Dr. F. X. Arinto Setyawan (Electrical Engineering Department, Universitas Lampung, Indonesia).

Dr. F. Yudi Limpraptono (Electrical Engineering Department, Institut Teknologi Nasional, Indonesia).

Dr. Isdawimah (Electrical Engineering Department, Politeknik Negeri Jakarta, Indonesia).

Dr. Amin Suharjono (Telecommunications Engineering Department, Politeknik Negeri Semarang)

Dr. Ir. Lobes Herdiman, M.T. (Industrial Engineering Department, Universitas Sebelas Maret, Indonesia).

PREFACE

We would like to present, with great pleasure, the first issue of Matrix: Jurnal Manajemen Teknologi dan Informatika in Volume 13, 2023. This journal is under the management of Scientific Publication, Research and Community Service Center, Politeknik Negeri Bali and is devoted to cover the field of technology and informatics management including managing the rapid changes in information technology, emerging advances in electrical and electronics and new applications, implications of digital convergence and growth of electronics technology, and project management in electrical, mechanical or civil engineering. The scientific articles published in this edition were written by researchers from Universitas Islam Negeri Sumatera Utara, Universitas Negeri Semarang, Politeknik Negeri Bali, and Universitas Flores. Articles in this issue cover topics in the field of The Modeling of Laboratory Information Systems in Higher Education Based on Enterprise Architecture Planning (EAP) for Optimizing Monitoring and Equipment Maintenance, The Development of Employee Attendance Application Based on Mobile Using The Spiral Method, Factors that Influence The Use of Digital Payments as Ease of Transactions in The Digital Era, The Grounding Resistance Improvement of The Distribution Substation Using Multiple Rods and Wood Charcoal as Soil Treatment, and Designing and Building A Business Data Collection Application Using The Waterfall Method. Finally, we would like to thank reviewers for their efforts and hard work in conducting series of review phase thoroughly based on their expertise. It is our hope that the work of the authors in this issue will be a valuable resource for other researchers and will stimulate further research into the vibrant area of technology and information management in specific, and engineering in general.

Politeknik Negeri Bali, 24 March 2023

Editor-in-chief

Gusti Nyoman Ayu Sukerti, S.S., M.Hum.

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The modeling of laboratory information systems in higher education based on enterprise architecture planning (EAP) for optimizing monitoring and equipment maintenance

Yahya Nur Ifriza [1]*, Trisni Wulandari Veronika [2], Trisni Suryarini [3], Antonius Supriyadi [4]

[1] *Information System Study Program, Universitas Negeri Semarang, Indonesia*
[2,4] *Faculty of Mathematics and Science, Universitas Negeri Semarang, Indonesia*
[3] *Accounting Study Program, Universitas Negeri Semarang, Indonesia*

*Corresponding Author: yahyanurifriza@mail.unnes.ac.id

Abstract: The laboratory is a place to conduct scientific research, experiments, measurements, or scientific training. FMIPA UNNES has several laboratories distributed in each department to support student lectures. Through the implementation of practicum in the laboratory, students are expected to be able to find a concept, and foster scientific attitudes, and critical thinking skills. Good laboratory management is expected to be able to utilize laboratory resources effectively and efficiently. Laboratory equipment must be ensured to function properly and be ready to be used for practicum. To support this, it is necessary to monitor the condition of the equipment and immediately repair the equipment if any damage is found. The current obstacle is monitoring tool repairs manually, so there are shortcomings such as poor documentation, and equipment conditions that cannot be monitored online. In this study, an information system for monitoring the maintenance of laboratory equipment in the departments in the FMIPA UNNES environment will be built. The research method begins with a literature study, initial data collection and observation, EAP-based system design, system testing, system analysis, and system evaluation. This study uses the SDLC (System Development Life Cycle) approach which is used to develop a product for the Monitoring Information System for the Maintenance of Laboratory Equipment. Testing is done using black box testing. From the results of development and testing, it can be concluded that the system can be used to simplify the process of managing laboratory equipment with a UAT value of 88% suitable for use.

Keywords: EAP, information system, laboratory, maintenance, optimization

How to Cite: Y. N. Ifriza, T. W. Veronika, T. Suryarini and A. Supriyadi, "The modeling of laboratory information systems in higher education based on enterprise architecture planning (EAP) for optimizing monitoring and equipment maintenance," *Matrix: Jurnal Manajemen Teknologi dan Informatika*, vol. 13, no. 1, pp. 1-11, 2023.

Introduction

A laboratory is a place to conduct scientific research, experiments, measurements, or scientific training. Now lab management has followed technological developments, through the application of information systems. This is because technology can facilitate human work. One of them is the existence of digital applications. Applications have various capabilities to help human work, ranging from office applications to management, personal, entertainment, and other fields of human work. With this equipment, human tasks become easier, faster, more thorough, and more efficient [1].

The implementation of lecture practicum in the laboratory is expected so that students can find a concept, and foster scientific attitudes, and critical thinking skills. So laboratory management needs to be empowered effectively and efficiently [2]. Laboratory equipment must be ensured to function properly and be ready to be used for practicum. To support this, it is necessary to monitor the maintenance of the equipment systematically. The current obstacle is that monitoring of tool repair is done manually, so there are shortcomings such as poor documentation, and the condition of the equipment that cannot be monitored online [3].

Currently, the FMIPA UNNES laboratory does not yet have an information system that can monitor the maintenance of laboratory equipment, starting from the condition of laboratory equipment to the repair process if there is damage [4]. Therefore, this study aims to create and implement an information system for monitoring the maintenance of laboratory equipment in the Department of Mathematics and Natural Sciences UNNES. Based on the description of the importance of laboratories to supporting lectures, the authors initiated the idea of researching the Development of Information Systems for Monitoring Laboratory Equipment Maintenance [5]. This is in line with the recommendation of the Minister of PANRB, which implies the use of IT and modern tools in completing work [6].

This monitoring system aims to create an information system that can perform two purposes at once, namely preventing laboratory equipment from being lost or damaged and making it easier for laboratory technicians to carry out maintenance of laboratory equipment [7].

Methodology

The stages in this research are data collection, analysis and design, stages of developing laboratory systems, and testing information systems [8]. The stage of data collection is done by using the method of interview and observation [9]. Interviews were conducted with lecturers, students, and department managers, to obtain overview of the needs and flow of laboratory management. Meanwhile, observations were made by observing what data would be used in the management of laboratory equipment, borrowing, and processing laboratory equipment at FMIPA UNNES [10].

At the system design stage, it is carried out using the Waterfall method. The Waterfall method is a sequential software development method and consists of five interrelated and influencing stages [11]. In this method, there are several stages, namely the analysis, design, implementation/coding, testing/verification, and maintenance stages. The stages of the Waterfall method are shown in Figure 1.
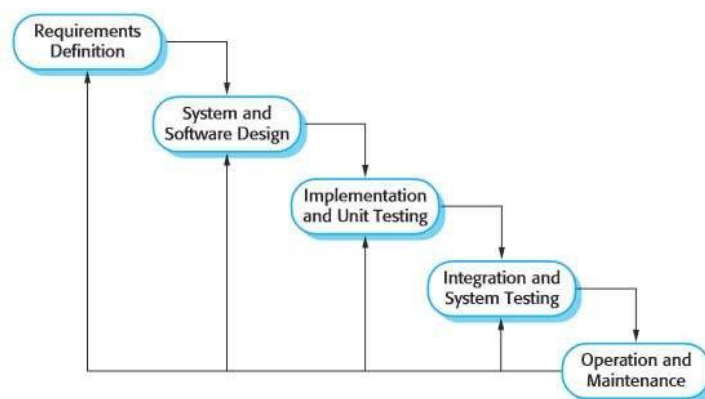
Figure 1. Waterfall Method

At the system design stage, it will produce a design for the database using ERD and DFD to describe the system framework that will later be built making it easier for the process of making the system needed by the user [12]. The development stage is by implementing the results of the design carried out. The process of developing information systems using the CodeIgniter Framework with the programming languages used are PHP and JavaScript. The next stage of this research is testing information systems. Testing using the Black Box Testing method. This test is carried out to find out what deficiencies and errors are in the system [13]. The system will be tested by conducting experiments directly by the user. Tests that will be carried out are using black box testing and Mean Opinion Score. Black-box testing is a testing process by checking one by one the functions that have been created, and whether they have been made in accordance with user requirements [14]. The Mean Opinion Score test is carried out by involving several respondents to try to use the system, then asking them to assess with a range of 1 to 4. Where a value of 1 represents the worst value and a value of 4 represents the best value. Then the

average rating of all respondents is calculated so that the Mean Opinion Score value is obtained from the system [15].

Development of information systems using the CodeIgniter Framework with the programming languages used are PHP and JavaScript. The next stage of this research is testing information systems. Testing using the Black Box Testing method. This test is carried out to find out what deficiencies and errors are in the system [16]. The system will be tested by conducting experiments directly by the user. Tests that will be carried out are using black box testing and Mean Opinion Score. Black-box testing is a testing process by checking one by one the functions that have been created, and whether they have been made in accordance with user requirements [17]. The Mean Opinion Score test is carried out by involving several respondents to try to use the system, then asking them to assess with a range of 1 to 4. Where a value of 1 represents the worst value and a value of 4 represents the best value. Then the average rating of all respondents is calculated so that the Mean Opinion Score value is obtained from the system [18].

Enterprise Architecture is a logical organization for the main business processes and Information Technology capabilities that reflect the need for integration and standardization of the company's operating model based on the Center for Information Systems Research [19]. Enterprise Architecture is a set of principles, methods, and models used in the design and realization of a company's organizational structure, business processes, information systems, and infrastructure [20]. Based on the description above, it can be concluded that enterprise architecture is the principles, methods, and models used in the design and realization of a company's organizational structure, business processes, information systems, and infrastructure. Enterprise Architecture Planning is a process of defining the architecture for the use of information to support the business and planning to implement the architecture [21], [22], [23].

Enterprise Architecture Planning methodologies and models are an early part of a major body of Enterprise Architecture knowledge that is still relevant and has influenced many frameworks, methodologies, and best practices in the public and private sectors [24], [25]. In this journal the research methodology used will be adapted to the architectural modeling steps in the EAP, namely planning initiation, business modeling, current system architecture and technology, development of enterprise architecture models in the form of data architecture, application architecture, technology architecture, and implementation [26].

Results and Discussions

The result of this research is an information system for the management of laboratory equipment. This system can be used to simplify the process of data collection, borrowing, and also processing the value of laboratory equipment results. The modeling steps in the EAP are steps that can be taken in building a blueprint for architecture. Following the steps in the EAP concept, it will be used to model the laboratory system at FMIPA UNNES.

A. Initiation of Planning

The users of this system are Department Lab Admin, tasked with inputting lab asset data in their respective departments, including conditions and suggestions for repairing tools. Faculty Admin, Faculty admin is tasked with making decisions about whether to approve or postpone the proposed tool repair. Finance Admin, tasked with approving budget allocations/ceilings.

The initial stage of the EAP is planning initialization, which defines the organization as an object by describing the organization's vision and mission which is linked to the vision of the information system planning so that the development of the architecture can be carried out in accordance with business objectives. In accordance with its existence as a university, the core business of a university consists of three main components, namely: education and teaching, community service, and research which is called the tri dharma of higher education. By providing educational services to the community to produce graduates who will be returned to the community.

Determining the future vision and mission is very necessary as a guideline for determining various IT strategies needed to support the vision and mission. The selection of the planning methodology approach will determine the results of the blueprint that will be made. The vision and mission of FMIPA UNNES are as follows.

The vision of FMIPA UNNES is to become a Faculty of Mathematics and Natural Sciences with a conservation perspective with an international reputation. The mission of FMIPA UNNES is to first organize and develop mathematics and natural science education in superior educational and non-educational programs with conservation insight and international reputation. Second, develop and create science and technology in the fields of mathematics and natural sciences, as well as civilizations with conservation insight and international reputation. Third, disseminate science and technology in the fields of mathematics and natural sciences with conservation insight and with an international reputation. Fourth, build and develop institutional cooperation in supporting the institutional strengthening of international reputation.

The goal of FMIPA UNNES is to produce human resources of MIPA that are superior at the international level. Produce MIPA science and education with superior conservation insight. Providing modern professional services in the field of Mathematics and Natural Sciences and education to the community, and implementing cooperation in the field of Mathematics and Natural Sciences to support the strengthening of institutions of international reputation.

B. Business Modeling

The organizational structure within universities is the main basis for conducting business modeling. The organizational structure will show what parts will be handled by a university. So the determination of the organizational structure will be very decisive in the business modeling step. As a higher education institution, it runs the Tri Dharma of higher education, namely education, research, and community service. So the main activities of higher education are grouped into the fields of Education, Research, and Community Service. This paper will only discuss the fields of education and research, especially laboratories, not including community service. Based on the value chain concept, the main functional areas for the education model in higher education can generally be grouped into main activities and supporting activities. The main activities consist of student admissions, academic operations, and graduation. Meanwhile, supporting activities consist of activities related to resource management (general), financial management, planning and information systems, and publishing and publication. Figure 2 shows the value chain for a university's education and research model.
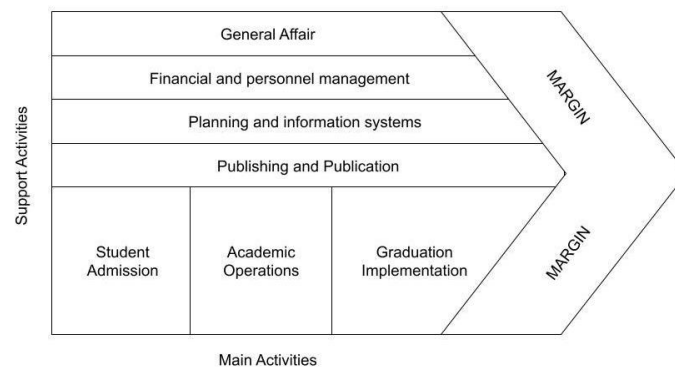
Figure 2. The laboratory value chain is in academic operations

Each of the main activities can be described. First, student admissions are all activities starting from the process of new student admissions, and selection of new student administration. Second, academic operations are all activities related to teaching and learning activities during the student's academic period. Third, graduation is an activity to release students academically at the end of student studies.

Each of the supporting activities can be described. First, the general division is the part responsible for the smooth operation of educational facilities and has carried out the development of infrastructure from year to year, both physical facilities and facilities to support educational activities. Second, finance and staffing are activities related to financial management, determination of investment budgets and determination of needs, and monitoring and allocation of human resources. Third, planning and information systems are activities related to the management and development of information system equipment and networks. Fourth,

publishing and publication are activities related to the management and publication of journals, bulletins, and student textbooks.

After initiating the organization's business function areas by utilizing Potter's value chain, it is possible to arrange the decomposition structure of the business functions using a function hierarchy chart. In accordance with the scope and limitations of this journal, the functions that are decomposed are those related to academics as the main functions with elaboration on student admissions, academic operations, graduation implementation, general division, financial and staffing management, planning and information systems, as well as publishing and publications. It can be depicted in Table 1.

Table 1. Details of Business Activities in Higher Education

Activity	Detailed activities
Student Admission	1. Student admission planning 2. Implementation of Selection 3. Implementation of Selection 4. Re-registration of new students
Academic Operations	1. Planning the implementation of academic activities 2. Re-registration 3. Study process 4. Laboratory Use 5. Re-registration of new students 6. Evaluation process 7. Implementation of student academic leave 8. Student final exam
Financial and personnel management	1. Budgeting 2. Budget allocation 3. Monitoring and evaluation 4. Budget revision 5. Financial accounting system 6. Employee development planning 7. Payment calculation 8. Employee performance evaluation
Graduation Implementation	1. Determination of graduation requirements 2. Diploma making 3. Generating transcripts of grades
Planning and information systems	1. Implementation of information system administration 2. Information system administration reporting 3. Development of software or information systems
General Affair	1. Implementation of the procurement of facilities and infrastructure 2. Implementation of inventory management 3. Supervision and evaluation of the use of facilities and infrastructure 4. Office inventory reporting
Publishing and Publication	1. Implementation of journal administration 2. Implementation of bulletin administration 3. Implementation of textbook administration

Figure 3 below shows the relationship between stakeholders and the main and supporting business functions in a university.
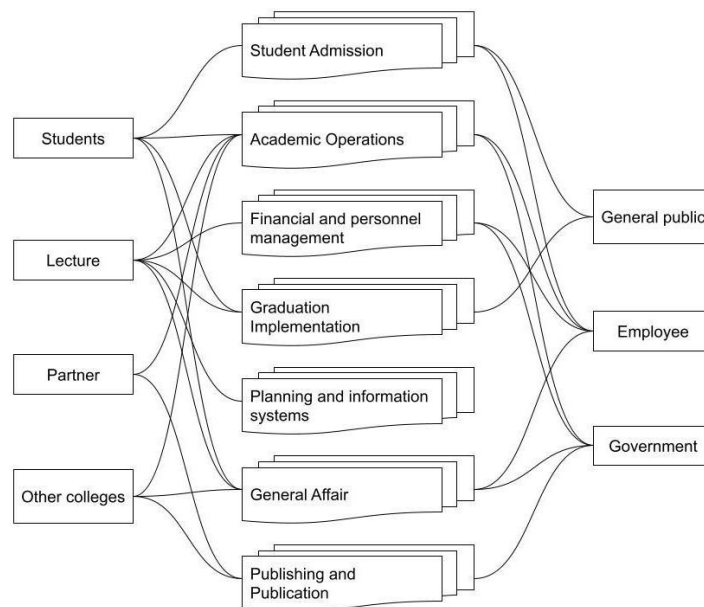
Figure 3. The main stakeholders of higher education

C. System Architecture and Technology

The current information system and technology provide an overview of the current state of information technology and systems, the development of information technology, and the desire and direction of information technology development in universities today. In this step, several things need to be considered and used as the main key in conducting the analysis, namely, the first condition of the organization, the second direction of information technology development strategy, and the third condition of the current information system and technology.

D. Development of enterprise architecture model

In building an architectural model, the first thing to do is create a data architecture. The data architecture that will be defined this time is the definition of the data usage that will be used in the application architecture later, which will be delivered at this stage according to the EAP stage in the data architecture.

An entity candidate is an entity that will be part of the enterprise architecture planning so that the determination can be based on the condition of the main business functions in the previously defined value chain, thus the entity that will be defined as a business entity, and based on the business entity data entities will be defined. In accordance with the condition of the value chain, the list of business entities and data in Table 2 that can be identified is as follows:

Table 2. Entity list

Business Entity	Data Entity
Tool Repair Entity	1. Tool Entity
	2. Period Entity
	3. Date Entity
	4. Urgency Entity
	5. Entity Status
Tool/ Material Lending Entity	1. Tool Entity
	2. Course Entities
	3. Class Entities
	4. Major Entity
	5. Lecture Room Entities
Loan Repayment Entity	1. Tool Entity
	2. Course Entities
	3. Class Entities
	4. Lecturer Entity

	5. Rombel's Entity
Practicum Entity	1. Tool Entity
	2. Space Entity
	3. Entity Type Practicum
	4. Lecturer Entity
	5. Entity Status
Transaction Recap Entity	1. Tool Entity
	2. Lecturer Entity
	3. Course Entities

To describe the relationship between entities, the conceptual depiction of the relationship will use the Entity-Relationship (E-R) diagram. Laboratory E-R Diagram is a logical data conceptual model that shows the relationship between entities in laboratories in universities. The last stage in modeling the architecture is defining the technology architecture. The EAP concept defines technology requirements that need to be provided in the business environment to run a data architecture that can manage data based on the application architecture, in other words, the technology architecture is an infrastructure requirement that must be provided to support the running of data and applications used by the organization. The principles and technology platforms were created to identify the main types of technology platforms needed to support shared data and application environments in universities. This principle is determined by considering trends and developments in information technology, business models, data architecture, application architecture, existing systems, and technologies as well as requests and findings from businesspeople within the organization. Table 3 will show the technology platforms that can be used to support data and applications in universities.

Table 3. Platform/technology architecture

Principle Area	Description
Operating system	The selected operating system is portable (can run on multiple platforms), scalable (can run on small to large-scale computers, interoperable (can run in heterogeneous environments), compatible (maintains existing software investments and allows technological advances to be applied to the environment).
Hardware	Hardware must be reliable and highly available and support future technologies
Communication and Network	The network environment is provided with sufficient bandwidth and a set of standard protocols to support network services and real-time access to information.
Application	All application designs should be modular and should be testable.
Database Management	The database model used is a relational database which is relatively easier to understand and more popular.
Security	Security requirements include secrecy (requirements in information systems that can only be read), availability (needs that information resources can only be obtained and used by authorized users), and integrity (needs that information resources can only be modified and maintained by authorized units).

E. Implementation and Testing

The laboratory system development stage is the implementation stage of the design stage. At this stage of development, it is done by coding the required pages on the laboratory system using the CodeIgniter framework. Figure 4 shows the results of the login page development, this page is an implementation of the login page mock-up. The login page is a page that is used to verify users, there are username and password inputs that must be filled in by

system users to be able to enter the system, if the username and password inputs do not match then the user cannot enter the system.

Figure 4. Login page

Admin users who have entered the correct username and password will enter the admin page. Figure 5 is a view of the admin page (Admin Data). This page is the result of the implementation of the mock-up of the Admin Page Mock-up. On the admin data page, admin users can view, add, change information, and can delete admin data.
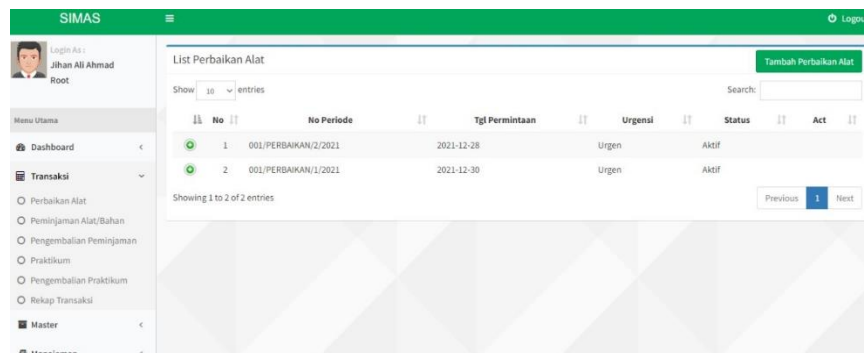

Figure 5. Admin Pages

The system testing stage or testing is the stage carried out to match and observe the results of the implementation that has been carried out. System testing or testing carried out in this study using the black box method and Mean Opinion Score. The testing process with the black box method is carried out by testing one by one the functions that have been made whether they are in accordance with user requirements and whether the output of these functions is in accordance with what is expected, while for MOS testing is carried out by subjective assessment of the quality associated with the system. The results of the tests carried out on the Website-based Pendadaran Information System using the Mean Opinion Score test method based on the User Acceptance Test (UAT) can be seen in Table 4.

Table 4. Eligibility Result by Expert

Code	Rating Indicator	Result
A1	Attractive Laboratory System Design	93%
A2	Laboratory System Color Match	87%
A3	Component Location in Laboratory System Appropriately	93%
A4	Laboratory System Size Appropriate	67%
A5	Easy-to-Use Laboratory System	93%
A6	Laboratory System Convenient to Use	87%
A7	Color on Laboratory System Clear	93%
A8	The image on Laboratory System Clear	87%

We also present expert validity data in the graph of each component, which can be seen in Figure 6.
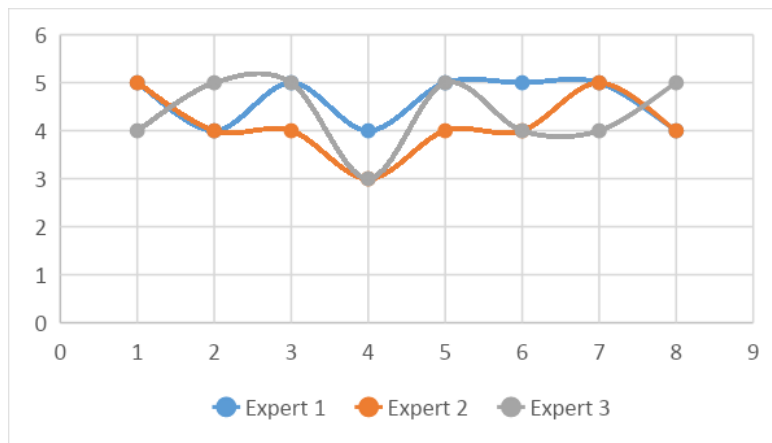

Figure 6. Expert validity of each component

Based on tool validation by UAT experts selected by the research team to validate the laboratory system for system validation sheets, the results of product feasibility from experts show valid and very valid results, starting from A1 with 93% results, and A2 with 87% results. A3 results in 93%, A4 results in 67%, A5 results in 93%, A6 results in 87%, A7 results in 93%, and A8 results in 87%, if the overall validity component is obtained on average, 88% of the products are very valid. These results can be presented in the form of Table 4 and Figure 6.

Conclusion

Based on the results of the study, it can be concluded that the use of laboratory systems for monitoring and maintenance in laboratory management has proven to be very valid. Before implementing the Laboratory System Identification Method laboratory tools and materials used were still manual. Enterprise Architecture Planning (EAP) is an effective approach to modeling laboratory information systems in higher education. EAP helps align the business and technology within the laboratory information system, making it easier to monitor and maintain equipment. Monitoring and maintenance of laboratory equipment play a critical role in ensuring the quality of collected data. EAP helps ensure that laboratory equipment is functioning properly and strengthens the laboratory information system. Modeling becomes an effective tool for applying the EAP concept in laboratory information systems. Modeling helps align the business and technology goals of the organization with the laboratory information system, ensuring the quality of collected data. The implementation of EAP in laboratory information systems in higher education has the potential to increase efficiency and effectiveness in monitoring and maintenance of equipment. It helps ensure that collected data is accurate and of high quality, making it easier to process analysis and make decisions. After implementing the EAP method, the laboratory system is safer, and access to tools and materials can be monitored properly. Test the validity of the laboratory system for monitoring and maintenance, with an average validity of the expert team reaching 88% Based on tool validation by UAT experts.

Acknowledgments

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The development of employee attendance application based on mobile using spiral method

Muhamad Alda

Information System Study Program, Universitas Islam Negeri Sumatera Utara, Indonesia

Corresponding Author: *muhamadalda@uinsu.ac.id*

Abstract: The Pangulu Nagori Amborokan Panei Raya Office is one of the governmental institutions tasked with serving the local population. The Pangulu Nagori Amborokan Panei Raya office still records employee attendance using the manual approach. Employee attendance is noted in the attendance book. When done this way, there are still issues that come up. Particularly the time and effort put forth to complete the attendance procedure. In addition, because attendance data has very little protection and is accessible to anyone, it is challenging to summarize staff attendance reports. Building an Android-based application that can be used to process and track employee attendance is the aim of the author's research. The author employs UML to visually create the application design (Unified Modeling Language). The system development methodology, however, is a spiral that includes the phases of customer evaluation, planning, risk analysis, engineering, building, and disposal. The Kodular framework and the Airtable database are used in the development of an Android-based attendance application. The results of the study are an android-based attendance application that can be applied to make it easier for employees to take attendance and monitor employee attendance in real-time using an Android smartphone.

Keywords: android application, attendance record, spiral method

How to Cite: M. Alda, "The development of employee attendance application based on mobile using the spiral method," *Matrix: Jurnal Manajemen Teknologi dan Informatika*, vol. 13, no. 1, pp. 12-24, 2023.

Introduction

Nowadays, technological advancements have been made quickly. especially advancements in the science of information technology. This is seen in daily life, as it is common for Indonesians to use technology to carry out routine tasks. However, it is still uncommon for employees to use technology at work to assist with tasks or meet demands. While still employing conventional methods for working and gathering the necessary data, there is still a lot of work that should have been done using technology [1]. Android smartphone is a technological development in which use is increasing.

Google created the Android operating system, which is based on the Linux kernel and supports touch-screen gadgets like tablets and smartphones. Almost all adults possess and use an Android phone for communication, entertainment, shopping, transportation, and location-based services using the coordinates of their starting and ending points. Android is open source, which means that software creators and developers are free to use, change, maintain, and distribute it. They are free to use this OS on their devices without a license or for free due to the open-source nature of technology businesses [2].

Employee attendance, which is linked to discipline and affects each employee's performance, is crucial for a company or agency to achieve its goals. As a result, particular data collection is required to track attendance and attendance so that work activities can be properly and in real-time recorded [3].

One of the government entities tasked with serving the populace is the Pangulu Nagori Amborokan Panei Raya Office. The Pangulu Nagori Amborokan Panei Raya Office continues to use the manual approach for tracking employee attendance. An attendance book is used to track employee attendance. There are still issues that arise while doing it in this manner. Particularly the time and effort put into conducting the attendance process. Additionally, it is challenging to

summarize staff attendance reports, because attendance data has very low security and is accessible to anyone.

The author wishes to conduct research by designing and developing an employee attendance application at the Pangulu Nagori Amborokan Panei Raya Office based on Android in response to the issues raised above. Using an Android smartphone, this software can let staff take attendance and provide the Pangulu Nagori Amborokan Panei Raya Office with easy access to information about employee attendance.

Data collecting on attendance, hours out, and employee attendance recapitulation takes a comparatively long time in the process of calculating and finding data since the attendance procedure is done manually. The manual attendance procedure is prone to data loss, which could undermine the validity of the information used to generate staff attendance reports. As a result, the authors built a web-based employee attendance information system and performed research. The waterfall method was employed by the author to design the system. The Nagreg Village Office has implemented an employee attendance information system to manage staff attendance data and enhance agency performance [4].

Similar studies have explored manual student attendance systems, which are particularly inefficient because the student or the teacher noting the student's attendance incorrectly could have provided false information about their attendance. Therefore, it is imperative to use technology that can assist in processing student attendance at school. so that it can raise the standard of the system's attendance-related services for students. To conduct their research, the authors created web-based applications in JavaScript using the React framework and Google Sheets as their data sources. The waterfall method is the one utilized for system development. With the help of this system, teachers will be able to regulate student attendance more easily, which will improve attendance and allow for precise calculation of absenteeism recapitulation [5].

Similar studies have highlighted the lack of real-time information access provided by Madrasah Aliyah (MA) Yusuf Abdussatar Kediri, particularly when it comes to processing student attendance data. As a result, an information system was created that makes it easy to process student data using the MySQL database and PHP programming language, both of which are based on local area networks (LAN). The waterfall method is used for system development. By using an information system, it is possible to minimize losses and errors in recording student attendance data as well as to make the attendance procedure, data search, and attendance summary computation more convenient [6].

The authors' research differs from previous research in that it builds Android-based applications using the Kodular framework and the Airtable database. The writers create applications using the spiral technique, which incorporates the phases of customer communication, planning, risk analysis, engineering, construction, and disposal, as well as customer evaluation.

Methodology

The spiral approach of system development was employed by the author in this study. The spiral model, also known as the spiral method, is a type of evolution that combines the waterfall model's systematic elements with the natural iteration technique from the prototyping model. A prototype of the program is created during the prototyping stage, and examples are presented to users or customers to solicit feedback. The procedure continues with creating the actual product by adding to and fixing the flaws of the earlier prototype if it complies with the user's or customer's wishes.

This model also mixes top-down and bottom-up design, where top-down design first establishes the overall system before moving on to the system's specifics, and bottom-up design does the opposite. With feedback from the two combinations, namely a combination of design and prototyping as well as a combination of top-down and bottom-up, which also applied to the waterfall and prototype models, this spiral model can be said to be a process model as a result of the combination of the two models. The top-down design is typically applied to the sequential waterfall model, while the bottom-up design is typically applied to the prototyping model. Therefore, complicated and large-scale software development typically uses this model [7]. The spiral model display can be seen in Figure 1.
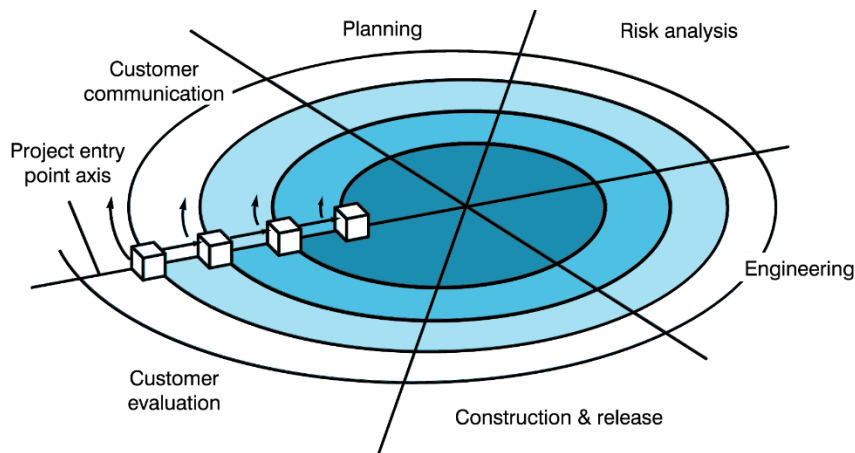
Figure 1. Spiral model

The activities used in the spiral model are listed below [8]:
Customer Communication
Activities particularly those pertaining to the needs of developers, were required to promote good communication between users or consumers and developers. Problem analysis and system requirements analysis are some of these processes.
Planning
Through this planning process, it is necessary to determine the data needed for software development, including resources and estimated processing times.
Analysis Risk
This risk analysis process evaluates managerial and technical risks. If iterations are not included in the process model, this phase might not occur; in such cases, the spiral model might be the only one where it does.
Engineering
Utilizing the Kodular framework and the Airtable database, create one or more technological representations of the actions related to an application.
Construction & Release
Software development, testing, installation, and user or customer support all involve training, documentation, and other procedures.
Customer Evaluation
Activities are necessary to get feedback from users or clients in response to assessments of how they portray the program at the engineering stage as well as during implementation during software installation during the build and release stage.
The primary method in research is data collection, which starts with gathering the data that serves as the study's principal goal. Of course, researchers cannot collect data that can supplement the existing data standards without knowledge of data collection methods [9].
The author followed the steps below to gather the information required to support this research:
Observation
In order to monitor the continuing staff attendance process and seek for issues that arise in the process at the Pangulu Nagori Amborokan Panei Raya Office, the author conducts direct observations at the research location.
Interview
The employee attendance method and the issues resulting from this approach are discussed by the author with employees and administrators at the Pangulu Nagori Amborokan Panei Raya Office.
Literature review
The author looks for references to the theories from books, journals, the internet, and other sources to assist research activities.

Results and Discussions

In this study, the author used the spiral methodology, which includes stages for customer evaluation as well as planning, risk analysis, engineering, construction, and release.

Customer Communication

The author now conducts customer interviews to gather all pertinent information about corporate operational operations. The author examines the systems needed and potential issues.

Problem Analysis

Analyzing the issues with the Pangulu Nagori Amborokan Panei Raya Office's attendance system was the first step the author took in conducting this study. The Pangulu Nagori Amborokan Panei Raya Office still uses the manual approach for tracking employee attendance. An attendance book is used to track employee attendance. When using this strategy, several challenges and issues remain, such as the time and effort required to complete the attendance process, the difficulty of accessing employee attendance data, and the challenge of tracking and recapitulating employee attendance.

System Requirements Analysis

The writers come up with a remedy to the issue based on the outcomes of the system analysis that has been carried out. The author created an Android-based employee attendance application that can assist Pangulu Nagori Amborokan Panei Raya Office staff members in taking attendance as well as the Pangulu Nagori Amborokan Panei Raya Office administrator in quickly and easily monitoring and processing employee attendance data.

Planning

At this point, the author decides what is required for performing research, including the location, the time, the equipment, and the materials

Research Sites

In carrying out this research activity, the authors determine the location and time of the research. The location specified by the author in this study is the Pangulu Nagori Amborokan Panei Raya Office which is located at Jalan Besar Panei Raya, Kec. Raya Kahean, Kab. Simalungun North Sumatra 21156.

Research Tools

The hardware used in this study included an ASUS Zenfone Android smartphone, an Acer Aspire E5-471G-5251 laptop with an Intel Core i5-4210U processor, NVIDIA GeForce 820M 2GB GPU, and 4GB DDR3 RAM. Max Pro 1 with GPU AdrenoTM 509, 6GB RAM, and 16GB memory and Qualcomm Technologies, Inc. specifications. SDM636. The author also uses software such as Windows 10 Pro, Microsoft Word 2019, Kodular framework, Airtable database, Microsoft Visio 2019, Google Chrome browser, and the Android 9.1 Pie operating system.

Research Materials

Materials needed by the author in research activities consist of employee data at the Pangulu Nagori Amborokan Panei Raya Office, attendance data, attendance reports, and attendance procedures.

Analysis Risk

The authors conduct a risk analysis of the intended use of the application at this point. Before performing a risk analysis, the author evaluates the functional specifications needed to build an application. The following menus in Table 1 will be created by the author.

Table 1. Functional needs

Requirement Name	Description
Login	The page that loads first when you access the program
Options Menu	After the user logs in, a page with many options displays.
Employee Menu	Data processing page for employees
Attendance Menu	A page for employee attendance
Report Menu	Page to view employee attendance reports

Engineering

A developed concept makes it simple to articulate what must be done. The design focuses on the process of creating detailed specifications for the project's architecture, aesthetics, material requirements, and style [10]. A technique or model called UML is used to design object-oriented software development. Additionally, UML offers a standard for creating blueprint systems, which covers business process ideas, creating classes in certain programming languages, database schemas, and software system components [11].

Use Case Diagram

Use case diagrams describe typical interactions between users (users) of one system and a different system by telling a narrative about how the system is utilized. In use case diagrams, an actor and the interactions he engages in are shown. These actors might be people, objects, other systems, or other systems that engage in interaction with the system [12].
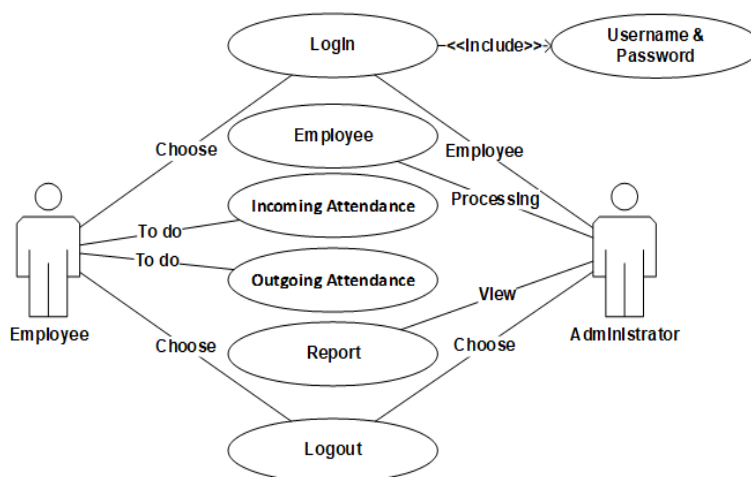

Figure 2. Use case diagram

Figure 2 illustrates the use case diagram of the application to be built. Use case diagrams to describe what actors can do in the application to be built. Android-based employee attendance applications can be accessed by two different types of users, namely administrators, and employees. Administrators can log in to the application by entering the specified username and password. Admins can perform data processing, and employee accounts can access the application. In addition, the administrator can also see reports of employee attendance data that have been processed. Employees can log in to the application by entering the username and password registered by the administrator. Employees can process attendance in or out after successfully logging in.

Sequence Diagram

A sequence diagram is a diagram that shows how various items work together dynamically. Its purpose is to display the exchange of messages between objects and their interactions [13].
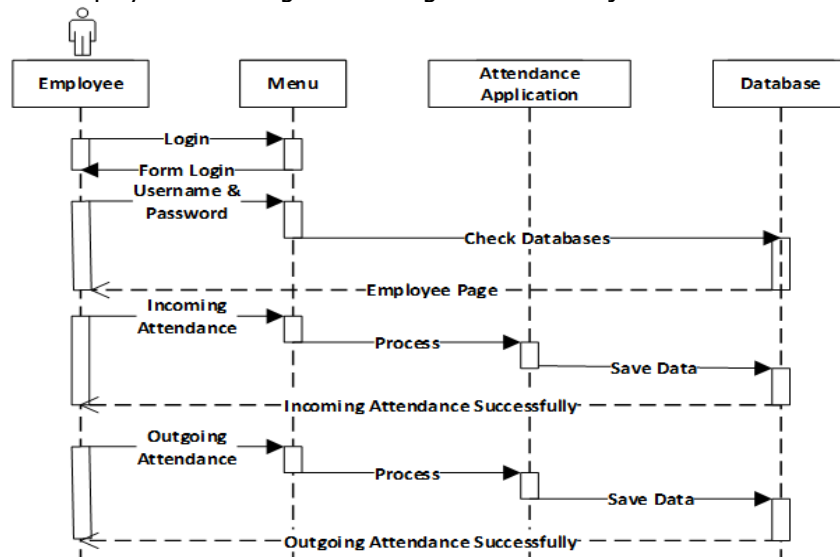

Figure 3. Sequence diagram

Figure 3 illustrates the sequence diagram of the application to be built. The sequence diagram of the Android-based employee attendance application that will be built begins when the admin logs in to the application. When the employee enters the username and password used by the login process, the system will check the username and password data in the database. Then the employee will enter the attendance page and select from the available menu consisting of incoming and outgoing attendance. When an employee selects one of the available attendance menus, the system will store the attendance data in the database.

Activity Diagram

Activity diagrams in software explain the workflow, activity, or business process of a system, business process, or menu. Instead of focusing on what actors perform, activity diagrams place more emphasis on describing system activities or activities that the system is capable of carrying out [14].
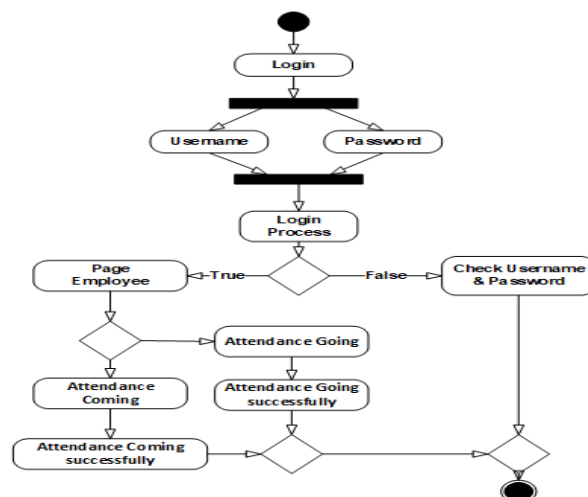

Figure 4. Activity diagram

Figure 4 illustrates the activity diagram. The activity diagram of the employee attendance application that will be built starts when the employee logs in to the application by entering the

specified username and password. Then the application verifies the username and password entered by the employee; if the username and password are correct, then the employee can enter the attendance page and select an option from the available attendance menu. If the username and password are incorrect, the employee cannot enter the application and must re-check the username and password entered. Employees can mark themselves as present or absent while in the attendance window. If the employee chooses to enter attendance, then the attendance data will be stored in the database. Similarly, if an employee chooses to leave attendance, the incoming attendance data will be saved in the database as well.

Class Diagram

A class diagram is a grouping of various classes and their connections. Classes are identical to entities expressed in a square with the name of the class written at the top, followed by a list of the class's characteristics and finally a list of its methods [15]. The class diagram is the foundation of object-oriented development and design because it is a specification that, when instantiated, creates an object [16].
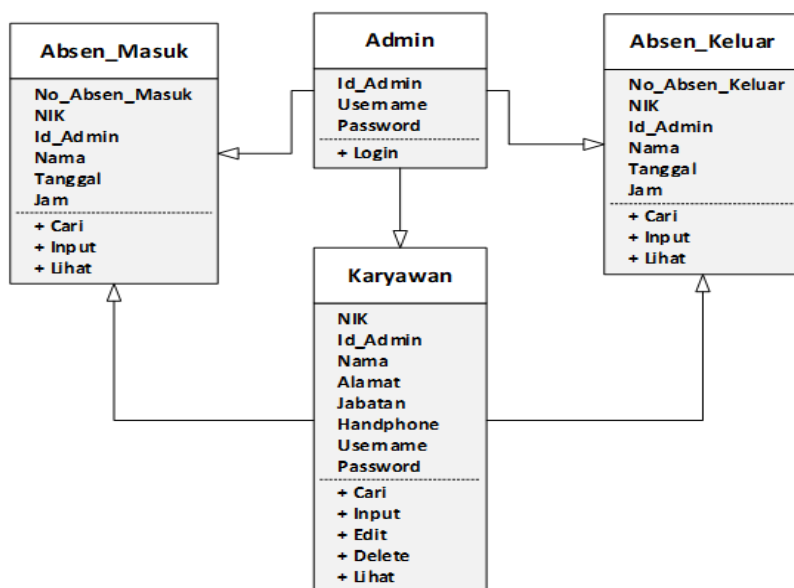

Figure 5. Class diagram

Figure 5 illustrates the class diagram or the relationship between each table in the application. Classes or tables in the employee attendance application at the Pangulu Nagori Amborakan Panei Raya Office consist of admin tables, employee tables, incoming attendance tables, and outgoing attendance tables. The admin table consists of id_admin, username, and password, the employee table consists of NIK, id_admin, name, address, position, mobile phone, username, and password, the incoming attendance table consists of No_attendance_in, NIK, Id_admin, name, date, time and outgoing attendance table consists of No_attendance_out, NIK, Id_admin, name, date, time.

Construction & Release

The implementation of software development is done at this point. The following display is the page for the employee attendance application. A page for logging in, a page for the options menu, a page for employees, a page for incoming and outgoing attendance, and a page for reports.

Login Page

The login page is the initial page that appears when the user uses the employee attendance application that was built. To provide security for using the application, before the user can access and use the application, on this page the user must first log in by entering the registered username and password. The login page display can be seen in Figure 6.

Figure 6. Login page

Attendance Page

After the employee has successfully logged in, he or she will go to the attendance page. On this page, employee data that has been processed by the administrator will automatically appear, consisting of NIK, Name, and Position, while the time for attendance has been adjusted to the current time. On this page, employees can check in and out of attendance. After the employee selects one type of attendance, a notification will appear explaining that the attendance process has been successfully carried out. The attendance page display can be seen in Figure 7.
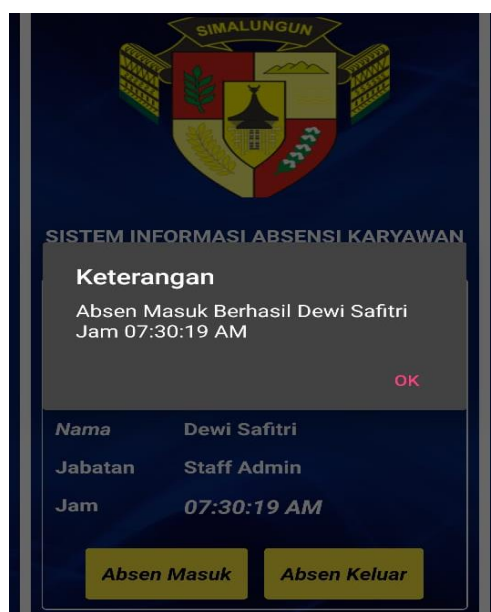

Figure 7. Attendance page

Options Menu Page

Administrators can choose from the menu available on this page after successfully logging in using the appropriate username and password. There are three menus available, the employee menu, the report menu, and the logout menu. On the employee menu, administrators can per-form employee data processing and determine accounts for employee logins. On the report menu, administrators can view employee attendance reports that have been processed. Meanwhile, on

the logout menu, the administrator can exit the options menu and return to the login page. The options menu page display can be seen in Figure 8.

Figure 8. Options menu page

Employee Page

After the administrator has successfully logged in, he or she can process employee data through the employee menu that has been selected. Administrators can get new employee information, consisting of NIK, name, address, position, and cellphone, and enter employee account data to carry out the login process, consisting of a username and password. In addition, administrators can also change employee data that has been previously selected on the view page if an error occurs. Administrators can delete employee data that has been sorted on the view page if the employee has resigned or is no longer in the Pangulu Nagori Amborokan Panei Raya Office. The employee page display can be seen in Figure 9.

Figure 9. Employee page

Report Page

On this page, administrators can view a recapitulation of employee attendance reports that have been processed. The report displayed is the result of a recapitulation of employee absences

every month. Reports will be displayed based on the month that has been selected by the administrator. The information displayed on the report consists of date, NIK, name, time of attendance in, and time of employee attendance out. The report page display can be seen in Figure 10.

Figure 10. Report page

Customer Evaluation
Activities are necessary to collect user or client feedback in response to the engineering stage evaluation of the software representation that has been produced as well as implementation during software installation during the development and release phases.

The author conducts testing for every component of the constructed application. Application testing with black boxes is the final test, comprising the user interface or external look of the program, process performance, input, process, and output generated by the application, and how to use application features in the user environment, followed by validation testing [17]. Table of test results can be seen in Table 2.

Table 2. Table of test results

Testing Module	Testing Procedure	Input	Output	Conclusion
Employee Login	- Open application - Entry username "007882" and password "123456" - Click login	Username "007882" and Password "123456"	Employees can enter the application and take attendance	Valid
Attendance	- Open application - Login - Choose click incoming attendance or outgoing attendance	Button incoming attendance or outgoing attendance	Employees successfully do attendance	Valid
Employee Data	- Open application - Login - Select the employee menu - Enter complete employee data - Click input	Complete employee data	Employee data added successfully	Valid

Report	- Open application - Login - Select the report menu - Select month	Select month	Show employee attendance reports based on the selected month	Valid

In addition, the author also tests the application when it is applied to an Android smartphone. In this testing process, the authors tested the application from the display, process, and performance sides when it was installed on different Android smartphone devices. The classification of Android devices determined by the author in this test consists of the operating system and the Android smartphone brand used by the user, consisting of ten devices: two Android version 8 devices, two Android version 9 devices, two Android version 10 devices, two Android version 11 devices, and two Android version 12 devices. The results of testing the application implementation can be seen in Table 3.

Table 3. Table of testing the application on android devices

Devices	Android Version	Information System Display	Information System Process	Information System Performance
Xiaomi Redmi 6A	Version 8	Success	Success	Success
Vivo Y71	Version 8	Success	Success	Success
Infinix Smart 3 Plus	Version 9	Success	Success	Success
Realme 3 Pro	Version 9	Success	Success	Success
Vivo X27	Version 10	Success	Success	Success
Xiaomi Mi 8 Pro	Version 10	Success	Success	Success
Oppo Reno 5 4G	Version 11	Success	Success	Success
Vivo V20	Version 11	Success	Success	Success
Oppo Find X3 Pro	Version 12	Success	Success	Success
Vivo V60 Pro	Version 12	Success	Success	Success

After testing, the author creates a questionnaire to obtain evaluation results from the use of the application that has been built. The questionnaire was administered to ten employees of the Pangulu Nagori Amborokan Panei Raya Office. The questionnaire instrument created relates to the ease of using the application, the appearance of the application, and the performance of the application in helping to facilitate the employee attendance process at the Pangulu Nagori Amborokan Panei Raya Office. Figure 11, Figure 12, and Figure 13 are the results of the questionnaire.

Kemudahan menggunakan aplikasi
10 jawaban

- Sangat Baik (Very Good)
- Baik (Good)
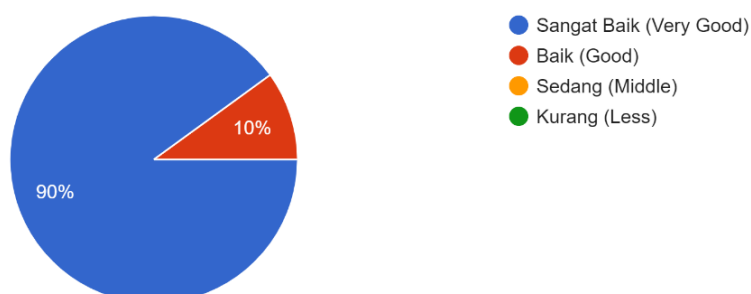- Sedang (Middle)
- Kurang (Less)

90%
10%

Figure 11. Application usage survey results

Tampilan menarik dan mudah dimengerti
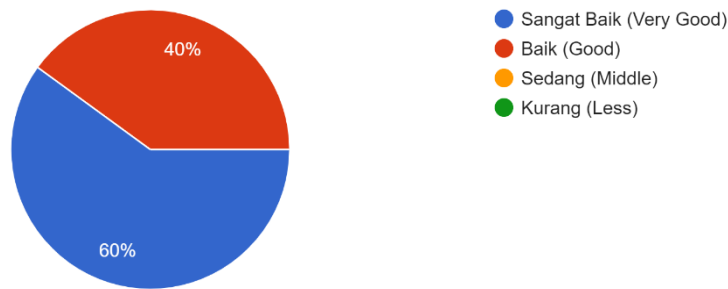10 jawaban

Figure 12. Application design survey results

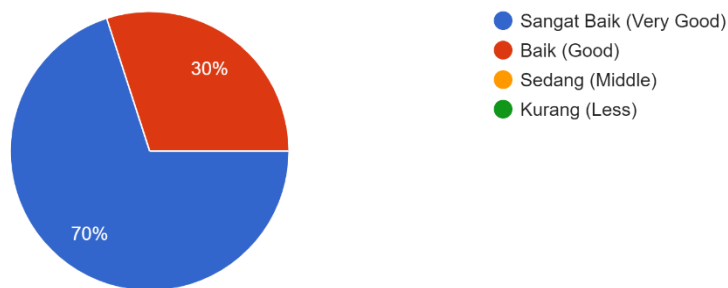Aplikasi membantu mempermudah proses absensi
10 jawaban

Figure 13. Application benefits survey results

Conclusion

In order to create applications that meet user needs, the spiral model system development method used in this study has structured and complex stages for carrying out system development, including customer communication, planning, risk analysis, engineering, construction, and release, as well as customer evaluation. Based on the results of a survey conducted by the author regarding applications that have been built based on the ease of use of the application, the appearance of the application is attractive and easy to understand, and the benefits of the application assist in carrying out employee attendance, Of the ten employees of the Pangulu Nagori Amborokan Panei Raya Office who filled out the questionnaire form, 90% of respondents answered very well for the ease of use of the application, and 10% of respondents answered well for the ease of use of the application. 60% of respondents answered very well regarding the appearance of the application, and 40% of respondents answered well regarding the appearance of the application. 70% of respondents answered very well about the benefits of the application in facilitating the attendance process, and 30% of respondents answered well about the benefits of the application in facilitating the attendance process. So it can be concluded that 70% of respondents answered very well about the application that was built in terms of ease of use, appearance, and benefits to facilitate the attendance process so that the application can assist employees in carrying out attendance via Android smartphones, and administrators can use Android smartphones to track employee attendance in real-time. The Pangulu Nagori Amborokan Panei Raya Office currently uses a manual attendance system that can be replaced with an Android-based attendance application to become a technology-based attendance system by utilizing an Android smartphone.

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Factors that influence the use of digital payments as ease of transactions in the digital era

Alya Aulia Nurdin [1]*, Agus Bayu Pamungkas [2], Alfina Nur Kholifah [3]

[1,2,3] *Information System Study Program, Universitas Negeri Semarang, Indonesia*

*Corresponding Author: *alyaaulianurdin@students.unnes.ac.id*

Abstract: Many things in the line of life are already shifting towards digital. The use of financial technology in the digital era is one of the new choices that are in great demand as a tool for transactions in society. The use of fintech payment services can further maximize banking product services so that the payment system in buying and selling transactions becomes more effective and efficient. This study aims to find out how massive the use of financial technology services is in digital payment transactions in the community and find out what factors influence people to use digital payment services so that they can facilitate their activities in transactions in their daily lives. The method used in this study is quantitative in the form of a survey. The questionnaire survey was distributed via Google Form to 102 respondents from the age range of 14-30 years. After that, the data was analyzed using the partial least square–structural equation model (PLS-SEM). The results showed that the proposed model is moderately accurate with an R-square value of 0.561. In this study, effort expectancy and performance expectancy significantly influence the intention to use digital payment. Meanwhile, culture, perceived security, and social factors did not have a significant influence. The conclusion is that the intention to use digital payment will get stronger if the service related to performance expectancy and effort expectancy are simultaneously improved.

Keywords: digital payment, fintech, services, transaction

How to Cite: A. A. Nurdin, A. B. Pamungkas & A. N. Kholifah, "Factors that influence the use of digital payments as ease of transactions in the digital era," *Matrix: Jurnal Manajemen Teknologi dan Informatika*, vol. 13, no. 1, pp. 25-32, 2023.

Introduction

In increasingly modern times, many technological innovations can help and facilitate human work. One of them is fintech (financial technology) digital payment or what is often referred to as digital payment services. These services can help make it easier for us to make payment transactions, purchases, and others in an online era [1]. Fintech is one of the innovations in the financial field that refers to modern technology [2]. According to Clayton, the innovation aims to introduce practicality, ease of access, convenience, and economical costs [3]. An NDRC research institute (The National Digital Research Centre) mentioned that Fintech is a term for innovation in financial services, where technology is the key.

Nowadays, internet technology is rapidly evolving and has extended to every corner of the globe [4], in the era of the industrial revolution 4.0 which leads to society 5.0, humans need to be more adapted to the existence of technology. Many things in the line of life are already shifting towards digital. The use of information technology currently plays an important role [5]. The development of information technology and telecommunications greatly impacts the business sector [6]. The industrial revolution that has brought significant changes to the sustainability of life applies the concept of automation. In its application, the majority is done by machines without the need for human labor intervention. The digital payment services that have been conveyed above also apply the concept of automation/digitization. However, due to uneven economic development [7], this fintech can be a solution for remote communities because it can use technology-based services without being hindered by distance. The use of fintech digital payment services can further maximize banking product services so that the payment system in buying and selling transactions becomes more effective and efficient [1].

According to [1], the fintech industry in Indonesia showed rapid development throughout 2018. In the Fintech Report 2018 of the Financial Services Authority (OJK), for e-money, Go-Pay is still ranked first, followed by OVO in the second position. In addition, it is also reported that the public is increasingly aware of the importance of fintech regulation. Therefore, the government must respond by providing regulations that provide more certainty for the industry, up to a better level of financial literacy [1]. Through the things mentioned above, the existence of financial technology, especially digital payment services, is one of the important innovations and needs to be developed as an effort to facilitate transactions in the digital era.

The massive use of digital payment services has made a few researchers conduct research related to the use of these services. As done by researchers from UIN Walisongo. In his research in 2019, [1] surveyed UIN Walisongo students to find out how significant the development of digital payment fintech services among its students is. The research conducted with the survey through the google form received mixed responses from survey respondents, in this case, students. From that result, most students use digital payment services for the last one to two years and on average they use digital payment services because they are influenced by the existence of social media.

In another study conducted by [8], the results obtained from ten speakers, including millennials, said that they already knew about fintech digital payment services and they had used this payment method for the past two to four years. The digital payment services they use include OVO, Dana, and Go-Pay where these transaction tools are most widely used. Another research conducted by [9] on the analysis of consumer preferences of online transportation users on digital payment systems (a case study of Gojek users in Malang City). It concluded that the ease of accessing digital payment systems will increase the desire of consumers who use online transportation to use digital payment services. So that when consumers consider it easier and less difficult to understand a payment system to apply, the higher the consumer's desire to choose to use digital payment services on online transportation will be.

Another research related to users' intention to use fintech digital payment was carried out by [10] with the condition of the respondents are Gen Z and [11] condition of respondents are young adults. Although there is still debate about the range of birth years of this generation, in general, Gen Z is those born between 1995-2010 who are capable of technology. In the study [10], there five factors measured whether it affected the intensity of using digital payments. These factors include culture, perceived security, performance expectations, business expectations, and social influence. And the result is only performance expectations, effort expectations, and social influences that show a significant influence on Gen Z's intention to use these FinTech services (sig < 0.05). Meanwhile, [11] used the technology acceptance model (TAM) dan the partial least square–structural equation model (PLS-SEM) to find out the factors that influence the use of e-wallets. By applying a two-step approach for instance, a measurement model for indicator loadings, convergent validity, reliability, and structural model for path analysis the findings from this study reveal that perceived usefulness, perceived ease of use, and privacy and security have a positive and significant relationship with behavioral intention to use an e-wallet. Several other researchers used TAM and the unified theory of acceptance and use of technology (UTAUT) to research the use of digital payments from a user perspective [12]–[16]. UTAUT is used to identify motivation use of technology developed by Venkatesh. UTAUT theory was developed through a comprehensive synthesis and an integration of the theory of reasoned action (TRA), the Technology Acceptance Model (TAM), motivational models (MM), the theory of planned behavior (TPB), combined TAM and TPB (C-TAM-TPB), the model of the PC utilization (MPCU), innovation diffusion theory (IDT) and social cognitive theory (SCT) [17].

Innovations developed by researchers and experts do not always run smoothly by getting a positive response from the public. In an invention/innovation, there are certainly a handful of people and even several people who don't know about it. Regarding the financial technology of digital payment services, many people already know about it, but the assumption is, some people also have never used it and don't even know it. In this study, an issue will be raised whether the use of fintech digital payment services is evenly distributed and whether this service can help ease transactions in the digital era. In addition, in this study, an issue will also be raised related to what are the factors that affect the community and make people interested in using digital payment services using the extended UTAUT model with several variables namely Culture, Perceived Security, Performance Expectancy, Effort Expectancy, Social Influence, and Intention

to Use [17]. These variables are used because the variable UTAUT explains as much as 70 percent of the variance in intention, we may be approaching the practical limits of our ability to explain individual acceptance and usage decisions in organizations [18].

Methodology

In this study, the method used was a quantitative method by distributing a questionnaire survey online through Google Form. The research conducted uses a quantitative approach because it is adjusted to the purpose of the study, which is to determine the factors that influence the use of digital payments, whereas quantitative research represents positivism [19]. Research by disseminating questionnaires can characterize the knowledge, attitudes, and behaviors of a large group of people through the study of a subset of them [20]. After that, the data is analyzed using PLS-SEM with the SmartPLS tool. Furthermore, this study uses a Likert scale of 1–5, which consists of strongly disagree, disagree, neutral, agree, and strongly agree [12]. The data obtained were 102 respondents from the age range of 14-30 years with a purposive sampling technique. The criteria for this respondent are set on the basis that someone of that age can evaluate fintech application products according to their perceived experience. In addition, in the age range above there is also an age range of students that can also represent online consumers, as online consumers are more educated and younger than traditional consumers. Further reasons for choosing those respondents include their understanding of e-services, their familiarity with electronic media, and their usage of e-services for communication and commercial transactions [21]. In determining the number of samples according to [22], 100-200 samples are categorized as good for calculating model paths in SEM. As for the research model, this study refers to the research model from [10], [17] which is an extending model of UTAUT that is shown in Figure 1.
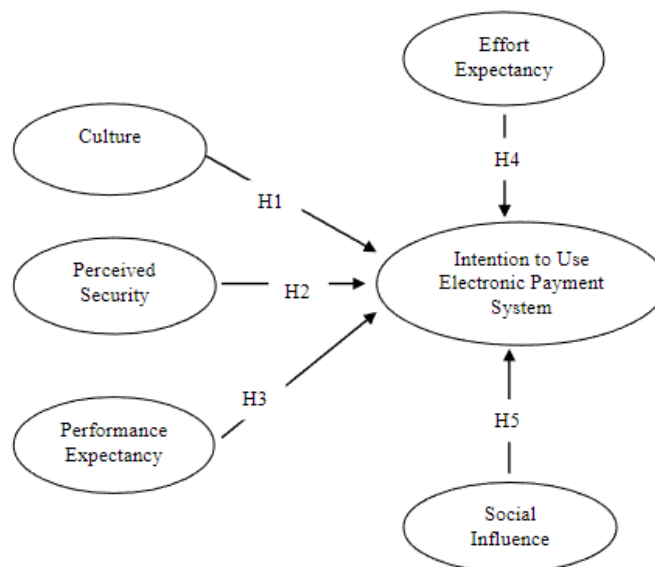

Figure 1. A model of factors influencing consumer's intention to use the e-payment system [17]

From Figure 1 above, there are a few hypotheses in this research, according to [17]. The research hypotheses to support the model of factors influencing consumers' intention to use the e-payment system or digital payment system, consists of H1, H2, H3, H4, and H5. H1 is culture has a positive effect on the intention to use electronic payment systems. H2 is that perceived security has a positive effect on the intention to use electronic payment systems. Culture and perceived security were included in this study because they are both important factors. The culture of one region to another might have differences. Consisting of several cultural factors that affect things such as knowledge of computers, internet access, use of the Internet, mobile phones, region of residence, and travel habits [17]. Meanwhile, security relates to how the electronic payment system can protect consumer transactions [23]. In addition, security is also associated with regulatory and legal protection perceived by consumers [24]. H3 is performance

expectancy has a positive effect on the intention to use electronic payment systems. In this study, performance expectancy was added because performance expectancy refers to how consumers feel that the use of electronic payment systems will help and give an advantage in conducting online transactions such as in terms of speed, security, and convenience of transacting [18], [25]. H4 is effort expectancy has a positive effect on the intention to use electronic payment systems. Effort expectancy relates to a system that is easy to understand and use without any particular skill [18], [25]. H5 is social influence has a positive effect on the intention to use electronic payment systems. Social influence is included in this study because it is the perceived influence of important others who encourage consumers to use electronic payment systems in the transaction. The important Others are intended for families, couples, and organizations [18], [25].

After collecting the data, validity and reliability test are conducted to measure whether a questionnaire is valid or not from a statement that can reveal something that will be measured from the questionnaire and to calculate the reliability of the data [26]. In PLS-SEM, validity and reliability are assessed in the measurement model. To evaluate internal consistency reliability and convergent validity, the value of both composite reliability and Cronbach's alpha are suggested to be higher than 0.7 [11]. Additionally, average variance extracted (AVE) values should be greater than 0.5. Then, the good discriminant validity as it illustrates the square AVE of each factor is larger than any of its correlations with the other factors [27]. After measuring the measurement model, the researcher conducts an assessment of the structural model. The structural model reflects the relationship between the constructs or the latent variables that were hypothesized in this study [11]. According to [27], R-square (R^2) values of 0.75, 0.50, and 0.25 describe substantial, moderate, and weak levels of predictive accuracy. The t-value > 1.96 is significant at p-value < 0.05.

Results and Discussions

This study was adapted from the extended UTAUT model [17]. This study uses six variables consisting Culture (CU), Perceived Security (PS), Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Intention to Use (IU). From the data collection that has been carried out, the sample illustrates that digital payment users are dominated by 71.6% of users of female, and another 28.4% are male. For Gopay payment services, it produced the highest rating used by respondents, which was 61.8%. Then followed by OVO with a percentage of 52.9%. Meanwhile, DANA obtained the third highest rating results after Gopay and OVO, which was 42.2% for the presentation of LinkAja, Jenius, PayTren, and other payment services. The demographic data of respondents are summarized in Table 1.

Table 1. Demographic data

Measure	Items	Percentage
Gender	Male	28.4%
	Female	71.6%
Know digital payment	Yes	99%
	No	1%
Use digital payment	Yes	95.1%
	No	4.9%
Digital payment used	Gopay	61.8%
	OVO	52.9%
	DANA	42.2%
	LinkAja	15.7%
	Jenius	3.9%
	PayTren	1%
	Others	27.5%

Then, convergent validity, discriminant validity, and internal consistency reliability were conducted to assess the measurement model. The result of internal consistency reliability and convergent validity are shown in Table 2. Table 2 shows good indicators and constructs in convergent validity and internal consistency reliability. All values of both composite reliability and

Cronbach's alpha are higher than 0.7 and average variance extracted (AVE) values greater than 0.5. Meanwhile, Table 3 shows good discriminant validity as it illustrates the square AVE of each factor is larger than any of its correlations with the other factors.

Table 2. Internal consistency reliability and convergent validity

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Culture	0.803	0.832	0.909	0.834
Effort Expectancy	0.789	0.794	0.904	0.825
Intention to Use	0.793	0.812	0.878	0.706
Perceived Security	0.852	0.894	0.910	0.772
Performance Expectancy	0.827	0.829	0.897	0.743
Social Influence	0.861	0.892	0.914	0.779

Table 3. Discriminant validity

	Culture	Effort Expectancy	Intention to Use	Perceived of Security	Performance Expectancy	Social Influence
Culture	0.913					
Effort Expectancy	0.625	0.908				
Intention to Use	0.597	0.654	0.840			
Perceived Security	0.718	0.441	0.567	0.879		
Performance Expectancy	0.651	0.742	0.683	0.640	0.862	
Social Influence	0.436	0.499	0.448	0.372	0.357	0.883

Based on Table 2 and Table 3 above, it can be seen that all items and constructs in this research are valid and reliable. Then, the next assessment was conducted, namely the assessment of the structural model. The result of the structural model is shown in Figure 2 and Table 4. The structural model examined the hypotheses, and whether they can be supported or rejected. It was assessed with R-square, Path Coefficient, p-value, and t-value. The path Coefficient assesses whether all indicators positively or negatively affect the variables. Figure 2 shows an R-square value of 0.561 or 56.1% for IU, which means that predictive accuracy for this model is moderate. The R-square value ranges from 0 to 1, with higher levels indicating higher levels of predictive accuracy, R-square values of 0.75, 0.50, or 0.25 for endogenous latent variables can, as a rule of thumb, be respectively described as substantial, moderate, or weak [27].
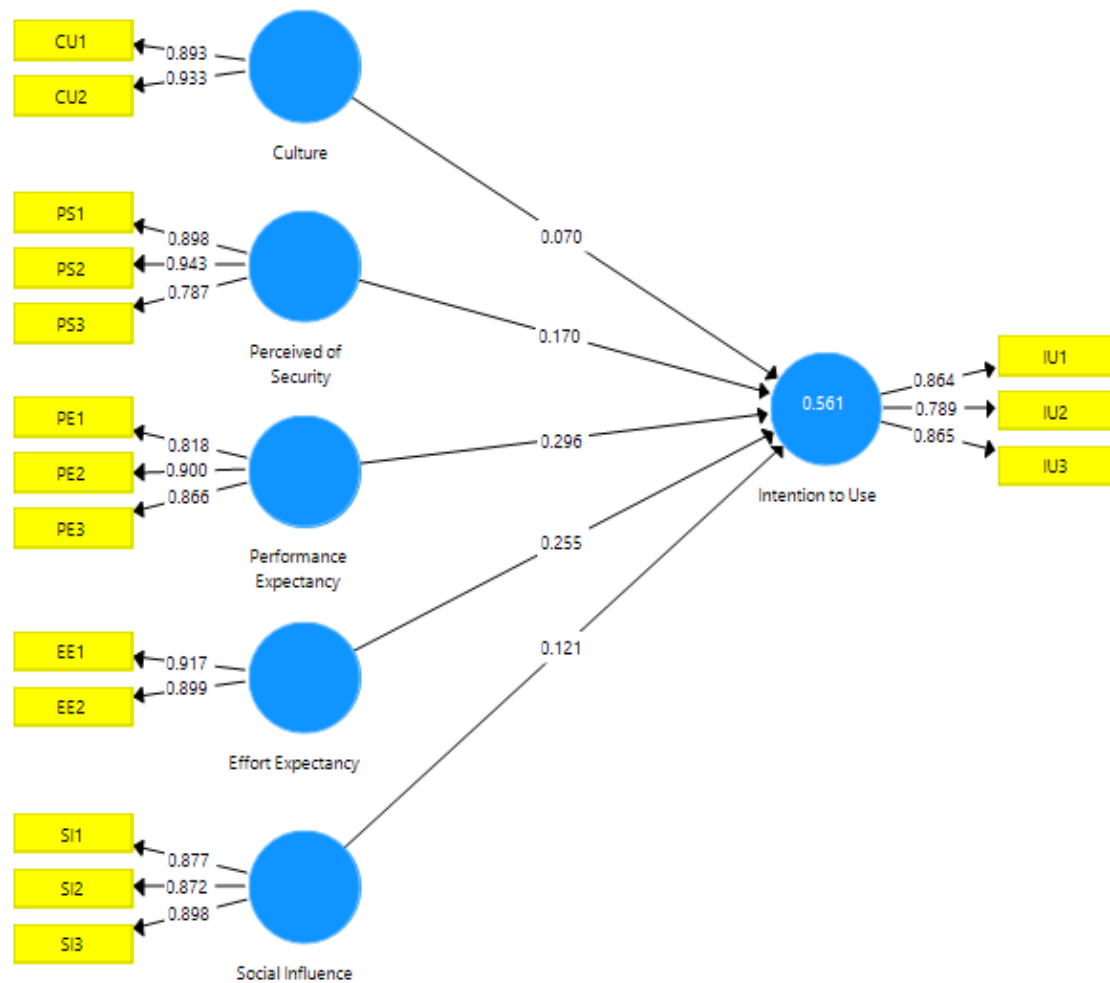
Figure 2. Path analysis, outer loadings, and R-square

Based on the analysis, two hypotheses are supported, and three other hypotheses are rejected. From Table 4, H1 ($\beta = 0.070, t = 0.553, p = 0.580$) is rejected, and culture (CU) does not have a positive effect on the intention to use digital payment. H2 ($\beta = 0.170, t = 1.387, p = 0.166$) is rejected, and perceived security (PS) does not have a positive effect on the intention to use digital payment. H3 ($\beta = 0.296, t = 2.634, p = 0.009$) is supported, performance expectancy (PE) has a positive effect on the intention to use digital payment, and it indicates the path between performance expectancy and intention to use digital payment is significant. H4 ($\beta = 0.255, t = 2.187, p = 0.029$) is supported, effort expectancy (EE) has a positive effect on the intention to use digital payment, and it indicates the path between effort expectancy and intention to use digital payment is significant. H5 ($\beta = 0.121, t = 1.077, p = 0.282$) is rejected, social influence (SI) has not a positive effect on the intention to use digital payment.

Performance expectancy and effort expectancy have a positive effect on the intention to use digital payment. That is because performance expectancy is related to how the consumer feels about the use of digital payment will provide benefits in online transactions. Besides that, effort expectancy is also related to the convenience felt by customers when using digital payment services [17]. Meanwhile, culture and perceived security did not affect the intention to use digital payment. This current study is in line with the prior research [10]. In other words, the intention to use digital payment will get stronger if the service related to performance expectancy and effort expectancy are simultaneously improved. Digital payment providers need to improve productivity, convenience, speed of transactions, ease of use, transaction flexibility, and ease of learning about digital payment services.

Table 4. Result of the proposed model

Hypothesis	Path	Path coefficient (β)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Decision
H1	CU -> IU	0.070	0.126	0.553	0.580	Rejected
H2	PS -> IU	0.170	0.123	1.387	0.166	Rejected
H3	PE -> IU	0.296	0.112	2.634	0.009	Supported*
H4	EE -> IU	0.255	0.117	2.187	0.029	Supported*
H5	SI -> IU	0.121	0.112	1.077	0.282	Rejected

Significant at $P^* < 0.05$.

Conclusion

From this study, it can be concluded that customers' intention to use digital payment (IU) is influenced by effort expectancy (EE) and performance expectancy (PE) based on the extended UTAUT model. These two factors are significant in influencing the customer's intention to use digital payment. Meanwhile, other three factors namely culture, perceived security, and social influence are not influencing customers' intention to use digital payment. This model is moderately accurate with an R-square value of 0.561. Based on the results of this study, digital payment provider must consider improving productivity, convenience, speed of transactions, ease of use, transaction flexibility, and ease of learning about digital payment services so that the customer's intention to use digital payment get stronger. Apart from all that, it should be noted that this finding has a few limitations because this research only focuses on factors influencing the use of fintech derived from the UTAUT framework. It is advisable to conduct further research by increasing the number of samples and including more variables such as trust, business, or other variables because fintech can support the improvement of community financial inclusion, namely community involvement in economic and business transactions, ranging from buying and selling, payments/contributions, to savings and loans. With fintech technology, it can bridge various economic transactions to increase financial inclusion.

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The grounding resistance improvement of the distribution substation using multiple rods and wood charcoal as soil treatment

Ni Made Karmiathi [1]*, Putu Martin Puja Yoga [2]

[1,2] *Electrical Engineering Study Program, Politeknik Negeri Bali, Indonesia*

*Corresponding Author: *made.karmiathi@pnb.ac.id*

Abstract: The grounding system plays the important role in securing the electric power system. Low grounding resistance ensures the proper operation of the grounding system. The lower the grounding resistance value, the easier current flow through the earth without any obstacles then prevents equipment from being damaged or causing the injury of personnel. According to the PUIL 2000 standard, grounding resistance should be less than 5Ω. Methods that can be performed to reduce grounding resistance are increasing the length and diameter of the grounding rod, using multiple rods, and treating the soil to reduce its resistivity. In this study, we would like to improve the grounding system of the KA2317 distribution substation located at Mertasari, Jimbaran in South Kuta, Bali which has a grounding resistance of 8.1Ω (more than 5Ω). The method that was applied in this study was grounding improvement by adding an electrode rod and adding wood charcoal to reduce soil resistivity. At the end of the study, grounding resistance can be reduced from 8.1Ω to 1.9 Ω or improved by 76.6%.

Keywords: charcoal, electrode rod, grounding resistance

How to Cite: N. M. Karmiathi, P. M. P Puja, "The grounding resistance improvement of distribution substation using multiple rods and wood charcoal as a soil treatment," *Matrix: Jurnal Manajemen Teknologi dan Informatika*, vol. 13, no. 1, pp. 33-41, 2023.

Introduction

The grounding system plays the important role in securing the electric power system. Low grounding resistance ensures the proper operation of the grounding system. The lower the grounding resistance value the easier the current flows through the earth without any obstacles, then prevent equipment from being damaged or causing the injury of personnel. According to the PUIL 2000 standard, grounding resistance should be less than 5Ω [1].

The value of grounding resistance is influenced by several factors, namely soil resistivity, size and the type of electrode used, and depth electrode implantation. While Soil type resistivity is influenced by soil composition, temperature, water content (moisture), and chemical content in the soil [2]. One method to get a lower grounding resistance and soil resistivity are by chemical soil treatment in the form of adding additives to the soil. Some additives that are often used are bentonite, gypsum, salt, and charcoal [3]. Wood charcoal has the highest percentage of carbon at 25.04%, and the least is hydrogen at 4.77% based on laboratory test results. The large active carbon content in wood charcoal acts as an additive that can increase water absorption due to its hygroscopic so that it can increase the electrical conductivity of soil [4].

Based on pre-research conducted on the K2317 distribution substation of PLN located at at Mertasari, Jimbaran in South Kuta, Bali, it was found that the grounding system at this substation has a resistance quite high of 8.1Ω (greater than the PUIL 2000 requirement). This situation could potentially endanger the electrical network system in that area from the possibility of overcurrent or lightning disturbances. In order to prevent the possibility of electrical interference, it is very urgent to improve the grounding system.

The studies of grounding system improvement have been developed in several scientific research works as described in the following summary. As published in [5] grounding improvement by implementing soil treatment biochar instead of chemicals. The method

contributes to reducing the earth's resistance over long periods to avoid the expensive cost of these elements and their secondary effects. The use of this method significantly reduced the earth resistance with one electrode from 242.0Ω to an average of 26.27 Ω with the Clay sandy soils of the Sahelian zone of Cameroon during the dry season and 2.1 Ω during the rainy season. While as published in [6] The effect of bentonite to reduce soil resistance was analyzed. The grounding resistance is observed with and without bentonite. The earthing system with bentonite as addictive has a smaller grounding resistance than that without bentonite. The biggest percentage of reduction in grounding resistance is 74% due to bentonite which is activated at a temperature of 2000C. Non-activated bentonite can achieve a 68% reduction in grounding resistance. In contrast, the composition of 50% non-activated bentonite and 25% soil can reduce the grounding resistance by 69%. The results obtained from the comparison using dry coconut shell charcoal and wet coconut shell charcoal show that measurements using wet coconut shell charcoal are better (less resistant) than using dry coconut shell charcoal. Soil resistivity measurements will be much better at the maximum depth than the usual depth (110 cm), better than 10cm [7]. The application of bentonite to improve the value of grounding resistance was found in the study [8]; bentonite was chosen because has various good properties including very low and stable resistivity; abilities to absorb and retain large quantities of water; can swell up to 13 times its dry volume; low cost; it will not gradually leach out because it is part of the clay itself. The result shows that the decrement of grounding resistance is around 16% - 48% (average 32%) with a deviation standard is 8%. The research on grounding system improvement that was conducted in the Laboratory of Electrical Engineering, University of Lampung shows that the lowest grounding resistance values were 45.896 Ω on the concrete with bentonite: cement: sand: gravel = 0.3: 0.7: 2: 4. By adding 1.5% coconut fiber, the grounding resistance value is 3.5 times smaller than the grounding resistance values of the soil (161.2 Ω). Adding bentonite and coconut fiber can decrease the grounding resistance values [9]. The research on Specific locations within the Niger Delta region of Nigeria shows that the deeper-driven single vertical electrode was observed to have decreased after the deeper-driven exercise. The resistance values of the deeper-driven electrodes showed resistance of up to 98% resistance reduction [10]. The research grounding improvement published in [11] shows that the best composition is 90% Zeolite, 5% NaCl, and 5% charcoal for the rod depth of 1.2m, resulting in a resistance decrease from 94.3Ω down to 5.3Ω (94.4%). In the research published in [12] the utilization of coconut charcoal as alternative media of grounding was investigated. The mesh-electrode was made of stainless steel of 8-mm diameter, whereas its lattice dimension was 50cmx50cm. Three variations of lattice number were considered, i.e. 1-, 2-, and 4-lattice structures. Dry and wet charcoal media were considered. Mesh location was fixed at the depth of 80cm under the ground, while the 10cm of medium thickness variation was chosen. The resistance obtained using a 10-cm thickness of the charcoal layer in a mesh consisting of 1-, 2-, and 4-lattices were 268, 131, and 78 ohms consecutively. The addition of layers up to 80 cm resulted in a resistance decrease of 48%, 33%, and 44%. Using wet charcoal, the 10-cm layer produced 26.5, 17.5, and 14.8 ohms of grounding resistance and a reduction of 25%, 10%, and 3.6% subsequently for 1-, 2-, and 4-lattice mesh structure if the layer thickness was 80cm. Meanwhile as reported in [13] there was a decrease in the value of grounding resistance which originally used a single-circuit electrode grounding system to a parallel-connected electrode grounding system of 52.307% and a parallel-connected electrode grounding system with charcoal media mixed with the soil by 60%. An almost similar finding was also reported in [14], the addition of wood charcoal and salt (NaCl) as a soil treatment to the electrode with a depth of 0.8 m resulted in a decrease in grounding resistance from 16.70Ω to 5.31Ω or an improvement of 68.2%.

All these above studies confirmed that additional electrodes and additives as soil treatment can reduce grounding resistance and improve the grounding system effectively. However, the weakness of using chemicals (i.e.: bentonite, NaCl) as soil treatment cannot achieve very small earth resistance for a long time, especially in the case of dry clay and dry sandy soils. Secondly, they are not only expensive but also not available everywhere and all the time. Some are corrosive and some are easily leached [5]. Meanwhile using bio charcoal like wood and coconut as soil treatment can provide small grounding at a low cost without causing corrosion issues against the grounding rods.

As previously described, in this research, we will carry out an improvement of the grounding system of the distribution substation located in limestone soil. Considering that the ground

condition is limestone soil which is alkaline in nature and has low conductivity-high resistivity on one hand. On the other hand, limestone soil in nature has a very hard surface which is become a constraint in implementing deep electrode rods to get lower resistance. So that to overcome this situation, we will carry out this grounding improvement by applying the addition of electrode rods in parallel combined with soil treatment. Considering that wood charcoal is a good soil treatment, does not cause corrosion and is easy to find, and has a low price, wood charcoal was chosen as an additive as a soil treatment in this study. By implementing these methods at the end of the study, it is expected that the grounding resistance will be improved and comply with the requirement according to PUIL 2000 Standard.

Methodology

This research was conducted at Distribution Substation KA 2317 located at Mertasari, Jimbaran in South Kuta, Bali in the period from Jul to Aug 2022. The supporting data was obtained from a). Field Observation b). Literature review from various relevant sources such as books, journals, and regulations related to grounding improvement.

The stage of work carried out in this study is shown in Figure 1, which includes:

First Stage, collecting existing grounding resistance data and references related to grounding system improvement;

Second Stage, compose a plan to improve the grounding system of the distribution substation by applying additional rods in combination with soil treatment;

Third Stage, implementing the grounding system improvement in three steps: (i) add new electrode rods, (ii) add wood charcoal as a soil treatment into the hole of additional Electrode gradually in 10% steps from 50% of hole volume until 100% then measure the grounding resistance at the end of every step, until getting resistance value lower then 5Ω, (iii) connecting additional new electrode rods to the existing electrode in parallel then we get the final grounding resistance value.

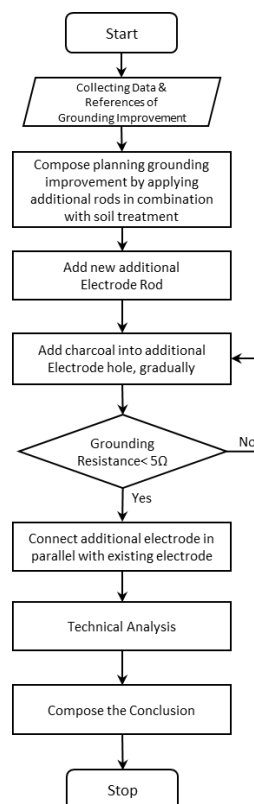*Fourth Stage*, conducting technical analysis and discussion. And finally, compose the conclusion.

Figure 1. Grounding improvement flowchart

Results and Discussions

Results

General Information of Object of Study

KA2317 Distribution Substation located at Mertasari, Jimbaran in South Kuta, Bali is one of the distribution substations of the Citraland Jimbaran feeder. This substation is a portal-type substation, with a capacity of 160KVA, in 2 directions, which serves residential housing. In this substation, valve-type arresters are installed, grounded in limestone-type soil. This substation is using single electrode rod grounding with resistance that does not meet the PUIL 2000 requirements, which is greater than 5Ω.

Existing Grounding System Measurement of KA2317 Substation

The measurement results of the existing grounding system KA2317 Substation (initially using an existing single electrode) are shown in Table 1.

Table 1. Grounding resistance measurement of existing electrode

Time	Grounding Resistance (Ω)	Soil Humidity (%)	Ambient Temperature (°C)
9:00	8.0	60	34.7
13:00	8.3	60	36.1
17:00	8.1	60	35.3
Average	8.1		

Measurements were taken 3 times (at 9 AM, at 1 PM, and 5 PM) with an average value of 8.1Ω which still does not meet the PUIL 2000 standard, namely <5Ω.

KA2317 Substation Grounding Improvement

According to the formulas developed by Herbert Bristol Dwight, an American-Canadian Electrical Engineer, and published in AIEE Transactions in December 1936, the grounding resistance can be calculated as follow [15]:

$$R = \frac{\rho}{2\pi L} \left(\ln \frac{4L}{a} - 1 \right) \tag{1}$$

Where,

R = Resistance to the ground (Ω)
ρ = Soil resistivity (Ωm)
L = Rod length (m)
a = Rod radius (m)

Refer to formula (1), several methods can be applied to reduce the resistance and improve the grounding system, i.e.:
- Increase the rod diameter
- Increase the length of the rod
- Use multiple rods in parallel
- Treat the soil to reduce its resistivity

Additional New Grounding Electrode

As a part of grounding improvement, in this research, we add a new grounding electrode made of copper-coated steel, with dimensions of 200cm in length and 1.5cm in diameter. This new electrode is installed around 300cm away from the existing electrode as shown in Figure 2.
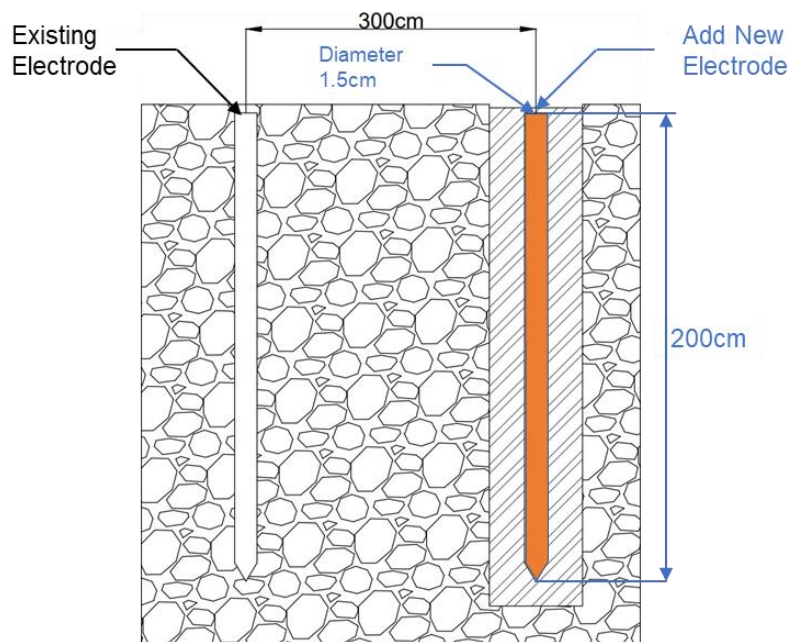

Figure 2. Existing and additional new grounding electrode

The same as for the existing grounding electrode, we did measurements of resistance of adding new grounding electrode, which was also taken 3 times (at 9 AM, at 1 PM, and at 5 PM) as tabulated in Table 2.

Table 2. Grounding resistance measurement of additional new electrode

Time	Grounding Resistance (Ω)	Soil Humidity (%)	Ambient Temperature (°C)
9:00	7.6	60	35
13:00	8.2	60	38
17:00	7.8	60	36
Average	7.9		

As shown in the above table, with an average value of 7.9Ω which still does not meet the PUIL 2000 standard, namely <5Ω. So that needs additional effort to reduce the grounding resistance.

Add Wood Charcoal as Soil Treatment

Considering the properties of wood charcoal i.e.: (i) it has a high active carbon content (25.4%) and is hygroscopic- so that it has a high water absorption capacity which can increase soil conductivity [4], (ii) it is easy to obtain and (iii) it is valuable cheap, in this research we choose wood charcoal as soil treatment additive as shown by Figure 3.

The step-by-step process of adding wood charcoal as a soil treatment is as follows:
- First, prepare a hole with a depth of 205cm and a diameter of 15cm for placing additional electrodes and additional wood charcoal additives.
- Second, preparation of wood charcoal powder of as much as ± 8 kg mixed with a little water.

- Third, installation of the electrode into the hole.
- Fourth: add wood charcoal powder which has been mixed with water using a measuring cup gradually starting from 50%, 60%, 70%, 80%, 90%, and 100% of the volume of the hole.
- Fifth: measuring the resistance of the grounding electrode at the end of each stage of filling the additive.
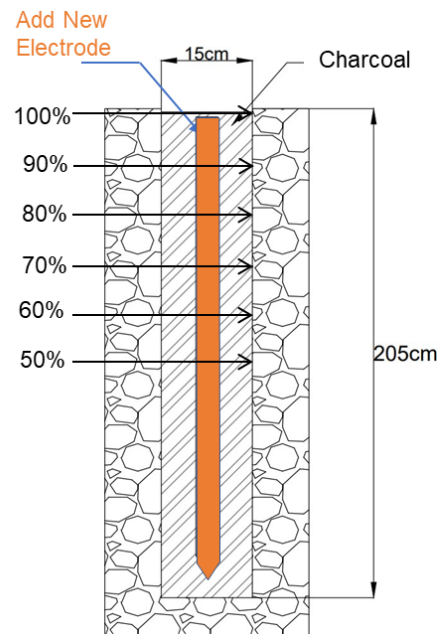

Figure 3. Additional charcoal stage as soil treatment

The results of grounding resistance measurements are recorded in Table 3.

Table 3. Grounding resistance variation after gradual addition of charcoal soil treatment

No	Charcoal filled Composition	Grounding Resistance (Ω)
1	50%	6.6
2	60%	5.2
3	70%	3.7
4	80%	2.2
5	90%	1.7
6	100%	1.3

As shown in Table 3, after 100% charcoal-filled composition is reached, measured grounding resistance achieves 1.3Ω which has met the PUIL 2000 requirement, namely <5Ω.

Parallel Connection Existing and Additional Electrode with Wood Charcoal as Soil Treatment
Referring to the results of grounding resistance measurements in tables 1 and 3, it is known that the resistance of the existing grounding electrode and the additional electrode with wood charcoal soil treatment is 8.1Ω and 1.3Ω respectively. To obtain a lower grounding resistance and meet PUIL 2000 requirements, the two grounding electrodes will be connected in parallel as shown in Figure 4.
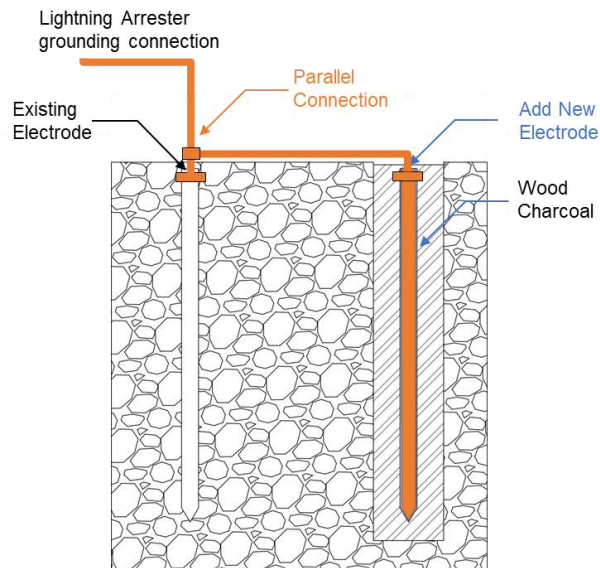
Figure 4. Parallel connection existing and additional electrode with charcoal soil treatment

In order to get a more accurate result, we did resistance measurements taken 3 times (in the morning at 9 AM, in the afternoon at 1 PM, and in the evening at 5 PM) as tabulated in Table 4.

Table 4. Grounding resistance measurement after parallel connection of existing and additional electrodes with wood charcoal soil treatment

Time	Grounding Resistance (Ω)	Soil Humidity (%)	Ambient Temperature (°C)
9:00	1.8	70	34
13:00	1.9	70	36
17:00	2.0	70	35
Average	1.9		

As shown by Table 4, the average resistance value of grounding after the parallel connection of Existing and Additional Electrode rods with Wood Charcoal Soil Treatment is 1.9Ω which has met to PUIL 2000 requirement. This grounding resistance value (1.9Ω) improves significantly compare with the grounding resistance of the existing electrode rod (8.1Ω). The percentage of improvement is around 76.6%.

Discussions

As shown in the previous section (Table 1), the grounding resistance of the K2317 distribution substation is quite high (8.1Ω). This high grounding resistance is caused by the following condition i.e.: first, the type of soil where the grounding is installed is limestone-type soil which is alkaline so it has low conductivity and high resistivity. Second, the hard limestone soil conditions also make it difficult to install deep electrodes.

In order to improve the grounding resistance, firstly we add a new electrode rod, which is installed at the same depth as the existing electrode rod without any soil treatment. With this condition produces a grounding resistance that is almost the same, i.e.: 7.8Ω (table 2). It shows that the high resistivity of the soil (limestone) has a significant effect on the high value of the grounding resistance.

The gradual addition of wood charcoal as a soil treatment to the new electrode hole resulted in a decreased value of the grounding resistance. Filling wood charcoal 50% of the new electrode hole, getting a resistance value of 6.6Ω. Adding more wood charcoal, getting more decreased in grounding resistance, and finally adding wood charcoal into 100% of the hole volume resulting the grounding resistance reduction to 1.3Ω, which met the PUIL 2000 requirement. This finding is in accordance with the results of previous research published in [3], [7], [9], [12], and [13]. Charcoal is effectively able to reduce soil resistivity because charcoal has a high percentage of active carbon at 25.04% which is hygroscopic and acts as an additive that can increase water absorption so that it can increase the electrical conductivity of the soil.

In the end, by making a parallel connection between the existing electrode rod and the new electrode rod which has been equipped with wood charcoal soil treatment, the final grounding resistance of the K2317 substation reaches 1.9Ω (Table 4) which meets the requirements of PUIL 2000. This grounding resistance significantly improve by 76.6% compared to the previous grounding resistance. The result of this study almost similar to the conclusion of studies that were published in [13] and [14], which was indicated that the use of wood charcoal as a soil treatment is very effective in improving the resistance value of the grounding system.

Conclusion

The distribution substation K2317 at Mertasari, Jimbaran in South Kuta, Bali initially has a high grounding resistance value (8.1Ω), which was not met the PUIL 2000 requirements (should be less than 5Ω). By applying the method of reducing grounding resistance through the addition of electrode rods (multiple rods) combined with applying wood charcoal as a soil treatment, the grounding resistance is reduced to 1.9Ω which meets the PUIL 2000 standard requirements. The percentage of grounding improvement through this method reaches 76.6%. Studies in this research only focus on aspects of planning and implementation. Further studies are needed from a maintenance aspect point of view, namely, to determine the effect of aging soil treatment with wood charcoal on the stability of grounding resistance.

Acknowledgments

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Designing and building a business data collection application using the waterfall method

Yoseph Dominikus Da Yen Khwuta [1]*, Maria Adelvin Londa [2], Yohanes Ardianus Wee [3]

[1,2,3] *Information System Study Program, Universitas Flores, Ende*

*Corresponding Author: *yohanesardinus@gmail.com*

Abstract: The Department of Industry and Trade of Ende Regency is a local government agency that is directly related to the process of data collection and assistance for small and medium industrial enterprises (SME) in Ende Regency which is still done manually, causing problems in data collection. the process is considered to be very slow so there is still a lot of SMI data that is not recorded clearly and completely. This website-based IKM data collection application aims to assist the Trade and Industry Office of the Ende Regency in the computerized IKM data collection process and checking of business assistance funds so that it can run effectively and efficiently. The software design methodology used in this study is the system development life cycle (SDLC) starting from the analysis, design, implementation, testing, and maintenance stages. In this study, researchers used 2 system testing methods, namely system usability scale testing (SUS), and black box testing. The results of the research on 4 respondents obtained an average SUS score of 86.2 with an acceptable interpretation of the B value category. While the results of black box testing are obtained from the tests that have been carried out, it can be concluded that all functional features can run well.

Keywords: application**,** business, SME, waterfall method

How to Cite: Y.D.A.Y Khwuta, M.A. Londa & Y. A. Wee, "Designing and building a business data collection application using the waterfall method," *Matrix: Jurnal Manajemen Teknologi dan Informatika*, vol. 13, no. 1, pp. 42-51, 2023.

Introduction

The Department of Trade and Industry (DISPERDAGIND) of Ende district is one of the local government agencies that have a very important role and task in the trade and industry sector of the Ende district government. The vision of the Department of Trade and Industry of Ende Regency is to carry out the task of leading, validating, coordinating, promoting, coordinating, and establishing local government policies in the fields of trade and industry [1]. The task of the Department of Trade and Industry of Ende Regency is to lead the implementation of trade and industrial activities and coordinate the implementation of trade and industrial activities [1]. In the field of trade and industry in Ende district, the existence of small and medium industrial enterprises (IKM) is needed for regioVnal economic growth, the distribution of Small and Medium Industries in Ende Regency is spread over 21 sub-districts, 23 sub-districts, and 255 villages which annually number of industrial business actors. Small and medium enterprises have experienced an increase and the data collection process carried out by the Department of Trade and Industry of Ende Regency is still done manually, causing problems in the data collection process which is considered very slow and there are still many IKM data that are not clearly and completely recorded. Based on these problems, the researchers designed a website-based information system for small and medium industry data collection to assist the Department of Trade and Industry of Ende Regency in the process of collecting data and checking computerized aid funds so that the data collection process can be carried out effectively and efficiently.

Previous research stated that the existence of a small and medium industry information system can help the Boyolali Regency Trade and Industry Office in data collection of small and medium industries online so that the data collection process can be carried out effectively and efficiently [2]. Furthermore, the existence of a geographic information system for small and medium industries can help the Jayapuran government in the process of collecting data and

finding locations for the distribution of small and medium industries faster and easier [3]. Furthermore, other research mentioned the existence of a Web-based IKM Mapping Geographic Information System can help the Mataram City Trade and Industry Office in the process of collecting data and finding IKM business locations [4]. Meanwhile, research also reported that the existence of an IKM data management information system can help the Palu City Trade and Industry Office in the process of collecting data, searching, and filtering IKM data effectively and efficiently [5].

The difference between this research and previous research is that in designing this system, the researcher wants to add a feature for checking business assistance funds where users (users) can check the data of IKM business actors who have received assistance by inputting the ID number of IKM business actors so that system users can check the data. the assistance of each IKM business actor so that there is no doubling of business assistance receipts in the same year. In this system, the researcher also added a search feature for IKM locations based on sub-districts, urban villages, and centers so that system users can easily find IKM locations, and the process of making reports based on location can be quickly and easily printed. The system testing method that the researcher uses in this research the SUS (system usability scale) testing and Blackbox Testing. SUS is a system testing stage that is used to measure the level of user satisfaction with the system that has been used. The SUS questionnaire consists of 10 question items using a 5-point Likert scale [6][7][8]. While black box testing is used by researchers to test whether the system's functionality can run well or not [9][10]. In designing the system in this study, researchers used the PHP programming language using the CodeIgniter framework. PHP is a scripting language that is popular in developing web-based applications. PHP itself is also a scripting language that is fast, flexible, and practical for creating a website [11]. While the Codeigniter framework is a very small PHP scripting language framework, built for developers who need a simple and elegant toolkit to create full-featured website applications [12]. By using the Codeigniter framework, researchers can easily and quickly develop web-based applications.

Methodology
The Research Stages

The method used in building this website-based small and medium industry data collection information system is the System Development Life Cycle (SDLC) method. The SDLC method is a method that provides a software life flow approach sequentially or sequentially starting from the stages of analysis, design, implementation, testing, and maintenance [7][13][14]. The analysis stage is used to collect data requirements, the design stage is used to design applications, the implementation stage is used to create a system using a computer programming language, the testing stage is used to test whether the system still has errors and the maintenance stage is used for if there is an error, then repairs are made to the application goes well The stages in the SDLC method can be seen in Figure 1.
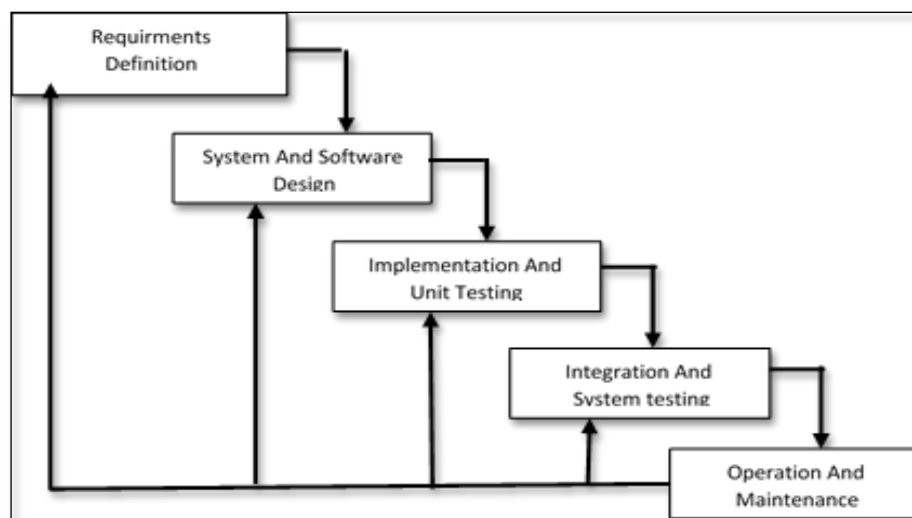

Figure 1. SDLC Model

Analysis

The analysis phase is carried out to obtain the program requirements to be developed including the desired data management needs and the required feature functions. In the analysis phase, the authors conducted interviews with employees of the Department of Trade and Industry (DISPERDAGIND) of Ende Regency. In the interview that the author conducted, it can be concluded that the system features needed to include, managing main data, managing KLBI and industrial permits, managing IKM data, managing assistance, and managing industrial data reports. The system is also expected to contain information on Small and Medium Industries in Ende Regency. Two users in the system will be created or developed. The first user is the admin of DISPERDAGIND who is in charge of monitoring activities on this system. The second user is a user or employee, who is also in charge of filling in the incoming industry data and available assistance.

Design

The design phase that the researchers used in this study included data flow diagrams (DFD) and Entity Relation Diagrams (ERD). A data Flow Diagram is a data process that describes where the data comes from and where the data goes out of the system and is stored [15]. While the Entity Relation Diagram (ERD) is a translator relationship that contains the components of the entity set and the relationship set that is equipped with attributes where to connect the entities, the primary key) key field of each entity is used [15].

Data Flow Diagram Level 0

The design data flow diagram (DFD) level 0 in Figure 2 describes the overall process model of the system, where the user (user) in this case is an employee of the Department of Trade and Industry (DISPERDAGIND) in charge of inputting sub-district data, village data, business data, data KLBI, IKM data, center data, and business assistance data into the system then the IKM data report which is the output of the system is given to the Head of the Department of Trade and Industry (DISPERDAGIND) Ende district.
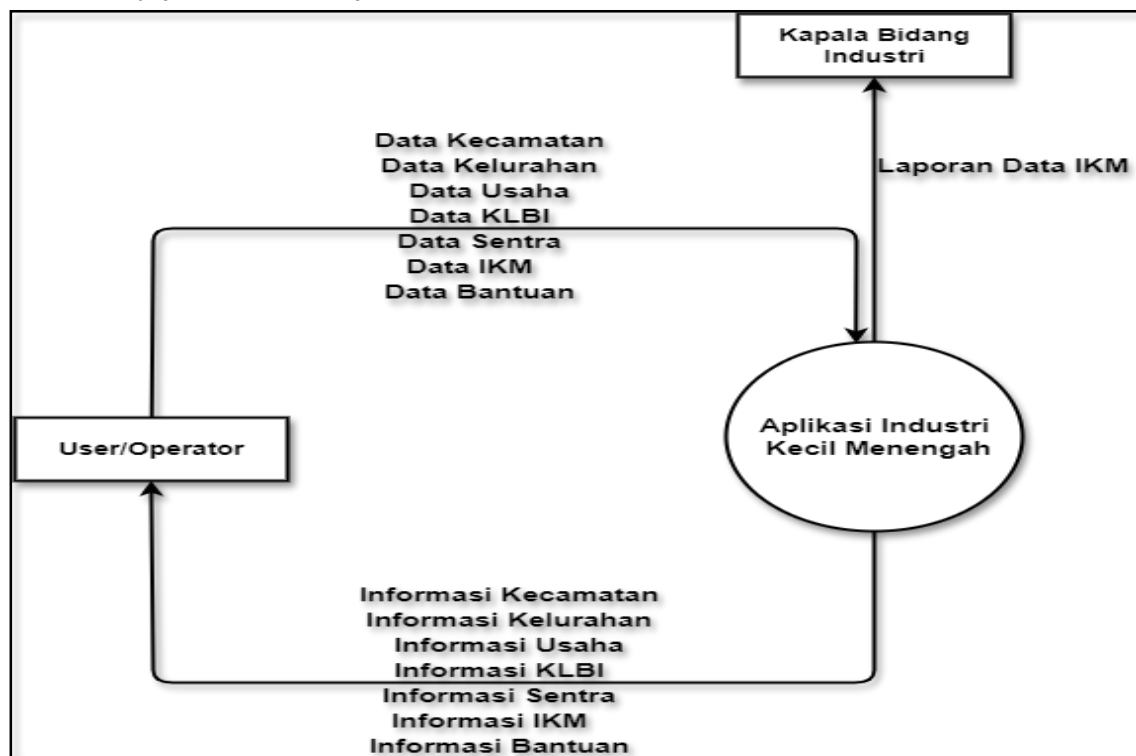
Figure 2. DFD Level 0

Data Flow Diagram Level 1

The level 1 data flow diagram (DFD) design in Figure 3 has 4 processes, namely the user data management process, business data management, sub-district data, center data, and KLBI data, then IKM data management and the last is business assistance data management.
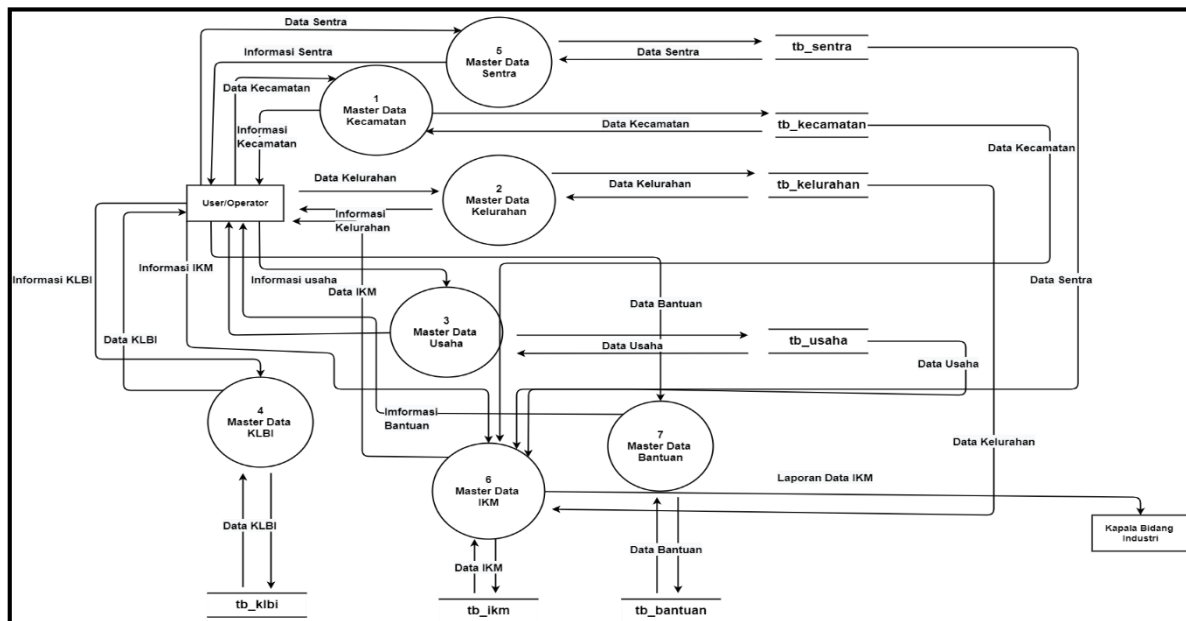
Figure 3. DFD Level 1

Entity Relation Diagram (ERD)

The table relation design in Figure 4 describes the design of the table structure and the relationship between tables used by researchers in this study. There are 7 tables used in this study consisting of sub-district tables, village tables, KLBI tables, centers tables, business tables, IKM tables, and assistance tables.
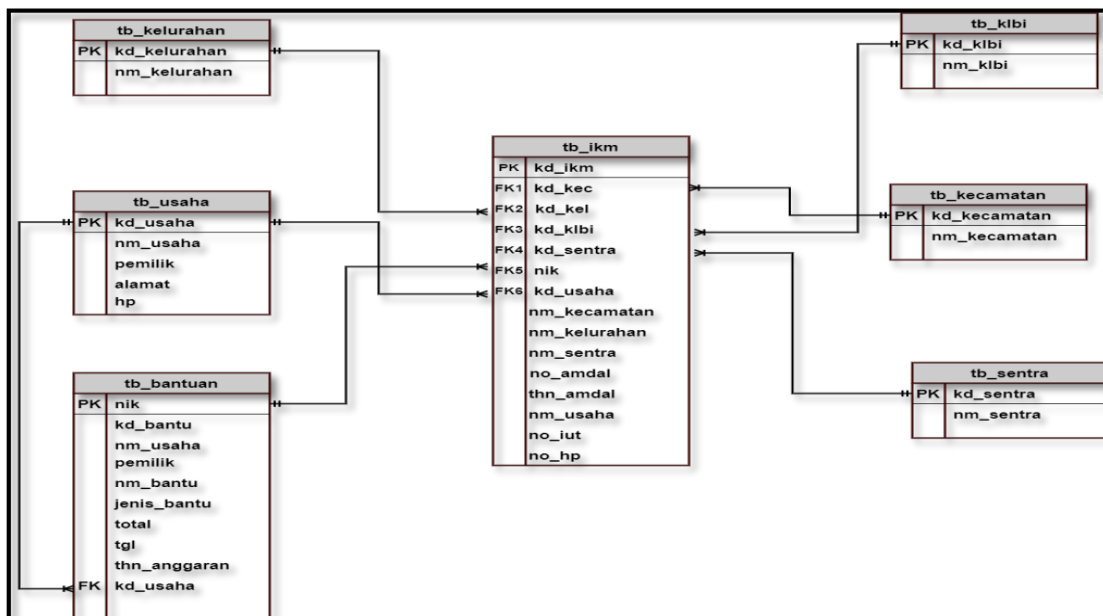
Figure 4. Entity Relation Diagram

Implementation

The results of this study produce an Information System for Small and Medium Industry Business Data Collection in Ende Regency, which has two users, namely Admin, User, or employees who run this information system. Admin has access rights to process existing data, has access rights to change data, delete data, add data and as monitoring data for small and medium industries that have been recorded by the Department of Trade and Industry, users or employees have access rights to register and Filling out data for Small and Medium Industries and data on regulations, permits, and assistance data.

Login Page

The login page is the first page that appears when accessing the system. Figure 5 shows the menu contained on the login page, to access the login page the user must input the nip and password. The login page is used to provide login access rights according to the user level.
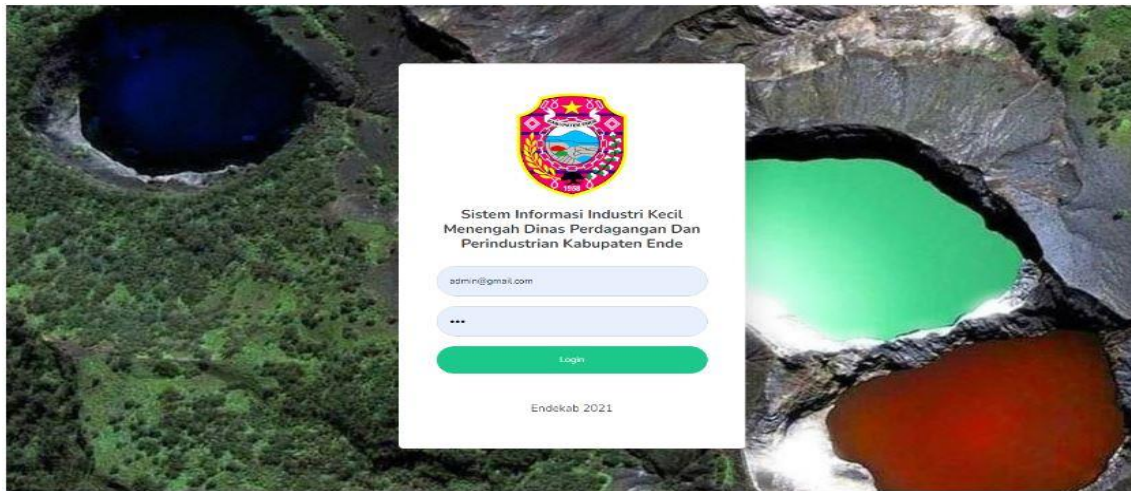
Figure 5. Login Page

Dashboard Page

The admin dashboard page is the main page that can be accessed at the admin level. Figure 6 shows the admin-level dashboard. This page is used to view information on the number of sub-districts, the number of sub-districts, and the number of IKM in the Ende district in real time.
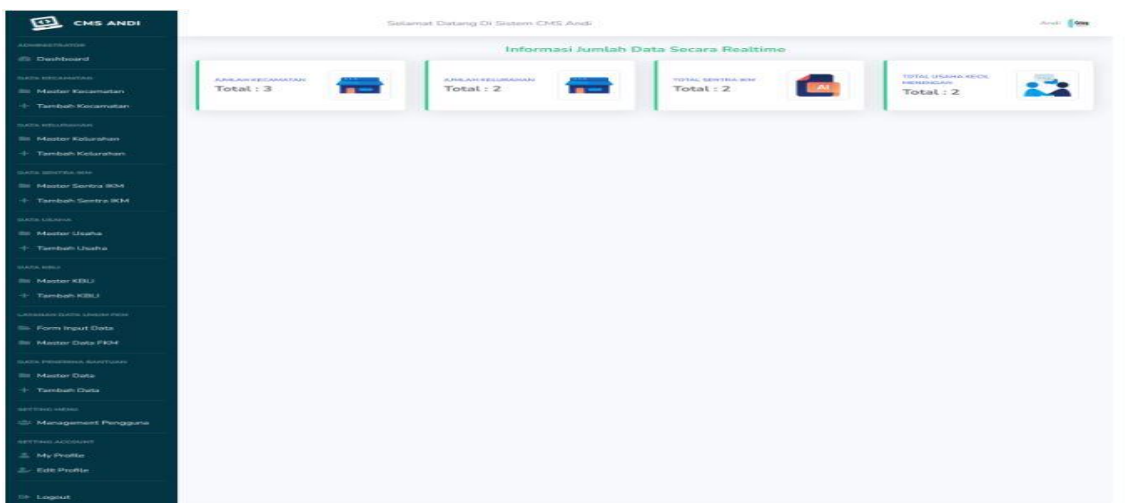
Figure 6. Dashboard Page

IKM Data Input Form Page

The IKM data input form page is a page that can be accessed at the Employee user level. Figure 7 shows the IKM data input form. This page is used for the process of inputting IKM letter data by the Ende Regency DISPERDAGIND employee.

Figure 7. IKM Data Input Form Page

Checking Business Aid Funds Page

The business assistance fund checking data input form page is a page that can be accessed at the Employee user level. Figure 8 shows the business assistance fund checking data input form. This page is used for the process of inputting data for checking business assistance funds carried out by DISPERDAGIND employees of the Ende district.
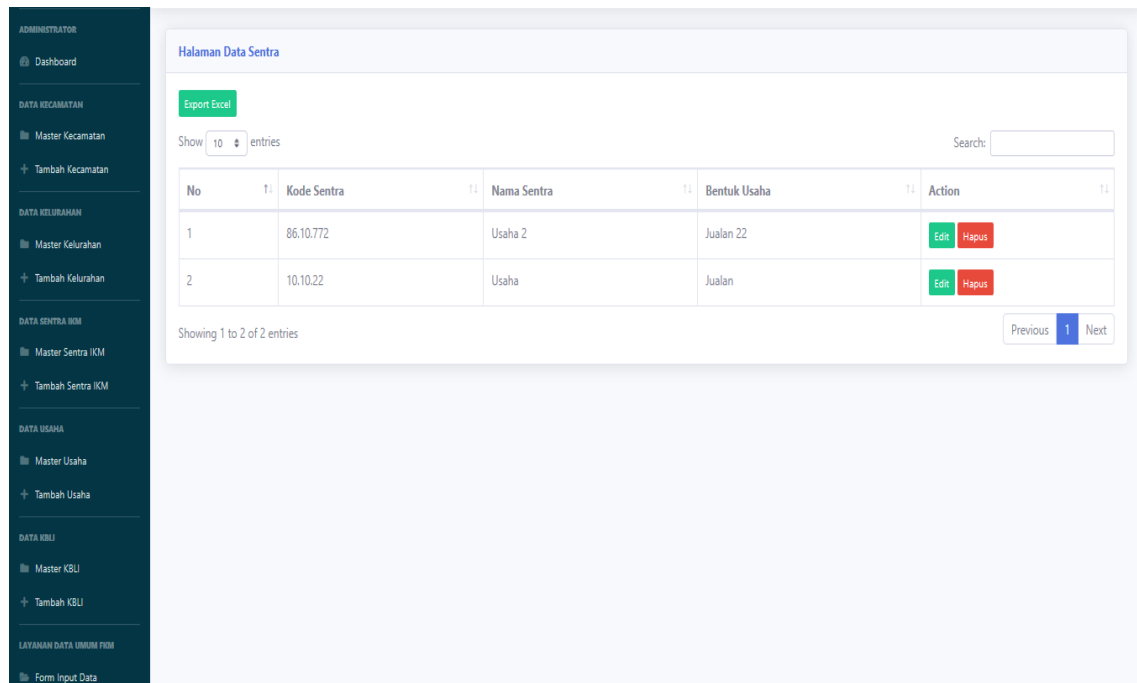
Figure 8. Checking Business Aid Funds Page

Master Data Center Page

The data center master page is a page that can be accessed at the employee user level. Figure 9 shows the center data master page. This page is used to view center data information
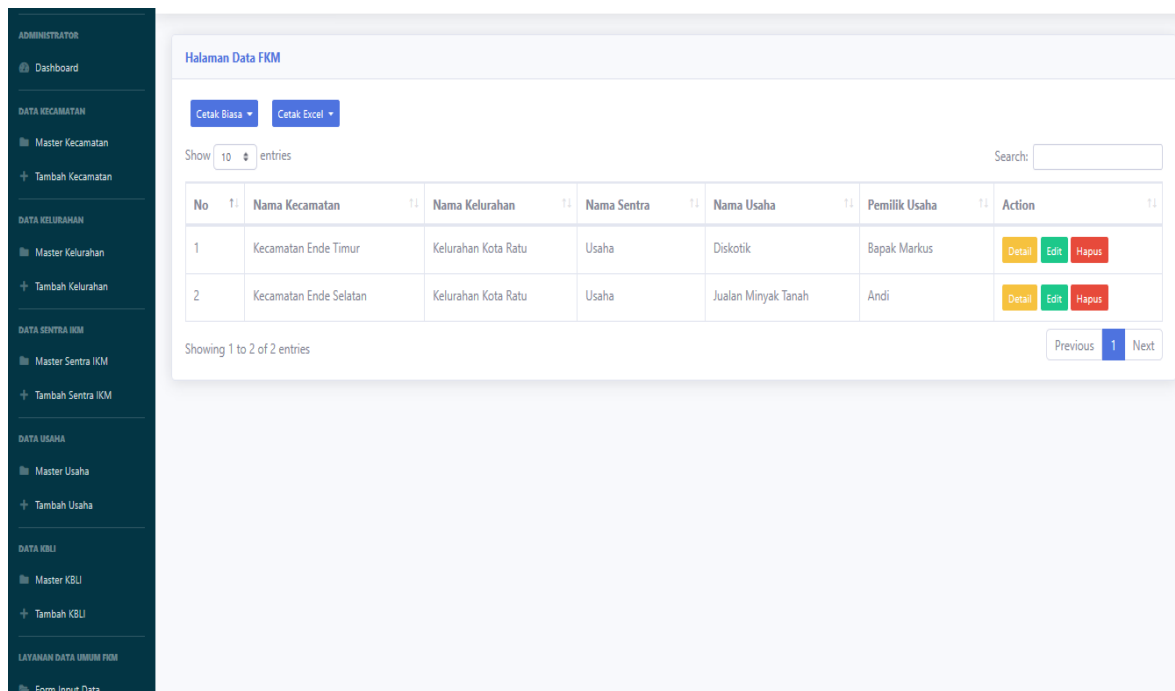
Figure 9. Master Data Center Page

Master Data IKM Page

The IKM master data page is a page that can be accessed at the Employee user level. Figure 10 shows the IKM master data page. This page is used to view information on IKM data.

Figure 10. Master Data IKM Page

System Usability Scale Test

Testing the system usability scale questionnaire is a system testing stage that is used to measure the level of user satisfaction with the system that has been used [7]. The results of the usability scale system questionnaire used to measure the level of user satisfaction distributed to 4 respondents who got an average SUS score of 86.2 can be seen in Figure 11.
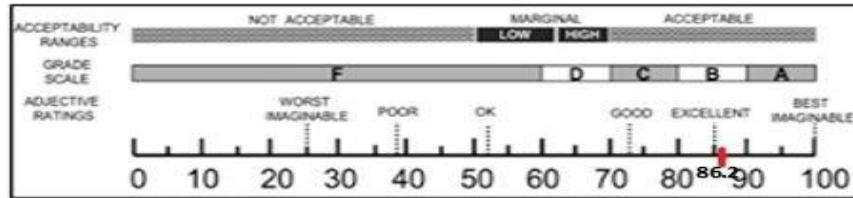

Figure 11. System Usability Scale Score

Based on this test, it was obtained that the score for the grade scale was at grade B, for the adjectives scale the score obtained was categorized as excellent and for the acceptability scale the score obtained was categorized as Acceptable, indicating that the score was classified as acceptable by the user

Blackbox Test

Testing on the system used black box testing which is a software development technique used to evaluate system functionality [16][17][18]. Blackbox testing focuses on the inputs (inputs) for the system and the expected outputs (outputs) for each input (input). This test method is based on software requirements and specifications. By the results of the tests that have been carried out, it can be concluded that all functional features can run well, as explained in Table 1.

Table 1. Blackbox Testing

Test	Function	Input	Output	Status
Login	Login menu to enter the system	Enter the correct user and password	Go to the main page	Valid
Login	Login menu to enter the system	Entering the wrong username and password	Back to the login page	Valid
Data center menu	View data center	Click on the data center	Displays a list of center industrial	Valid
Data center menu	Data center input	Click on add data	Showing the new sentra data entry	Valid
Small and medium industry data Menu	View ikm data	Click on ikm data	Displays a list of small and medium industries	Valid
Small and medium industry data Menu	Input ikm data	Click on add data	Displays a list of small and medium industries	Valid
Menu business assistance data	View business assistance data	Click on business assistance data	Display business assistance data	Valid

Test	Function	Input	Output	Status
Menu business assistance data	Input data business assistance	Click on add data	Displaying business assistance data fields	Valid
Menu business assistance data	Input nik businessmen ikm	Click on add data	Displaying business assistance checking information	Valid

Conclusion

After designing, implementing, and testing a website-based small and medium industry data collection information system, it is concluded that several conclusions are obtained. in Ende Regency. This system provides information related to small and medium industries in Ende Regency. Researchers are trying to make the system as expected from the Department of Trade and Industry of Ende Regency as best as possible. In the future, it is still necessary to develop a system to be better so that the information system for data collection of small and medium industries can have better features and make it easier for users or employees of the trade and industry office of Ende Regency to operate. As for suggestions for further research, it is necessary to test in terms of user experience (UX) and user interface (UI) to increase user satisfaction and comfort in using the system.)

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