

IDOL: Retrofit-Kotlin Service-Based Online Digital Library Application and College Open Data Repository

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Abstract: Digital libraries promise new social benefits, especially for e-learning in the age of digital technology. Integrated Online Digital Libraries are required to have professional knowledge and information on one service. Digital library innovation still needs to be researched regarding initiation; development; application; exploitation; the role of the external competitive environment; the role of the organization's internal environment; and products, services, and process outcomes. In the research, the Integrated Digital Online Library – IDOL application developed will fulfill every feature of the digital library system where four core concepts (Content, User, Functionality, Quality, Policy, and Architecture) as the core model of IDOL need to be considered in relation to four main and interrelated factors. Interact with the developed digital library system, and special studies are still needed on this development research. This research focuses on the development of the Integrated Digital Online Library – IDOL by implementing Retrofit-Kotlin as a highly secure REST-client library for Java and Android. The RAD (Rapid Application Development) method is used in the development process of this platform. The results of this study still need further development, both regarding functionality, interactive and collaborative web various functions are still needed. Regarding user feedback, both the interface is a factor that must be considered in future development. Regarding data speed, we adopted the HTTP/2 protocol as a data loading strategy and the IDOL platform has successfully implemented the use of Retrofit-Kotlin. Based on the test results, the level of failure in the UT-7, UT-8, and UT-10 tests with achievements of less than 80% of respondents failed to answer. For a success rate above 80% on UT-1, UT-2, UT-3, UT-4, UT-5, UT-6, and UT-9 tests.

Index Terms: Retrofit-Kotlin; Service-Based; Online Digital Library; Open Data Repository.

1. Introduction

Digital libraries promise new social benefits, especially for e-learning in the age of digital technology. Integrated online digital libraries are required to have professional knowledge and information on one service. Digital library innovation still needs to be researched regarding initiation; development; application; exploitation; the role of the external competitive environment; the role of the organization's internal environment; and products, services, and process outcomes. The Application Programming Interface is needed to add features to the digital library application as well as allow data/content updating and sharing from various online digital sources. In the research, the Integrated Digital Online Library – IDOL application developed will fulfill every feature of the digital library system where four core concepts (Content, User, Functionality, Quality, Policy, and Architecture) as the core model of IDOL need to be considered in relation to four main and interrelated factors. Interact with the developed digital library system, and special studies are still needed on this development research. Integrated Digital Online Library Services - IDOL needs to be explored about how they provide digital services to explore and map library digital services and their response to current learning technology and support "Merdeka Learning-Independent Campus" in Universities in Indonesia, especially for STMIK Indonesia Banda Aceh as app user partner.

Technological changes in the field of libraries have served people who are blind or handicapped. Technology is needed to produce and distribute books in various formats, and technical tools are often used as a means for someone to read books. However, the development of digital technology combined with the evolution of the Internet has driven significant changes to library services and operations in recent years [1]. In principle, the Digital Library can provide access to all digital and digital offline and online resources [2], online electronic journals [3], electronic documents and virtual

resources [4], and virtual libraries [5]. In the development of digital libraries, it is appropriate at this time to involve various API supports in data integration. This is in accordance with the research of Concordia, Gradmann, & Siebinga (2010) that the service platform is open in accessing and managing large collections of digital content through application program interfaces (API) [6]. APIs are currently the hottest topic in the elearning industry [7], and digital transformation is accelerating with the rapid emergence of open APIs [8]. Several studies have revealed the use of APIs with various techniques offered. The results of research by Petrera *et al* (2021) resulted in the zbMATH links API presenting the zbMATH Open dataset based on the example of the NIST Digital Library of Mathematical Functions [9]. Another finding was also expressed by Sturgeon (2021) who went through a technical approach and innovation in digital library design for the implementation of the Chinese Text Project of premodern Chinese writing [10]. Several studies have focused on different objects, but in the evolution of the API it can identify, benchmark and understand the evolution of API developers and users with various programming languages [11].

The research we do is more focused on the Development of the Integrated Digital Online Library – IDOL and has a difference from the object of the research conducted. This research was conducted as an initial data investigation for the development of the Integrated Digital Online Library – IDOL application, by testing the Retrofit-Kotlin service as a very secure REST-client library for Java and Android. This Retrofit library will later be used as an interface in accessing the HTTP API. The use of Retrofit Kotlin was chosen because it has the advantage of using API calls as simple Java method calls, and all JSON/XML parsing network calls are fully handled by it (Gson for JSON parsing), along with support for arbitrary formats with pluggable serialization/deserialization. So that Retrofit is expected to be able to handle all things related to data connections from android to the internet to the developed Integrated Digital Online Library – IDOL application. When viewed from previous research, not many have discussed technically and implemented the use of Retrofit-Kotlin so that the originality of this research is a novelty in the development of digital libraries in the future.

2. Research Method

In accordance with the RAD (Rapid Application Development) method which is a concise development process to produce high quality systems with low investment costs [12]-[13]. The workflow for the development of the Integrated Digital Online Library – IDOL uses four stages, namely: requirements planning, user design, development or construction and transition (from the old system to the new system). The user design and construction stages will continue to be repeated until the user declares that the results are in accordance with their wishes.

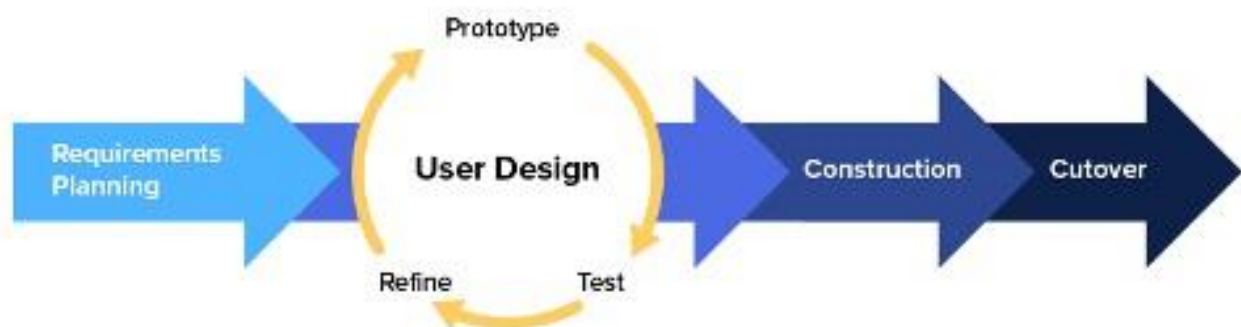


Fig 1. Stages of Rapid Application Development Model

Regarding phase 1, the category of software requirements planning, hardware has been identified: student final project data is taken from the campus repository as a test in the data integration process. The main user requirements identified in phase 2 are: ease of use, accessibility with various types of devices (smartphone, tablet, desktop), clear and complete information, report generation, and data download. In the third phase, testing the use of the Retrofit-Kotlin API from the Repository data for the Integrated Digital Online Library – IDOL application development process which is designed.

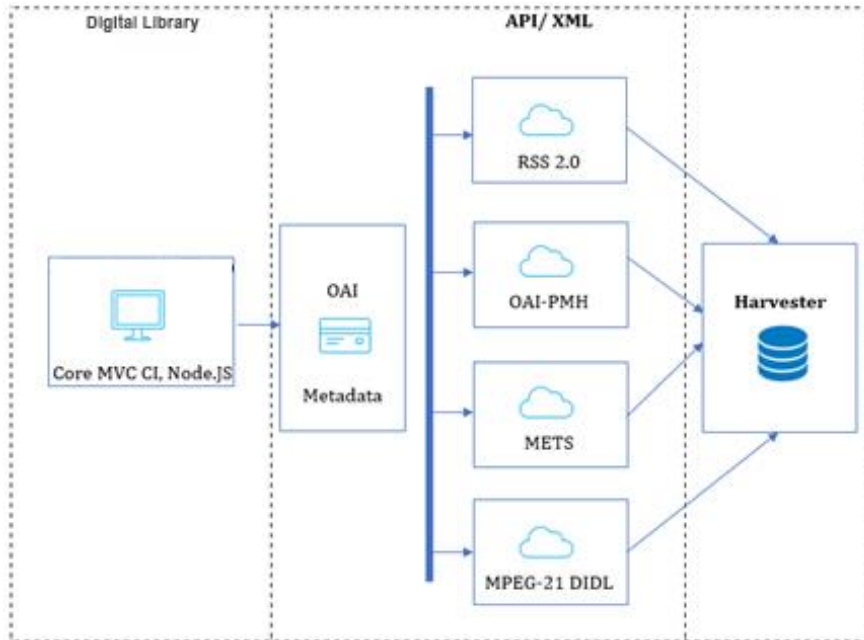


Fig 2. Planning of the proposed Digital Library System Framework (IDOL) (Source: Researcher)

It can be seen in Figure 2 that the proposed digital library system framework planning, on the client side the digital library prototype built can work on smartphone operating systems (android, IOS, and NET.Core) as well as on the browser side. The application model is built using the MVC technique and utilizes the Codeinigter and Node.JS frameworks, and XML is used to send packets to the server with the API module so that the harvester server can provide feedback on data received through the RSS 2.0 data model, Archives Initiative Protocol for Metadata Harvesting. (OAI-PMH), Metadata Encoding and Transmission Standard (METS), and MPEG-21 Digital Item Declaration Language (DIDL) which will be sent later [14], [15]-[16]. In preparation for using Retrofit Kotlin, start by creating Retrofit Dependencies, Model Classes, Retrofit Instances, and Setting Up Retrofit Interfaces, Consuming REST Web Services, and Retrofit Response Data to Recyclerview. For the interface use Android Studio, where Android Studio provides full support for Kotlin, allows adding Kotlin files to existing projects and converting Java language code to Kotlin, then can use all existing Android Studio tools with Kotlin code, including autocomplete, collation lint, refactoring, debugging.

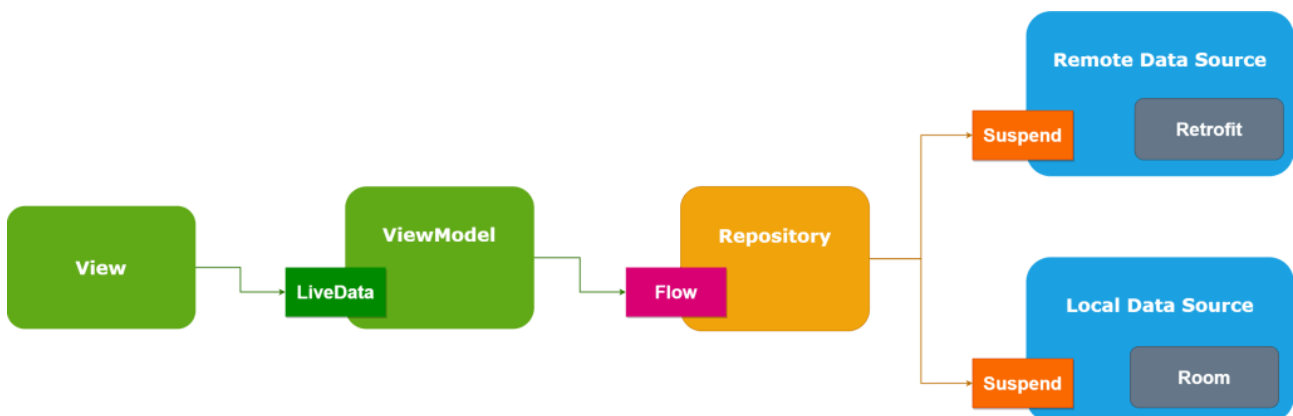


Fig 3. Coroutine Flowchart Framework with Retrofit in ViewModel.

3. Result and Discussion

3.1 Results

The Digital Online Library – IDOL platform started with the development of the AMIK Indonesia university repository which has been used in the first 2 years of activity (November 2020 to March 2022), the repository application users (Figure 4) have been used by more than 500 students. The peak number of users is related to the platform presentation webinar and information dissemination to professionals through zoom and socialization meetings for students and alumni.

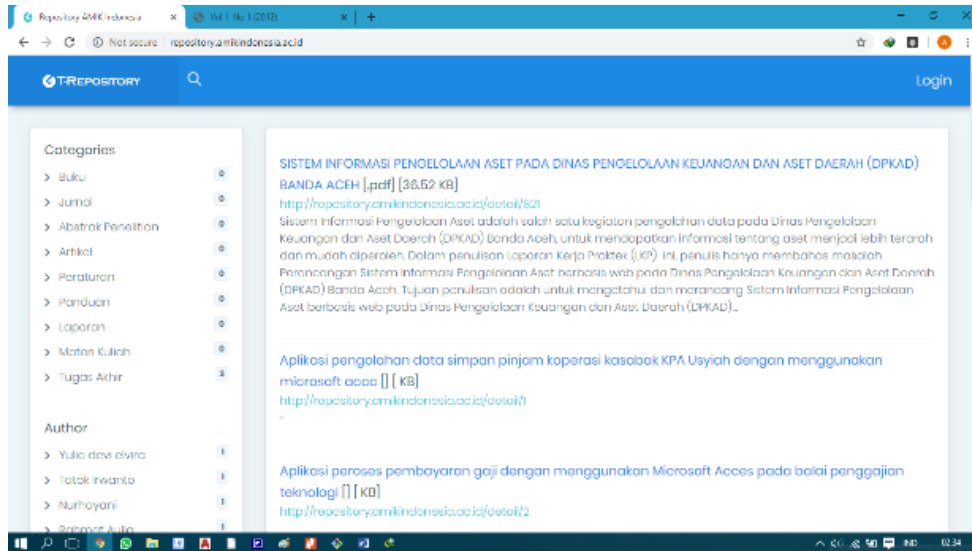


Fig 4. Repository View

In this test task, there are 10 usability test questions, the following is a table from the test results of the Digital Online Library Platform – IDOL. From the test results, in the first test (UT-1), students can answer questions by opening the IDOL website page. In the second question (UT-2), students try to find the final assignment every year but cannot find the information. In the next question (UT-3), students search for the final assignment of one of the students. For the fourth test (UT-4) students browse and search for books and journals every year. In the fifth test (UT-5), of the 22 respondents who did not succeed, only 19 people. While the sixth question (UT-6) can answer 22 people, the seventh question (UT-7) 15 people succeeded and the eighth only 12 people (UT-8). In the test "There are several errors in IDOL data information, please search and how to find them" (UT-9) only 1 respondent could not do it. In the next test (UT-10) there are 4 (four) respondents who can answer.

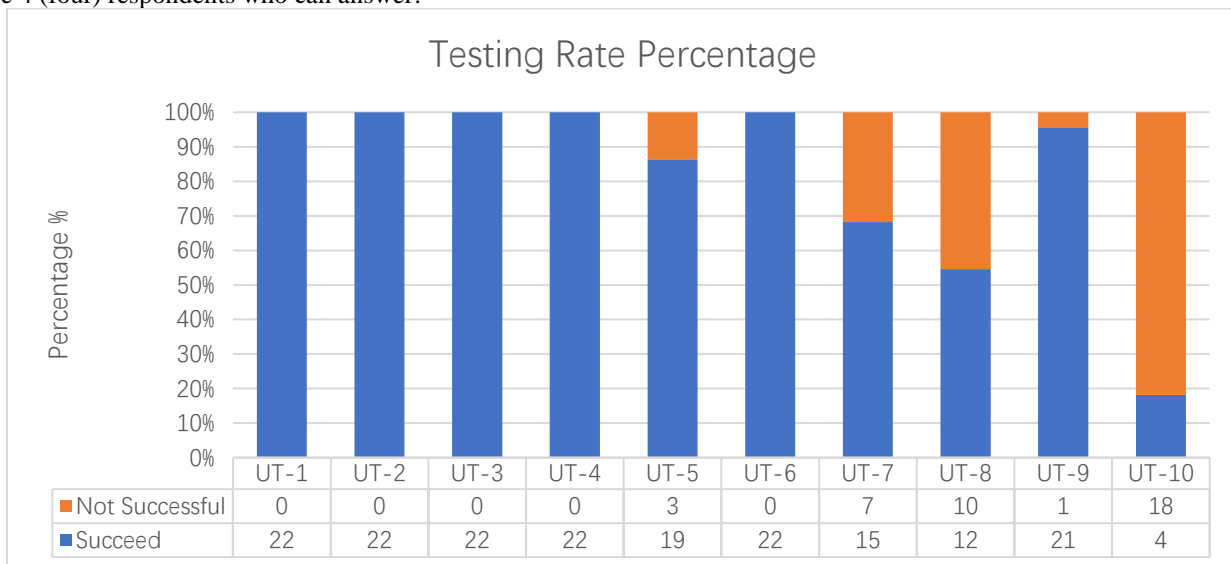


Fig 5. Testing Success Rate Percentage

Based on the test results, the level of failure in the UT-7, UT-8, and UT-10 tests with achievements of less than 80% of respondents failed to answer. For the success rate above 80% on the UT-1, UT-2, UT-3, UT-4, UT-5, UT-6, and UT-9 tests.

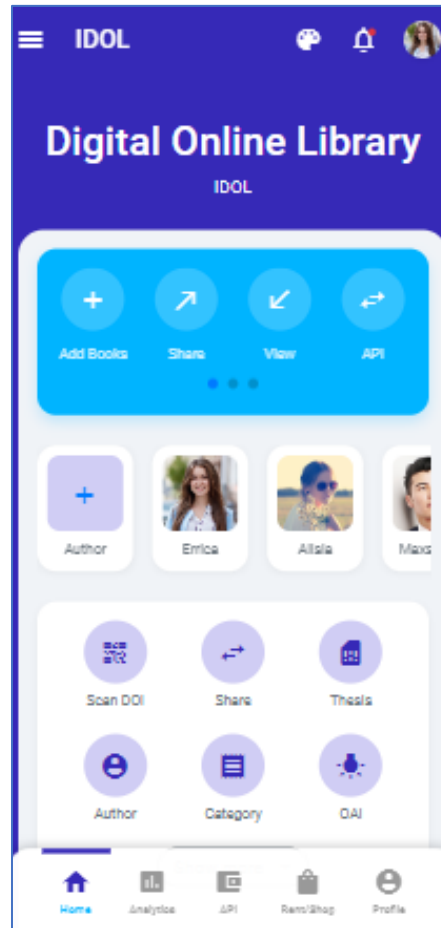


Fig 6. Digital Display Online Library – IDOL

3.2 Discussion

The Digital Online Library Platform – IDOL still needs further development, both regarding functionality, interactive and collaborative web various functions are still needed. Regarding user feedback, both the interface is a factor that must be considered in future development. Regarding data speed, we adopted the HTTP/2 protocol as a data loading strategy. However, we have not disseminated feedback on the use of the application due to the regulation on the unification of Indonesian AMIK universities with STMIK Indonesia which causes obstacles in the process of further research. This research will be continued in the following year in the study of system documentation and the existence of the technology concept has been validated, and scientific feasibility is demonstrated through analytical and laboratory studies. Meanwhile, the final data collection after the implementation process will be carried out by making a checklist of the planned and fulfilled features, as well as performance testing to obtain data on system implementation hardware requirements. Then the prototype was tested on users to get feedback in the form of questionnaires and also direct interviews. The results of the questionnaire will be inputted into tabulations and simple calculations are performed to obtain quantitative data on the success of the system. Meanwhile, interview data will be documented and categorized to distinguish evaluations for program improvement that can be carried out in this research, or will be used as input for the next year's research. Furthermore, experimental research in the laboratory and dummy data to ensure the technology is feasible to be developed with various system models tested by implementing it on the server and ready for simulation. Testing the system prototype on users in the environment and simulation of the prototype is carried out. In the testing process, the black-white box testing method is used where testing is done by looking into the module to examine existing program codes, and analyze whether there are errors or not and test-case design that uses a procedural design control structure to obtain test-cases.

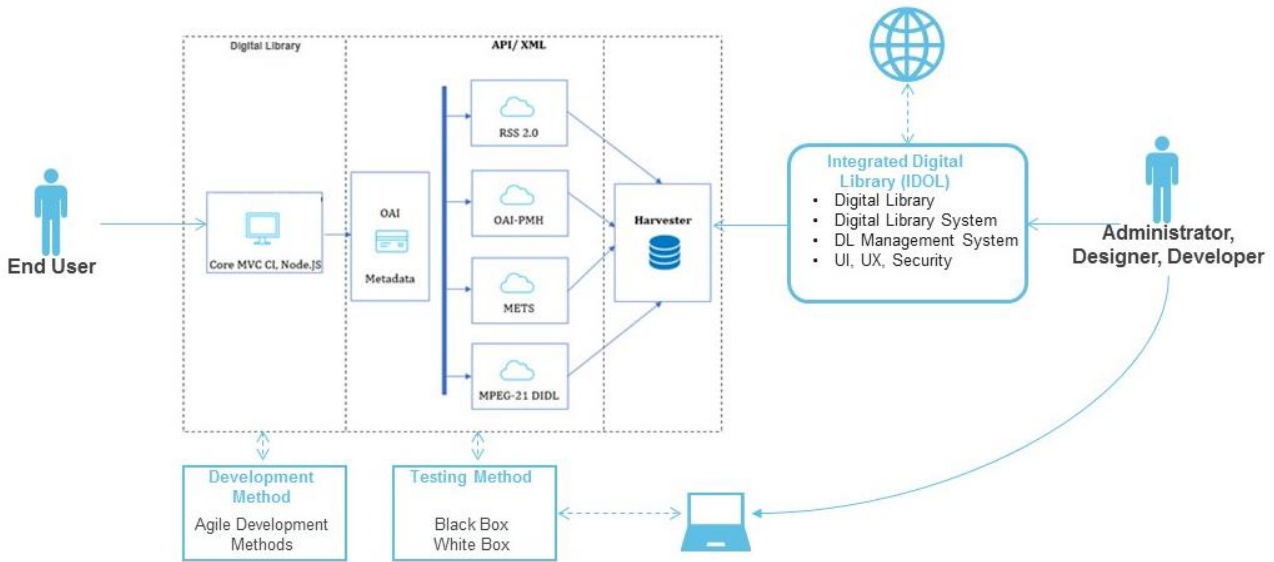


Fig 7. Next System Implementation Experiment

While Digital Online Library – IDOL development took about 5 months, we started with Development using Retrofit-Kotlin. In the REST architecture, the REST server acts as a provider of resources (data) while the REST client acts as a user to display resources for use. Each resource is identified by URIs (Universal Resource Identifiers) or global IDs. The resource is represented in the form of text, JSON or XML format. In general, the formats used are JSON and XML. In Web-based programming, the REST server is within the scope of work of the Back-End Developer while the REST client is within the scope of the work of the Front-End Developer. In the development of the Digital Online Library – IDOL is also a Mobile-based programming, both Android Developers and IOS Developers only act as REST clients just like Front-End Developers. REST clients access resources (data) to the REST server where each resource is distinguished by a global ID or URIs. There are 3 main components in Retrofit, namely; Databases, Models, and Data Access Objects.

4. Related Work

The National Library of the Republic of Indonesia (Perpusnas) has built a National Main Catalog (KIN) with an architecture that utilizes the concepts contained in SOA (service-oriented architecture) and observer design patterns [17]-[18]. The results of research conducted by Kurniawan, Noor, & Santoso (2021), stated that the Observable-SOA architecture could be a substitute for the monolithic architecture currently used by National Library of Indonesia to develop KIN without burdening library members with various additional devices [17]. In addition to KIN, the INLISLite application is an integrated library system software automation application to support the implementation of a digital library network [19]. However, the digital library architecture is still in the development stage so that the application architecture is integrated from various online catalogs and other libraries [20]. Research conducted by Wicaksono (2019) states that a digital library is in line with the digital ecosystem and society 5.0, where the Visitor Experience (VE) concept in the library needs to be applied [21]. The development of technology has given rise to a library in a new form, many library managers are vying to build a digital library so that it raises new issues in the world of libraries. These issues are related to digital preservation, copyright, plagiarism, and HR issues [22].

Research conducted by Menntang, Qashlim, Sarjan (2021) states that an integrated library information system should at least contain information and every journal source [23]. The statement is also mentioned in the research of Ravelli & Mataloni (2022) that the Digital Index is needed to collect every library data in a digital library system [24]. Access to alternative information from the digital library interface also needs to be improved in order to get positive results from the satisfaction of digital library users [25]. A number of studies that have been carried out have shown that the digital library has an integrated architecture from various other digital library platforms and its visualization and application are still being studied in order to become an innovation of a complex digital open access library. The same thing is also stated by Luna, Raimondi, & Carpani (2021) that the DL platform becomes an effective collaborative and interactive open learning [26], and Pahlvanzadeh & Zahedi Nooghabi (2021) also explains that DL can be integrated to find and retrieve information from university institutional repositories, and higher education and research institutes [27]. Therefore, it is necessary to develop an Integrated Digital Online Library (IDOL) model, where the digital library will have an integrated architecture from various digital library platforms and online sources. Judging from the various studies that have been carried out, it is related to the function of the necessary development of a digital library. Although at the technical level it is revealed that each metadata and object has its own characteristics in the further development of future digital libraries.

We see that this research is unique and differs in the technical level and the selection of the API used, although all agree that the JSON API is good, but several technologies with different programming languages are needed for further testing.

5. Conclusion

The Integrated Digital Online Library – IDOL application has not met current needs and technology. When viewed from the current trend, AR and IR multimedia have entered a role in 2022. A vision and strategy for a digital library innovation must follow public trends and collaboration between various actors (public and private). Automatic recommendation of content resources for users is one of the most promising functions of digital libraries. The underlying strategy should take into account individual progress to provide appropriate recommendations. The results of this study still need further development, both regarding functionality, interactive and collaborative web various functions are still needed. Regarding user feedback, both the interface is a factor that must be considered in future development. Regarding data speed, we adopted the HTTP/2 protocol as a data loading strategy and the IDOL platform has successfully implemented the use of Retrofit-Kotlin. Based on the test results, the level of failure in the UT-7, UT-8, and UT-10 tests with achievements of less than 80% of respondents failed to answer. For the success rate above 80% on the UT-1, UT-2, UT-3, UT-4, UT-5, UT-6, and UT-9 tests. However, we have not disseminated feedback on the use of the application due to the regulation on the unification of AMIK Indonesian with STMIK Indonesia which causes obstacles in the process of further research. It is hoped that the Integrated Digital Online Library – IDOL can involve productive learning strategies, such as reading and accessing materials, analyzing online data and learning content. The results of this study are also expected to be able to solve problems related to the architecture and interaction of the Integrated Digital Online Library - IDOL and have the potential to help future students in more productive learning.

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