译文

PHP 框架在 web 应用开发中的可用性

摘要：一个框架定义为支持动态网站、web 应用程序和服务开发的结构。框架代码和设计通常是可重用的，用于辅助定制、资源服务和与 API 相关的任务。这项研究讨论了当前的实践，以帮助开发者理解 PHP 开发框架在 web 应用开发中的应用。本文选择了三种方法来理解 PHP 开发框架的特点：系统方法、评分标准评估和 PHP 开发框架的技术因素。比较了 23 种不同的框架特性,包括 ORM、代码生成器、模板引擎和 CURD 生成器。除了 PHP 框架特点，理解构建 web 应用程序的基本核心 PHP 将会对学习 PHP 框架有很大帮助。此外，新的开发者不应该仅仅局限于一个特定的 PHP 框架，还应该允许自己在 web 应用程序项目的开发中探索各种 PHP 框架。

1 介绍

PHP 最初是由 Rasmus Lerdoff 在 1994 年开发的，用于监控他的在线简历和相关的个人信息，PHP 最初将这些信息命名为“个人主页”。然而，两个项目 Zeev Suraski 和 Andi Gutmans 在 1997 年重建、更新并发布了 PHP 内核，并将首字母缩写 PHP 改为“超文本处理器”[9]。随着时间的推移，PHP 已经被用作万维网(WWW)或所谓的互联网的语言，开发人员发现 PHP 是一种易于学习、社区友好、作为开源软件可用且易于部署的语言。当前的 PHP 环境要求开发人员创建系统的接口组件，链接到数据库和用户身份验证。框架的使用可以通过重用代码来克服开发生命周期环境中的问题，从而节省设计、开发代码和测试的时间和成本[13]。本文探讨了在构建 web 应用程序中理解 PHP 语言和 PHP 框架的实践。任何希望采用 PHP 开发框架来构建 web 应用程序的开发人员应该了解 PHP 开发框架相关的基本概念，并掌握成为一个综合 web 应用程序开发人员所需的必要知识和技能这项研究的意义将为希望使用 PHP 开发网络应用程序的开发人员提供一个洞察力。开发人员将会对适合在他们的 web 应用程序开发环境中实现的 PHP 框架有更好的了解有关 PHP 开发框架的相关研究。

2 有关 PHP 开发框架的相关研究

PHP 是一种服务器端编程语言，通常用于网站开发。W3Techs [2]进行的研究发现，PHP 是网站开发中最流行的服务器端编程语言，如图 1[2]所示。

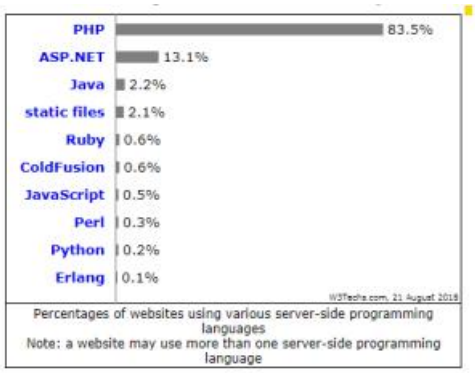


图 1：用于网站开发的服务器端编程语言

PHP 或者核心 PHP 是一种基本的编程语言，也可以用来开发动态网页。核心 PHP 没有库或内置的功能，通常开发人员必须使用他们的技能和逻辑编写代码脚本。另一方面，PHP 框架是一个框架，它在一个特定的架构中包含有组织的源代码，以支持动态网站应用程序和服务的开发[26]。

研究人员进行了一些比较研究，以确定哪些 PHP 框架能够为开发人员提供性能、开发过程和代码维护方面的更好特性。这些研究人员已经介绍了一些测试，如负载测试和压力测试，以衡量特定 PHP 开发框架的性能效率。该讨论涉及到与 PHP 开发框架相关的各种问题的适合性选择，用于指定的 web 应用程序开发。通常，这种比较是基于研究人员对某些 PHP 开发框架进行深入研究的兴趣。已经进行的一些 PHP 框架比较研究如下:

(1)CakePHP and CodeIgniter [10], [7].

(2)CakePHP, Yii, Zend, CodeIgniter, Pradoand Symfony [26].

(3)CodeIgniter, Laravel and 核心 PHP [6].

(4)Symfony, laravel, CodeIgniter, Phalcon and 核心 PHP [24].

(5)CakePHP, Laravel and CodeIgniter [15].

(6)CakePHP2, CodeIgniter, Symfony2, Yii and Phalcon [23].

(7)CakePHP,CodeIgniter,Laravel,Symphony,Yiiand ZendFramework [17].

这些研究大多选择 CakePHP 或 Codeigniter,或者两者都选择，与其他 PHP 框架，如 Yii，Zend，Prado，symfony，Laravel 和 Phalcon 进行比较。与几年前发布的其他框架相比，CakePHP 和 Codeigniter 自 2005 年和 2006 年发布以来已经使用了相当长的时间。这些研究也表明，希望学习 PHP 开发框架的开发人员应该首先了解 PHP 语言本身。除此之外，他们也可以通过学习 HTML，CSS，JavaScript 和 MYSQL 来理解 web 应用程序的基本开发理解框架需要管理现代软件开发的技术。PHP 开发人员可以在开发吸引人的应用程序方面有所接触，对设计模式的使用有清晰的认识，在更复杂的框架上阐明概念，了解协作模式，特别是设计和代码的重用，了解商业工具，运用 OOP 概念，了解强大而灵活的软件设

计中的 MVC 框架概念[28]。然而，要在最短的时间内选择最适合和最容易学习的 PHP 框架，需要仔细研究。最近，2018 年最受欢迎的 PHP 开发框架有 Laravel,CodeIgniter, Symfony, Phalcon 和 CakePHP [16]。然而，尽管 Laravel 是最受欢迎的，但是对于初学者来说对核心 PHP 和 OOP 的概念有很深的理解，比如类、对象、 属性、方法和其他框架特性是必不可少的。

3 PHP 框架概念

框架被定义为一个应用程序的骨架，其内置的相关对象集合被分解成框架代码或设计可重用的类。换句话说，框架是一组源代码组织成一个架构，支持动态网站、web 应用程序和服务的开发[26]。框架还协助进行定制、资源/服务和与 API 相关的任务[21]。

(1)PHP 框架的概念与面向对象编程(OOP)和模型视图控制器(MVC)有关。MVC 是一种应用软件开发概念的设计模式，最初的设计目的是为现代交互式应用程序虚拟地提供相同数据的多种视图[18]。MVC 模式允许多种类型的数据和方法之间的交互，并为应用程序开发中可能出现的问题提供了可能的解决方案[4]。MVC 模式有三个独立的应用组件，如下文[26]：模型-代表性数据结构关系和依赖关系，它提供了一个接口来操作与应用程序的逻辑对象相对应的所有类。

(2)视角-在不同的应用程序上表示屏幕显示，其中应用程序可以获得多个数据视图。

(3)控制器-表示为一个信息收集器或输入为用户和传输的信息到模型。

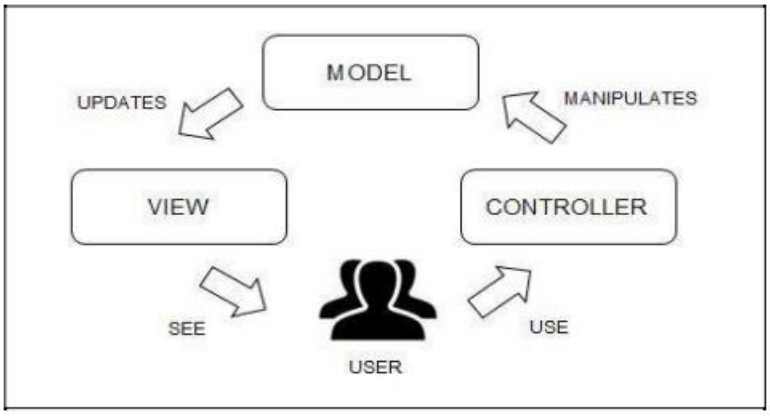
在 PHP 框架中使用 MVC 的想法是代码表示和布局将更加简单和分离，从而使应用程序保持可维护性。换句话说，控制器可以轻松地处理文件内部的视图和模型内部的逻辑。图 2 显示了 MVC 模式[20]中每个组件之间的交互流。基本上，MVC 通过有效地将流程划分为更小的步骤并将它们清晰地分开，从而改进了 PHP 的处理流程。使用 MVC 的动机如下[20] ：

(1)内置的库、辅助程序和较少的代码来开发应用程序功能。

(2)标准化、一致性和可预测性，并允许软件组件被共享和重用。

(3)可以很容易地看到整个系统是如何工作的。

(4)安全性、互操作性和维护性。此外，MVC 模式的神经学概念也在 PHP 框架中实现。OOP 是一种将数据、逻辑和交互抽象为一组对象的编程语言概念。面向对象的领域涉及了类、实例、方法、消息传递、继承、抽象、封装、多态性和解耦等概念[5]。然而，这项研究不会进一步讨论 OOP 概念。



4 选择 PHP 框架方法

任何有意在PHP框架方面积累知识和技能的开发人员都需要对web应用技术的发展趋势保持警惕。目前，有许多 PHP 框架具有独特的功能，因此应该仔细选择适合它们的框架。这个问题引起了如何选择正确的 PHP 框架的问题，因为选择可能取决于哪个 PHP 开发框架拥有庞大的用户基础和社区支持，有用的特性，流行的，趋势的和广泛使用的[4]。这项研究已经确定有三种方法可以用来确定哪些PHP开发框架应该为初学者或者任何希望在最初阶段完全理解PHP开发框架概念的人选择。该方法是一个系统的方法，评分标准的评价，和 PHP 框架/技术因素。

4.1 系统的方法

Parker [22]提出的系统方法描述了 it 课程选择软件工具中常用的方法。这项研究采用了系统化的方法来选择可用的 PHP 开发框架如下:

(1)编译 PHP 开发框架标准列表。

(2)加权 PHP 框架的每个标准。

(3)确定 PHP 开发框架列表。

(4)为每个 PHP 开发框架打分。

(5)计算每个 PHP 框架的加权得分。

系统化的方法要求每个 PHP 框架使用一些评估标准进行测试，例如性能、维护。 因此，PHP 框架的相关性可以通过测试过的每个框架的权重得分来确定。Milos 和 Zurkiewicz 进行的另一项研究建议，对 PHP 框架权重标准的评估应包括以下分析:

(1)文档和技术支持——确保源代码的可靠性。

(2)支持 web 应用开发的工具——通过生成源代码来减少程序员的工作量。

(3)编程技术——减少源代码数量以获得可靠的应用。

(4)数据库技术——允许应用程序与系统的其他元素集成。

(5)缓存(缓冲)——确保应用程序的最优性能。

(6)整合——确保与信息系统其他要素的兼容性。

(7)源代码的简洁性——减少在提高应用程序的可用性方面出错的可能性。

(8)框架效率——决定服务器工作负载，使资源得到充分利用。

因此，任何希望采用任何 PHP 框架来构建其系统或应用程序的组织都应该考虑提出的权重标准。

4.2 得分标准评估

另一种评估方法是采用评分标准/评价。分数标准评估采用了 Chao 等人的方法来确定哪个 PHP 框架对于初学者来说是相关的。Chao 的研究对 PHP 框架做了一些比较，比如 Zend CakePHP CodeIgniter Yii 和 SymFony。Chao 等人建议，任何组织，特别是高等教育机构，如果计划采用 PHP 框架来培养具有 PHP 技能和知识的学生，应该考虑以下评估分数的标准:

(1)教学特点——学生学习与初学者的框架复杂性有关的曲线[12] ，并有充足的时间学习至少四个月或一个学期以了解深层次的知识[22]。

(2)行业渗透——学生具有市场杀伤力，采用行业软件工具和技术将使学生接触未来的工作实践[14]。

(3)支持和培训要求——各方面的资源，例如文件的可用性、培训和对思维结构师和学生的支持[3]。

(4)软件成本——PHP 开发框架通常是开源软件。

(5)软件特性——大多数 PHP 开发框架具有类似的特性，在所有平台上都可以使用。

(6)课程方法/软件范例—— PHP 开发框架通常实现 MVC 设计模式。

(7)学术环境认可。

在这里输入译文关于 PHP 开发框架在课程中的适用性，Chao 等人讨论了在选择合适的 PHP 框架时，教学特性是最重要的。结果的每个标准元素的加权分数也表明 Yii PHP 框架与 CodeIgniter、 CakePHP SymFony 和 Zend [4]相比有着最高的评分。然而，在 ProKoFyeva 和 Boltunova 进行的另一项研究中，CakePHP 被认为是与 Zendd 相比最容易学习的 PHP 框架，CodeIgniter 和 SymFony 相对简单和复杂[23]。

因此，为初学者或黑人学生选择最合适的作品通常需要参与课程规划的院士进行广泛的研究和良好的实践经验。

4.3 PHP 开发框架技术因素

除了了解和学习 PHP 的标准外，PHP 框架的技术因素与 PHP 框架组件的适用性[29]是必不可少的，需要研究的内容包括与源代码相关的框架性能、框架文档的质量和技术支持的可用性。框架中已经内置的其他技术特性包括应用工具、支持技术和编程技术，也应该考虑如下:

(a)web 应用工具: 该框架最终与支持源代码元素开发的工具一起发布。这种工具可以加快开发应用程序源代码的进程，减少程序员的工作量，减少编程错误[29]。支持 MVC 模式的工具应该包含以下元素:

(1)模型——MVC 模式代表了业务逻辑中用于表映射的一个问题。

(2) CRUD——(创建、读取、更新和删除)工具能够对数据库记录进行基本操作。

(3)控制器——类负责 MVC 模式中控制器的功能。

(4)视图—— MVC 模式元素。

(5)形式——单个类或类组负责条目数据的呈现和验证。

(6)模块——分离功能，确保源代码在项目之间的可移植性。

(b)支持技术和程序设计技术: 支持技术和程序设计技术根据 web 应用项目开发的框架效用而有所不同，如下[29]，[17]：

(1)模型-视图——控制器(MVC)。

(2)对象关系映射(ORM)——用于映射数据库对象和编程语言类之间的关系的技术。

(3)代码生成器——生成视图、控制器、路由、迁移和格式请求等资源。

(4) DB 对象——支持对数据库的访问。

(5)模板——管理中的支持技术,模板（两步视图或复合视图）。

(6)缓存——用于存储中间结果的技术。

(7) AJAX 框架提供了提高性能和简化源代码的类。

(8)模块-将源代码划分为功能组，以提高项目之间源代码的管理和可移植性。

(9) EDP(事件驱动编程)源代码组织技术。

(10)名称空间-提供更好的源代码管理。

因此，PHP 框架技术将简化 web 应用程序开发的复杂性。目前，有 42 种不同类型的 PHP 框架用于 web 应用程序开发[11]。然而，这项研究只比较了表 1 中所示的 21 个 PHP 框架特性。其他的框架，如 Flight, Meedo, Simple MVC, PHP Mini, Silex (在 2018 年 6 月到达了它的生命尽头)，Typo3 Flow，Guzzle PHP，YAf，Akelos PHP，Qcodo，EvoCore，Stratus，Seagul，Maintenable，Limb，Phocoa，AJAXAc，ZOOP，BluesShoes，Incumul and PHPdevshell，这些都没有列在表 1 中，因为关于这些框架的内部信息不会在本文中被深入讨论。在选择 PHP 框架时应考虑的特性有 ORM、代码生成器、 模板发动机和 CURD 生成器。

框架中的模板引擎在分离应用程序逻辑和显示逻辑方面非常有用，因此后端开发人员和前端开发人员可以在网站的同一领域进行协作，并且不会互相干扰代码。通用的模板引擎有刀片引擎，胡子引擎，自作聪明引擎，树枝引擎和伏特引擎。

(c)PHP 微框架：微框架是专门为简化小型网站的开发而设计的。它们通常不具备表 1 中列出的其他框架所提供的一些先进特性。更少的功能和模块使其轻量级和快速。因此，微型框架和小型网站之间的整合不会影响其性能和用户体验。每个微框架都提供了小型网络应用程序的开发特性，同时减少了开销并简化了部署。下面列出的是 PHP 微框架:

(1) Laravel - laravel.com
(2) Symfony - symfony.com
(3) CodeIgniter - codeigniter.com
(4) Yii Framework - yiiframework.com
(5) Phalcon - phalcon.com
(6) PHPixie - PHPixie.com
(7) Slim - slimframework.com
(8) POP PHP - popPHP.org
(9) Fat-free - fatfreeframework.com
(10) Limonade - limonade-PHP.github.io

5 讨论和结论

PHP 开发框架需求决策也非常重要，需要考虑是使用框架还是从头开发。在使用框架开发 web 应用程序时，有一些至关重要的要求需要考虑，如表 2 所示的使用框架的优点和缺点[25]。

除了表 2 中讨论的优点之外，PHP 框架对于大型复杂的 web 应用程序来说是足够的，但是对于小型简单的 web 应用程序来说，框架的好处不能被充分利用，理由应该是框架的使用是否足够充分，是否需要彻底的考虑或评估[27]。另一方面，核心 PHP 没有任何额外的库，开发人员应该有很强的编程技能和逻辑。因此，拥有强大核心 PHP 基础的开发人员会发现 PHP 开发框架更容易理解，特别是如果对 PHP 的基本知识，如函数、类和方法都非常精通的话。

对于那些希望开始使用框架的开发者来说，了解核心 PHP 来构建 web 应用程序将有助于改进整个 web 开发，开发者不会仅仅局限于某个特定的 PHP 框架。开发初学者还应该考虑学习赵等人讨论过的最简单的框架，以建立他们的知识和技能信心水平。另一个需要考虑的重要因素是框架选择标准，例如积极开发或改进

的内置特性，来自服务提供商的持续支持，以及遵循软件工程实践。最后，结论是 PHP 开发框架的选择取决于相应的 web 应用项目，每个项目都有不同的要求或特点，有时这个选择可能不太适合下一个新项目。

因此，希望开始使用框架的开发人员需要了解核心 PHP 来构建 web 应用程序。这些知识将有助于改进整个 web 开发，开发者不会仅仅局限于一个特定的 PHP 框架[19]。初学者/开发者还应该考虑学习 Chao 等人讨论的简单框架，以建立他们的知识和技能的信心水平。另一个需要考虑的重要因素是框架的选择标准，如内置功能的积极开发或改进，不断支持服务提供商和遵循软件工程实践。最后，结论是 PHP 开发框架的实现取决于 web 应用程序项目，在这个项目中，每个项目都有不同的需求或特性，有时候选择并不完全适合下一个新项目。

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PHP Frameworks Usability in Web Application Development

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Abstract*:*A framework defined as a structure thatsupports the development of dynamic websites, web applications, and services. Framework code and design are often reusable to assist customization, resource service, and API-related tasks. This study discussed current practice to help a developer understand PHP frameworks adoption for web application development. Three approaches were selected to understand the features suitability of the PHP frameworks: the systematic approach, corescriteria evaluation, and PHP framework technical factors. A comparison of 23 different frameworks features also has been studied that involves features such as ORM, Code Generator, Template Engine, and CRUD Generator. Besides PHP framework features, understanding the basic corePHP to build web application would help a lot in learning PHP frameworks. Moreover, new developers should not limit themselves to a particular PHP framework only but also allow themselves to explore various PHP frameworks in the development of web application projects.

Index Terms: PHP framework, Web Application, User Experience, Usability

I. INTRODUCTION

PHP was initially developed by Rasmus Lerdoff in 1994 to watch over his online resume and related personal information in which PHP initially named as" Personal Home Page". However, two programmers Zeev Suraski and Andi Gutmans rebuilt, updated and released the PHP core in 1997 and changed the acronym PHP to" Hypertext Processor" [9]. Through time PHP has evolved and PHP has been used as a language for the World Wide Web (WWW) or so called Internet in which developers find PHP is a language that easy to learn, community friendly, freely available as an open source software and easily to deployed. The current PHP environment requires developers to create interfaces components of the system, link to database and user authentication. The usage of framework could overcome the problems during development life cycle environment by reuse of code which could save times and costs to design, developing codes and tests [13]. This study discussed on the current practice to understand PHP language and PHP frameworks in building web application. Any developer who wished to adopt the PHP framework to build web applications should understand on the basic concept related to PHP framework and grab the necessary knowledge and skill required to become a competent web application developer. The significance of this study will provide an insight for developers who wished to develop web application using PHP frameworks. Developers would have better knowledge on which PHP frameworks that are suitable to be implemented in their web application development environment.

II. RELATED STUDIES ON PHP FRAMEWORKS

PHP is a server-side programming language which commonly used for websites development. The studies conducted by W3Techs [2] has identified that PHP is the most popular server-side programming languages for websites development as shown in Figure1 [2].

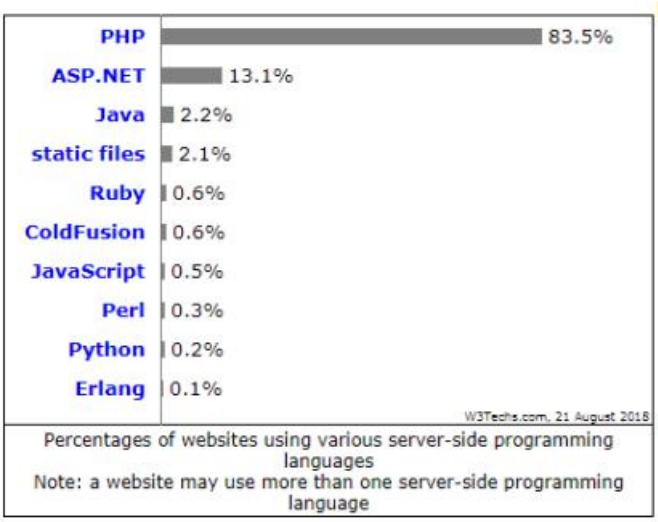


Figure 1: Server-side programming languages for websites development

PHP or corePHP is a basic programming language which could also be used to develop dynamic web pages. The corePHP works without libraries or built-in functionalities and usually developers have to make the code script using their skills and logic. On the other hand, PHP framework is a framework that consist a collection of organized source codes in a specified architecture to support the development of dynamic websites applications and services [26].There are a few comparison studies have been conducted by researchers to identify which of PHP frameworks would provide developers with better features regarding performance, development process and code maintenance. These researchers have conducted several testing such as load testing and stress testing to measure the performance efficiency on the specified PHP frameworks. The discussion involved the suitability choices on various issues related to PHP frameworks for specified web application development. Usually, the comparison made based on the researchers' interest to study in depth on certain PHP frameworks. A few PHP frameworks comparison studies which have been conducted are as follows:

1) CakePHP and CodeIgniter [10], [7].
2) CakePHP, Yii, Zend, CodeIgniter, Pradoand Symfony [26].
3) CodeIgniter, Laravel and corePHP [6].
4) Symfony, laravel, CodeIgniter, Phalcon and corePHP [24].
5) CakePHP, Laravel and CodeIgniter [15].
6) CakePHP2, CodeIgniter, Symfony2, Yii and Phalcon [23].
7) CakePHP, CodeIgniter, Laravel, Symphony, Yii and Zend Framework [17].

Most of these studies have chosen either CakePHP or Code Igniter or both in comparing with other PHP frameworks such as Yii, Zend, Prado, Symfony, Laravel and Phalcon. CakePHP and CodeIgniter have been used for quite some time since their release in 2005 and 2006 respectively compared with other frameworks which are released a few years ago. These studies also suggest developers who wished to learn PHP frameworks should have first knowledge of the PHP language itself. Besides, they might as well learned HTML, CSS, JavaScript and MySQL to have a firm understanding of the fundamental development of web application. Understanding frameworks require

techniques in governing modern software development. The PHP developers would have exposure in developing appealing application, clear view on the use of design patterns, illustrate the concepts on more complex GUI frameworks, understanding the collaboration pattern especially the reuse of design and code, exposure on the commercial tools, utilization of the OOP concepts [4] and understand the MVC frameworks concepts in displaying powerful and flexible software design [28]. However, to choose which PHP frameworks most suitable and easy to learn in the shortest time requires careful studies.

Recently, the most popular PHP frameworks in 2018 as discussed in a survey by Lunarpages are Laravel,CodeIgniter, Symfony, Phalcon andCakePHP [16]. However, even though Laravel is the most popular but for beginners strong understanding of corePHP and OOP concepts such as classes, objects, properties, methods and other framework features is essential.

III. PHP FRAMEWORKS CONCEPT

A framework is defined as the skeleton for an application with a built in collection of related objects, factored into classes in which the framework code or design are reusable [8]. In other words, a framework is a collection of source codes organized into an architecture that supports the development of dynamic websites, web applications and services [26]. Frameworks also assist for customization, resource service and API-related tasks [21].

1) The concept of a PHP framework is related to Object Oriented Programming (OOP) and Model View Controller (MVC). MVC is a design pattern that applies the concept of software development and originally designed to provide multiple views of the same data virtually for modern inter- active applications [18]. The MVC pattern allows the interaction of data and methods in multiple classes and offers possible solutions to problems which could arise in the application development [4]. MVC pattern has three separate application components as follows [26]: Model —represent data structure relationship and dependencies which provides an interface to manipulate all classes corresponding to the logical object of the application.

2) View —represent screen presentation on different de- vices in which the application could have multiple views of the data.

3) Controller —represent as an information collector or input for the user and transfers the information to the model.

The idea of having MVC in PHP frameworks are the code presentation and layout will be simpler and well separated that will make the application more maintainable. In other words, the controller could easily handle the view inside the files and the logic inside the model [1]. Figure 2 shows the interaction flows between each component in MVC pattern [20]. Basically, MVC would improves the PHP processflow by effectively divided the flow into smaller steps and separate them clearly. The motivations in using MVC are as follows [20]:

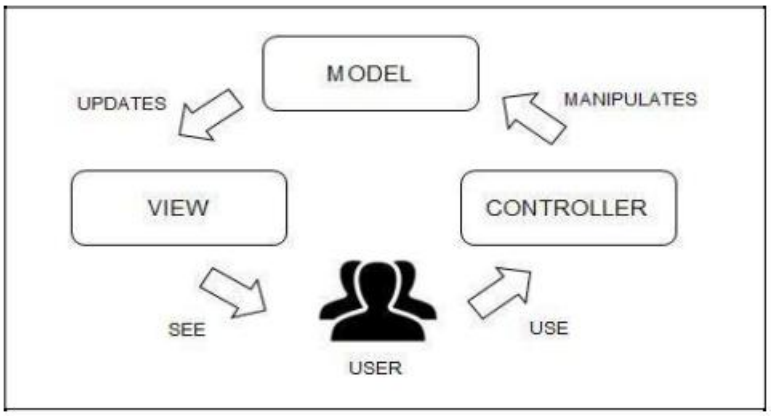
1) Built in libraries, helpers and less codes to developed application functionality.

2) Standardize, consistency and predictability and allow software components to be shared and reused.

3) Allows easy visualization on how the entire system works.

4) Security, interoperability and maintenance. Besides MVC pattern the OOP concept is also implemented in PHP frameworks. OOP is aprogramming languages concept which abstract the data, logic and interactions into a set of objects. The areas of Object Oriented (OO) involves the concept such as class, instance, method, message passing, inheritance, abstraction, encapsulation,

polymorphism and decoupling [5]. However, this study will not discuss further on the OOP concepts.



IV. THE SELECTION OF PHP FRAMEWORKS APPROACH

Any developers who have the intention to build knowledge and skill regarding PHP frameworks requires to be vigilant on the current trend regarding the development on web application technologies. Currently, there are many PHP frameworks with unique features, thus careful selection should be made to identify which framework is suitable for them. The question aroused how to choose the right PHP frameworks because the choice might depend on which PHP frameworks that have a large user base and community support, useful features, popular, trendy and widely used [4]. This study has identified that there are three approaches could be conducted to identify on the choice on which PHP frameworks should be selected for beginners or anybody who wished to fully understand the concept of PHP frameworks at the initial stage. The approach is a Systematic approach, S 核心 Criteria Evaluation, and PHP framework technical factors.

A. Systematic Approach

The systematic approach proposed by Parker [22] described the commonly approach used in selecting software tools for the IT curriculum. This study adopted the systematic approach on the selection of the suitable PHP frameworks as follows:

1) Compile the PHP frameworks criteria list.
2) Weight each of the criteria of the PHP frameworks.
3) Determine the PHP frameworks list.
4) Rate each of the PHP frameworks.
5) Calculate the weighted core for every PHP framework.

The systematic approach requires each of the PHP frameworks to be tested using a few evaluation criteria such as performance, maintenance,suitability, and other software assessment evaluation. Hence, the relevance of the PHP frameworks could be determined through the weight core of each PHP frameworks that have been tested. Another study conducted by Milos and Zurkiewicz [17] suggested that evaluation on PHP frameworks weight age criteria should include these analyses as follows:

1) Documentation and technical support—to ensure the source code reliability.
2) Tools are supporting web application development—to reduce programmer’s workload with generated source codes.
3) Programming techniques—to reduce the amount of source code for a reliable application.

4) Database technologies—to allow applications to integrate with other elements of the system.
5) Caching (Buffering)—to ensure optimum performance application.
6) Integration—to ensure compatibility with other elements of IT system.
7) Conciseness of source code—to reduce the possibility of making mistakes in improving the reliability of the application.
8) Framework efficiency—important to determine the server workload so the resources could be used intensively. Therefore, any organization who wished to adopt any PHP frameworks for building their IT system or application should consider the weight criteria as proposed.

B. Score Criteria Evaluation

Another assessment approach is using core criteria evaluation. The core criteria evaluation is adopted from Chao et al. [4] to identify which PHP framework is relevant to be learned or taught for beginners. Chao studies has makes a few comparison of the PHP frameworks such as Zend, CakePHP, CodeIgniter, Yii, and Symfony. Chao et al. suggested any organization especially Higher Education Institution(HEI) which have planned to adopt PHP frameworks in preparing their students with PHP skills and knowledge should consider these evaluative scores criteria as follows:
1) Pedagogical features—students learning curve associated with framework complexity for beginners [12] and ample time to study in at least four months or a semester for in-depth understanding [22].
2) Industry penetration—students have marketable skills and the adoption of industry software tools and technologies will expose students with future workplace practices [14].
3) Support and Training requirement—resources on various aspects such as availability of documentation, training and support for both Instructors and students [3].
4) Software Cost—PHP frameworks usually are open source software.
5) SoftwareCharacteristics–Most PHP frameworks have similar features and are available on all platforms.
6) Course Methodology / Software Paradigm–PHP frameworks usually implement an MVC design pattern.
7) Acceptance in Academic Environment–perception about PHP frameworks suitability in ITcurriculum. Chao et alstudy discussed that pedagogical features are the most important in choosing the right PHP frameworks. The weighted core for each criteria elements of the result also suggested that the Yii PHP framework has the highest ratings compared to CodeIgniter, Cake PHP, Symfony, and Zend [4]. However, in another study conducted by Prokofyeva and Boltunova,, the CakePHP is identified as the easiest PHP framework to learn compared to Zend which is quite complex,CodeIgniter and Symfony are moderately easy and complex[23]. Therefore, selecting the most appropriate framework for beginners or students in HEI usually requires the academician involves in the course planning should do extensive research and well versed hands-on experience [4].

C. PHP Framework Technical Factors

Apart from understanding the criteria in learning PHP, the PHP framework technical factors which are related to the PHP framework components suitability [29] are essential to be studied such as the performance of the framework related to the source code, the framework documentation quality and availability of technical support. Other technologies feature that already built in the PHP frameworks are application tools, support technologies and programming technique should also be considered as listed follows:
a) *Web Application Tools:* The frameworks usually distributed together with tools that support the

development of the source code elements. The tools could speed up the process of developing the source code of an application, reduce programmer's workload and decrease programming mistake [29]. The tools that support the MVC patterns should have the following elements:

1) Models —MVC pattern represent a problem subject to business logic in which models is use for table mapping.

2) CRUD — (Create, Read, Update and Delete records) tools enable to perform basic operations on the database record.

3) Controller —classes are responsible for the functionality of a controller in MVC pattern.

4) Views —MVC pattern elements.

5) Forms —single classes or groups of classes responsible for rendering and validating logic of entry data.

6) Modules—separate functionality and ensure the portability of the source code between projects.

b) Support Technologies and Programming Technique: The support technologies and programming techniques vary based on the framework usefulness for the development of web application project as follows [29],[17]:

1) Model-View-Controller (MVC).

2) Object Relational Mapping (ORM) - technique for mapping database objects and relationship between programming language classes.

3) Code generator - generate resources like views, controllers, routes, migrations and form requests.

4) DB objects - support access to databases.

5) Templates - support techniques in managing templates (two step view or composite view).

6) Cache - technique for storing intermediate results.

7) AJAX - frameworks provide classes that increase performance and simplify source code.

8) Modules - divide source code into functionality groups which improves management and portability of source code between projects.

9) EDP (Event Driven Programming) - source code organization technique.

10)Name space - provide better source code management. Consequently, the PHP frameworks technologies are to simplify the complexity of the development of web applications. Currently, there are 42 different type of PHP frameworks for web application development [11]. However, this study only compare 21 PHP frameworks features as shown in Table 1. Other framework such as Flight, Meedo, Simple MVC, PHP Mini, Silex (reached its end of life in June 2018), Typo 3 Flow, Guzzle PHP, YAF, Akelos PHP, Qcodo, evoCore, Stratus, Seagul, Maintainable, Limb, Phocoa, AJAXAc, ZOOP, BlueShoes, Recess and PHPDevShell that are not listed in Table 1 will not be discussed deeply in this paper because the insufficient information regarding the frameworks. The features that should be considered in the selection of PHP frameworks are ORM, Code Generator, Template Engine and CRUD Generator. Template engine in a framework is useful in separating between application logic and display logic, therefore the back-end developers and front-end developers could collaborate on the same areas of the website and they will not interfere with each other codes. The common template engines are Blade, Mustache, Smarty, Twig and Volt.

c) PHP Micro-framework: The micro-frameworks are designed specifically to simplify development of small websites. They usually do not have some of the advanced features provided by other frameworks listed in Table 1. The fewer features and modules make it lightweight and fast. Therefore, integration between the micro-framework and small website will not be affecting its performance and

user experience. Each micro-framework offers features to up development ofsmall web application, while reducing overheads and simplifying deployment. Listed are the PHP micro-frameworks.

1) Laravel - laravel.com
2) Symfony - symfony.com
3) CodeIgniter - codeigniter.com
4) Yii Framework - yiiframework.com
5) Phalcon - phalcon.com
6) PHPixie - PHPixie.com
7) Slim - slimframework.com
8) POP PHP - popPHP.org
9) Fat-free - fatfreeframework.com
10) Limonade - limonade-PHP.github.io

V. DISCUSSION AND CONCLUSION

The PHP framework requirement decision is also important to be put into consideration whether to use a framework or develop from scratch. There are a few requirements that vital to be considered in the development of web application using framework as shown in Table 2 on the advantages and disadvantages using frameworks [25]. Besides the advantages discussed in Table 2, PHP frameworks exploitation is adequate for a large and complex web application, however, for the small and simple web applications the benefits of frameworks could not be fully utilized, and justification should be made whether the framework usage is over sufficient and thorough consideration or evaluation is required [27]. On the other hand, the corePHP works without any extra library and developers involved should have strong programming skill and logic. Consequently, developers with a strong foundation of corePHP would find PHP frameworks are much easier to understand especially if the basic knowledge of the corePHP such as functions, classes, and methods is deeply well-versed. Looking at this situation for developers who wished to start using frameworks, understanding corePHP to build web application would amazingly help to improves the web development as a whole and developers will not limit themselves to a particular PHP framework only [19]. The beginner developer should also consider learning the easiest framework as discussed by Chao et al [4] to build their knowledge and skills confidence level. Another important thing that should be considered is the framework selection criteria such as built-in feature actively developed or improved, continuous supported from service provider and follow the software engineering practices. Lastly, the conclusion is the choice of the PHP framework is dependent on the web application project in which every project has different requirement or features and sometimes the choice might not quite suitable for the next new project. The PHP framework requirement decision is also important to be put into consideration whether to use a framework or develop from scratch. There are a few requirements that vital to be considered in the development of web application using framework as shown in Table 2 on the advantages and disadvantages using frameworks [25]. Besides the advantages discussed in Table 2, PHP frameworks exploitation is adequate for a large and complex web application, however, for the small and simple web applications the benefits of frameworks could not be fully utilized, and justification should be made whether the framework usage is over sufficient and thorough consideration or evaluation is required [27]. On the other hand, the corePHP works without any extra library and developers involved should have strong programming skill and logic. Consequently, developers with a strong foundation of

corePHP would find PHP frameworks are much easier to understand especially if the basic knowledge of the corePHP such as functions, classes, and methods is deeply well-versed. Therefore, developers who wished to start using frameworks are require to understand the corePHP to build web application. The knowledge would amazingly help to improves the web development as a whole and developers will not limit themselves to a particular PHP framework only [19]. The beginner developer should also consider learning the easiest framework as discussed by Chao [4] to build their knowledge and skills confidence level. Another important thing that should be considered is the framework selection criteria such as built-in feature actively developed or improved, continuous supported from service provider and follow the software engineering practices. Lastly, the conclusion is the choice of the PHP framework is dependent on the web application project in which every project has different requirement or features and sometimes the choice might not quite suitable for the next new project.

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