DESIGN OF AN AGRICULTURAL EXTENSION SCHEDULE MANAGEMENT SYSTEM

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Received: 02, September, 2023 ***Revised: 23, November, 2023*** ***Accepted: 08, December, 2023***

ABSTRACT

Based on the strategic plan of the Ministry of Agriculture for 2015-2019, development in the agricultural sector will refer to the Agriculture for Development Paradigm which positions the agricultural sector as a driver of balanced and comprehensive development transformation including demographic, economic, intersectoral, spatial, institutional and development governance. With such great potential, the Pasuruan Regency Food and Agriculture Security Service has problems in the availability of human resources in quantity, especially agricultural instructors. For this reason, there is a need for a system that can optimize existing human resources. The system development method used is the waterfall method, the waterfall method is a method that works sequentially, the development of the agricultural extension schedule management system has been going well. So that it can help the work management process of agricultural instructors in distributing agricultural extension at the village level. This agricultural extension schedule management system is implemented using a MySQL database and the PHP programming language. This system is easy to use so it helps related parties in schedule management and recording extension activities.

Keywords: Waterfall, System, Management, Schedule, Extension

1. INTRODUCTION

The Pasuruan Regency Food Security and Agriculture Service plays a crucial role in supporting regional leaders in agricultural governance (Areas, 2020). By Regional Regulation no. 16 of 2016 and Pasuruan Regent Regulation no. 183 of 2021, dated December 31, 2021, the organizational structure and management of the Food Security and Agriculture Service are defined as follows: The service is headed by a leader who is accountable to the Regent through the Regional Secretary. Its primary task is to assist the Regent in agricultural governance based on the principles of autonomy and support (Koloay et al., 2023).

Considering the region's characteristics, Pasuruan Regency Agriculture encompasses a wide range of agricultural sub-sectors, spanning from lowlands to highlands and mountains. This diverse landscape presents opportunities for the development of various food crop commodities, including horticulture and plantations, which can become key regional products

(Giller et al., 2021). The agricultural potential within the region encompasses a variety of crops, such as rice, corn, soybeans, peanuts, green beans, wheat, cassava, and sweet potatoes.

Additionally, horticultural crops like vegetables (chilies, tomatoes, eggplant, spring onions, potatoes, cabbage, carrots, and peppers), fruits (papaya, avocado, mangosteen, duku, banana, salak, durian, apples, mangoes, grapes, oranges, and sugar apple), ornamental plants (tuberrose, rose, jasmine, orchid, heliconia, anthurium, and chrysanthemum), and biopharmaceutical plants (ginger, turmeric, laos, galangal, key, ginger, bitter, Mahkota dewa) can be cultivated. Plantation crops, including coffee, cloves, coconut, ylang ylang, sugar cane, and kapok, also hold potential for development. The Ministry of Agriculture's strategic plan for 2015–2019 emphasizes the Agriculture for Development Paradigm, which positions the agricultural sector as a catalyst for balanced and comprehensive development transformation. This paradigm considers the agricultural sector's role in demographic, economic, intersectoral, spatial, institutional, and development governance aspects. It recognizes that the agricultural sector serves not only as a provider of food security for the community but also as a driver of multifunctional interests.

The agricultural sector plays a vital role in addressing environmental and social challenges such as poverty and justice, while also contributing to agrotourism by providing tourism facilities (Zvavahera & Chigora, 2023). In conclusion, the Pasuruan Regency Food Security and Agriculture Service plays a significant role in supporting agricultural governance. The region's agricultural potential spans from lowlands to highlands and mountains, offering opportunities for the development of various food crop commodities. The strategic plan of the Ministry of Agriculture emphasizes the multifunctional role of the agricultural sector in driving comprehensive development and addressing environmental and social challenges. Additionally, agriculture contributes to agrotourism, making it a crucial sector with diverse interests beyond food security (Bahnasy, 2023).

The Pasuruan Regency Food and Agriculture Security Service is facing challenges in terms of the quantity of available human resources, particularly agricultural instructors, despite its tremendous potential (Wahyudi et al., 2023). These instructors play a crucial role in providing counseling to farmers through a farmer group approach, aiming to enhance their knowledge, skills, and attitudes in managing their farming businesses. However, the process of recruiting additional officers to meet the demand is still ongoing and will require more time to be implemented (Maulu et al., 2021).

Consequently, there is a pressing need for a system that can optimize the utilization of existing human resources. As mentioned previously, the management of training activities and visits, known as LAKU, is currently done manually, relying on the creation of tables in Excel to organize and coordinate all extension management activities, as well as the scheduling of time and location for these activities. Unfortunately, this manual approach leads to slow and uneven progress in these activities. Moreover, the recorded data from these activities is not automatically connected to other sections within the service, resulting in a lack of coherence and integration.

Additionally, the data related to the assisted groups and villages is not effectively and efficiently stored and managed, further hindering the service's ability to provide comprehensive support to these communities (Chen et al., 2021). To address these challenges, it is crucial to develop a more advanced and integrated system for managing the scheduling of training activities and visits, which would automate the process and ensure seamless connectivity and accessibility of data across relevant sections (Himeur et al., 2023). By doing so, the Pasuruan Regency Food and Agriculture Security Service can significantly improve the effectiveness and efficiency of their operations, ultimately benefiting the farmers and farming communities they serve.

2. THEORY

The structured approach utilized by the author in this research ensures a systematic and organized process in its creation. By adopting the waterfall model, a well-established software development method, the author ensures a sequential and linear progression throughout the project (Mishra & Alzoubi, 2023). This model involves distinct phases such as requirements gathering, design, implementation, testing, and maintenance (Mishra & Alzoubi, 2023). The author's choice of this model demonstrates a deliberate and methodical approach in developing the research.

Overall, this research builds upon existing literature and incorporates a systematic software development approach to contribute to the field (De Bernard et al., 2022) on an agricultural extension information system using the SDLC waterfall method. The SDLC (Software Development Life Cycle) waterfall method is an approach in software development that follows a process that runs linearly and sequentially, starting from the planning, analysis, design, coding, testing, and implementation and maintenance stages (Alazzawi et al., 2023). Analysis and design were carried out to build a model that could facilitate agricultural extension activities. Furthermore, in research entitled "Design of an Information System for Vegetable Cultivation Extension Based on SMS Gateway)" by (Agung & Djuniadi, 2014) explains that several agricultural problems that occur are the lack of platforms provided by instructors for the benefit of farmers.

The limited facilities and infrastructure that extension agents have in carrying out their duties and functions, causes low mobility of instructors and less than optimal service to farmers (Witinok-Huber et al., 2021). The research method consists of the data collection stage which includes observation and literature study as well as the complete system design stage. The results of the research are the design of a vegetable cultivation extension information system based on an SMS gateway consisting of a server application as a back office (web system administrator and web system SMS management), a user application as a front office (information system services and interactive SMS services) and equipped with features interactive SMS in the form of SMS autoreply and SMS autoforward services. This information system can be used by extension agents and extension targets as a means of communication and exchange of information / extension materials (Hancock et al., 2021).

Another research was conducted by (Hamdia et al., 2021) who explained that scheduling problems arise because several jobs are carried out simultaneously, while resources are limited.

Solving this problem requires computational techniques and methods for optimal results. This research proposes a genetic algorithm method to solve this problem. System testing that has been carried out by combining hard constraints and soft constraints produces course scheduling that is created automatically and a solution that does not conflict with the schedule preparation time is relatively faster. Scheduling information systems can be developed with web-based applications and other optimization methods.

3. METHOD

In conducting this research, the author meticulously applied a methodical and structured approach throughout its inception. The chosen software development strategy followed the systematic waterfall model, ensuring a comprehensive and organized research process. The flow that the author will carry out in carrying out this research is as shown in Figure 1 (Suradi, 2022).

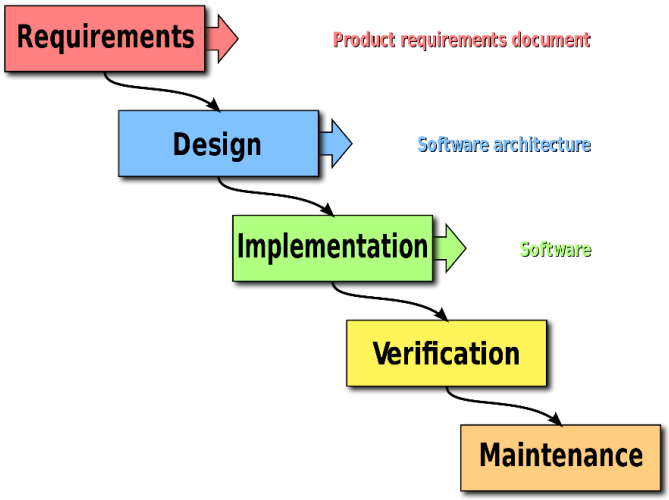

Figure 1 Waterfall Method

Based on the research steps depicted in Figure 1, the activities carried out in each research step are:

a. Requirements

This research focuses on the urgency of implementing the algorithm chosen as the method for managing and scheduling training and instructor visits in agriculture. The aim is to establish a system that can accommodate the entire workforce and regions involved. In the context of this research, emphasis is placed on developing an efficient and effective algorithm to maximize the scheduling of training activities and visits by agricultural instructors. In this way, it is expected to achieve optimization of resource allocation, improved operational efficiency, and adequate service to the entire area and workforce.

b. Design

To successfully implement the Agricultural Instructor Schedule Management System in the Pasuruan District Food Security and Agriculture Office, several important data points need to be collected. This involves information on the instructors involved, the target groups and villages to be served, the coverage area for trainings and visits, and the format of reports needed in softcopy. The data collection process for this study was conducted at the Pasuruan District Food Security and Agriculture Office itself. By collecting and analyzing this data, the system

can be customized to meet the specific needs and requirements of the service, thus ensuring efficient scheduling and management of agricultural training and visits.

c. Implementation

Before actualizing the software, it is imperative to undergo a system design phase to guarantee a clearly defined workflow. This ensures a more accessible understanding of the system's operations and guarantees that the result aligns with the anticipated outcomes for both users and developers. In this study, the system design is crafted based on use case diagrams. These diagrams offer a visual depiction of user (actor) interactions with the system, illustrating the diverse actions and scenarios that the system can manage. Through the utilization of use case diagrams, the research endeavors to construct a comprehensive system design that precisely encapsulates the requirements and intended functionalities. This will serve as groundwork for the developmental phase, facilitating the creation of a software system that satisfies the needs and expectations of the involved stakeholders.

d. Verification

Following the finalization of the system design process, the subsequent step involves commencing the implementation phase, translating the design into tangible lines of program code. In the development of the lecture management system, PHP will be employed as the programming language, coupled with the utilization of the MySQL database. PHP stands out as a widely employed scripting language for web development, recognized for its versatility and seamless interaction with databases. On the other hand, MySQL is a well-known open-source relational database management system renowned for its efficient data storage and retrieval capabilities. By harnessing the capabilities of PHP and the reliability of MySQL, the lecture management system can be efficiently brought to fruition, facilitating the effective management of lectures and associated processes. The implementation phase holds paramount significance as it breathes life into the design, transforming the envisioned system into a functional reality.

e. Maintenance

In the next phase of the research, the focus shifted towards conducting system testing maintenance. This crucial step was necessary to verify the proper functioning of the developed system, aligning it with the initial expectations set at the beginning of the research. If any discrepancies were identified during this testing phase, where features did not align with their intended functionality, a thorough problem analysis would be conducted. This analysis would help determine the root cause of the issue, leading to either a redesign of the system or adjustments to the existing design. To ensure comprehensive testing, the team employed black box testing, a technique that evaluates the system's functionality without delving into its internal structure. Additionally, this stage aimed to generate user guidelines, which would serve as a valuable resource for users, offering assistance and instructions on how to effectively utilize the system. These guidelines would enhance the user experience and facilitate seamless adoption of the system.

4. RESULTS AND DISCUSSION

P-ISSN : 2088-6705
E-ISSN : 2621-5608

The system design in this research uses a use case diagram as in Figure 2.

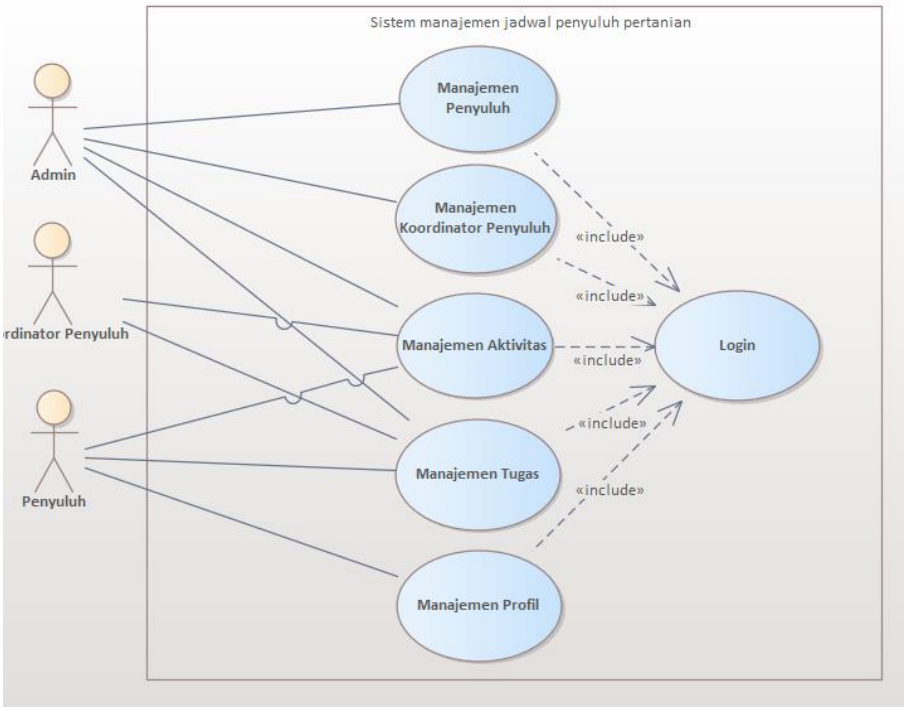

Figure 2. use case diagram

The implementation of the user interface is divided into user categories, namely: admin, extension coordinator and instructor. In Figure 3, the login page is shown as follows:

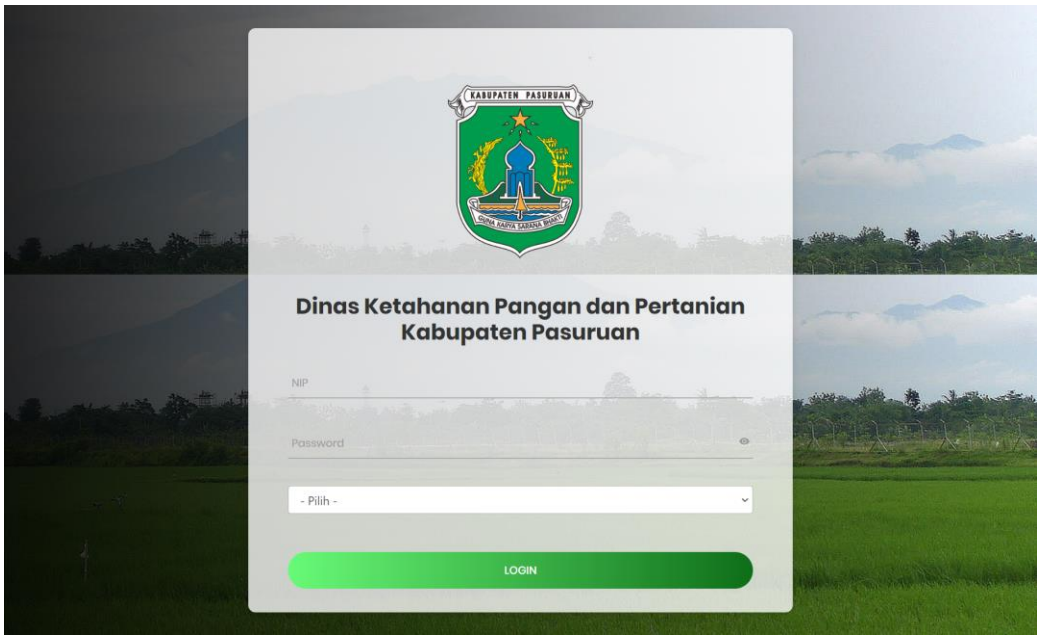

Figure 3. Login Page

On the login page, users are required to enter their username and password to access the system. As an administrator, users can view information on the main page, as shown in Figure 4.

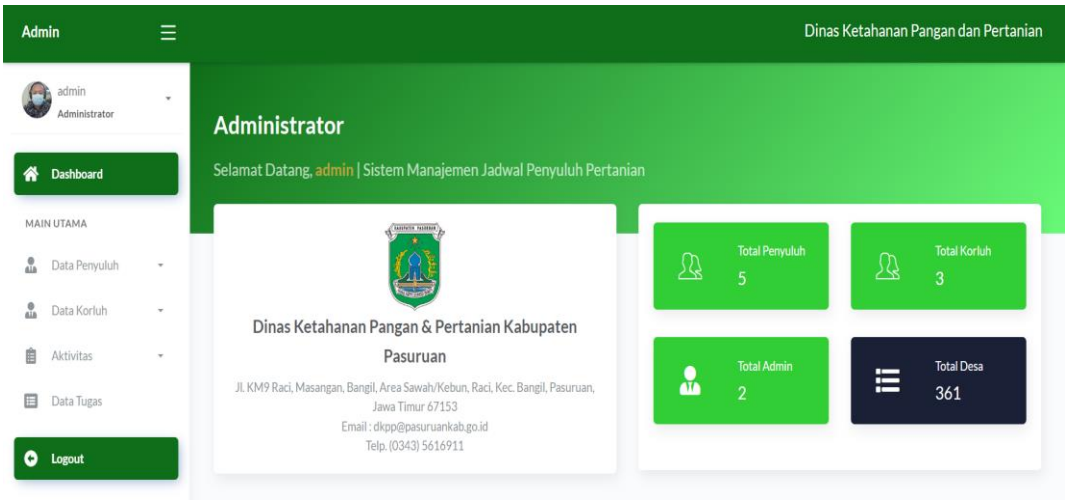

Figure 4. Dashboard Page

After the system implementation is complete, the final stage of the waterfall method is to carry out black box testing. The following table summarizes the testing results:

Table 1. Testing Result

Code	Feature	Validation
A1	Admin login	Valid
A2	Admin can manage extension data	Valid
A3	Admin can manage extension coordinators	Valid
A4	Admin can manage activity data	Valid
A5	Admin can manage task data	Valid
B1	Extension coordinator login	Valid
B2	Extension coordinators can manage activity data	Valid
B3	Extension coordinators can manage task data	Valid
C1	Instructor login	Valid
C2	Extension agents can manage assignment data	Valid
C3	Extension agents can manage activity data	Valid
C4	Extension agents can manage profile data	Valid

The feature validation tests that have been carried out have resulted in 12 features running well. In percentage terms, this system was successfully implemented 100%.

5. CONCLUSIONS AND SUGGESTIONS

In summary, the preceding chapters have provided a comprehensive insight into the Web Extension Schedule Management System. It has been established that this system serves as a valuable tool for systematically organizing and managing extension activities. Through the implementation of this system, the scheduling and reporting of agricultural extension activities are significantly simplified, contributing to a more efficient and effective management approach. Moreover, the evident success of the system lies in the seamless integration of all planned features, which are currently operational and functioning smoothly. This accomplishment underscores the system's reliability and its capability to fulfill its intended purpose. The system's capacity to accommodate diverse extension activities and streamline their management processes adds substantial value to agricultural extension practices. Overall,

the Web Extension Schedule Management System emerges as a valuable solution for enhancing the efficiency and effectiveness of scheduling and reporting extension activities within the agricultural sector.

REFERENCES

Alazzawi, A., Rahmatullah, B., & others. (2023). A Comprehensive Review of Software Development Life Cycle methodologies: Pros, Cons, and Future Directions. *Iraqi Journal For Computer Science and Mathematics*, *4*(4), 173–190. https://doi.org/https://doi.org/10.52866/

Areas, R. A. I. I. C. (2020). Food Security And Performance Of Rice Agribusiness Institutions In Coastal Areas Of Seluma Regency. *Journal of Agri Socio-Economic and Business*, *2*(2), 69–84. https://doi.org/https://doi.org/10.31186/jaseb.2.2.69-

Bahnasy, N. (2023). The interplay of tourism economy and food security in dessert-prone agricultural heritage sites. *Journal of Humanities and Applied Social Sciences*. https://doi.org/10.1108/JHASS-08-2023-0090

Chen, J., Ramanathan, L., & Alazab, M. (2021). Holistic big data integrated artificial intelligent modeling to improve privacy and security in data management of smart cities. *Microprocessors and Microsystems*, *81*, 103722. https://doi.org/https://doi.org/10.1016/j.micpro.2020.103722

De Bernard, M., Comunian, R., & Gross, J. (2022). Cultural and creative ecosystems: a review of theories and methods, towards a new research agenda. *Cultural Trends*, *31*(4), 332–353. https://doi.org/https://doi.org/10.1080/09548963.2021.2004073

Giller, K. E., Delaune, T., Silva, J. V., Descheemaeker, K., van de Ven, G., Schut, A. G. T., van Wijk, M., Hammond, J., Hochman, Z., Taulya, G., Chikowo, R., Narayanan, S., Kishore, A., Bresciani, F., Teixeira, H. M., Andersson, J. A., & van Ittersum, M. K. (2021). The future of farming: Who will produce our food? *Food Security*, *13*(5), 1073–1099. https://doi.org/10.1007/s12571-021-01184-6

Hamdia, K. M., Zhuang, X., & Rabczuk, T. (2021). An efficient optimization approach for designing machine learning models based on genetic algorithm. *Neural Computing and Applications*, *33*, 1923–1933. https://doi.org/https://doi.org/10.1007/s00521-020-05035-x

Hancock, D. R., Algozzine, B., & Lim, J. H. (2021). *Doing case study research: A practical guide for beginning researchers*.

Himeur, Y., Elnour, M., Fadli, F., Meskin, N., Petri, I., Rezgui, Y., Bensaali, F., & Amira, A. (2023). AI-big data analytics for building automation and management systems: a survey, actual challenges and future perspectives. *Artificial Intelligence Review*, *56*(6), 4929–5021. https://doi.org/https://doi.org/10.1007/s10462-022-10286-2

Koloay, R. N. S., Goni, C. J. J. G., Sumakul, T. F., Londa, J. E., Doodoh, M., Rimbing, N., & Lawotjo, S. (2023). The implementation of local government organizational structures formation: A legal study in indonesia. *The International Journal of Social Sciences World (TIJOSSW)*, *5*(1), 349–356. https://doi.org/https://doi.org/10.5281/zenodo.7992554

Maulu, S., Hasimuna, O. J., Mutale, B., Mphande, J., & Siankwilimba, E. (2021). Enhancing the role of rural agricultural extension programs in poverty alleviation: A review. *Cogent Food \& Agriculture*, *7*(1), 1886663. https://doi.org/https://doi.org/10.1080/23311932.2021.1886663

Mishra, A., & Alzoubi, Y. I. (2023). Structured software development versus agile software development: a comparative analysis. *International Journal of System Assurance Engineering and Management*, 1–19. https://doi.org/https://doi.org/10.1007/s13198-023-01958-5

Wahyudi, S. T., Badriyah, N., Nabella, R. S., Sari, K., & Radeetha, R. (2023). Economic empowerment through strengthening the role of farmer groups in TNBTS. *Journal of Community Service and Empowerment*, *4*(2), 425–435. https://doi.org/https://doi.org/10.22219/jcse.v4i2.26030

Witinok-Huber, R., Radil, S., Sarathchandra, D., & Nyaplue-Daywhea, C. (2021). Gender, place, and agricultural extension: a mixed-methods approach to understand farmer needs in Liberia. *The Journal of Agricultural Education and Extension*, *27*(4), 553–572. https://doi.org/https://doi.org/10.1080/1389224X.2021.1880453

Zvavahera, P., & Chigora, F. (2023). Agritourism: a source for socio-economic transformation in developing economies. *Qeios*. https://doi.org/https://doi.org/10.32388/5OUMQA