the web [6]. Nowadays, a framework has been proposed as an

addon for SDLC to ensure the effectiveness of web development process in terms of time effective. It is consists of a library and tools for developing modern web application [5]. Compared to traditional web application, developers no longer need to rebuild every page from scratch [4]. Besides, the framework offers a very usefully and demanding architecture which is Model-View-Controller (MVC). The MVC is well known as "separate content from the presentation", which means the folder for the web interface and the back-end is on separate file [8]. Fig. 3 shows the MVC architecture. When a client sends an HTTP request, the controller gets the request and translates it into actions. The controller passes the action to the model and selects an appropriate view to handle the response. The view is the representation of the user interface triggered by the controller to present data. The view makes direct requests to the model without controller interferences. The Model function in the MVC is to manage all tasks related to data validation and session state control, and to minimize the level of complication of code the developers needs to write. It is responsible to maintain data in the application and respond to the request from the view action [9]. Thus, the MVC used by the framework is the most often used by developers in modern web development [8].

Fig. 2 Client-Side Architecture [1]

IV. LITERATURE REVIEW

A framework is a form of model that reuses programming which includes high-level design. Differing from other reuse techniques, framework is stated in a programming language, while the other reuse technique is depending on a special purpose design and necessitates special software tools [10]. Framework focuses on the few primary factors that characterize software development which are process coverage, process change ability, interposes coordination and site, product, deployment and policy abstraction [11].

Compared to the traditional software development method, framework includes support programs, a compiler, code libraries, a tool set and an application programming interface to bring out developer ingenuity and productivity allowing a

developer to focus on the software requirement rather than software structure, which allows for easier software development. One of the concepts is the loop event which allows the programmer to write a lot of code that can be written together rather than separately, as was the traditional way [7].
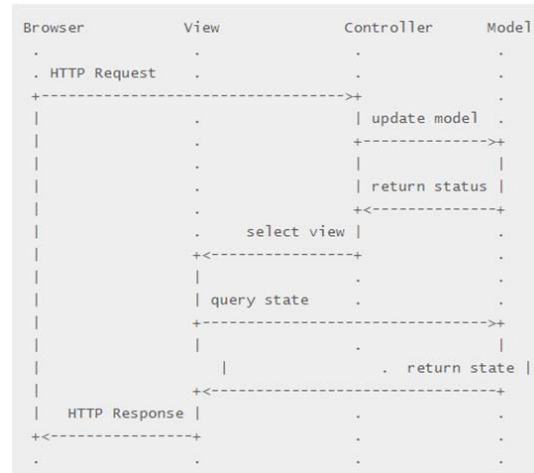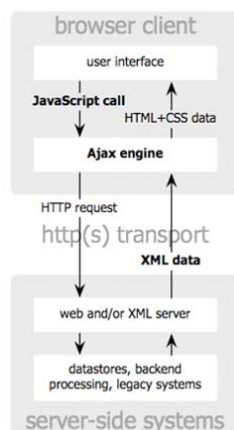

Fig. 3 MVC Architecture [1]

The main goal is to reuse existing frameworks or libraries rather than build codes from scratch [12]. The reuse model in web development must achieve its goals which are to improve time to market, lifecycle cost and web application quality [10]. Literally, web development requires the combination of multiple technologies in order to complete it [13]. It is crucial to improving the previous methods of web development which systematically reuse application code and design structures [13]. A framework can be found in four languages which are PHP, Ruby, Python, and Java [4].

The advantages of using the framework are its reusability [7]. By reusing the code, the cost of development can be minimized and it is easier for a developer to custom the web application [7]. The framework also solved a problem that previously occurred during web development through a standardized template for web development [4]. This problem has been solved before and it will make it easier to develop a new web application without thinking about the previous bug. Besides that, the framework allows more flexibility towards developer design style which allows them to design based on the application model [14].

The disadvantages of using the framework for web development are that certain frameworks are difficult to learn or implement which will take more effort from developer. [7]. The framework can be very costly since it requires experience and good developers for the development process to be executed [7].

Web application through library style defines developing the system using a number of external libraries to deliver feature-rich and high-quality software in a cost and time efficient manner [15]. This method is more towards recycling the existing libraries to minimize software development efforts

[12]. JQuery or Google Analytics are an example of libraries that been use for web development which are easier, cheaper and provide better quality [16].

An advantage of using a library for web development is that it provides high-quality code that helps in preventing errors. As well, this method helps to increase the productivity of a developer [16]. This method does not require the developer to reinvent the coding which helps in reducing web development time [17]. Research on GitHub projects with substantial size and found that 93.3% of the projects use third-party libraries [17].

Despite the advantages that web development through a library offers, there are some disadvantages to using it. The most common difficulty is software maintainability [15]. In using a third-party library, the migration towards new patches requires more effort to ensure the changes will not affect the current business process [15]. Another part is that by updating to the latest libraries, the web application might face a library stability problem [15]. In these cases, the library provider might update the patches frequently, which can lead to many versions of updates making the update process very complex [16]. As an example, JavaScript has become one of the most popular libraries used by developers which makes them relevant to update regularly to avoid those libraries depreciating [16].

Secondly, choosing a good library is crucial to ensure it matches the web requirement [17]. Developers are required to check manually from thousands of libraries which one matches with their web requirement [17]. In these cases, developers need to know all kinds of objects they require and the specific method sequence and match it with the specific library [12].

The last disadvantage of using a library for web development is that the developer needs to learn how to use such library methods properly; this is especially important for a inexperienced developers [17]. Even worse, those libraries are not well documented for developer reference [12]. Developers are required to learn and adapt to the library-style on their own.

V. Comparing Framework and Library Approach

A comparison regarding framework and library will be made based on reusability, flexibility, time-efficiency and cost-effectiveness. For reusability, it will compare which derived better reusability compared to each other. Reusability describes which method is easier for developers to reuse previous code. Both framework and library can provide reusability but they are effective in different ways. Reusability here means that developers are not required to develop code from scratch, but instead they can use the previous code without any error. In terms of flexibility, changes can be made to the functions available in framework, which allows to develop the web application based on the web requirement. For library, developers are required to follow the existing library to ensure no errors occur during compilation. Framework offers greater support and compatibility for heterogeneous website. Thus, it must be well documented for

future web enhancement [14].

In terms of time-efficiency, there are three factors to be considered such as time to learn, to choose models and to update patches. It is undeniable that framework is more complex which means that it will take more time to learn than library. However, once a developer gets used to working in framework, the time taken for web development will be reduced [7]. In the early stages, the time taken to complete web development using the library is fast, but when it comes to maintenance, developers are required to do so manually, a task which is time consuming. Time taken to update will be longer rather than framework. As well, the time taken for a developer to choose which library to use will take longer than when choosing the framework. There are lots of libraries for a developer to test, while for framework, the developer only has to choose the type of language and select the popular framework. Update time will be reduced using framework, since if there is an update, the provider will auto-update their framework. Contrary to library, developers are required to test if the update is compatible with their web application.

In terms of cost-effectiveness, it relies on the complexity of the websites; the more complex the website, the more time and effort required. The library is available in open source, which is free of charge, but is limited with regard to certain functions. However, framework can be expensive due to complex website which requires developer expertise. Since the library is an open source, developer need to be aware of the possibility of the library to be obsolete; no latest updates. It gives a huge impact to company in terms of cost because the existing web application will not be functioning well and requires developer to find other alternatives to replace the old one. Thus, the cost of rebuild the entire website is costly. On the other hand, framework makes it possible to rely on the provider for automatic updates, which will minimize the efforts of the developer.

TABLE I
COMPARISON BETWEEN FRAMEWORK AND LIBRARY

	framework	library
Reusability	Can reuse previous standard functions	Can reuse previous standard functions
Flexibility	Flexible. The developer can change a function based on the web requirements.	Non-flexible. The developer is required to follow existing code to avoid any bugs.
Time-efficient	**Time required to learn:** Longer due to it is high-scalable programming. **Time required to choose model:** Short. All frameworks are standardized depending on the programming language. **Time required to update:** Short. Auto updates by framework provider.	**Time required to learn:** Short because it is easy to learn. **Time required to choose model:** Longer, as the developer is required to ensure the functionality of the library to match with the web requirement. **Time required to update:** Longer due to compatibility checking.
Cost-effective	Costly at the early stage because it provides a variety of functions.	Cheap, but comes with limitation functions.

Table I shows a summary of the comparison between web development using a framework and a library. From this table, the impact to management and developer can be defined.

A. Company Management

This paper defines that the management is a group of members that lead an organization regardless of the business approach they use. Reusability, flexibility, time-efficiency and cost-effectiveness are the kinds of information used by management in defining their business process. Thus, it is the responsibility of the company to decide which method, library or framework, is the most suitable in developing a web application. As presented in Table I, this paper defined both methods in terms of company management perspectives. With regards to reusability, both framework and library can be reused, which helps in their production. Besides, the reusability factors contribute to rapid company development. Furthermore, flexibility helps to maintain the quality of the web application; and, similar web pages can be created with the same manners. Flexibility allows management to custom their own web application based on their requirements. Compared to library, the fewer functions offer requires management to spend more effort to meet company requirements. In regard to the time factor, framework is difficult for a new developer to understand. However, an experienced developer can make it easy and reduce the time taken to develop a web application using framework. On the other hand, library is relatively easy to use and understand by a developer. In terms of being time-consuming, choosing a library is a more tedious than in framework, since the developer is required to check each library one after another to ensure it meets the company's needs and wants. In addition, the developer needs to keep the library up-to-date in order to ensure business continuity. In the library, patches or updating it will take more time since developer is required to update manually. This can affect company business process, since it is necessary to wait for the update to complete. Compared to library, framework is more efficient in terms of time. For cost-effectiveness, it is undeniable that library is cheaper since it is open source; thus, is freely available and used. However, it requires continuous support from the community to keep the libraries up to date. On the other hand, framework tends to be costly in the beginning because it requires developer expertise to plan and build the entire website. However, the cost can be reduced in the end as code can be reused. In addition, the cost of maintenance remains low.

B. Developer

This paper defines the developer as a programmer who develops a web application regardless of the programming language they use. Based on the characteristics in Table I, the positive impact of reusability for the developer is very obvious, since this function can increase their productivity, requiring less time for them to develop new web applications. With regard to flexibility, framework offers more diversity in which the developer can customize different kinds of functions to fulfill business requirements. In terms of time-efficiency, a developer can choose to learn library as it is easy. However, they need to consider the time taken for library maintenance as they are required to manually patch the libraries from time to time. Instead, a developer can choose to learn framework, which requires more time to understand at the beginning; however, this can be justified as framework is relatively cost-efficient.

VI. Conclusion

This paper compares the library over framework model for developing web applications. Besides, it also briefly explains the impact of the models through company management and developer perspectives. In addition, this paper also shows the advantages and disadvantages of the models for company management and developers to decide which one is the best option for building web applications.

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