Asia Information System Journal
Volume 2, Issue 2, 53-59
http://ejournal.radenintan.ac.id/index.php/AISJ/index

AISJ Asia Information System Journal
e-ISSN 2963-8593
p-ISSN XXXX-XXXX

IMPLEMENTATION OF RAPID APPLICATION DEVELOPMENT (RAD) METHOD IN THE DESIGN OF RESEARCH PARTNER RECOMMENDATION SYSTEM IN HIGHER EDUCATION

Purnama Anaking*
Department of Information System
Telkom Technology Institute
Surabaya, INDONESIA

Mochamad Nizar Palefi Ma'ady
Department of Information System
Telkom Technology Institute
Surabaya, INDONESIA

'Ainatul Fathiyah Abdul Rahim
Faculty of Administrative Science and Policy Studies, Univercity Technology Mara Pahang, Raub, MALAYSIA

Article Info

Article history:

Received: Aug 31th, 2023
Revised: Oct 10th, 2023
Accepted: Nov 20th, 2023

Keywords:

Software,
Technology,
Rapid Application Development,
Research Partner

Abstract

In a higher education environment that carries out "Tri Dharma" obligations of Higher Education, one of the roles of a lecturer is to be a researcher. Collaboration between researchers who have different expertise is important to provide solutions to problems and can also improve the quality of the research itself. This research is present to provide a research partner recommendation system by applying the Naïve Bayes machine learning algorithm and the Rapid Application Development (RAD) method. Software development is done with PHP programming language and MySQL database. Testing of the software developed using black box testing. The application provides recommendations for research partners based on keywords entered in the form of research topics. Research partner recommendations are given in the form of a weighted value of the percentage of suitability for the keywords entered. The algorithm has been successfully applied and testing has been successfully passed so that researchers can use this software to get the right research partner according to the research topic concerned.

To cite this article:

INTRODUCTION

Higher education as an entity that organize higher education, has an obligation to carry out the Tri Dharma which covers the implementation of education, research and community service[1]. Lecturers who are part of the academic community who carry out the Tri Dharma are scientists who are obliged to conduct scientific research and disseminate it.

In a scientific research often requires collaboration between lecturers as researchers who have different knowledge[2]. Increasing scientific collaboration between researchers is a common thing along with the development of science that provides scientific solutions to problems. So collaboration between researchers in various fields is important to improve the quality of a study[3].

Finding suitable partners for research that requires collaboration across scientific fields is a problem and challenge in itself. This was the issue raised and the background for this research to be carried out.

Recommender System

The need for cross-field researcher recommendations can be solved with the help of a technology-based software. A recommendation system can make it easy for users to get content and information based on

● **Corresponding author:**
Purnama Anaking, Department of Information System, Telkom Technology Institute Surabaya, INDONESIA.
✉ purnama.anaking@ittelkom-sby.ac.id.

the keywords given[4]. And in the topic of software development process we know the term Software Development Life Cycle (SDLC). With SDLC we will be given clear guidelines and stages starting from the initial process to the end[5]. One of the SDLC models that is appropriate with the characteristics of software development that is limited in time and resources is Rapid Application Development (RAD). RAD can accelerate the software development process with a prototype approach and is accompanied by continuous iteration and feedback until the final software results meet user needs[6]. Cross-field researcher recommendations can be provided from a machine learning-based recommendation system developed with the RAD approach.

Related Research

In research conducted by Kristian Tanuwijaya, Liliana, Daniel Soesanto[7] developed a scholarship recommendation system by applying machine learning algorithms that can help students get scholarship recommendation information to improve Customer Relationship Management (CRM) services at the University of Surabaya.

In research conducted by Dita Novita, Winia Waziana, Even Riyadi who developed an Android-based school information system, it was said that rapid development can make it easier for users to access information anywhere and anytime[8].

RAD is a derivative of the agile methodology. Gustrio Saputra has conducted research using a derivative of the agile methodology, namely the prototyping method, to develop a laboratory service information system in Lampung province[9].

Amir Saleh, NP Dharshinni, Despaleri Perangin-Angin, Fadhillah Azmi, Muhammad Irfan Sarif conducted research to develop a recommendation system for determining learning strategies that can be used by a teacher in the classroom using the application of the Naïve Bayes algorithm[10].

Muhamad Tabrani, Hananda Priyandaru, Suhardi conducted research that developed a software information system for receiving zakat at BAZNAS Karawang using the SDLC approach of the Rapid Development Lifecycle (RAD) model. The RAD approach that was carried out resulted in an objective software according to user needs and effective and optiomal development time[11].

Machine Learning-based Search Engine

Although we employed machine learning algorithm into the proposed software, this paper does not pay attention too much to such. Nevertheless, the principle of the appropriate software development life cycle, which we conduct rapid application prototype model, contributes a significant successful impact to our program. On the other hand, we embedded Naïve Bayes algorithm into the search engine of the software in order to fulfill the functional requirements.

As we might know, Naïve Bayes algorithm is a typical statistical formula which relies on the probability to process the training data to increase the accuracy. In our context, we tend to perform Naïve Bayes in the form of recommendation system instead of classification task. Suppose, the user inputs some keywords in the search engine (see Figure xx), then the system should provide a list of recommendation of research partners.

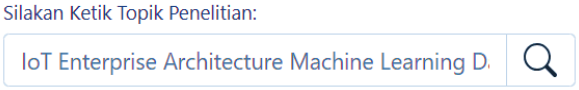

Figure 1. The example of input search.

Based on this problem, a traditional software is commonly incapable to solve. Therefore, we embedded such algorithm to find the optimal solution. The basic formula is mainly used (1), where k is number of articles of Sj, f(Wk|Sj) belong to total keyword occurrences of Wk, and Wk is the total keywords of Sj in training data. The probability of P(Wk|Sj) is used for recommending the most appropriate partners based on article published. The formula should connect to the database containing a list of keywords as features and so the lectures identities.

$$P(Wk|Sj) = \frac{|f(Wk|Sj)|}{|Wk|} \quad (1)$$

In the Naïve Bayes literature, the output is chosen by selecting the highest score of the classes. However, this approach may affect round up the gap between classes, Therefore, instead of classification, we transform to output to the percentage display by leveraging a

nonlinear tool such sigmoid activation function. By using this way, we can obtain an output in a range of 0.0 to 1.0. Then, we simply multiply them by 100 to have the percentage display. The formula is depicted as (2) where Sig(Sj) is the new output of the Naïve Bayes algorithm, and Sig(Sk) is for the old one.

$$Sig(Sj) = \frac{1}{1+e^{-Sig(Sk)}} \quad (2)$$

We omit the above details due to save space, hence, this paper is extended version of our presented works in International Conference on Computer and Informatics Engineering (IC2IE)[12]. Nevertheless, the next section explains our result representations.

From the above phenomenon, we developed a research partner recommendation system starting from the internal environment of higher education. In the software, we will get recommendations for lecturers or researchers according to the keywords of the research topic entered by applying the Machine Learning Naïve Bayes algorithm. The software is developed with PHP programming language with MySQL database. At the final stage of development, the software is tested using the black box testing method to measure the functional aspects that have been developed.

METHOD

The software development method used is Rapid Application Development (RAD). RAD is an adaptive software development method based on models or prototypes. It is iterative based on feedback in each iteration. The RAD approach emphasises the software development process through models or prototypes rather than detailed and in-depth planning. The RAD methodology was chosen because it is agile. With this approach, the development of the recommendation system will be faster and focus on providing results in stages and have a continuous iteration process until finally it can provide a recommendation system that suits user needs. This approach fits the characteristics of this research, which has limited time and requirement specifications that have the potential for change and adjustment over time. The RAD software development approach is illustrated in Figure 2 below.

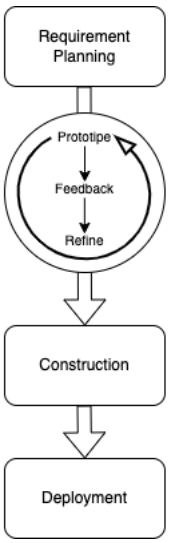

Figure 2. Stages of Rapid Application Deveopment (RAD) Method

1. Define the Requirements

The requirements planning stage in RAD does not require and require us to get detailed requirements specifications, but can simply get general or broad needs. From these needs, developers can immediately proceed to the next stage, where if there are detailed needs later, they will be accommodated by the iteration process in the development cycle.

2. Prototype

This is the stage that characterises the RAD approach. Development is done quickly when the main requirements are generally in place and prototypes are built based on these key features. As soon as possible the results of the prototype are given to the end user and feedback is given whether it is appropriate or not. If it is not then there will be a process of iterating prototype development and adjustments.

3. Construction

At this stage, the development team intensively builds the program code according to the prototype that has been in accordance with the feedback given by the end user. At this stage, a machine learning algorithm approach using Naïve Bayes was also applied to produce a research partner recommendation system according to the keywords entered by the end user. At this stage, software testing is also carried out using the black box testing method. At the testing stage, the application of the Naïve Bayes algorithm and sigmoid activation

function was also tested to see whether it had produced the right values based on the criteria explained in the previous section above, so that the system could provide partner recommendations that matched the keywords entered.

4. Deployment

This is the last stage of RAD, where the software is ready to run on a production server and can be widely accessed by end users. The software deployment on the production server environment covers the back-end database to the front-end application.

RESULTS AND DISCUSSION

As stated in the previous section, the software development of this research partner recommendation system uses Rapid Application Development (RAD). The stages of the RAD method have also been presented in the previous section. The description of the application of each stage is in this section.

Requirements Definition

Based on the results of interviews with end users, we get a main picture of the functional and non-functional needs of the research partner recommendation system to be developed. Functional requirements include: users can enter research topic keywords, users can get a list of researcher recommendations that match the research topic. Non-functional requirements include: web-based system, system can be accessed by chrome, firefox, and edge browsers.

Prototype Development

Prototype development uses PHP programming language and MySQL database. For user interface development using the Bootstrap CSS framework. From the main requirements that have been obtained, the prototype development process is carried out quickly and immediately gets feedback from users. Adjustments to prototype development are made based on the feedback given by the user. The process is illustrated in table 1 below.

Table 1. Prototype development feedback

No	User Feedback	Prototype Improvements
1	Users want a simple and minimalist app interface.	Create a simple, minimalist UI that focuses on the main features.
2	Users want the UI of the application to be accessible on both desktop and mobile devices.	Implement responsive design on the application UI.
3	The user wants to see a comprehensive list of researchers.	Create a page that will display a list of all existing researchers.
4	Users want the system to be able to handle if keywords are not filled in on the search form.	Create a 404 page that will appear if the keyword is not filled in the search form.
5	Users want the system to be able to provide info about the application and the algorithms implemented in it.	Create a page that displays info about the app and the algorithms implemented in it.

The system usecase of the final prototype produced can be seen in Figure 3 below.

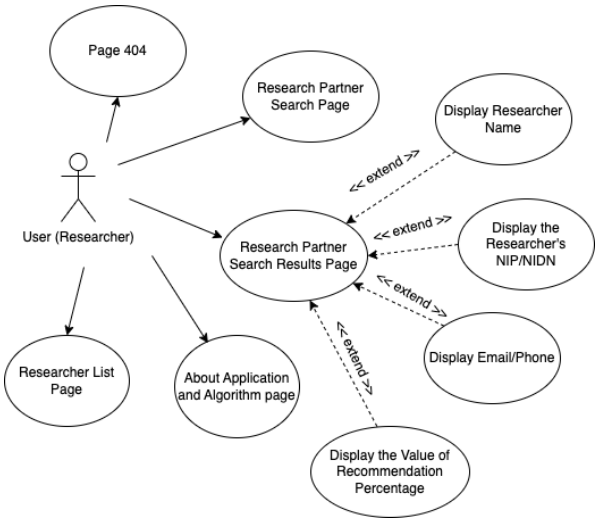

Figure 3. Final prototype usecase diagram

Application Development

Rapid development is carried out based on the results of the existing final prototype. A detailed discussion of the application of the Naïve Bayes algorithm and sigmoid activation function to provide a percentage value for the suitability of research partner recommendations can refer to our presented works in the International Conference on Computer and Informatics Engineering (IC2IE).

Figures 4 and 5 below show the main page that provides an input display to enter keywords in the form of research topics. Based on the feedback that occurred in the previous stage, this page can be accessed with a display for both desktop and mobile versions.

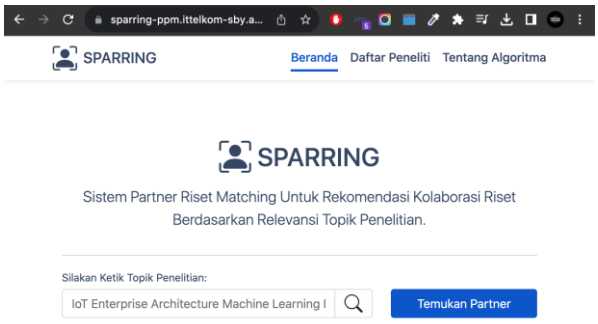

Figure 4. Desktop version of the research partner search page

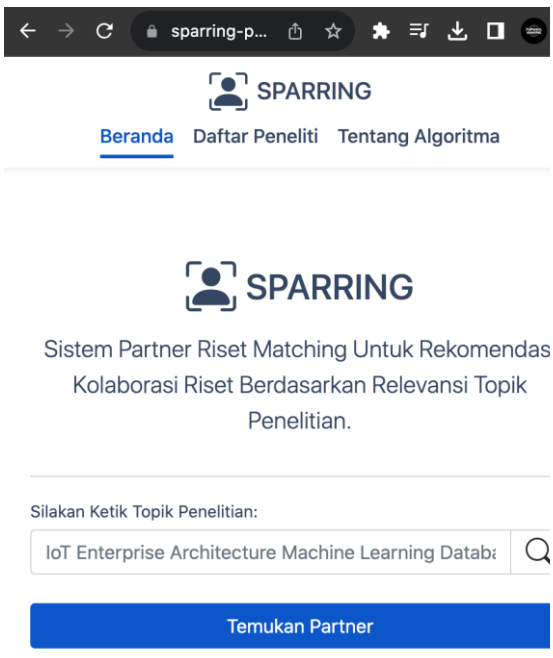

Figure 5. Mobile version of the research partner search page

Figures 6 and 7 below show the results page of the research partner search based on keywords entered in the form of certain research topics. Information is given in the form of the researcher's name, NIDN/NIP, Email / Telephone and also the weight value in the form of a percentage match with the keywords entered. The list of researchers can be displayed as a whole and also displayed per study programme. This page is also compatible with desktop and mobile devices.

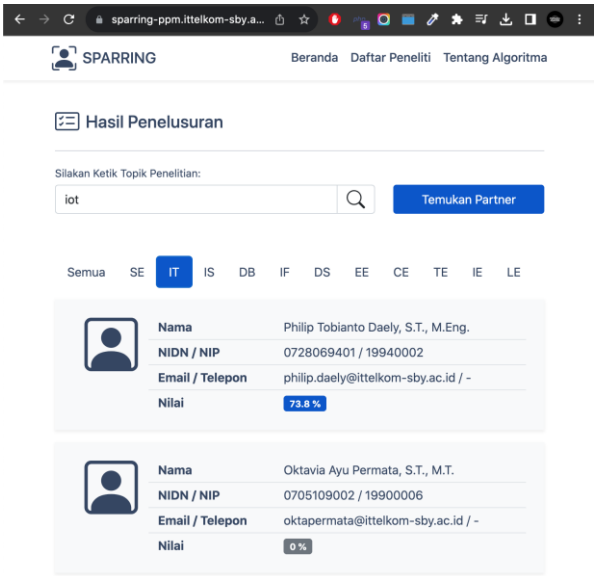

Figure 6. Desktop version of the search recommendation results page

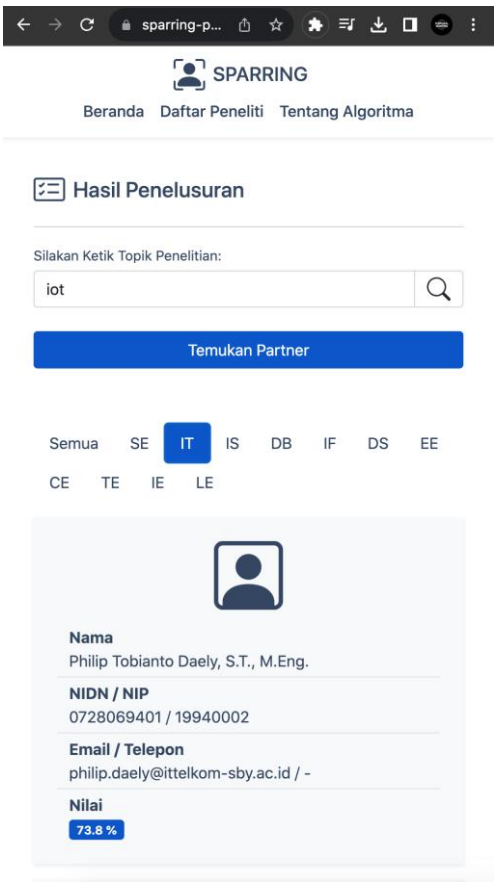

Figure 7. Mobile version of search recommendation result page

Application Testing

Black box testing is done to ensure that each functional requirement can run properly. The results of the test can be seen in table 2 below.

Table 2. Black Box Testing Results

No	Testing Activity	Test Results
1	Access the research partner search page.	Successfully display the research partner search page.
2	Perform a search by entering keywords in the form of research topics.	Successfully display recommendations for research partner search results along with the percentage weight value.
3	Access the research partner search results page.	Successfully displayed the search results page.
4	Display the search results of the list of researchers based on the study programme.	Successfully displayed a list of researchers based on study programme.
5	Did not fill in the keywords on the search form.	Successfully displayed the 404 warning page.
6	Access the researcher list page.	Successfully displayed the researcher list page.
7	Access the page about the app and algorithm.	Successfully displayed the page about the application and algorithm.

CONCLUSION

Based on the research that has been conducted, the development of a research partner recommendation system in higher education applying the Naïve Bayes learning machine algorithm has been successfully carried out using the Rapid Application Development (RAD) approach. RAD has been able to provide an optimal and effective approach to develop the system in a short time and focus on the main features desired by researchers who in this case are the end users. The recommendation system has been successfully tested and provides recommendations for a list of researchers along with the value or weight of the percentage of their respective suitability for research topic keywords entered by users. So that this recommendation system can help researchers to choose the right partner in the research they want to do in higher education so that research can be carried out by the right people to produce much higher quality research products.

REFERENCES

[1] *Law of the Republic of Indonesia Number 12 of 2012 Concerning Higher Education*. Indonesia, 2012, pp. 1–32.

[2] F. Ebrahimi, A. Asemi, A. Nezarat, and A. Ko, "Developing a mathematical model of the co-author recommender system using graph mining techniques and big data applications," *J. Big Data*, vol. 8, no. 1–15, 2021, doi: 10.1186/s40537-021-

00432-y.
[3] L. Aldieri, G. Guida, M. Kotsemir, and C. P. Vinci, "An investigation of impact of research collaboration on academic performance in Italy," *Qual. Quant.*, pp. 1–38, 2019, doi: 10.1007/s11135-019-00853-1.
[4] D. Roy and M. Dutta, "A systematic review and research perspective on recommender systems," *J. Big Data*, vol. 9, no. 59, 2022, doi: 10.1186/s40537-022-00592-5.
[5] K. Kyeremeh, "Overview of System Development Life Cycle Models," *SSRN Electron. J.*, vol. 11, no. 1, pp. 12–22, 2019, doi: 10.2139/ssrn.3448536.
[6] Team Kissflow, "What is Rapid Application Development (RAD)? An Ultimate Guide for 2023," Kissflow. Accessed: Nov. 01, 2023. [Online]. Available: https://kissflow.com/application-development/rad/rapid-application-development/
[7] K. Tanuwijaya, Liliana, and D. Soesanto, "Pengembangan Sistem Student Relationship Management di Universitas Surabaya," *Teknika*, vol. 9, no. 1, pp. 66–73, 2020, doi: 10.34148/teknika.v9i1.273.
[8] D. N. Sari, W. Waziana, and E. Riyadi, "Utilization of Android Technology As an Alternative Media Information System for Hybrid-Based School Exams," *Asia Inf. Syst. J.*, vol. 1, no. 2, pp. 68–73, 2022.
[9] G. Saputra, A. Suhelmi, Nizamiyati, I. A. Puspitasari, and W. Howards, "PROTOTYPING METHOD IMPLEMENTATION IN HEALTH LABORATORY SERVICE INFORMATION SYSTEM AT LAMPUNG PROVINCE," *Asia Inf. Syst. J.*, vol. 1, no. 2, pp. 80–85, 2022.
[10] A. Saleh, N. Dharshinni, D. Perangin-Angin, F. Azmi, and M. I. Sarif, "Implementation of Recommendation Systems in Determining Learning Strategies Using the Naïve Bayes Classifier Algorithm," *Sinkron*, vol. 8, no. 1, pp. 256–267, 2023, doi: 10.33395/sinkron.v8i1.11954.
[11] M. Tabrani, H. Priyandaru, and Suhardi, "Application of the Rapid Application Development Method To the Baznas Zakat Receipt Information System in Karawang," *J. Teknol. Dan Open Source*, vol. 4, no. 1, pp. 78–84, 2021, doi: 10.36378/jtos.v4i1.1365.
[12] M. D. Fauzi, P. Anaking, and M. N. P. Ma'ady, "Research Partner Recommender System for Academia in Higher Education using Non-Linear Approach," in *5th International Conference of Computer and Informatics Engineering (IC2IE)*, Jakarta, Indonesia, 2022, pp. 355–360. doi: 10.1109/IC2IE56416.2022.9970164.