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Business Intelligence Dashboard Visualization on Information Systems for Online Verification of Invoice Documents and Requests for Goods or Services

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Abstract

In the daily running of their business, business companies are usually faced with the problem of adapting to changing trends related to the business world. To make a decision that is precise, fast, and accurate based on data and analysis, the company must apply Business Intelligence (BI) based technology. In this research, the study was conducted at PT ADHI KARYA (Persero) Tbk, which has a problem with the document verification system which is still done manually. To help the above problems, a solution is offered by utilizing Business Intelligence (BI) based technology to create a dashboard of information systems for verification of invoice documents and requests for goods and services online. For evaluating the performance of employees or verifier officers can use the collaboration between BI and the K-Means Algorithm by classifying incoming data based on the duration of the data input until the e-Verification sheet is sent by the system. The system development method in this study uses the RAD (Rapid Application Development) method of rapid application development. Which is expected to produce a solution in the form of a visualization dashboard for online verification information systems for invoice documents and requests for goods and services based on Business Intelligence technology.

Keywords: *Business Intelligence, World technology, Analysis*

1. INTRODUCTION

It is a necessity and obligation for businesses or organizations to use technology in the current era, where communication and information technology is growing rapidly[1], [2]. Business Intelligence technology, which we often know as BI technology, can analyze data, present data in the form of attractive visualizations and make it easier for users to make important decisions on data analysis in their business or business, the goal of which is to make the right decisions, quickly based on data analysis [3]. To monitor the movement of worker productivity in the field, companies can visualize data in real-time, integrated, and automatic [4]. Business Intelligence techniques are a form of dashboard visualization that is interactive and easy to understand to make important decisions based on system analysis data [5].

2. RESEARCH METHODOLOGY

2.1. Place and Time of Research

This research was conducted at PT ADHI KARYA (Persero) Tbk which is located at Jl.Raya Pasar Minggu Km .18 South Jakarta 12510.

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Table 1. Research Timetable

Activity	Week																			
	I					II					III					IV				
Problem Identification																				
Query and database settings																				
Creating application interfaces																				
Application testing																				
Analysing and training users																				

2.2. Data Collection Methods

In conducting research to obtain data and information, the techniques that can be used in the data collection process are as follows:

a) Interview

At this interview stage, the researcher conducts interviews directly with the parties involved in this study to obtain the information needed in accordance with this research.

b) Documentation

In this method the authors collect data in the form of documents needed in designing a business intelligence dashboard.

c) Observation

The author makes observations by seeing how the process of filling, updating and utilizing existing data.

d. Literature study

This method is done by reading textbooks, scientific papers, or research journals related to student achievement data processing.

2.3. System Development Method

In the development of this information system Business Intelligence technology, the author uses the Rapid Application Development (RAD) method. The following is a picture of the RAD cycle.

Figure 1. The RAD cycle

The RAD Rapid Application Development (RAD) method is a software development process in which the development is relatively short, namely the system can be completed within 30-90 days where in system development, the model is the one that works[6]. RAD itself has three stages including:

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a) Requirements Planning

This is the stage of the RAD method where users discuss with analysts to determine system requirements and the need to achieve goals[7]

b) System Design

At this stage the System Design Analyst provides a system design that has been designed, and makes revisions if there is a mismatch with the system design.

c) Implementation

Implementation The design that has been approved by the user is given to the programmer and the programmer develops the design[8]. However, before the system is published to an institution, stages are carried out to test the system.

2.4. Research Flow

The following is a research flow diagram [9]conducted by the author in the figure below.

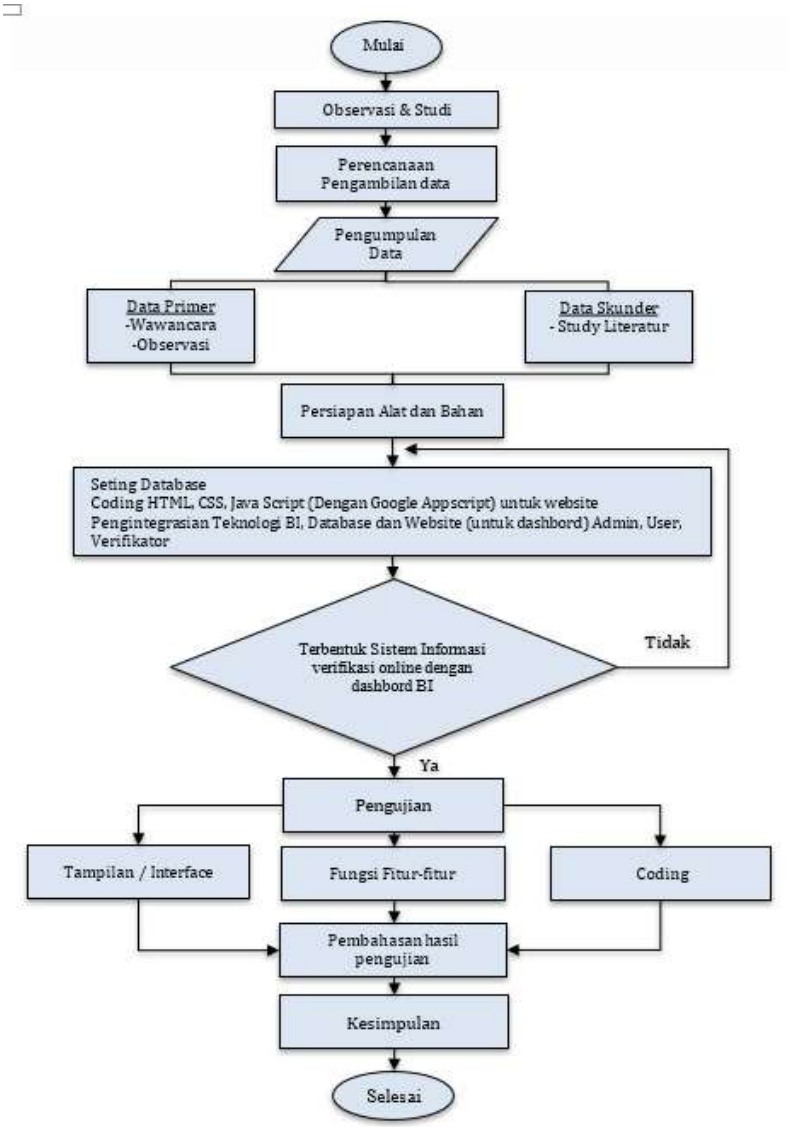

Figure 2. Research Flow

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3. RESULTS AND DISCUSSION

3.1. Application Architecture

The following is the architecture of the information system that will be built in this study:

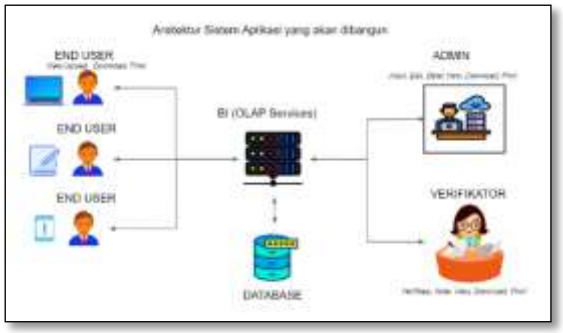

Figure 3. Application Architecture

3.2. Application Architecture

The picture below explains the use case diagram, namely the relationship between interactions between actors and the system [10]formed as follows:

Figure 4. Use case diagram

3.3. Activity Diagram

The following activity diagram illustrates [11] the login, upload and document verification process carried out by users and admins as follows:

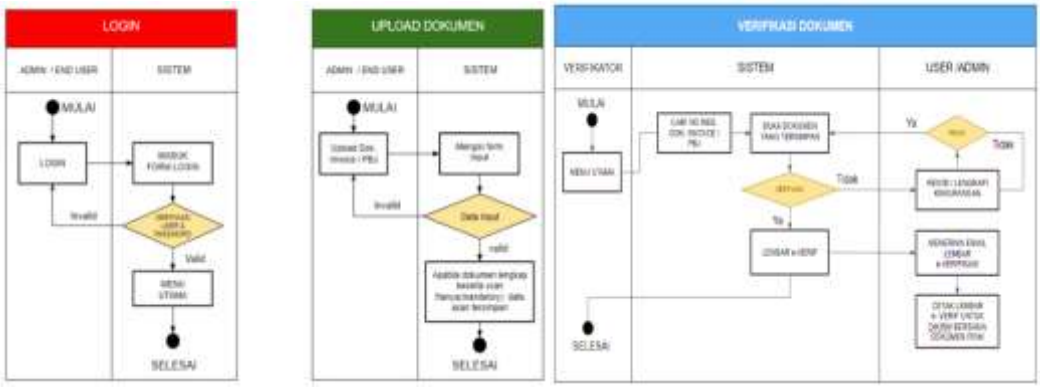

Figure 5. Activity Diagram (*login, Upload, and document verification process*)

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3.4. Sequence Diagram

The sequence diagram that describes the activities carried out in the system in detail [12]can be seen in the figure below:

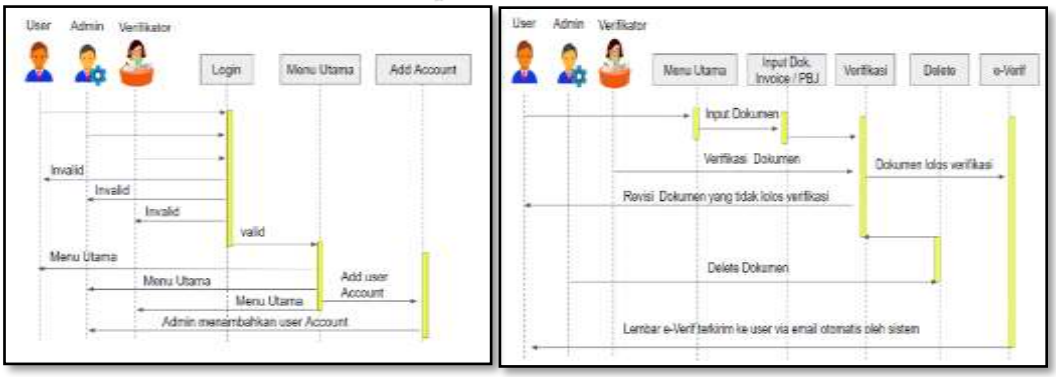

Figure 6. Squence Diagram (*User*, *Admin*, *and Verificator*)

From the result of this sequence diagram, we can see that the system will automatically send an email to users who have uploaded documents if the document has passed verification by the verifier, all document data and records that occur during the verification process are recorded into the system built.

3.5. Class Diagram

Then the most important part of UML (Unified Model Language) is the Class diagram, which is a diagram that describes classes, attributes that have relationships in a system. [8]in this study the class diagram can be seen in the following figure:

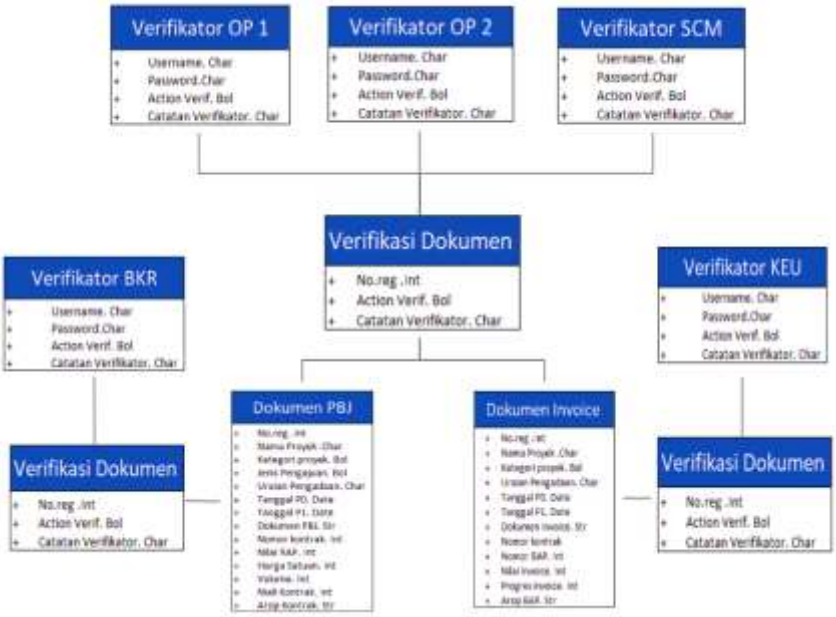

Figure 7. Class Diagram

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3.6. Business Intelligence Dashboard Online Document Verification

In making this dashboard, the programming language used is JavaScript, HTML and connected to the spreadsheets database, while for Business Intelligence using the Google Looker Studio application.

3.6.1. Login page

The following is the design of the login form in the system to be built, users can log in or sign up first. Then the backend program sets the user login level according to their respective levels [13]:

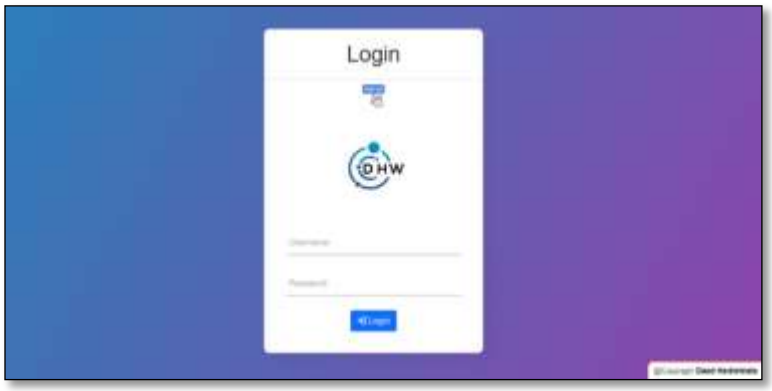

Figure 8. Login Page

3.6.2. Main Menu

The main menu is an illustration of the display on the main page after login explaining the amount of data that has been uploaded, data that has passed verification, data that is still in process or revision (outstanding data).

Figure 9. Main Page

3.6.3. Verifier Worksheet

This page will display the documents uploaded by the user. Then the document will be verified by the officer. The officer has the right to process or postpone with a note if it is assessed that the document does not meet the established standardization.

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Figure 10. Verifier Page

3.6.4. E-Verification Sheet

As for the e-verification sheet, it will be created by the system automatically when the verification process has been completed by three verifiers in different functions, all of whom click "**process**".

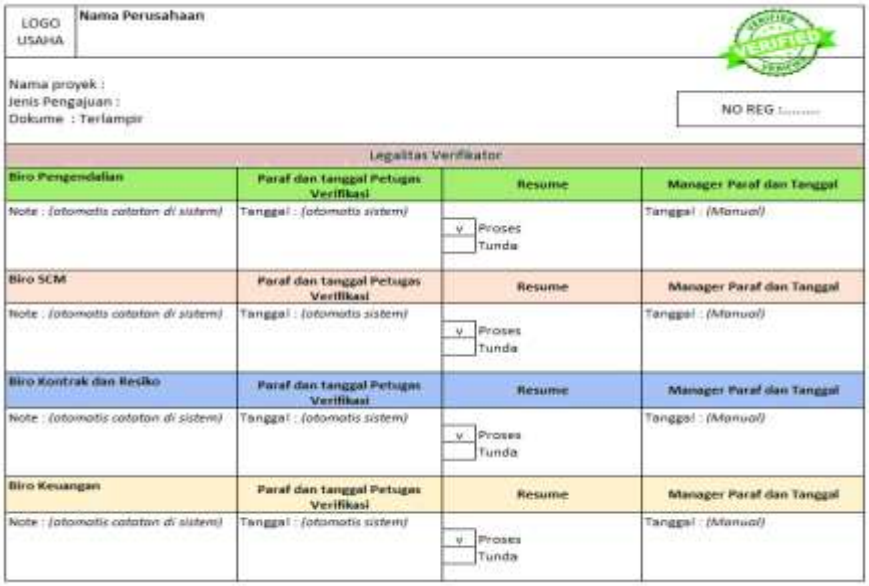

Figure 11. E-Verification Sheet

3.6.5. Dashboard Manager

In this manager dashboard, the BI role of the system is to display the efficiency graph carried out by each procurement item so that management can monitor procurement items that produce efficiency.

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Figure 12. Manager Dashboard (Efficiency display)

Just like the manager dashboard above, the manager dashboard below facilitates management to monitor fluctuations in the prices of materials that have been contracted. So that by looking at the price trend of construction materials, management can determine what strategy to take towards the price situation. For example, if the price is high, partial purchases can be made, but if the price trend is low, umbrella contracts and others are common.

Figure 13. Manager Dashboard (fluctuations in the prices of materials)

3.6.6. Document Input Form

The following illustrates the document input form that will be built on the online verification information system for Invoice documents and Procurement of Goods or Services. This form contains document data that will be inputted to the system. The important data that must be filled in will be marked (*) or mandatory [14] if the data is not filled in the system will refuse to be saved. In the Information System that will be built, the author prepares two kinds of input forms that produce two different tables, namely the Invoice document table and the PBJ document table. The following forms made in this information system can be seen in the picture below:

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Figure 14. Document Input Form

3.6.7. Data labeling with K-Means Clustering

We know that one of the functions of the K-Means algorithm is to label data that amounts to thousands of data (Mundakir et al., 2023). The K-Means algorithm itself is a clustering algorithm based on data distance from the cluster center (Centroid)Click or tap here to enter text.. How to measure the distance between data is as follows:

$$d = \sqrt{\sum_n (Xi - Yi)^2} \quad (1)$$

Measurement of distance between data or Euclidean Distance where:
d = distance (distance between data);
Xi = First data;
Yi = Second data.
For example, in this application the following data is obtained:

Table 2. Data Set Table

No.Reg	Upload Time	e-Verif Sheet sent
Ceh001	17/11/2021 10.00	18/11/2021 10.00
bon002	24/11/2021 14.14	26/11/2021 14.14
mbi003	19/04/2022 13.07	20/04/2022 17.07
ang004	15/04/2022 12.29	15/04/2022 15.29
dan005	15/04/2022 12.34	15/04/2022 16.34
Ceh006	15/04/2022 12.37	18/04/2022 12.37
bon007	15/04/2022 12.40	15/04/2022 15.40
mbi008	15/04/2022 12.43	15/04/2022 14.50
ang009	24/05/2022 13.26	26/05/2022 13.26
dan010	20/06/2022 16.51	20/06/2022 17.51

From the data table above the word gets the following data set:

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{1.00, 2.00, 1.17, 0.12, 0.17, 3.00, 0.13, 0.09, 2.00, 0,04}
Then we will divide the above data into two clusters so k = 2 using the K-Means Algorithm then obtained:
First, we determine the cluster center (Centroid) m1 and m2 by taking random numbers in the data set obtained m1 = 1.00 and m2 = 2.00 after we get it we do iteration table distance data as follows:

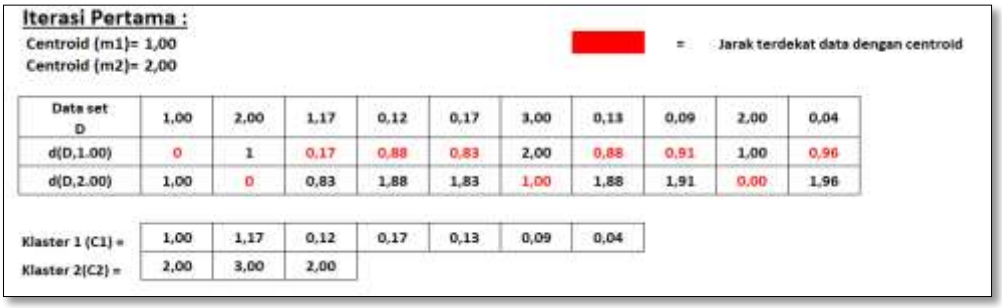

Figure 15. First iteration

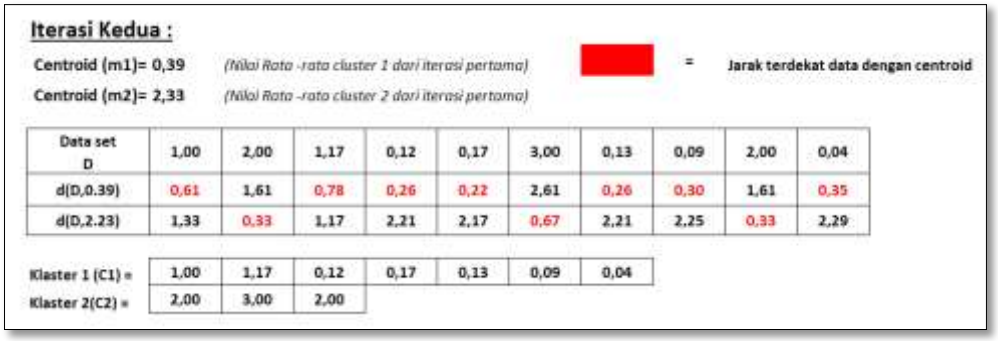

Figure 16. Second iteration

After two iterations of each cluster's data there is no change, so it is declared that the data is final or final cluster. Then we can label the data as follows:

Table 3. Data Classification

No. Reg	Upload Time	e-Verif Sheet sent	verification Duration	Class Data	Information
Ceh001	17/11/2021 10.00	18/11/2021 10.00	1,00	C1	Fast
bon002	24/11/2021 14.14	26/11/2021 14.14	2,00	C2	Slow
mbi003	19/04/2022 13.07	20/04/2022 17.07	1,17	C1	Fast
ang004	15/04/2022 12.29	15/04/2022 15.29	0,12	C1	Fast
dan005	15/04/2022 12.34	15/04/2022 16.34	0,17	C1	Fast
Ceh006	15/04/2022 12.37	18/04/2022 12.37	3,00	C2	Slow
bon007	15/04/2022 12.40	15/04/2022 15.40	0,13	C1	Fast
mbi008	15/04/2022 12.43	15/04/2022 14.50	0,09	C1	Fast
ang009	24/05/2022 13.26	26/05/2022 13.26	2,00	C2	Slow
dan010	20/06/2022 16.51	20/06/2022 17.51	0,04	C1	Fast

From the clustering above, we can conclude that if the uploaded data is verified in less than 2 days, the verification process is declared **"fast"** and vice

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versa if the data is completed more than or equal to 2 days, the verification process carried out by the verifier is **"Slow"** as follows:

Figure 17. Classification Data Dashboard

4. CONCLUSION

From the research conducted, the following conclusions were that the rapid development of BI (Business Intelligence) technology is currently felt to be very helpful in today's business world. With the ease of BI (Business Intelligence) technology in sharing reports or sharing dashboards so that monitoring and control functions within the company can be easily implemented. BI (Business Intelligence) technology can also provide real-time data information that can be used as a reference as a decision-making tool or determinant of business strategies that will be carried out by companies based on analytic data.

With the conveniences provided by BI technology, of course, we must continue to explore or develop various functions of the features contained in BI technology itself, not only limited to this research. In terms of data security or data security, we must strengthen it with algorithms that can support the performance of this BI application. Because matters concerning business data are very important for a company or organization.

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