CHAPTER II
LITERATURE REVIEW

2.1 Literature Review

According to the research by Ouni, Kessentini, Sahraoui, Inoue, & Deb (2016) with the title of “Multi-Criteria Code Refactoring Using Search-Based Software Engineering: An Industrial Case Study”, concluded that refactoring is one of the most used technique to enhance the overall quality of the existing software. While it’s crucial to propose refactorings that advance the structure and quality of the software, other standards are also important to consider, such as preserving the semantics of the software design, reducing the number of code changes and lines with every refactoring, and being consistent with the previously applied refactorings.

In research by Kim, Jang-Eui, Iichul, & Sang-Ho (2016) entitled “Code Refactoring Techniques for Reducing Energy Consumption In Embedded Computing Environment”, they defined code refactoring as the process of restructuring existing source code without altering its external behavior to enhance maintainability and reusability of software components by improving nonfunctional attributes of the software. One of the nonfunctional attributes that are often ignored is energy consumption. Reducing energy consumption can help to provide endurable services based upon a finite power resource. They also defined energy-consuming constructs as suspicious codes that are suspected to consume a lot of energy and develop the related techniques to remove these constructs.

Based on a journal by Vashisht, Sanjay, & Sushma (2018) titled “Analysing Impact of Code Refactoring on Software Quality Attributes”, they explained that software has two types of quality attributes, both internal and external. Internal attributes use software metrics to predict the value of itself in finding the impact of refactoring on software quality. These are factors that can be measured directly e.g. number of classes and lines of codes. And external attributes refer to reusability, flexibility, functionality, understandability, extendability, and effectiveness. These are factors that cannot be measured directly e.g. understandability and maintainability. The external attributes are dependent on internal quality attributes.
or software metrics. Bad smells also explained in this journal, referred it as the indication of something wrong in the code that requires refactoring. And refactoring has two steps. First is analysis, to determine whether the desired pre-conditions are satisfied or not and detect whether bed small occur in the software or not. After the first step is fulfilled, then the second step is execution, the actual transformation of source code by applying refactoring techniques to remove bad smells that are found in the first step.

Meanwhile, as mentioned in an article by Majchrzak, Biørn-Hansen, & Grønli (2018) with the title “Progressive Web Apps: the Definite Approach to Cross-Platform Development”, although software development has matured, cross-platform development remains a preeminent topic. Apps should naturally support different operating systems, they ought to operate smoothly on various devices and compatible with a different host of platform versions. And with the addition of developing device categories, multi-platform support has become more difficult. The problem-solving technology remains to be found, but Progressive Web Apps (PWA) might be a step towards. Since the industry started to embrace PWAs.

For the last, based on a journal written by Majchrzak, Biørn-Hansen, & Grønli (2018b) entitled “Progressive Web Apps for the United Development of Mobile Applications”, they described Progressive Web Apps (PWAs) as an approach for web applications to be developed as an online-first app, enabled web apps to be downloaded, installed and used offline on various operating systems or platforms.

Table 2.1 Literature Review and Summary

<table>
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<tr>
<th>Author</th>
<th>Year</th>
<th>Title</th>
<th>Summary</th>
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<tbody>
<tr>
<td>Tor-Morten Gronli, Andreas Biorn-Hansen, Tim A. Majchrzak</td>
<td>2018</td>
<td>Progressive Web Apps for the United Development of Mobile Applications</td>
<td>This article compares PWAs against other cross-platform app development approaches. And explained, how PWAs differ from normal websites.</td>
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<td>Authors</td>
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<tr>
<td>Himanshi Vashish, Bharadwaj Sanjay, Sharm Sushma</td>
<td>2018</td>
<td>Analyzing of Impact of Code Refactoring on Software Quality Attributes</td>
<td>The journal list down different kind of software quality attributes and steps in software refactoring.</td>
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<tr>
<td>Andreas Biorn-Hansen, Tor-Morten Gronli, Tim A. Majchrzak</td>
<td>2018</td>
<td>Progressive Web Apps: the Definite Approach to Cross-Platform Development?</td>
<td>The researchers analyze the foundations of PWAs in cross-platform development and inspect the status quo of current possibilities.</td>
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<tr>
<td>Marouane Kessentini, Houari Saharaoui, Katsuro Inoue, Kalyanmoy Deb, Ali Ouni</td>
<td>2016</td>
<td>Multi-Criteria Code Refactoring Using Search-Based Software Engineering: An Industrial Case Study</td>
<td>This journal referred refactoring as one of the widely implemented techniques to improve the quality of existing software.</td>
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<tr>
<td>Kim Doohwan, Hong Jang-Eui, Yoon Ilchul, Lee Sang-Ho</td>
<td>2016</td>
<td>Code Refactoring Techniques for Reducing Energy Consumption In Embedded Computing Environment</td>
<td>In this literature work, the researchers focused on suggesting new refactoring techniques for reducing energy-consuming codes in an embedded computing environment.</td>
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With the reference of all research articles above, the writers will implement the related technologies that are mentioned as the solutions to solve problems regarding user experience of web development.

### 2.2 Theoretical Basis

#### 2.2.1 Computer Science

Computer science emerged from Babbage’s Analytical Engine with Ada Lovelace’s programming (to 1871) and from mathematics with Godel’s incompleteness theorem(1931). Computer science is an element of the school timetable, a field of study in the school curriculum. The popularity of computer
science since World War II has led to the massive growth of Information Technology in every aspect of human life (Fluck et al., 2016). Computer science is often considered as programming or contemplated to be entirely mathematical or even something based on particular technologies. It also refers to the scientific discipline encompassing principles such as algorithms, data structures, systems architecture, design, problem-solving and many more (Webb et al., 2017).

2.2.2 Information Technology
The use of computers literally anywhere, from industry, commerce, the arts and so on, involving using software packages, aspects of IT systems architecture, project management, and human factors, etc (Webb et al., 2017).

2.2.3 Computing
The broad subject area consists of IT, Computer Science, digital literacy and problem-solving in the context of deploying computational thinking (Webb et al., 2017).

2.2.4 Programming
A process of analysis or understanding problems, identifying and evaluating potential solutions, then generating algorithms in the code of a particular language as the solutions, also involves testing and debugging to formulate solutions into executable computer programs (Webb et al., 2017).

2.2.5 Software Engineering
Software engineering is the systematic application of engineering approaches to the development of software. Understanding about the program and possessing the skill to debug and fix errors are essential skills of software engineering (Nivala, Hauser, Mottok, & Gruber, 2016). Software engineering becomes the main focus in recent years, as it plays more and more important role in everyday life (Gold-Veerkamp, Abke, & Diethelm, 2017).

2.2.6 Web Development
Among different types of IT and programming development. Web development is one of the most popular, with a focus on the design and development of websites and web-based applications (Haq, Raja, Nosheen, & Sajjad, 2018).
2.2.2 Cross-Platform Development
Software developers choose to use the cross-platform approach to develop apps once and run it on many platforms (El-kassas, Abdullah, Yousef, & Wahba, 2017). The approach has emerged as a good alternative to native development. It not only allows apps to run on multiple platforms but also decreases the cost, effort and development time. In addition to the increased delivery time and easy maintainability (Dimovska & Trajkovik, 2017). Cross-platform development is classified into four approaches: Web Approach, Hybrid Approach, Cross-Compiled Approach, Interpreted Approach. An appropriate approach needs to be chosen according to the app types. The app types are classified into client-server apps, server data-driven, sensor/IO based, standalone.

2.2.4 Website
The website is a collection of web pages, which are normally served through a single web domain. The initial web page of a website is called the index page, the page is served by the webserver when a user queries the domain name or IP address of the corresponding website (Panchenko et al., 2016). In the days that everyone has access to the internet at any given time, making a website just makes more sense. Not just a website that connects between web pages, but one that is mobile friendly and offers native features (Mckinley, 2018).

2.2.5 User Experience (UX)
The UX is provided by developers to serve the website with quality, design, and usability. Such as meaning, context, aspect, environment and many more (Gómez-López, Simmaro, & Bonal, 2019). The website or any software needs to be cultivated to such a degree in order to provide a great user experience. UX refers to the perceived attractiveness, ease of use, degree of usage or utility of the product (Rajanen, Clemmensen, Iivari, Inal, & Sivaji, 2017).

2.2.6 Progressive Web App (PWA)
Progressive Web App is the new approach to develop apps with the combination of web technologies’ ease of use and the versatility of native apps (Majchrzak et al., 2018a). Progressive refers to the concept of Progressive Enhancement, which stands upon the idea that products like a website can
progressively become more advanced and better depending on the device and browser of a user (Biorn-Hansen, Majchrzak, & Gronli, 2018).

2.2.11 Integrated Development Environment (IDE)

IDE is a tool that comes with all the features that are needed for the developers during different phases of software development. It provides integrated debuggers, automated refactorings, even assistance tools like integrated version control and code completion (Amann, Proksch, Nadi, & Mezini, 2016).

2.2.12 Forum Kerukunan Umat Beragam (FKUB)

FKUB is an institution with roles to maintain and harmonize the religious communities of a particular area in Indonesia (Kaharuddin & Darwis, 2019). Also a meeting forum for religious leaders, which is directly funded and fostered by the local government. This forum operates for communication between religious communities with the aim of rejecting the acts of anarchism. Because religious rights are human rights that cannot be abused under any circumstances (Mudha, 2019).

2.2.13 E-Government

E-Government aims to improve the accessibility of information, services, and transactions by using the information and communication technologies including but limited to the computers, the internet, mobile devices and automation equipment (Al-Sai & Abualigah, 2017). E-Government often refers to the citizens, businesses interact with government institutions electronically. The success of e-government can be influenced by the access, the competencies and the usage of it. Meanwhile, the most important success criteria are the citizens’ acceptance and usage (Meiyanti, Misbah, Napitupulu, Kunthi, & Indah, 2017).

2.2.14 Unified Modeling Language (UML)

UML is a collection of modeling languages in the field of software engineering that is intended to provide a standard way to visualize the design and architecture of systems.
1. Use Case Diagram
Use case diagram is a series of system actions from the end user’s perspective. It uses circles to represent an object, person, or even external system and other actors that come in contact with the application itself (Huang, 2017).

2. Entity Relationship Diagram
Entity Relationship Diagram (ERD) is a visualization of a group of entities, with each entity consists of many attributes. The relation and interaction between entities are also visualized here. It is an abstract representation in graphic form to present database structure in an information system. ERD can then be mapped into tables by database administrators to create a complete relational database.

3. Sequence Diagram
Sequence Diagram is an interaction-based diagram that is arranged sequentially. The time continues as you fluctuate the page, what and when the events occur, it illustrates how each operation goes through (Huang, 2017).

4. Activity Diagram
A graphical representation of workflows in a diagram that displays the stepwise course of control from one activity to another. It shows control flow, branch, concurrency, and object flow with support for iteration, choice, and concurrency.

2.2.15 Consumer to Government (C2G)
Consumer to Government model enables consumers to request information or give various feedbacks regarding public matters directly to the government administration (Lipu, 2018).

2.2.16 Application Programming Interface
API is a computing interface provided by a particular software, to allow third parties to use the functionality of that software. It includes specifications for functions, data structures, object classes and variables (Mahiddini, 2017).
2.3 Development Tools and Technologies

2.3.1 Visual Studio Code

Visual studio code is an IDE provided and maintained by Microsoft Corporation for platforms like Linux, Windows, and macOS. It includes features for debugging, embedded Git control or version control, intelligent code suggestion, syntax highlighting, code refactoring and snippets. Also, enable adding plugins for additional features.

2.3.2 HTML

HTML is an acronym of HyperText Markup Language. HTML, the essential foundation of online web pages that appear on the World Wide Web, consists of two pieces: a set of instructions that tells the computer how to display content and information. Rather than perceived as a programming language, HTML is actually a set of instructions about how to display content in a web browser (Brooks, 2017). Knowledge of semantic HTML can improve the accessibility of websites. Just like a house without a frame, that’s what a website might be without semantic HTML (Gilbert, 2019).

2.3.3 CSS

Cascading Style Sheets are a set of programmable instructions to define how web pages look like. The styles described by CSS include the colors, fonts, layout, and other presentation aspects of a page, including differentiation in the display for different screen sizes and displays. One CSS file can describe a general style applicable to many documents (Wolf & Henley, 2017).

2.3.4 PHP

PHP, originally invented as a simple scripting language for building home pages, is now a full-fledged object-oriented language focused on server-side development. As of February 2020, it is the 8th most popular language as ranked by the TIOBE with ratings 2.060%. The popularity of PHP has also resulted in a large number of open-source projects, such as MediaWiki for Wiki creation, WordPress for blogging, Magento for creating and deploying eCommerce sites, and web development frameworks like CodeIgniter, Symfony, and Laravel (Hills, Klint, & Vinju, 2016).
2.3.5 MySQL

MySQL is the relational database management system based on SQL, it was being developed in Sweden, 1995 and now purchased and maintained by Oracle Corporation (Letkowski, 2015). MySQL is able to run on almost any platform, including Windows, Linux, Unix, NetBSD, Novell NetWare, OpenBSD, Symbian, SCO UnixWare, Sanos, Tru64, and macOS.

2.3.6 MySQL Administrator

MySQL Administrator comes with features for observing the Server operation, to configure the settings, to create databases, to register views, tables, and procedures, to access created schema and data, to set security measures and grant privileges to users (Martinez-Garcia, 2015).

2.3.7 dbForge Studio For MySQL

dbForge Studio For MySQL is a querying tool for MySQL that is being used to establish database connections, compare schemas and data between databases and running queries into each database. dbForge Studio For MySQL is not a suitable tool for common users because of its multiple design connections and complex functionalities. But it’s a perfect tool for professionals and experts.

2.3.8 Google Chrome

Google Chrome is a browser provided by Google that enables users to access the internet. Through browsing, users can do different things such as internet banking, accessing email and social networking sites (Rathod, 2017).

2.3.9 Lighthouse

Lighthouse is a google chrome extension which is designed to give an overall score about a particular website, it will generate a comprehensive report about the state of the website, provide information about how to optimize code and assets. help optimize websites for better rendering speed and provide better user interaction and general compliance with PWAs and the future of mobile web experience. (Biorn-Hansen et al., 2018)