PROTOTYPE OF DIGITAL LIBRARY APPLICATION USING MICROFRAMEWORK FLASK

Ridha Sefina Samosir[1*)]; Ester Lumba[2]; Poltak Pancarian Situmorang[3]

Program Studi Sistem Informasi[1,3]
Institut Teknologi dan Bisnis Kalbis
ridha.samosir@kalbis.ac.id[1*)]
www.kalbis.ac.id[3]

Teknik Informatika[2]
Universitas Bunda Mulia
www.ubm.ac.id
l0178@lecturer.ubm.ac.id[2]

Abstract— Covid-19 encourages the use of Digital Library sources. especially for students who are completing college assignments, wtudents who are preparing their final project, lecturer in compling 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

Intisari— Pandemi Covid-19 mendorong pemanfaatan sumber-sumber pustaka secara digital. Perpustakaan digital sangat di butuhkan dalam situasi pandemi oleh mahasiswa yang sedang membuat tugas-tugas kuliah, mahasiswa yang sedang menyusun tugas akhir. dosen dalam menyusun bahan ajar dan para peneliti. Di sisi lain teknologi sudah berkembang demikian pesatnya. Perkembangan teknologi telah mengubah pola kehidupan manusia dan mengubah model bisnis berbagai organisasi agar tetap survive di era digital ini. Namun secara khusus institusi pendidikan belum memaksimalkan pemanfaatan teknologi. Salah satu contoh adalah banyak institusi pendidikan yang tidak memiliki perpustakaan digital. Hal ini mendorong tim peneliti melakukan penelitian bagaimana membangun perpustakaan digital. Penelitian ini menggunakan metode pengembangan perangkat lunak Extreme programming (XP). Penelitian ini bertujuan untuk merancang prototipe Digital Library menggunakan Microframework Flask. Melalui penelitian ini diharapkan dapat menjadi acuan atau model dalam mengembangkan perpustakaan digital (Digital Library) bagi institusi-institusi pendidikan.

Kata Kunci: digital, microframework flask, 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 of 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 as members 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 Megagawaty 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 a 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 & Bano, 2020). Smart libraries provide many services by leveraging the I0T 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
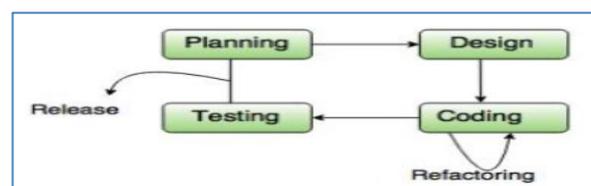

Figure 1. Software Development Life Cycle of XP

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.
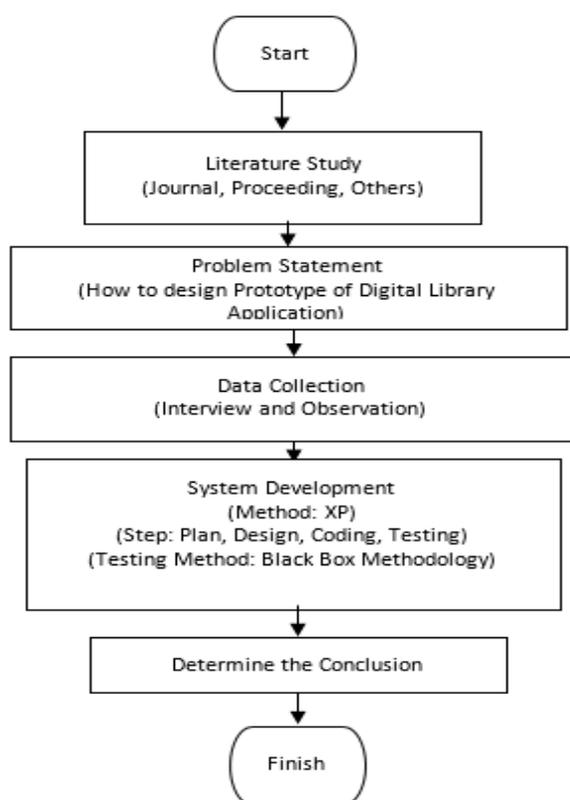

Figure 2. Research Framework

RESULT AND DISCCUSION

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 Fungtional 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 Flask, *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.
E. Fuctional reuirement 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.
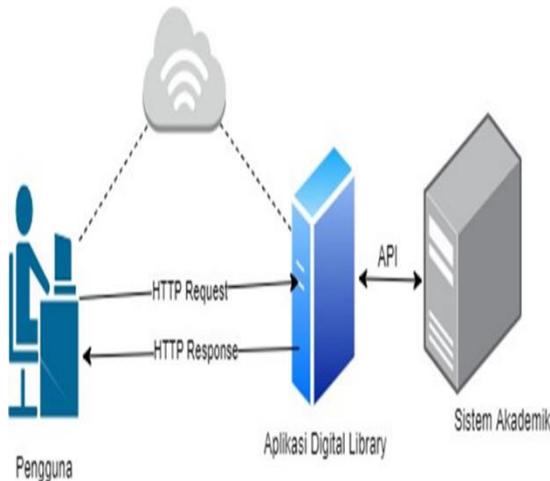

Figure 3. Design of Digital Library Architecture

Based on the class diagram, 8 (eight) classes will simultaneously be modelled on the database, including lecturers, students, departments, members, authors, books, and publishers. However, the class of students, lecturers and the modelling department is carried out in the academic system. All these classes will define the

modules to be developed through coding. The information in the class shows the attributes (variables) and methods (processes) that are applied to the class. Figures 6, 7, and 8 represent use cases, classes, 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:
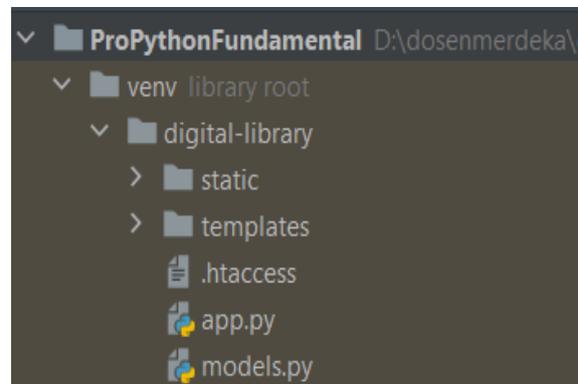

Figure 4. Project Structure

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.

Figure 5. Program Script
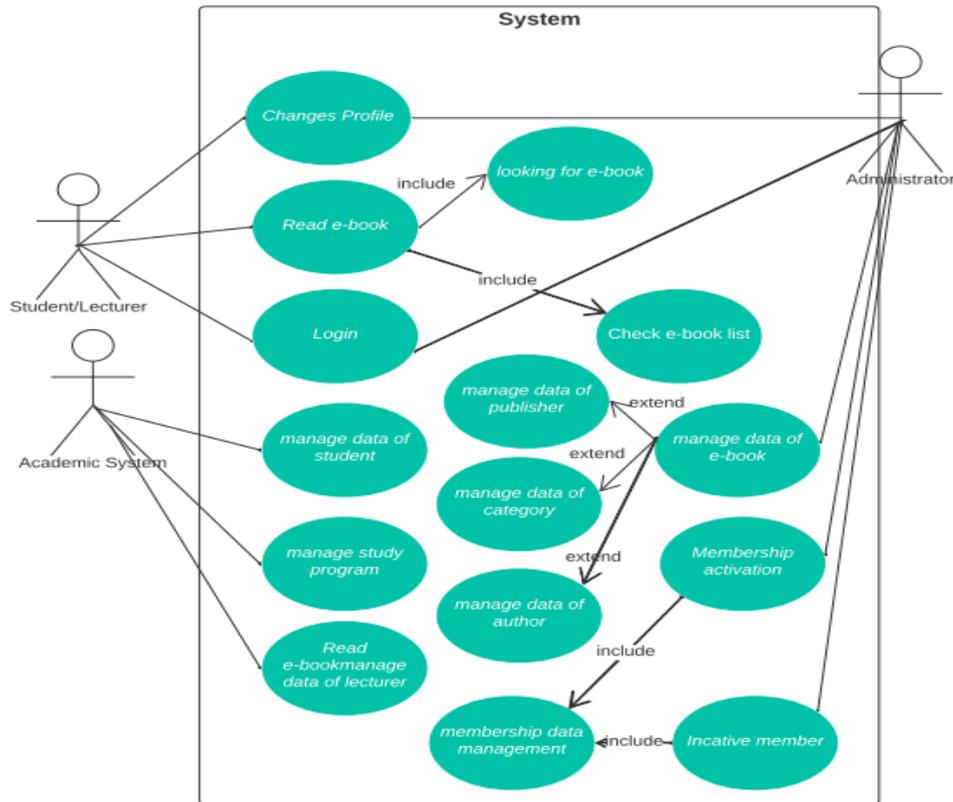
Gambar 6. Usecase Diagram

Result

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.
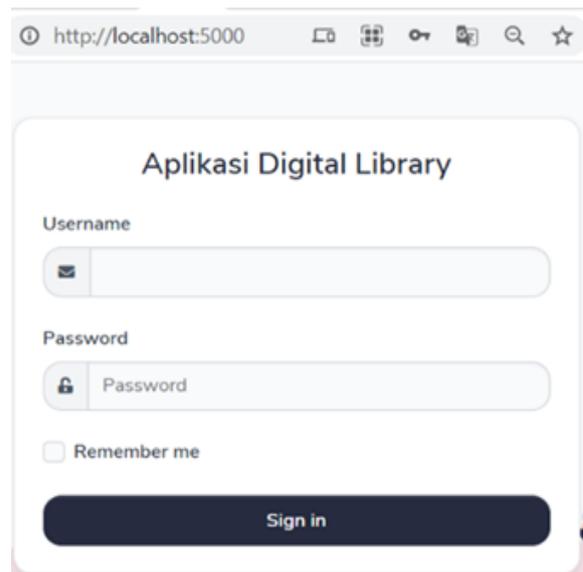

Figure 7. *Sign In Menu*

P-ISSN: 1978-2136 | E-ISSN: 2527-676X
Techno Nusa Mandiri : Journal of Computing and Information Technology
As an Accredited Journal Rank 4 based on **Surat Keputusan Dirjen Risbang SK Nomor 85/M/KPT/2020**
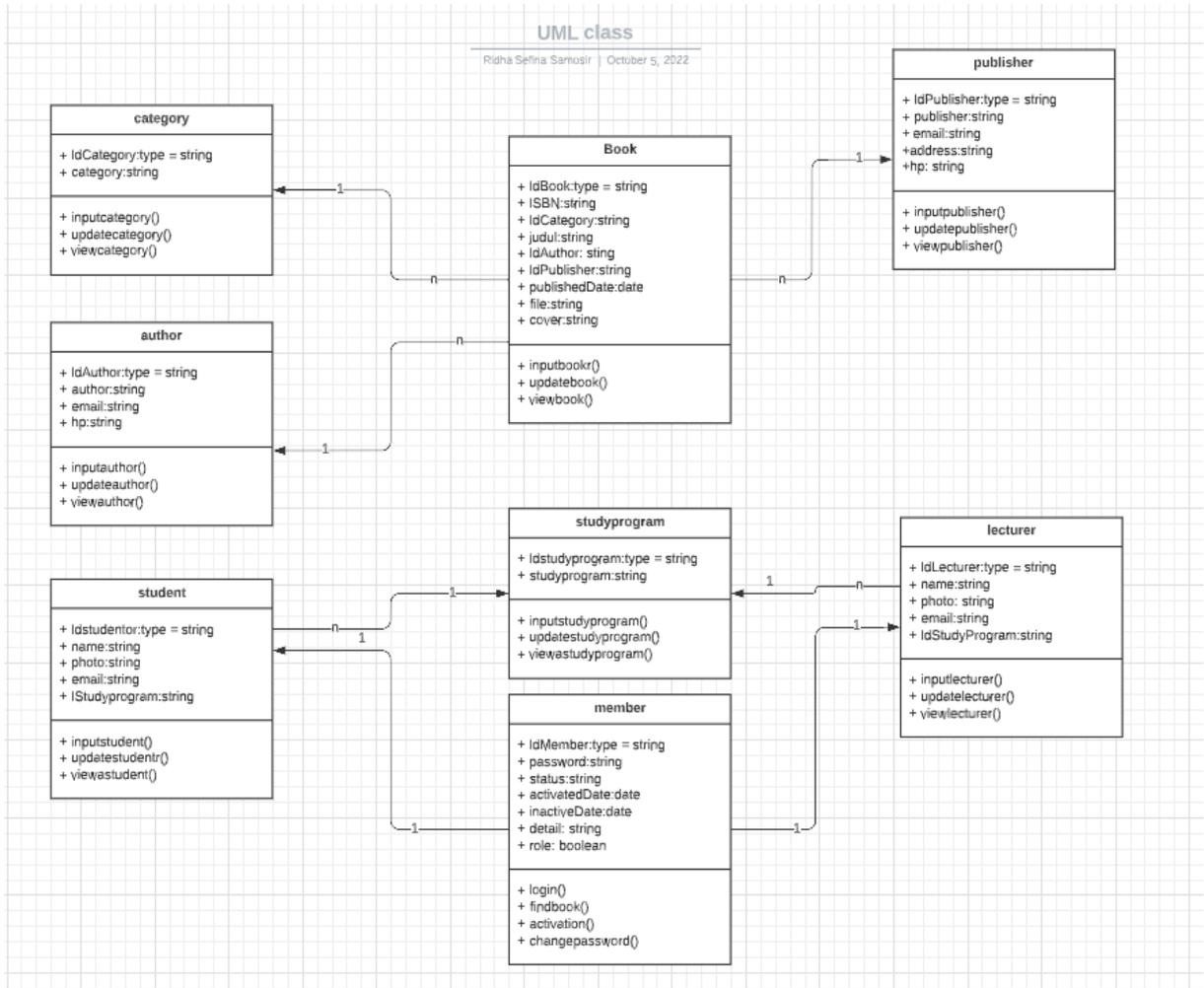
Figure 8. Class Diagram
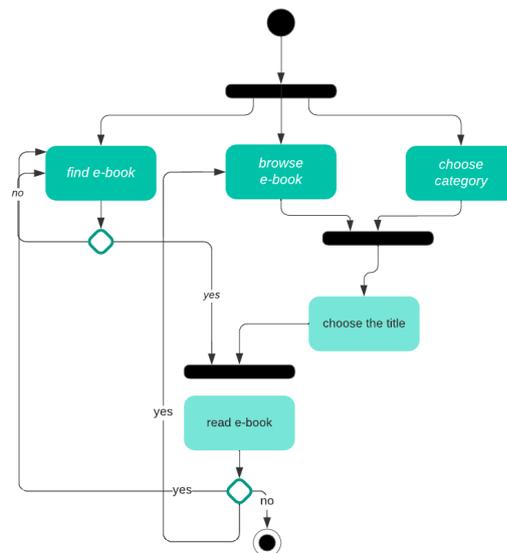
Figure 9. Activity Diagram Read E-Book Function

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

P-ISSN: 1978-2136 | E-ISSN: 2527-676X
Techno Nusa Mandiri : Journal of Computing and Information Technology
As an Accredited Journal Rank 4 based on **Surat Keputusan Dirjen Risbang SK Nomor 85/M/KPT/2020**

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.
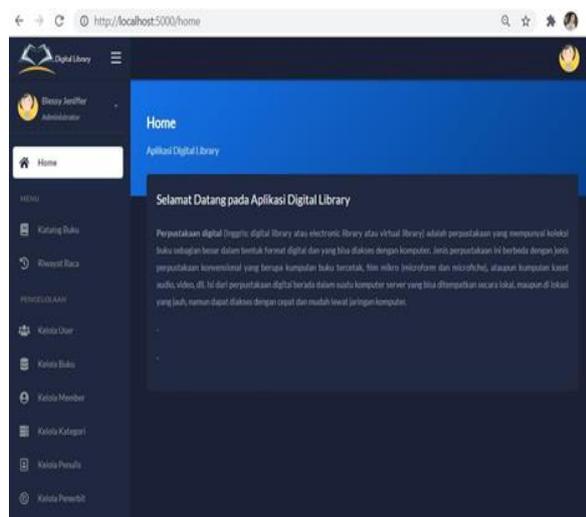

Figure 10. E-Book Catalogue Menu

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 1. Prototype Testing Result

No	Function	Detail	Result
1	Login Function	Access (entry) Digital Library	Ok
		Validate user account	
		Account Validated	
		User can entry the system	
		If failed, then user (students and lecturer) call	
		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 e-book	Ok
		Check based on category	
4	E-Book Management Function	Administrators input new e-book collection	Ok
		Administrators fill the new collection form	
		Administrators save new collection data	
		Administrators changes the data of e-book	
		Administrators changes the data via form	
		Administrators save the changes	
		Administrators delete	
		Notofication/Confirmation	

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

P-ISSN: 1978-2136 | E-ISSN: 2527-676X
Techno Nusa Mandiri : Journal of Computing and Information Technology
As an Accredited Journal Rank 4 based on **Surat Keputusan Dirjen Risbang SK Nomor 85/M/KPT/2020**

a mobile platform so that it can be accessed via smartphone devices.

REFERENSI

Ahmad, I., Borman, R. I., Fakhrurozi, J., & Caksana, G. G. (2020). Software Development Dengan Extreme Programming (XP) Pada Aplikasi Deteksi Kemiripan Judul Skripsi Berbasis Android. *INOVTEK Polbeng - Seri Informatika*, *5*(2), 297. https://doi.org/10.35314/isi.v5i2.1654

Ahmad, K., Jian Ming, Z., & Rafi, M. (2018). Assessing the digital library research output: bibliometric analysis from 2002 to 2016. *Electronic Library*, *36*(4), 696–704. https://doi.org/10.1108/EL-02-2017-0036

Alzahrani, A. I., Mahmud, I., Ramayah, T., Alfarraj, O., & Alalwan, N. (2019). Modelling digital library success using the DeLone and McLean information system success model. *Journal of Librarianship and Information Science*, *51*(2), 291–306. https://doi.org/10.1177/0961000617726123

Armash Aslam, F., Nabeel Mohammed Jummal Musab Mohd Munir Murade Aaraf Gulamgaus, H., & Lokhande Assistant Professor, P. S. (2015). Efficient Way Of *Web* Development Using Python And Flask. *International Journal of Advanced Research in Computer Science*, *6*(2), 54–57. www.ijarcs.info

Arora, D. (2018). Building Digital Library of Technology Focus Using Dspace. *IEEE 5th International Symposium on Emerging Trends and Technologies in Libraries and Information Services, ETTLIS 2018*, 83–86. https://doi.org/10.1109/ETTLIS.2018.8485231

Aruna, J. (2015). An Overview of Digital Resources for Academic Libraries. *International Journal of Library and Information Studies*, *5*(1), 158–163.

Ayu Megawaty, D., Alita, D., & Sukma Dewi, P. (2021). Penerapan Digital Library Untuk Otomatisasi Administrasi Perpustakaan. *Journal of Technology and Social for Community Service (JTSCS)*, *2*(2), 121–127. https://ejurnal.teknokrat.ac.id/index.php/teknoabdimas

Cabana, A., Charrier, C., & Louis, A. (2018). A new black box evaluation protocol for biometric

systems. *Proceedings - 2018 International Conference on Cyberworlds, CW 2018*, 369–374. https://doi.org/10.1109/CW.2018.00073

Endang Kartini, Lalu Mimbar, I. (2021). Tantangan dalam pembelajaran Perguruan Tinggi dan Implementasi Merdeka Belajardi Masa Pandemi COVID-19. *Journal Ilmiah Rinjani (JIR) Media*, *9*(2), 43–50.

Fitriyani., Mukhlis, S. (2021). Urgensi Penggunaan Digital Literasi dalam Pelaksanaan Pendidikan Dimasa Pandemi: Systematic Literature Review. *Jurnal Dikoda*, *2*(1), 13–20.

Hamza, Z. A., & Hammad, M. (2019). *Web* and mobile applications' testing using black and white box approaches. *IET Conference Publications*, *2019*(CP758), 20–23. https://doi.org/10.1049/cp.2019.0210

Rahmah, E. (2018). Akses dan Layanan Perpustakaan: Teori dan Aplikasi. In *Prenadamedia Group* (1st ed., Issue 1). PRENADAMEDIA Group.

Sari, Y. S. (2018). Analysis and Design Outpatient Administration Information System With Object Oriented Methodology. *International Educational Journal of Science and …*, *November*, 1–7. http://iejse.com/journal/index.php/iejse/article/view/23

Shah, A., & Bano, R. (2020). Smart library: Need of 21 st Century . *Library Progress (International)*, *40*(1), 1. https://doi.org/10.5958/2320-317x.2020.00001.x

Suharso, P., Arifiyana, I. P., & Wasdiana, D. (2020). Layanan Perpustakaan Perguruan Tinggi dalam Menghadapi Abstrak. *Anuva (Jurnal Kajian Budaya, Perpustakaan, Dan Informasi)*, *4*(2), 271–286.

Susanto, A., & Meiryani. (2019). System Development Method with The Prototype Method. *International Journal of Scientific and Technology Research*, *8*(7), 141–144.

Vrbančič, G., Brezočnik, L., Mlakar, U., Fister, D., & Fister Jr., I. (2018). NiaPy: Python microframework for building nature-inspired algorithms. *Journal of Open Source Software*, *3*(23), 613. https://doi.org/10.21105/joss.00613

P-ISSN: 1978-2136 | E-ISSN: 2527-676X
Techno Nusa Mandiri : Journal of Computing and Information Technology
As an Accredited Journal Rank 4 based on **Surat Keputusan Dirjen Risbang SK Nomor 85/M/KPT/2020**