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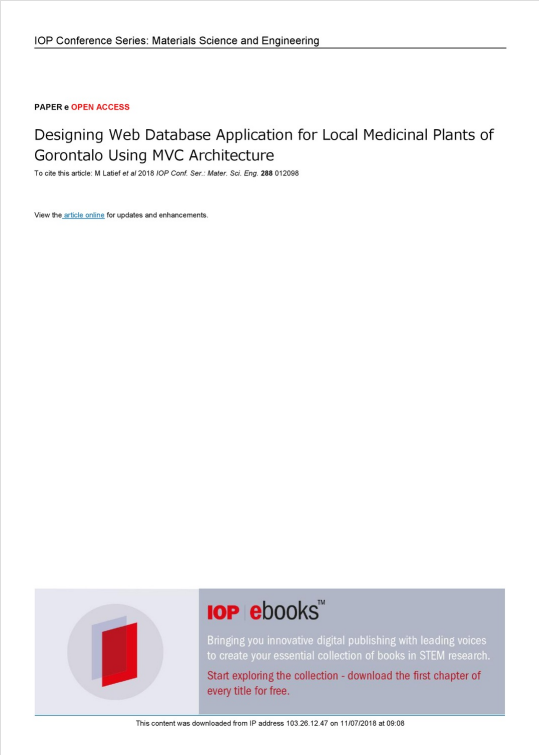

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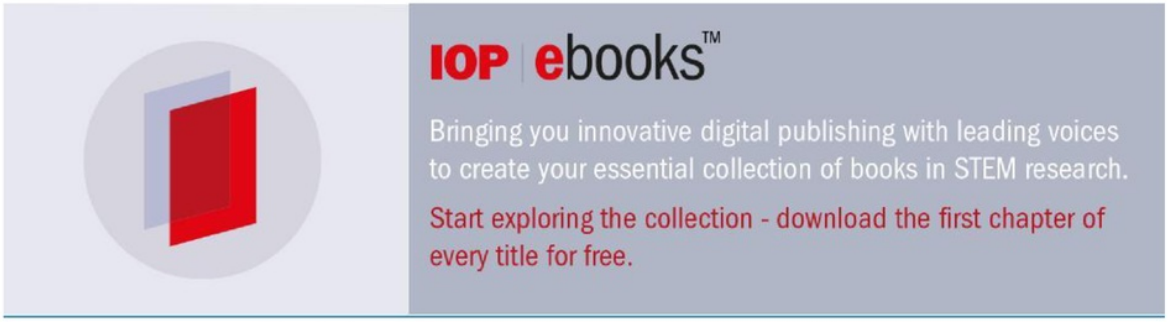

Designing Web Database Application for Local Medicinal Plants of Gorontalo Using MVC Architecture

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Abstract. There is a significant number of unpublished research by university lecturers and students about Gorontalo's local medicinal plants that have contributed to the insufficiency of information to the society regarding the benefits of local medicinal plants. Moreover, the public lacks digital backup and documentation of the medicinal plants referred. This research aims to create a web database of Gorontalo's local medicinal plant, by comprising waterfall method of software engineering approach. The waterfall method involves four steps. The first step is system requirement analysis through preliminary study and observation based on field study and library research. The second is system design, by context diagram and system architecture designs, i.e., use case diagram, class diagram, activity diagram, and database design. The third is coding using PHP programming language by OOP (object oriented programming) concept and MVC (model view controller) architecture. The last step is system test using the black-box testing method. The result shows that the web application designed is able to operate properly.

Introduction

Medicinal plants have long played important roles in the treatment of diseases all over the world [1]. World health organization (WHO) recently has published a strategic plan for the development and promotion of traditional medicine in 4 areas [2], including: Identification of traditional medicine, development of research and education, Establishment of unity and cooperation between the employees of traditional and modern medicine and Development of cultivation of the needed herbs to prevent destruction of natural resources.

Gorontalo is among the regions where the use of medicinal plants remains popular. Apart from preserving tradition from ancestors, people value a study herbs, which enable them to possess excellent potential knowledge of the medicinal plant. Herbal medicine plays an important role in rural areas, and various locally produced drugs are still being used as household remedies for different ailments [3]. The increasing use of traditional therapies demands more scientifically sound evidence for the principles behind therapies and for effectiveness of medicines [4]. Herbal medicine is still the mainstay of about 75–80% of the world population, mainly in the developing countries, for primary health care because of better cultural acceptability, better compatibility with the human body, and lesser side effects [5]. Also, traditional knowledge is the most affordable and accessible method available for the treatment of various diseases. Forests represent an important resource for local inhabitants who gather and sell medicinal plants as part of their livelihood [6].

As cited in Regional Mid-term Development Plan of Gorontalo Province of 2013 – 2017, there is an increase of 3,9 percent production of medicinal plant per year [7]. The history of medicinal plants utilization started from a mix of herbs as traditional medicine. The timeline continued until today, where the herbal medicines are being modernized and mass-produced. Each region has its distinct medicinal plants, and the expertise of it is inherited from ancestors. As time passes by, more chemical medicines are manufactured, making the knowledge about medicinal plants utilization limited to particular groups of people [8].

Medicinal plants are a source for a wide variety of natural antioxidants and are used for the treatment of diseases throughout the world [9]. Some of these properties are antimicrobial [10], anti-cancer [11], anti-diabetic [12], anti-atherosclerosis [13], immunomodulatory [14], and even reno-protection or hepatoprotective effects [15,16]. Studies on medicinal plants by kandowangko, katili [17,18,19] shows that there are numerous varieties of medicinal plants in Gorontalo, and among the varieties, it is possible to combine one another to create more new varieties of medicinal plants. Nonetheless, this situation is not supported by the existence of complete data documentation and archiving of the medicinal plants. Information of medicinal plants utilization is not disseminated thoroughly to the society as a result of a deficiency of information technology in the form of database to file the medicinal plants. This will eventually lessen the efforts of medicinal plants preservation if the situation remains unchanged. Ultimately, the public needs a database system of information of varieties and utilization of medicinal plants in Gorontalo which provides ease of access to its users.

2. Literature review

2.1. Previous researches

The term medicinal plants are referred to plants with medicinal properties and used for disease healing and prevention. By having medicinal properties, it means that the plants contain active substances to cure certain diseases; or if the plants do not contain any active substances, they provide resultant or synergy effect of various curing substances consumed [20].

Indonesia has diverse kinds of medicinal plants with a different use. There are more than 1.000 species of medicinal plants in Indonesia; most remain scientifically unidentified. Almost all regions in Indonesia have their distinct medicinal plants which are empirically proven to be effective. Some plants are included in featured herbs, i.e., *chamberbitter*, cat's whiskers, *temulawak* (Javanese ginger), turmeric, ginger, *morinda*, green *chiretta*, bay cedar leaves, guava, *daun salam* (bay leaf), and long pepper [21].

Furthermore, the research result of [22] concerning on ethnobotany of medicinal plants by indigenous community of Kampung Dukuh, Garut, West Java shows that the Kampung Dukuh community has identified about 137 kinds of medicinal plants. The community utilises different parts of medicinal plants, i.e., roots, stems, seeds, fruits, flowers, leaves, rhizomes, and tubers, in which leaves are the most utilised part. Likewise, [23] has conducted an ethnobotanical study of medicinal plants in Samin indigenous community of Bojonegoro regency, East Java. The result identified and documented about 54 kinds of herbs which are generally used by the people. Concurrently, research by [8] has discovered that among 30 varieties of plants used daily, there are 24 kinds of medicinal plants utilised by people nearby Tangale natural reserve to cure diseases.

The studies are in line with a study of ethnobotany of medicinal plants in Bone Bolango regency, Gorontalo which discovered 20 species of medicinal plants which are well-known to the society. Moreover, [20] in her research has designed an information system plan of medicinal plants.

The previous research described that there are diverse kinds of medicinal plants in Indonesia. Particularly, in Gorontalo, there are still a small number of findings of medicinal plants. However, it does not rule out the possibility that more kinds of the medicinal plant will be discovered. Medicinal plants have a promising future because there are about half million plants around the world, and most of them their medical activities have not investigate yet, and their medical activities could be decisive in the treatment of present or future studies [24].

This deficiency of database of Gorontalo's medicinal plants is feared to cause the knowledge and interest of utilising the medicinal plant to decrease gradually. Given that, a database system is needed to archive and provides people with the availability of information regarding the kinds and utilisation of medicinal plants in Gorontalo. Also, the software is expected to give ease to the public and the stakeholders in classifying different kinds of herbs and recommending suitable plants to use to cure certain diseases.

3. Methods

This study comprises software engineering approach by waterfall method. The waterfall model is a sequential, down-flow model often used in software development processes, it is called so because all the phases of Analysis, Design, Production/Implementation, Construction, Testing, and Maintenance are executed one by one and flow downwards like a waterfall [25] The main data needed in this research are data of medicinal plants varieties, each plant's utilisation, and images of medicinal plants varieties. The data are further processed and used as a reference in conducting experiments in the laboratory to achieve the purposes of this study. The research involves observation, library research, and documentation to acquire the data.

4. Results and discussion

4.1. System analysis

This study engaged system analysis to collect information regarding needs of database system development of medicinal plants. An analysis was conducted to model a running business process and thus proposing a new one. The model uses context diagram model as in shown in Figure 1.

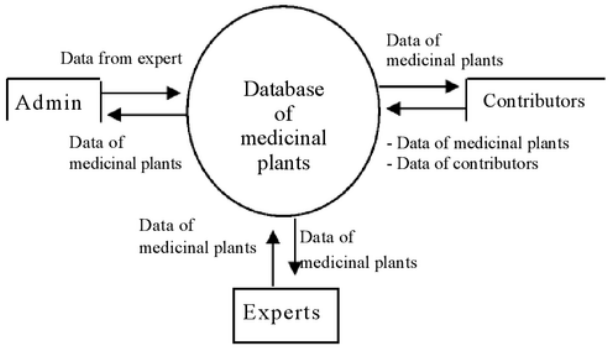

Figure 1. Context diagram of system proposed

From the Figure 1, this study formulated three functional system requirements, i.e.:

1. Administrator: an operator whose role is to input data from expert into descriptions of medicinal plants, not to modify the data of medicinal plant.
2. Contributor: Public who can register and log into the system to add and modify the data of medicinal plants
3. Expert: specialists and practitioners of medicinal plants registered by the administrator to add and modify the data of medicinal plants.

Furthermore, the previous functional were then elaborated into five functions which are related to system users (actor). The system is accessed by three actors, i.e. administrator, contributor, and expert. Every actor needs to log into the system before using it. The following Figure 2 displays the designed use case diagram.

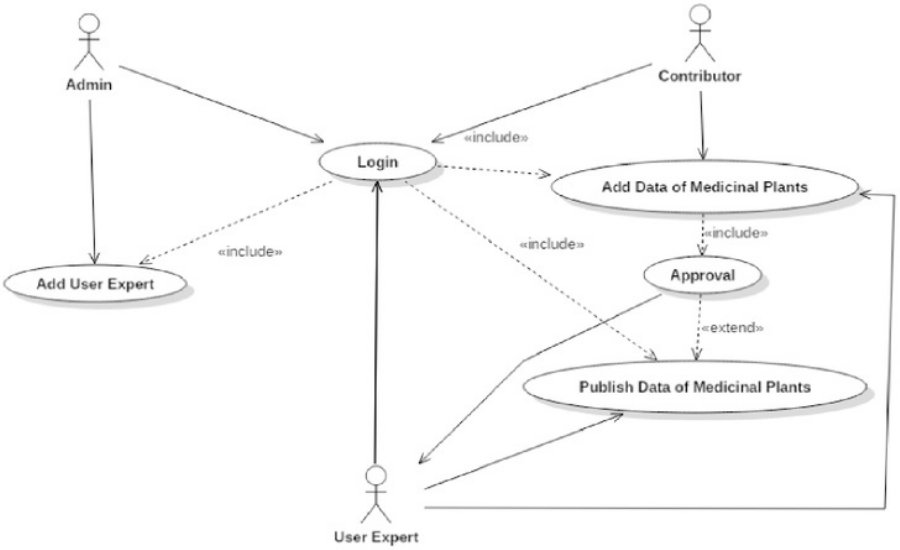

Figure 2. Use case diagram of medicinal plants database

This study created an activity diagram of one of the functions of the program elaborated on use case diagram to get the details of the business process. It is showed in Figure 3 as follows.

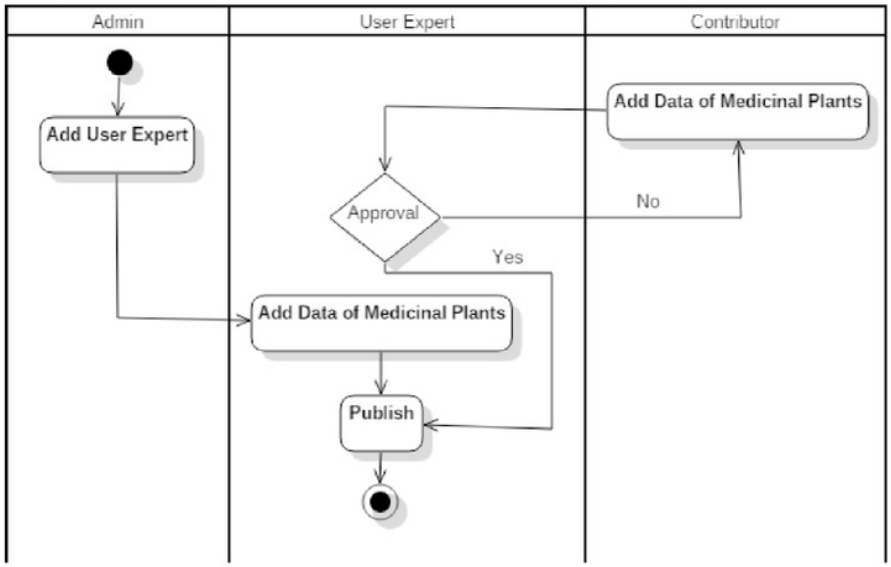

Figure 3. Activity diagram of medicinal plants database

5. System design

This phase engaged process of designing the application architecture, the program in the form of a class diagram, data design (ERD), and the user interface.

5.1. Application architecture

The study employed MVC architecture to design the web application of medicinal plants database by OOP (Object Oriented Programming) concept by PHP programming language and library JavaScript (jQuery). For the user interface, the study used HTML5 and Bootstrap 3 for responsive mobile. MVC architecture separates data (model), interface display (view), and how to process the two components (controller). When a user inputs a request to the system, the router identifies which controller and method to operate. Afterwards, the Controller finds the suitable data to be displayed by View to the user. MVC design pattern is very suitable for the development of web applications because they combine some of technology that's usually divided into a set of layers [26]. The complete breakdown of MVC architecture in an application is elaborated in Figure 4 as follows:

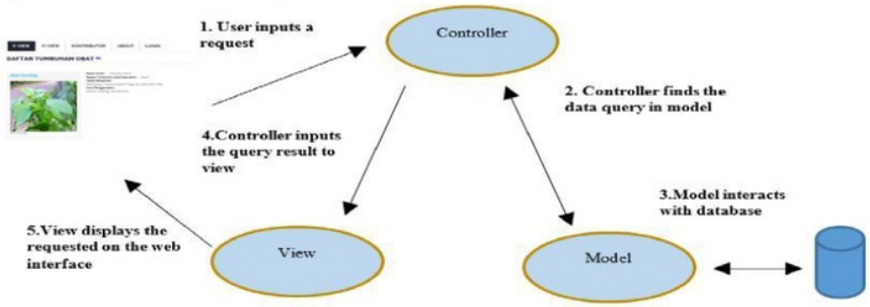

Figure 4. MVC Architecture in an application

5.2. Class diagram

The class diagram is quite popular among web developers. It is a description of the hierarchy structure of a system. By class diagram, this study expected maximum result when designing system in a phase of implementation. Moreover, the attributes and functions of each class are detailed in the chart. Functions in each class have their tasks in accordance with the system requirements. The following Figure 5 presents the elaboration of class diagram.

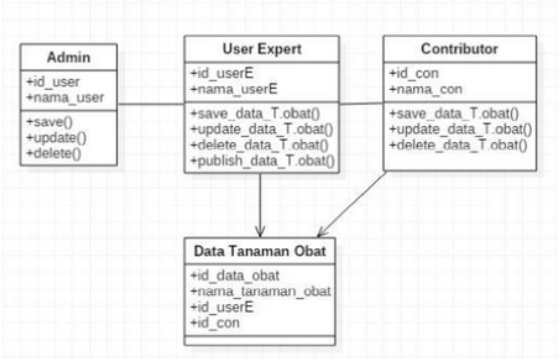

Figure 5. Class diagram of medicinal plants database

5.3. Database design

The phase began by arranging database structures based on an entity used and its connection with other entities. The connection between entities is displayed in an ERD representing data model in the system. Each table is related one another. The database of the application was entitled db_tanamanobat_sql which consists of a table of the user, medicinal plants, and picture detail. The detail is shown in Figure 6 as follows.

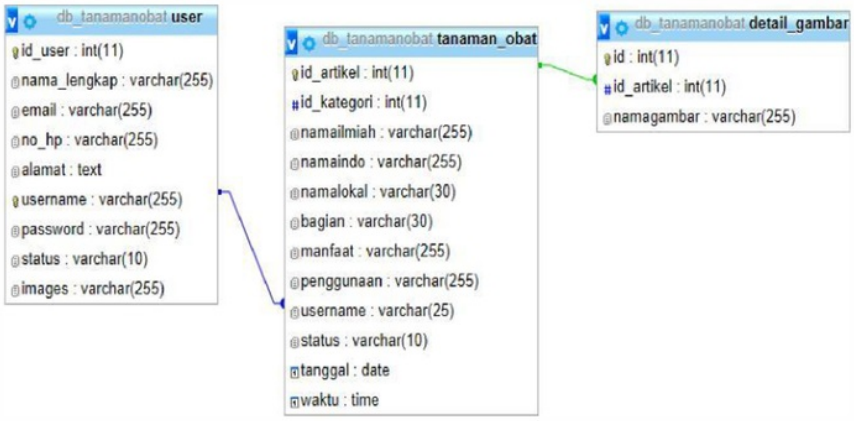

Figure 6. Design of medicinal plants database

6. Coding

This study created the system of the medicinal plant's database by PHP ver. 5.6.15 programming language, while the web server to run the programming was set up by using Apache ver. 2.4.17. Moreover, Database MySQL ver. 5.0 is used to store the data of the medicinal plants. The web application is accessible via browser with an internet connection by typing the web address http://tanamanobat-gorontalo.id. The following Figure 7 displays the main menu interface of the web application.

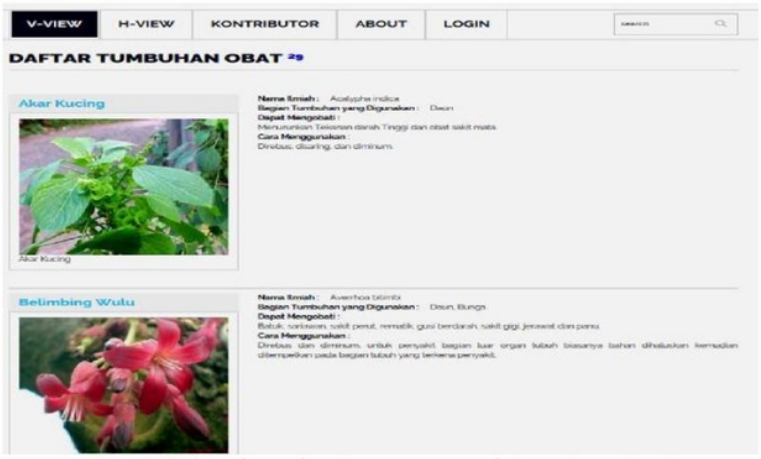

Figure 7. Interface of main menu page of the web application

7. System testing

In this phase, a thorough system testing of the web application was undergone to ensure that every part can operate properly. The system testing employed a black-box testing method, i.e. a testing method focusing at functional availability check of the application. The result showed that the system could meet the requirements set in the analysis phase. The full result of black-box testing is provided in Table 1.

Table 1. Black-box testing result of the application system

No	*Use Case*	Result
1	*Use case log in*	Checked and fulfilled
2	Register expert user	Checked and fulfilled
3	Add and modify data of medicinal plants	Checked and fulfilled
4	Publish data on medicinal plants	Checked and fulfilled
5	Approval	Checked and fulfilled

8. Conclusion

A web application of local medicinal plants database of Gorontalo has been successfully built to solve problems of the public regarding database of medicinal plants in Gorontalo. The system development engaged waterfall method which involves four phases, namely: analysis, design, coding, and testing. Most importantly, the system has features of seven main functional requirements and three actors, i.e. the admin, contributor, and expert user. Moreover, to build the web application, this study employed PHP programming language, while the system testing was undergone by using the black-box method with five tested items. Ultimately, the system testing resulted that the system has met the functional requirements as expected.

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