PROTOTYPE OF DIGITAL LIBRARY APPLICATION USING MICROFRAMEWORK FLASK

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Abstract— Covid-19 encourages the use of Digital Library sources, especially for students who are completing college assignments, wutudens who are preparing their final project, lecturer in compiling teaching material, including researchers. On the other hand, technology has developed rapidly. Technological developments have changed the pattern of human life and changed the business models of various organizations in order to survive in this digital era. However, there are still many organizations have not optimized the use of technology. One example is a university that does not yet have a Digital Library. This prompted the research team to conduct research on how to build a Digital Library. This study uses the Extreme programming (XP) software development method. This study aims to design a Digital Library prototype using a Microframework Flask. This research is expected to be a reference or model in developing digital libraries.

Kata Kunci: digital, flask, Digital Library, prototype, XP

INTRODUCTION

The COVID-19 pandemic has changed the social life of humans and organizations in various sectors. Likewise, higher education also changes the way of learning from face-to-face in class to virtual (online) (Endang Kartini, Lalu Mimbar, 2021). Before the COVID-19 pandemic emerged, some universities had implemented online learning specifically for specific subjects. However, currently, all courses must be delivered online, including practicum courses which should be in the laboratory. Including reference sources in various libraries that have been available in print versions, they must keep up with changes. The COVID-19 pandemic is precisely the right momentum to improve the education ecosystem, including the availability of digital library resources on campuses (Fitriyani., Mukhlis, 2021).
Higher education students need to cite some references provided by the library in their university to finish their lecturer assignments or final assignments. But during this pandemic, almost all campuses, learning activity including libraries, do not operate offline. The impact of this condition shows that the quality of student assignments is not good because students get answers only by relying on the google search engine. In addition, the students’ insight from the tasks was lacking in detail. It will be different if students get answers directly by reading suitable library sources. Through appropriate library sources, students gain better insight. In addition, the quality of assignments produced by students is also better. With the increase in cases of positive COVID patients, many universities still decide to carry out operations activities on campus online. This condition also provides an opportunity for libraries to improve their services as learning centers and sources of information by digitalization. In the end, more and more people besides the academic community can access these digital library resources.

Based on the problems described above, the research team proposes research to design a prototype (Susanto & Meiryani, 2019) digital library using Microframework Flask. Flask is the Digital Library development framework because it is pretty light and has flexibility in terms of using components for web applications provided by third parties. Flask has no dependencies for web application project settings. In contrast to other web development frameworks in general, which already offer all components in one framework, even though not all of these components are used. Flask has high scalability because it’s perfect for simple and complex web applications. So the extensions used can be adapted to the needs of the application.

The results of this study are expected to be the basis for developing a Digital Library for educational institutions and society in general. (Aruna, 2015). Digital Library is an application that gives users access to borrow and read content available in digital form via computers and smartphones. (Suharso et al., 2020). Digital Library is an application that gives users access as members to borrow and read content available in digital form via computers and smartphones. Every member, anytime and anywhere, can access library resources in the Digital Library through computer and mobile devices.

In application development, this study proposes the extreme programming (XP) method (Ayu Megagawayt et al., 2021). The XP method is suitable for small and medium development teams, considering the team only has three people. In addition, the software developed is also not too complex. In addition, the need for digital libraries during the COVID-19 pandemic is quite urgent, so fast development process is needed. Data collection is done through observation and interviews with the library to explore business processes, bibliography data, bibliography classification, digital documents from library sources, and others.

Several studies on Digital Library development have been carried out. A researcher tried to research the quantity of access to the Digital Library from 2002 to 2016 (K. Ahmad et al., 2018). The results of the study show that there are more than 4,236 documents on the ISI Web of Science, the productivity of the number of research publications through the Digital Library, an increase in the number of citations, the United States as a leader, and others. Other research says that smart libraries are a necessity in the 21st century (Shah & Ban, 2020). Smart libraries provide many services by leveraging the IOT architecture. One of the modeling methods in the development of the Digital Library is using the DeLone and McLean method (Alzahrani et al., 2019).

The findings of this study are the quality of a good system affects the level of satisfaction and intention of users or accessing materials in the Digital Library. Digital Library development can be done by utilizing an open-source platform. The principle used in the development of the Digital Library in this research is the user’s need to access content easily and free of charge (Arora, 2018).

RESEARCH AND METHODOLOGY

The method of collecting data in this research is through interviews and observations of the library unit to explore all the data and business processes that occur there, including digital documents from library sources, books, journals, and other library sources. This study’s data source is a library at a private university in Jakarta. In addition, researchers also do literature review through books and journals related to the research for exploring the current digital library application update. Development of Digital Library Prototyping using the Flask Microframework approach and follows the rules of software development named Extreme programming (XP) (Vrbančič et al., 2018). Figure 1 is life cycle of XP Programming method.
XP is a fast, efficient, low-risk, flexible, predictable, scientific software development method (I. Ahmad et al., 2020). This model uses an Object-Oriented approach. In Extreme programming, trim and medium-sized teams can be formed. The goal is to deal with unclear requirements as well as the occurrence of swift changes in requirements. The stages in software development using the Extreme programming method consist of planning, design, coding, and testing.

To do requirements analysis and system design process, Unified Modeling Language (UML) is used for documenting (documentation artifacts) and modeling the system (Sari, 2018). UML diagram can help to present a problem easier. Also facilitate for needs understanding quickly.

Overall, the framework of this research begins with the literature study to explore the development of digital libraries and then continues with the formulation of research problems. Then proceed with observations and interviews to collect all the data needed. After all the data is collected then, start building the system. However, system development is just until developing a prototype of the system. The prototype system that has been completed is then tested using the black box method. Finally, the study ends with concluding.

**RESULT AND DISCUSSION**

This section explains all the results obtained from all stages, especially the system prototype development stage. Following the extreme programming method, the development stage includes planning, design, coding, and testing.

**Plan**

In this section, the research team analyzes why this digital system or application needs to be developed. The things that are done are by making System Requests, Business Needs, Business Values, non-functional requirements, functional requirements, making use case diagrams and use case descriptions:

A. **System Request:** The COVID-19 pandemic situation requires lectures to be conducted online. This causes access to conventional libraries to be constrained. Therefore, the library manager wants to create a digital library system so that it can be accessed online.

B. **Business Needs:** This application was built for the literacy needs of students and lecturers. Literacy is needed to prepare teaching materials for research or final assignments and college assignments.

C. **Business Value:** This application will reduce the cost of rent, librarian and administrative costs.

D. **Non Functional Requirements Analysis:** This web-based Digital Library application has non-functional requirements, which are divided into four parts, namely:

1. **Operational Needs**
   - The application needs WGSI and Library Flaks, database management system (MariaDB).
   - Provider for Hosting. This apps can be accessed through internet connection.

2. **Performance Needs**
   - Response time not more than 20 seconds while user access main menu and all features.

3. **Security Needs**
   - Just administrator can do activation or reactivate the member.
   - Just member can access the digital library system.

4. **Politics and Culture Needs**
There are no special needs related to politic and functional requirement of this system consist of three part such as data management (references), membership, and academic data management:

Design
At this stage, the team builds the Digital Library application architecture and makes modelling by designing use case diagrams and class diagrams. The first step is building the Digital Library application architecture, shown in Figure 3 below. In Figure 3, both admin and member users access (make a request) the Web Server Gateway Interface (WGSI), and then the WGSI server responds according to the request from the client. Through the Application Programming Interface (API), the WGSI server communicates with the Academic System when performing certain data operations. In this case, the client is a system user, both admin and members (students, lecturers).

The team’s next step is to design an activity diagram based on the use case diagram and use case description of this Digital Library application. After creating a use case diagram, the next step is to create a class diagram of this digital library application. The class diagram is built based on functional requirements on use case diagrams and activity diagrams.

Coding
Following the XP method, coding is the third stage after the design stage. Coding means translating the design results into code with a programming language. The team coded the program using Python and the Jinja2 template with Microframework Flask at this stage. The first thing to do is to create a project structure with a directory structure, as shown in Figure 4 below: 

The Digital Library Application Project is created in a virtual environment with the name venv. Digital Library is the name of the project’s folder in which there is a static folder that is useful as a place to store all project assets. The templates folder stores file written using the Jinja syntax and HTML. The models.py file is written using the Python syntax used for user modelling. Inside the model, the User class is declared, which is used to instantiate user objects in the application. The whole program code snippet from models.py is shown in figure 5.
The results of this study are a prototype of a digital library application written in the Jinja file format (Armash Aslam et al., 2015). According to the explanation of the advantages of Flask, in writing this prototyping program, many libraries are used and are not tied to the framework. Therefore, developers can take existing components without following the usage rules set by the framework. In addition, when the prototype is executed, it does not require too heavy computation because Flask is relatively light in programming.

Users of this application consist of admins as managers of digital library applications and members consisting of lecturers and students. This application is still running on the local computer. To access it, use the URL http://localhost:5000 (http://127.0.0.1:5000) in the browser’s address bar. The Sign-In page will be displayed when accessing the URL, as shown in Figure 7. All users will use this page to enter the digital library application. When logging into the system, you will enter the admin page or member page according to the role of each user.

**Result**

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Another prototype is for admin and user menus. Users use the menu with admin roles to manage ebook lists, members, ebook catalogues, ebook categories, authors and publishers. The
admin has complete control over the application, which is to add data, change and delete data on each entity in this application. A menu also shows the ebook list management page owned by the Digital Library application. Admin has full rights on this page, such as being able to add ebook data, change or modify ebook data and can delete ebook data. On the member page, there is only an ebook catalogue menu. All users have the right only to view the list of ebooks through the catalogue menu and can read the ebooks listed in the catalogue. Figure 10 is a display of the ebook catalogue that users can access.

![E-Book Catalogue Menu](image)

Figure 10. E-Book Catalogue Menu

Testing
At this stage, the researcher conducts prototype testing to determine whether its functions are as expected. The testing method used is the black box method (Cabana et al., 2018) with alpha testing. Table 1 is the result of testing with alpha testing of the proposed prototype. Functions tested based on features/functions in use case diagrams (Hamza & Hammad, 2019):

<table>
<thead>
<tr>
<th>No</th>
<th>Function</th>
<th>Detail</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Login</td>
<td>Access (entry) &lt;br&gt; Digital Library</td>
<td>Ok</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Validate user account</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Account Validated</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>User can entry the system</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>If failed, then user (students and lecturer) call</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Prototype Testing Result

administrator to do manual activation

2 | Membership Activation Function | Administrators find number and name of member | Ok |
3 | Reading e-book Function | Students and lecturers check all e-book | Ok |
4 | E-Book Management Function | Administrators input new e-book collection | Ok |

CONCLUSION

From the whole series of research activities that have been carried out, the extreme programming method is suitable for developing systems that are not too large, and the business processes involved are not complex. In this case, it is suitable for developing a digital library system.

With the research output in the form of a prototype of the proposed system, the prototype testing with alpha testing is quite good because from the test results, it can be seen whether the proposed features are following the system requirements.

By utilizing diagrams in UML, the requirements for the system development process can be easily identified as the next stage of research.

This study recommends that it be continued with the development of the system. Then the system to be developed can accommodate
a mobile platform so that it can be accessed via smartphone devices.

**REFERENSI**


