TEKNOKOM

Jurnal Teknologi dan Rekayasa Sistem Komputer

TABLE OF CONTENTS

About this Journal

TEKNOKOM Copyright Transfer Agreement

DESIGNING A WORK PERMIT REPORTING INFORMATION SYSTEM ON HIBA GROUP

Pramitha Dwi Larasati[1], Ari Irawan[1], Ayub Boy Sandi Sipahutar[2]
[1]Department of Information System, Tanri Abeng University, Indonesia
[2]Department of Informatics Engineering, Tanri Abeng University, Indonesia

ABSTRACT

In 1949 the HIBA Group was here to meet the transportation needs of the community. The company's commitment is to provide increased customer satisfaction through professional management and operational team support to the demands of the changing times. HIBA Group offers complete, professional, modern, and integrated transportation services. In addition to providing comprehensive, professional, current, and integrated transportation services, the HIBA Group also provides work comfort to employees, especially for maintenance, construction, and bus bodybuilding. In the construction or maintenance process, each activity must report a work permit or Permit to Work (PTW), whose function is to monitor and analyze the work to be carried out. The analysis is carried out from the workers' health, difficulty, the environment, and work tools (PPE). The reporting process is still manual form or conventional system to slow down the work being done if the work is essential for a tender. The PTW must also be analyzed and reported on the related circumstances so that PTW work tends to be slow. An online-based PTW information system Website design was made to simplify and speed up the PTW reporting to solve this problem. The method used for developing information systems uses the Prototype Model with an object-oriented system approach modeled using the Unified Modeling Language (UML). This research is the design of the PTW information system Website used in the HIBA Group.

Correspondence:
Pramitha Dwi Larasati,
Department of Information System,
Tanri Abeng University, Indonesia,
Emai: pramitha.dwi@tau.ac.id

INTRODUCTION

The activities are parts of a particular job, must have a high risk, and require reasonable control. Under certain conditions, it is necessary to implement a work permit system or Permit to Work (PTW) [1]. The procedure in a work permit or PTW system is a written (formal) entitlement system used to control certain types of work that have a high-risk potential [2]. With the PTW system, communication between plant/site management, plant supervisors, operators, and those doing the work can be established [3].

Essential things from the PTW system, namely [4]; (1) Identify in detail and firmly the authority for a job (and there are limits to the source) and the person in charge (PIC) precisely to determine preventive actions if needed. (2) Training and instructions on issues and the use of work permits or Permit to Work in detail and procedures must be adhered to concerning the published PTW system. (3) Monitoring and auditing is needed to ensure the system is working correctly. The PTW system aims to ensure that the planning considers the risks involved in a particular job [5]. In addition, an improvement in VM performance can be obtained by installing network and server monitoring tools [6].

HIBA Group was founded in 1949 to provide complete transportation that is comfortable, safe, and quality. HIBA Group offers comprehensive, professional, modern, and integrated transportation services [7]. As for its activities, the HIBA Group has worked in hot areas, working in cold regions, working in confined spaces, and many more. They must report to the Occupational Health and Environment (K3LH) department for safety validation according to the work to be carried out.

This research was motivated by standard and document reports and prior research employing [8] which a safe system work is needed. One of cleaning and maintenance operations is that employees working away from the base or working alone can not be physically eliminated, and some elements of inherent risk remain. Therefore, about safe work systems becomes planning of permit to work. Good practices of the initial phases of maintenance and repair work to safeguard operators in routine activities and become the most suitable kind of safe work system. A permit to work (PTW) aims to monitor the kind of job occupation which likelihood treacherous from human errors with standardized plant analysis risk-human (SPAR-H) methods to predict of human error probability. The average probability of human error in this system is estimated to be 0.11 in a flammable gas test, i.e., 50.7 percent of the permit to work on human error rate. The Permit to Work System (PTWS) identified early is of system non-conformance. Therefore, it is proposed to audit the PTWS procedure in South Pars Gas Complex (SPGC), which one corporation of Bushehr Province located, Southern of Iran, utilizing a structured Delphi method. Furthermore, the study recommends the PTW system to identify forecasted HSE risks that can be eliminated or minimized using appropriate control measures [9]. The Permit to Work (PTW) identified that the flowchart and document flow diagram is running ineffectively. Therefore, it is proposed to expand knowledge of the PTW management for a system to accomplish a solution utilizing an SDLC phase. Furthermore, the study recommends the Visual Basic application obtain to build up the PTW system further [10]. The design of information systems of the research permit with Agile dan Laravel framework method for product recommendations thru website design for solve problems. The design and analysis results have the function of research permit management utilize of Unified Modelling Language (UML) dan testing of the application with White Box Testing [11].

Several issues observed, i.e., the person in charge (PJ) of work must inspect the employees who will work, work area, target time, facilities used, budgeting for work, and personal protective equipment accompanied by filling out the inspection K3LH department. Then the PJ of work offers the report results to the K3LH department and must wait for approval from the relevant department before doing the work. Finally, K3LH Department validates the statement by checking all of the details from the completeness and approval form provided.

The K3LH Department documents and collects reports received and then submits reports to superiors for PTW signing. After the PTW is approved, the K3LH Department gives the PTW form to the PJ of work, and then the work can be completed. As for the approval and validation of PTW, it can take days to get approved, for that the submission of PTW is done h-7 or no later than h-3 from the time it should be

Current technological developments are considered to be able to help complete the work. The design of the Permit to Work information system can assist in the approval and validation of PTW forms within 1x24 hours. Furthermore, relevant departments and superiors can access PTW's information system anywhere without having to meet face-to-face. According to the things described, that the study specifically will design a website for the Permit to Work information system at the HIBA Group.

RESEARCH METHOD
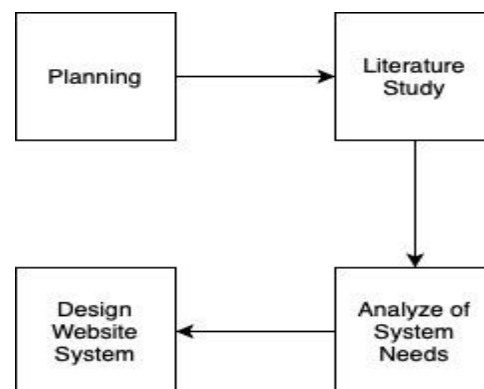
Figure 1. Research Method [12]

Figure 1 display the flow of the research methodology where this research is carried out in several stages. These designs are important for measuring properties and detecting errors in the use of measurements at an initial stage [13]. These stages were adopted from the Prototype Model. It consists of 4 (four) sets. First of all, (1), the researcher plans to collect and collect data (observations and interviews) [14]. They were followed by (2 and 3) by analyzing the existing problems and making a problem-solving plan for the system requirements related to the users involved and its business processes. The final stage (4) research makes the design and interfaces as a design system is created. This research was only carried out up to the Design

System stage, not yet at the Implementation and Maintenance System stage [15].

RESULTS AND DISCUSSION
Analysis of Problems and Solutions
     The results of observations and interviews were conducted to analyze the problems that occur in the company. The results of the problem analysis and solutions to these problems are described in table 1 below.

Table 1. Analysis of Problems and Solutions

No	Object	Factor	Problem	Solution
1.	Report	The report generated is still in manual form	Difficulty in summarizing all the reports.	Making this report support software can help report recording so that the delivery of information becomes effective
2.	Data of Workers	Paper-based Reported PTW data	Difficulty when searching for data and paper forms are easily damaged	Making PTW supporting software into a database so that it is accessible to search
3.	Validation and Verification Result	Provision of information that must be accompanied by validation and verification from the person in charge (Face-to-face)	The person in charge of the job sometimes cannot come for some reason	Creating supporting software that will facilitate the provision of accessible information

Design of Systems
     In system design, the author describes the observations in a flowchart. The flow describes how the processes that occur in the system are shown in Figure 2.
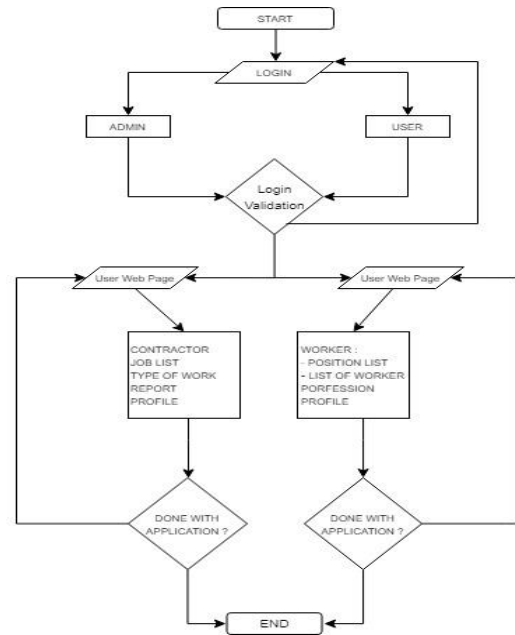
Figure 2. Flowchart System

     After knowing the system's process flow, use case diagrams, activity diagrams, and system database designs. Figure 3 uses Case Diagram in a system consisting of 3 (three) actors and 12 Use Case used. Furthermore, based on the use case diagram, an activity diagram is made. The design of the Activity diagram is shown in Figure 4, which is used to find out how actors can relate to the system and the behavior carried out by actors in the system.
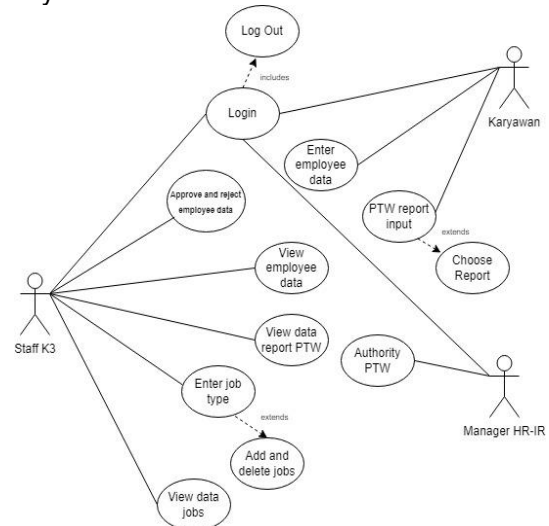
Figure 3. Use Case Diagram
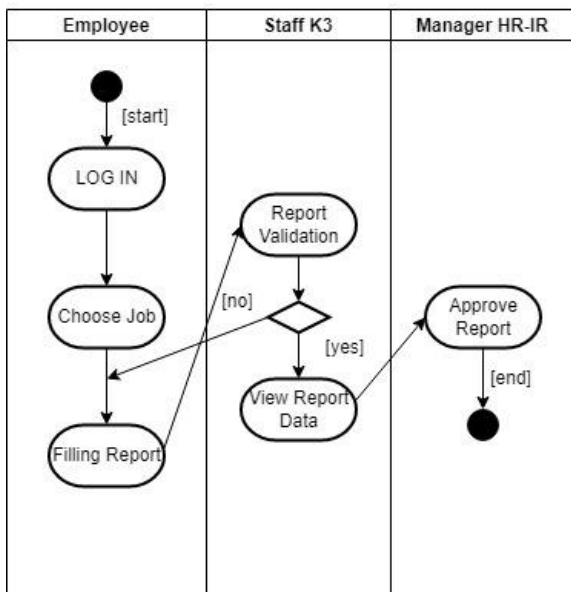
Figure 4. Activity Diagram

The next step in the design of this system is the design of the database used in the system. Figure 5 below is used to describe the database that will be created and used in the system. The database consists of 8 tables. These tables are connected so that transactions between data can occur.
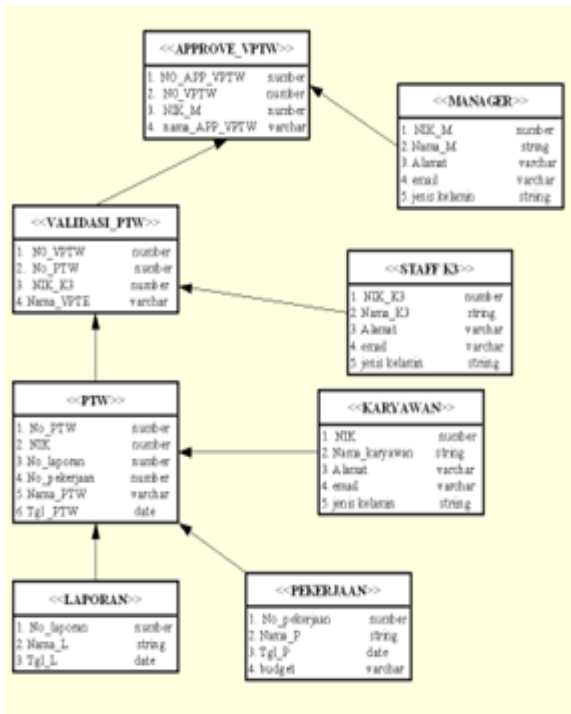
Figure 5. Database Design

DESIGN OF INTERFACE
Log In Interface

The login page is the initial page that will appear when the system is running in a web browser. The login page design is presented in Figure 6 below.
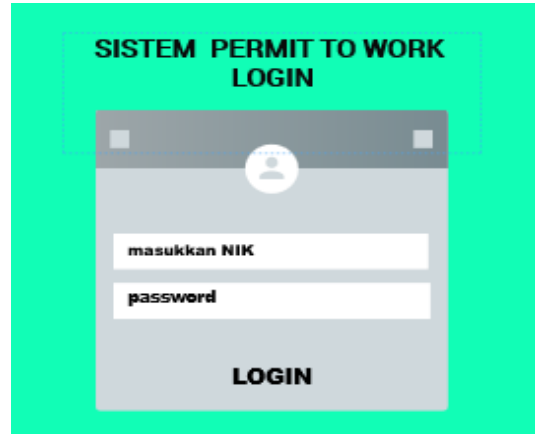
Figure 6. Log in Interface

Home Interface

The main page interface (Home Page), shown in Figure 7, will appear when the K3 employee/manager successfully logs in and on the main view attach history about members, jobs, PTW reports.
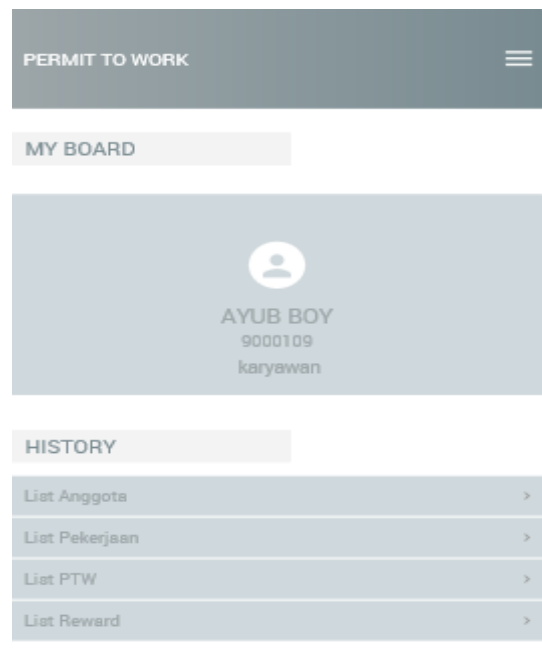
Figure 7. Home Page

User Menu Interface

The menu display appears when the employee clicks on the menu (right corner of the application). The employee can fill in the PTW report, update profile data, and log out from the application on this page. The user menu interface is shown in Figure 8. While Figure 9 shows the staff menu interface. The menu display appears when the K3 staff clicks the menu (right corner of the application). On this page, K3 staff can view PTW reports, job reports, add users, and Logout.

Figure 8. User Menu Interface

Figure 9. Staff Menu Interface

PTW Report Interface

Figure 10 is the PTW report page interface for employees, and this page appears when the employee selects the PTW report content menu. Here the employee will input or fill out the form that has been done regarding the Permit to Work report, then click submit to forward to the K3 staff or remove the report.

Figure 11 is a staff report page interface. On this page, staff and managers validate user reports that have been submitted through the PTW reporting system application. Then click comment if the report has deficiencies, then click update on the report, then click print to forward it to the HR/IR manager. On this page, the HR/IR manager can view the PTW employee report that has been submitted and updated by the K3 staff. Then the manager can click approve if the report is valid, and then it can be done by the employee or click reject if the HR. IR manager still states that the report is not valid.

Figure10. Interface o PTW Report as User

Figure 11. The interface of PTW Report as Staff

CONCLUSION

The Permit to Work Information System Web design was carried out by adopting the Prototype Model, explicitly designed by the HIBA Group. The Permit to Work Information System web application is created using cases and activity diagrams based on the results of problem analysis. This Permit to Work Information System web application makes it easier to manage mechanical, body, and construction work permits because every information needed is stored in a database.

Future Works for this research can be developed with an Implementation and Maintenance System and add a Security System to run optimally and is safe for various online transactions.

REFERENCES

[1] SHENA - Industry Guidance Note, "Guidance to Permit to Work," IGN/2020/03, April 03, 2020.

[2] J. Ridley, Kesehatan dan Keselamatan Kerja (Ikhtisar), 3rd ed. Jakarta: Erlangga, 2008.

[3] BP Wind Energy, "Permit To Work (PTW):," Warrenville, Illinois, Policies And Procedures HSSE 13.20.01, 2011.

[4] IOGP, "Guidelines on Permit to Work (PTW) Systems," International Association of Oil & Gas Producers, London, http://www.ogp.org.uk/pubs/189.pdf 1993.

[5] Health and Safety Executive (HSE), "A review of safety culture and safety climate literature for the development of the safety culture inspection toolkit," Human Engineering, Bristol, Research Report 367 ISBN 0 7176 6144 X, https://www.hse.gov.uk/research/rrpdf/rr367.pdf, 2005.

[6] Taufik Hidayat and Mudrik Alaydrus, "Performance Analysis and Mitigation of Virtual Machine Server by using Naive Bayes Classification," in Fourth International Conference on Informatics and Computing (ICIC), 2019, p. 19342838.

[7] Hiba Gorup. (2016) About Us. [Online]. https://hibautama.com/company

[8] Occupational Safety & Health Council, "Save Systems of Work," Labour Department, Hongkong, Guidebook https://www.labour.gov.hk/eng/public/os/D/SafeSystem.pdf, 2004.

[9] Phil Hughes and Ed Ferrett, Introduction to Health and Safety at Work, 4th Ed. Slovenia: Elsevier, 2009.

[10] Mehdi Jahangiri, Naser Hoboubi, Akbar Rostamabadi, Sareh Keshavarzi, and Ali Akbar Hosseini, "Human Error Analysis in a Permit to Work System: A Case Study in a Chemical Plant," Safety and Health at Work, vol. 7, no. 1, pp. 6-11, March 2016.

[11] Hamid Sarkheil, Yousef Azimi, and Javad Jafari Aghdash, "An Innovative Permit to Work System Disconformities Identification (PTWDI) in the Commissioning and Start Up Phases of South Pars Gas Complex, Iran," International Journal of Occupational Hygiene, vol. 9, no. 1, pp. 1-8, 2017.

[12] Gusti Ayu Dewi Puspa Kartikasari, "Improving Permit to Work Registration System at PT. X Using Visual Basic for Application," President University, Jakarta, Repository 2017.

[13] Augie David Manuputty, Steven Hendrawan, and Budi Haryanto, "Design of Information Systems for Research Permit Application with Agile Method and Website Based Laravel Framework," Journal of Information Systems and Informatics, vol. 2, no. 1, pp. 60-78, 2020.

[14] T. Husain, Maulana Ardhiansyah, and Dedin Fathudin, "Confirmatory factor analysis: Model testing of financial ratios with decision support systems approach," International Journal of Advances in Applied Sciences (IJAAS), vol. 10, no. 2, pp. 115-121, 2021.

[15] T. Hidayat, D. Sianturi Tigor Franky and R. Mahardiko, "Forecast Analysis of Research Chance on AES Algorithm to Encrypt during Data Transmission on Cloud Computing," 2020 2nd International Conference on Broadband Communications, Wireless Sensors and Powering (BCWSP), 2020, pp. 163-166.

APPLICATION OF CLASSIFICATION ALGORITHM FOR SALES PREDICTION

Sendi Permana[1*], Rosadi[1], Nikki[1]
[1]Computer Science Study Program, Universitas Nusa Mandiri, Indonesia

A R T I C L E I N F O	**ABSTRACT**
	Increasing sales results is a desired target for all companies both at home and abroad. The company has a wide variety of products to offer. This paper (to fulfill a Business Intelligence course assignment) is the result of an experiment from data (keaggle) about consumer demand for products during the 2013-2015 period, then based on this data we try to predict to classify product sales, in order to make it easier for companies to classification for sales predictions. To find out the sales of the best-selling products, data mining classification techniques are used, namely XGBoost, Decision Tree, Random Forest, Linear Regression, and Nave Bayes. Based on the test results of the five classification techniques, the XGBoost model is the best with the data training value producing an RMSE value of 0.68% and data testing of 0.79%. This method is also better than the results of previous studies.
Correspondece: Sendi Permana, Computer Science Study Program, Universitas Nusa Mandiri, Email : 14207003@nusamandiri.ac.id	

INTRODUCTION

Indonesia is a country with the largest mini market in Southeast Asia. Retail sales in Indonesia increased by 130% between 2010 and 2015, with 43,826 stores opening in mid-2019. A number of factors are driving this growth, including the growth of a young middle class and an increasingly congested life, especially in big cities, where easy access and Shopping convenience is very important for consumers[1].

With increasing internet penetration and greater exposure to brands, products and services, consumers in the region are becoming smarter and more informed when making purchasing decisions. Offers tailored to local tastes and buying behavior are critical to maintaining business continuity. In this field, intelligent systems and data science can help solve market and consumer segmentation problems [2].

In this study, the classification method is used to solve the problem of predicting sales in the next period. The purpose of this study is to make it easier for the company to classify for sales predictions so that it can reduce the error rate in the difference in data calculations that often occur [3].

LITERATURE REVIEW
XGBoost

Extreme Gradient Boosting or XGBoost is a decision tree or regression tree based enhancement algorithm[4]. Figure 1 shows an overview of the regression tree-based boosting algorithm. The first estimation results are obtained from the learning process of the first tree from the training data. The second tree carries out the learning process from the training data, where the value of $|Y-Y1|$ is the difference between the true label and the predicted label from the previous step. The third tree performs the learning process from the data and produces an estimate of Y3. This can effectively reduce the error value.

Related Research

There is a lot of research in the field of forecasting, and the methods vary widely. The model developed so far mainly focuses on two aspects, namely time series methods and machine learning. The XGBoost algorithm is one of the more popular techniques in the amplifier group due to its good convergence properties. There is a lot of research on the use of XGBoost for forecasting and market segmentation.

XGBoost can be used to predict customer loyalty or churn with high accuracy. XGBoost can give better results than other methods. XGBoost

produces a good level of generalization in stock price predictions, so it can predict the opening price correctly. Applying XGBoost to malware detection achieves high accuracy. Many machine learning methods perform poorly when handling high-dimensional data.

The second study conducted by Ma et al.,(2018) entitled "Estimating Warehouse Rental Price using Machine Learning Techniques" aims to predict warehouse rental prices on the market. To get the best model, this research uses four methods, namely Linear Regression, Random Forest Regressor, Regression Tree, and Gradient Boosting Regression Trees. The results of this study indicate that the Random Forest Regressor method has the highest accuracy and shows the results that the distance variable from the city center has a major influence on the accuracy of warehouse rental price predictions [5].

The third study was conducted by (Čeh et al., 2018) entitled "Estimating the Performance of Random Forest versus Multiple Regression for Predicting Prices of the Apartments"[6]. This study aims to analyze the prediction performance of the machine learning random forest method with multiple regression methods in predicting apartment prices. The dataset used is apartment transaction data for real estate sales in the city of Ljubljana, Slovenia in 2008-201. From this study, the results of the Rsquare value, sales ratio, average percentage error (MAPE), coefficient of dispersion (COD)) revealed that the random forest method had much better results. The fifth study conducted by (Borde et al., 2017) entitled "Real Estate Investment Advising Using Machine Learning" aims to compare several methods, namely the gradient descent method, K-nearest neighbor regression and random forest regression in predicting real estate prices. shows from the calculation of MAPE, RMSE and MAE errors the random forest method has the smallest error value[7].

RESEARCH METHOD
Proposed Model
The proposed model is a comparison between those generated by the XGBoost Algorithm, Decision Tree, Random Forest, Linear Regression, Naïve Bayes.

XGBoost
XGBoost was one of our early preferred algorithms. Statistically, it is the most commonly used model for Kaggle competitions. It provides system optimization through parallelization and hardware optimization. XGBoost has an advantage over general gradient enhancement as it provides regularization via a combination of

ridge regression and lasso regression. It also handles different types of Sparsity Patterns in data is valid [8].

XGBoost is a regression tree with the same decision rules as the classic decision tree. In a regression tree, each internal node represents a value for the attribute test, and a leaf node with a score represents a decision. The output is the sum of all the scores predicted by the K-tree, as shown below.

$$\gamma = \sum_{k=1}^{K} fk(xi), fk \in F \qquad (1)$$

where x t is the i-th sales training sample, fk is the k-th tree score, and F is the function space containing all the regression trees. XGBoost uses the same gradient enhancements as the Gradient Boosting Machine (GBM), but with slight improvements to the regularization objective that reduce model complexity.[9]

Decision Tree
Often called a decision tree. It is like a tree structure where there are internal nodes that describe attributes, the results are represented by each branch. The attribute test of each leaf describes a class. The C4.5 algorithm is the ID3 algorithm. Thanks to this development, the C4.5 algorithm has the same basic working principle as the ID3 algorithm[10].

Random Forest
Random Forest (RF) is a method that can improve the accuracy of the results because the generation of children for each node is done randomly[11]. This method is used to extract attributes and data randomly to build a decision tree consisting of root nodes, internal nodes, and leaf nodes, in accordance with applicable regulations. The root node is the node at the top, or commonly referred to as the root of the decision tree. An internal node is a branch node that has a minimum of two outputs and only one input. While the leaf node or terminal node is the last node that has only one input and no output [12]. The decision tree first calculates the entropy value as a determinant of the level of attribute impurities and the value of information acquisition. The entropy value is calculated using Equation 1, while the information gain value is calculated using Equation 2 [13].

Linear Regression
Regression method is a statistical method that uses the development of a mathematical relationship between variables to make predictions, the dependent variable (Y) and the

S. Permana et al., Application of Classification Algorithm for...

independent variable (X) [14]. The dependent variable is the variable that affects or affects and the independent variable is the causal variable or affects. If the independent variable is known, then the value of the dependent variable can be predicted. Usually, sales or demand for a product is represented as a large dependent variable or its value is influenced by an independent variable, and linear regression is one of the methods used in production to predict or predict quality and quantity characteristics [15].

Naive Bayes

The Naive Bayes classifier algorithm is a tool for writers to solve existing problems. The advantage of using the naive bayes classifier is that this method only requires a little training data to determine the estimated parameters needed in the classification process [11]. In the naive bayes classifier approach, which separates constant string data from continuous numeric data, this difference can be seen when determining the probability value for each criterion, both criteria for string data values and for standard numeric data values [16].

RESULTS AND DISCUSSION

Sales data is public data obtained from Kaggle, from 2013 – 2015 and the data obtained are 2935849 Sales data, 22170 item data, 84 category data and 60 store data. Prior to predictive modeling, several methods were used for research, these methods can be seen in Figure 1 below:
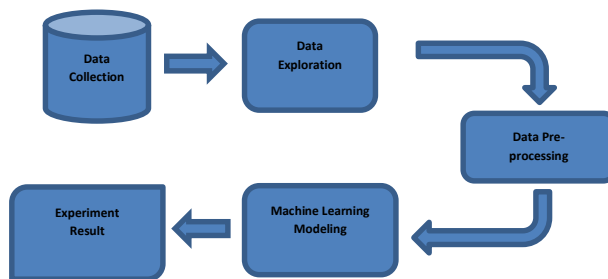
Figure 1. Research Flow

a. Data collection
   At this stage the author takes data from kaggle
b. Data Exploration
   After the data is obtained, the next step is the data exploration stage, where at this stage the data is explored and identified missing values or empty data that will cause inaccurate predictions.
c. Data Pre-processing
   At this stage, before we use the data for prediction purposes, the data must be preprocessed beforehand because not all the

attributes in the data will be used for further processing so that the data used will suit our needs.
d. Machine Learning Modeling
   To make a prediction with Machine Learning, of course, it is necessary to choose the right Machine Learning model to process the data we have so that the results obtained are in line with expectations.
e. Experiment Results
   After carrying out several stages of data processing and then the data is processed, at this stage an evaluation of the experimental results is carried out using a classification algorithm to predict prices with the performance metric used is based on the Root Mean Squared Error (RMSE).

Translate Data

The data obtained is data in Russian, and to facilitate the research, the first step in this research is to translate the data into Indonesian. The features that are translated are category names and item names.
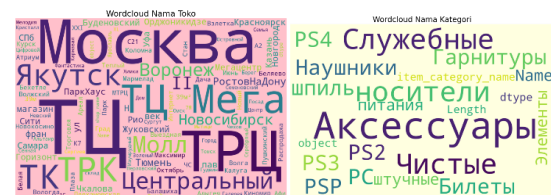
Figure 2. Wordcloud before Translation

It can be seen in Figure 2, which is a Wordcloud of store name data and category names before being translated into Indonesian using the googletrans translator function and the translation results can be seen in Wordcloud Figure 3. as follows.

Figure 3. Wordcloud after Translation

Data Analysis Exploration

Data Exploration Analysis was carried out in order to know the characteristics of the data before testing the model. The results of data exploration to see the relationship between stores, items and item prices can be seen in Figure 4 below.
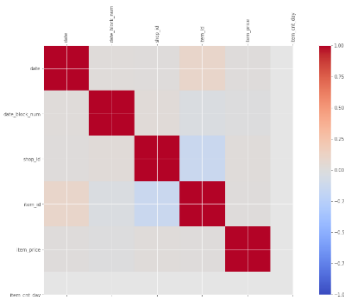
Figure 4. Relationship Between Shop, Item and Item Price
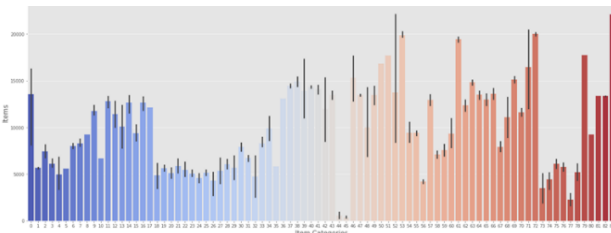
Figure 5. Number of Items Sold

Based on Figure 5 the most sales of items in each category can be seen in the item category id 83 which shows a fairly significant bar chart. Next is the analysis of data items sold every month from February 2013 – October 2015 as follows.
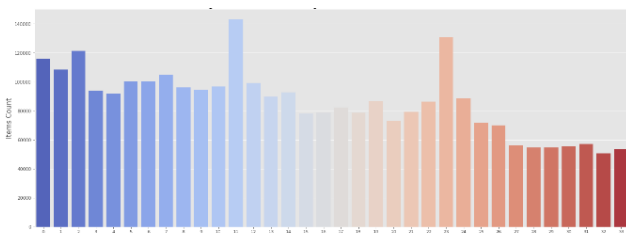
Figure 6. Number of Items Sold

Figure 6 shows the results of item sales data analysis with the highest number of item sales shown in the 12th month and the second highest rank is in the 24th month.
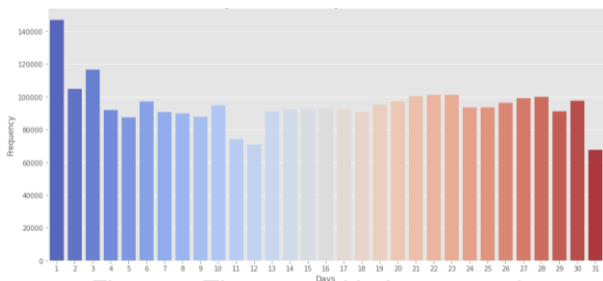
Figure 7. The store with the most sales (in days)

Figure 7 Shows The highest average daily sales are shown significantly on the 1st of more than 140000 sales. But the average number of

daily sales is not stable so that the sales per day are very diverse.
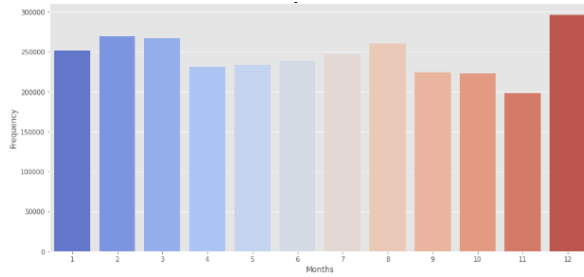
Figure 8. The store with the most sales (in months)

Based on Figure 8, the store with the most sales can be seen in the December sales frequency of almost 30000 sales. And the year with the highest sales frequency is shown in 2013, it can be seen in Figure 9 following.
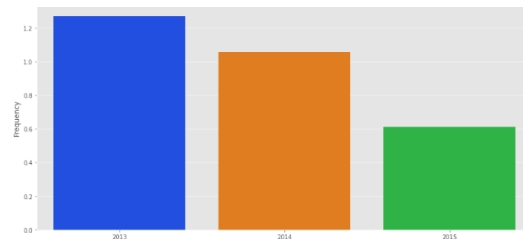
Figure 9. The store with the most sales (in Years)

Feature Engineering

Based on the exploration data analysis process, the resulting features for prediction are made by making master data by combining sales data, items and category items into one training data. Next, make a name for each feature that will be used. After the renaming, the next step is to create a sales feature based on 'date_block_num', 'shop_id', 'item_id', create item_cnt_month based on 'shop_id', 'item_id', create item_price_unit based on item_price/ item_cnt results, increase items based on item_price-hist_min_item results items based on the results of hist_max_item_price - item_price and make shifts to items 'shop_id', 'item_category_id', 'item_id' and fill 0 values for each shift with Missing Value.

Preprocessing data

Before the data mining process can be carried out, it is necessary to do a preprocessing stage, at this stage data cleaning is carried out to produce a clean dataset so that it can be used in the next stage, namely mining. Then before doing algorithm modeling, first the data used is filled with features that are shifted and emptied by 0

then the test data is filled with the mean value for the missing value.

Model Testing

In order to get the expected results, in this study several experimental models were carried out so that the expected results would be more optimal. The tests carried out included the following:

a. Testing with XGBoost algorithm

The architecture used in the XGBoost algorithm as an optimization of prediction results in order to produce a lower error value can be seen in table 1 below.

Table 1. Parameter XGBoost

No	Parameter	Optimal Value
1	max_depth	10
2	n_estimator	250
3	eta	0.5
4	min_child_weight	500
5	subsample	0.7
6	colsample_bytree	0.7

In addition to the architecture used, in table 1 there is feature engineering used in the XGBoost algorithm modeling, feature engineering is made so that the prediction results are more optimal by getting fewer error values.

Table 2. Best features used in XGBoost

No	Parameter	Optimal Value
1	Shop_mean	3275
2	Shop_item_mean	1113
3	Item_count_mean	818
4	Item_count_shifted3	677
5	Item_count	626
6	Item_count_shifted1	609
7	Item_trend	603
8	Item_count_shifted2	483
9	Item_count_std	288
10	Mean_Item_count	269

b. Testing With Decision Tree

Decision tree model testing is done after preprocessing the data and splitting the data with a comparison of 80% of training data and 20% of testing data. The test is carried out with the help of sklearn with the cross-validation function n_splits = 5.

c. Testing With Random Forest

The comparison of the data used in the Random Forest model testing is also the same as the previous model, namely 80% training data and 20% testing data. In Random Forest, the test also uses the help of a sklearn setup with many trees or n_estimator as much as 20 and random_state = 0 which means that seeds with random numbers are not used.

d. Testing With Linear Regression

Testing with linear regression also uses the help of sklearn and the LinearRegression function by determining the value of the Root Mean Squared Error (RMSE) on 80% of the training data and 20% of the testing data.

e. Testing With Naïve Bayes

Predictions based on the performance of the Root Mean Squared Error (RMSE) value in nave Bayes are also used with the help of sklearn and the GaussianNB function.

Results

Based on the results of experiments that have been carried out, the best model produced is using XGBoost when compared to the performance of other models using data training and data validation which are not much different. The RMSE validation results from the value experiment using the XGBoost Training RMSE model reached 0.689928548 for the Testing RMSE value reaching 0.790317290, for the Decision Tree model the RMSE Training value reached 1.177446199 and the Testing RMSE value reached 1.471040079. Then to see the detailed results of the RMSE Training and RMSE Testing scores on the Random Forest, Linear Regression and Naive Bayes models, see table 3 below.

Table 3. Parameters Model

No	Model	Training RMSE	Testing RMSE
1	XGBoost	0.689928548	0.790317290
2	Decision Tree	1.177446199	1.471040079
3	Random Forest	1.178820744	1.378878961
4	Linear Regresi	1.6290920563	1.350822234
5	Naïve Bayes	2775.944893	2763.692180

CONCLUSION

Based on the results of experiments carried out in the previous discussion using the XGBoost , Decision Tree, Random Forest, Linear Regression and Naïve Bayes models, it can be concluded that the best performance is by experimenting with XGBoost. This can be seen based on the lowest Root Mean Squared Error (RMSE) value in the experiment using the XGBoost model on the training data resulting in an RMSE value of 0.68% and in the testing data, which is 0.79%. Suggestions for the next research

is optimization at the selection stage so that the attributes can be reduced. Thus, it is expected that the value of accuracy and precision will increase.

SUGGESTIONS

Based on the discussion that has been described in the previous chapter, the suggestions can be given for prediction development sales are as following:
1. Adding attributes for data Product sale.
2. Using another method to make sales predictions such as k-means and Support Vector Machines.

REFERENCES

[1] A. K. Aslam, J. Teknik, P. Wilayah, D. A. N. Kota, F. Sains, and D. A. N. Teknologi, "Pengaruh pertumbuhan minimarket terhadap minat dan kebiasaan belanja masyarakat di kelurahan tamamaung kota makassar," 2017.

[2] R. Siringoringo, R. Perangin-angin, and M. J. Purba, "Segmentasi Dan Peramalan Pasar Retail Menggunakan Xgboost Dan Principal Component Analysis," METHOMIKA J. Manaj. Inform. dan Komputerisasi Akunt., vol. 5, no. 1, pp. 42–47, 2021, doi: 10.46880/jmika.vol5no1.pp42-47.

[3] R. N. Hay's, Anharudin, and R. Adrean, "Sistem Informasi Inventory Berdasarkan Prediksi Data Penjualan Barang Menggunakan Metode Single Moving Average Pada Cv.Agung Youanda," Protekinfo, vol. 4, no. 5, pp. 29–33, 2017.

[4] R. Siringoringo, R. Perangin-angin, and J. Jamaluddin, "Model Hibrid Genetic-Xgboost Dan Principal Component Analysis Pada Segmentasi Dan Peramalan Pasar," METHOMIKA J. Manaj. Inform. dan Komputerisasi Akunt., vol. 5, no. 2, pp. 97–103, 2021, doi: 10.46880/jmika.vol5no2.pp97-103.

[5] A. N. Rachmi, "Xgboost Pada Klasifikasi Customer Churn," 2020.

[6] M. Čeh, M. Kilibarda, A. Lisec, and B. Bajat, "Estimating the Performance of Random Forest versus Multiple Regression for Predicting Prices of the Apartments," ISPRS Int. J. Geo-Information, vol. 7, no. 5, 2018, doi: 10.3390/ijgi7050168.

[7] S. Borde, A. Rane, G. Shende, and S. Shetty, "Real Estate Investment Advising Using Machine Learning," Int. Res. J. Eng. Technol., vol. 4, no. 3, pp. 1821–1825, 2017, [Online]. Available: https://irjet.net/archives/V4/i3/IRJET-V4I3499.pdf.

[8] J. Statistika, F. Matematika, D. A. N. Ilmu, P. Alam, and U. I. Indonesia, "Implementasi Metode Extreme Gradient Boosting (Xgboost) untuk Klasifikasi pada Data Bioinformatika (Studi Kasus : Penyakit Ebola , GSE 122692)," 2020.

[9] R. Rismala, L. Novamizanti, K. Nur Ramadhani, Y. Siti Rohmah, S. Parjuangan, and D. Mahayana, "JEPIN (Jurnal Edukasi dan Penelitian Informatika) Kajian Ilmiah dan Deteksi Adiksi Internet dan Media Sosial di Indonesia Menggunakan XGBoost," vol. 7, no. 1, pp. 1–11, 2021.

[10] A. Puspita, "Prediksi Kelahiran Bayi Secara Prematur dengan Menggunakan Algoritma C . 45," vol. II, no. 1, pp. 11–16, 2016.

[11] B. Dan, R. Forest, and P. Klasifikasi, "Analisis perbandingan kinerja cart konvensional, bagging dan random forest pada klasifikasi objek: hasil dari dua simulasi," vol. 12, no. 2, pp. 1–12, 2019, doi: 10.14710/medstat.12.1.1-12.

[12] V. O. L. N. O. Desember, N. I. Prabawati, and M. F. Duskarnaen, "Kinerja Algoritma Classification a nd Regression Tree (Cart) da lam Mengklasifikasikan Lama Masa Studi Mahasiswa y ang Mengikuti Organisasi d i Universitas Negeri Jakarta Avalaiable at : Avalaiable at :," vol. 3, no. 2, pp. 139–145.

[13] S. Saadah and H. Salsabila, "Prediksi Harga Bitcoin Menggunakan Metode Random Forest," J. Komput. Terap., vol. 7, no. 1, pp. 24–32, 2021.

[14] P. Kasus and D. Pemasaran, "Development of Multipolynomial Regression Model."

[15] G. N. Ayuni and D. Fitrianah, "Penerapan metode Regresi Linear untuk prediksi penjualan properti pada PT XYZ," J. Telemat., vol. 14, no. 2, pp. 79–86, 2019, [Online]. Available: https://journal.ithb.ac.id/telematika/article/view/321.

[16] M. Guntur, J. Santony, and Y. Yuhandri, "Prediksi Harga Emas dengan Menggunakan Metode Naïve Bayes dalam Investasi untuk Meminimalisasi Resiko," J. RESTI (Rekayasa Sist. dan Teknol. Informasi), vol. 2, no. 1, pp. 354–360, 2018, doi: 10.29207/resti.v2i1.276.

PRE-INCUBATION FRAMEWORK OF SOFTWARE STARTUP USING GROW COACHING MODEL, BLOCK SCHEDULING AND DAILY SCRUM

Eko Heri Susanto[1*]
[1]Department of Computer Engineering, STIKOM PGRI Banyuwangi, Indonesia

ABSTRACT

The purpose of this research is to produce a framework for pre-incubation activities to improve the understanding and ability of tenants to develop software. In this pre-incubation activity, all tenants were students who participated in the "Merdeka Belajar-Kampus Merdeka (MBKM)" program, an entrepreneurship (startup) sub-program. The objects studied were 14 people, which were divided into 3 groups. Where the problem they face is the gap between the knowledge they receive in class and the software development needs of software startups. At startups, they are required to be able to develop software in a fast time, while the results of lessons in class do not support it. To overcome these problems, researchers designed and implemented learning methods in the pre-incubation activities. The method used by the researcher is to combine three approaches, namely the psychological approach, organizing the learning curriculum, and applying communication management between work groups and the administration of performance progress. In the psychological approach, the researcher applies the GROW coaching model method. While implementing the learning curriculum, the researcher applied the block scheduling method, and to manage communication management between group members, the researcher used the daily stand-up meeting (daily scrum) method. The success rate of this research is evaluated based on the speed of the tenant group in building software for a minimum scale of viable products. If before participating in pre-incubation activities, these tenants take 5 months to 6 months (1 semester) to build software, then after participating in pre-incubation, they are able to build software within 5 days to 20 days (1 week to 4 weeks).

Correspondece:
Eko Heri Susanto,
Department of Computer Engineering,
STIKOM PGRI Banyuwangi,Indonesia
Email : ekoheri@gmail.com

INTRODUCTION

It is widely acknowledged that the development of science and technology has transformed the economic order of society. Where the transformation is marked by the process of transferring ideas that were originally from the laboratory to the market [1].

To promote technology transfer, academics especially universities, continue to improve their technology transfer mechanisms to promote entrepreneurial activities and create new startups. Several mechanisms for promoting entrepreneurship are carried out, among others, through business incubators, technology parks (techno parks), and the provision of office space side by side with the development of these new businesses [1].

There is a study that mentions a framework for mapping business incubation activities to support the accelerated process of student start-up development. Where in the study, business incubation activities were divided into two activities, namely (1) pre-incubation activities, and (2) incubation activities [2].

At Stanford University, a pre-incubation activity termed Startup Garage is an intensive, project-based course where students design and test new business concepts that meet real-world needs. So this startup garage is a learning class where students will learn to apply the concepts of design thinking, engineering, finance, and business organization skills. At the end of the learning activity, the student team will develop,

prototype, and test new products or services, business models, and company creation plans [2].

During the period September 2021 to February 2022, the author fosters 3 student teams to develop startup companies. The three teams consisted of 14 students. Over a period of 6 months, the three student teams went through a series of pre-incubation processes with the aim of improving their skills to develop software. Where the software they develop will later be used as the main object of business in their startup.

One of the problems that occur between education at universities and business incubators is the gap, such as prospective startup developers (tenants) who do not understand financial risk, lack of mastery of knowledge and skills, ignorance of market potential, and ignorance regarding business risk prevention. For this reason, before the tenants enter the incubation phase, they should first need to be bridged by a series of pre-incubation processes. Where some of the pre-incubation activities include market testing with sales, coaching, training, and insurance [3].

In the field of software startups or startup companies that focus on software development as the core business, mastery of knowledge and skills in software development is very important. In this study, the authors will focus on coaching and training activities, with the aim of eliminating the gap between the lack of mastery of knowledge and skills and the demands for speed in software development in the start-up companies they build.

In order to optimize the pre-incubation process in accordance with the targets that have been set, the authors collaborate with three methods that have been tested previously. Broadly speaking, the first method used aims to explore self-potential and strengthen the mentality of the tenants. In the second step, researchers provide learning materials that are compressed but sufficient to meet the needs of basic theory and practical theory according to the latest technological trends. The last step is to provide a structured mechanism so that the process of communication and collaboration between individuals in each team is well coordinated.

To optimize the first step, namely mental strengthening and revealing self-potential, the author utilizes coaching techniques using the GROW (Goal, Reality, Options, Will) method. Meanwhile, to optimize the second step, the author applies a learning pattern with block scheduling. Meanwhile, to optimize the third step, the author uses the daily stand-up meeting method or sometimes also known as the daily scrum. Where the daily scrum is one of the practical methods in a series of Agile Scrum management patterns.

Until now, coaching activities have been used by organizations to improve the performance of the people in it. In the United States, between 25% and 40% of Fortune companies regularly use the services of a coach. The same was also reported in Europe and Australia [4].

There is an emerging evidence base that coaching is a powerful tool to support learning and development for students, faculty/teachers, university leaders, and educational institutions. Various coaching approaches have been used successfully [5]. One coaching methodology that is very easy to implement is behavioral coaching such as GROW, which stands for Goals, Reality, Options, and Will [5]. By utilizing this GROW model, it is proven that the morale and potential of the coachees can be improved and maintained for 3 months during the coaching period [6].

The second mechanism given to tenants is the preparation of the curriculum for learning materials. The step-by-step arrangement of learning materials is of course the main thing in the learning process. From the research results, it is proven that the learning system with block scheduling is able to significantly increase student achievement [7]. In recent years, many schools in the United States have modified their learning model. Some educators suggest using block scheduling, where this model allows students to take less learning material over a longer period of time. So this can minimize disruption of student concentration because of the large amount of material that must be studied. Where the final result of learning this model will increase student achievement [7].

One of the contributions to this research is the mechanism for compiling a block scheduling curriculum which consists of 6 lesson topics. Each lesson topic contains a series of teaching materials that are arranged using the Example-Problem-Based-Learning (EPBL) learning pattern. According to the research results, EPBL is proven to be more effective than the Teacher-Centered-Learning (TCL) learning pattern [8].

In other studies, to optimize the learning process, teachers also need to pay attention to the characteristics of each student's learning style. The academic literature identifies several learning styles. Visual, Auditory, and Kinesthetic Style (VAK) are usually used to classify learners as Visual learners, Auditory learners, or Kinesthetic learners [9]. Based on the results of the study, the research on the block scheduling sequence also considers the learning styles of each tenant.

Startup development is certainly done in groups, so the learning process must also be done in groups. When individuals are involved in group work, they need to have regular discussions

to solve various problems and share information with each other as they learn. For this reason, it is necessary to have a structured team management mechanism so that the process of sharing information and solving problems occurs in a positive and well-documented manner.

One method for managing team performance is scrum. This scrum method has been widely used in various fields, including to manage software development [10]. Scrum was first introduced in 1986 by Hirotaka Takeuchi and Ikujiro Nonaka in an article in The Harvard Business Review entitled "The New Product Development Game" [11]. Many Scrum methods are implemented so that a system can continue to adapt to an ever-changing environment [11]. The scrum framework is divided into several parts, namely (1) Product Backlog, Sprint Planning, (3) Daily Scrum, and (4) Sprint Review & Retro [10]. In the pre-incubation activities, not all Scrum frameworks were applied. Therefore, in this study, one of the scrum elements used is the daily scrum, or another term is the daily stand-up meeting.

One of the effective communication management models between individuals is the daily stand-up meeting or the so-called daily scrum. The daily stand-up meeting is one practical part of a series of Scrum frameworks. Based on the results of research on 12 software development teams in Malaysia, Norway, and Poland, it was found that the daily stand-up meeting was able to contribute to positive attitudes, including communication to solve problems, share information and improve reporting of work status to company leaders [12].

In previous studies, this pre-incubation activity was divided into several aspects of measurement. The first measurement is hard skill measurement which includes (1) successful feasibility study, (2) potential customer, and (3) Potential source of funding. While the second aspect is the measurement of soft skills which include (1) business skills, (2) professionalism (3) innovativeness of the proposed business (4) commitment (5) client knowledge [3]. From several aspects of the measurement, the need for hard skills that must be answered at the beginning is a successful feasibility study. While on the soft skills side what must be built at the beginning is commitment and professionalism.

The problem that occurs is the gap between the university and the business incubator. One example of the problem is the lack of knowledge and skills [3], so a successful feasibility study on the educational process at universities is not measured properly. Too much learning material is one of the contributing factors. In the end, it

makes students less focused on learning the learning material. In addition, the second problem, the composition of the curriculum and learning materials is also not necessarily in accordance with the learning style of each student. Students who have a visual kinesthetic or visual kinesthetic learning style, of course, will find it difficult if the teacher delivers the material with many lectures and little practice [14]. The third problem, learning materials in class, is sometimes not case-oriented. There are still many teachers who use the teacher-centered-learning method so student learning performance is not optimal. In fact, from the research results, it is proven that how to learn example-problem-base-learning is more effective than teacher-centered-learning [8].

In terms of soft skills, there are also gaps in education at the university. There are almost no educational curricula at universities that provide soft skills education, such as interpersonal skills, values, attitudes, motivation, achievement, and team players. Whereas soft skills education for adults (andragogy), is the key to the success of hard skills education [14]. This soft skill education competency is indeed very difficult to measure and very difficult to observe [14]. Due to this level of difficulty, not many university lecturers apply it. In fact, it is this factor that reason the initial gap in education at university.

To narrow the educational gap, three methods were used in this research approach. The first method is the GROW coaching model, which aims to find motivation and learning commitment from tenants. The second method is to rearrange the curriculum and learning materials, which are adapted to the learning styles of the tenants. The learning materials used are, of course, example-problem-based-learning. While the third method is a management system to manage and observe their work commitments. For this third method, researchers use daily stand-up meetings (daily scrums). Where the results of this daily scrum will later be written on the Kanban board diagram.

RESEARCH METHOD

In this study, the research object was 14 students of STIKOM PGRI Banyuwangi, which were divided into 3 teams. Where the 14 students are taking "Merdeka Belajar-Kampus Merdeka (MBKM)" program, specialy the entrepreneurship sub-program. Of course, students who take part in the MBKM program do not follow the regular class learning process. The entire study period is carried out at the STIKOM PGRI Banyuwangi Business Incubator.

In this study, the formulation of the problem discussed is "how is the influence of GROW

coaching model, block scheduling, and Daily Scrum to improve tenant ability?". Where the tenant's ability is measured by their speed in developing the minimum version of the software product or the term is the minimum viable product (MVP).

Therefore, the theoretical model that is used as a reference in this study is shown in Figure 1. Three methods (GROW coaching model, block scheduling, and daily scrum) proposed in this study were used as independent variables. However, before the three methods were applied, the researcher applied a pre-test to explore the initial data on the ability of tenants. The results of the observations of the independent variables are written in the level section. Where this level section contains the results of observations of the quality of soft skills and hard skills. If the variable quality of soft skills and hard skills can be improved, it will affect the dependent variable, namely when the tenant is in the minimum viable product (MVP) software development stage. Improving the quality of soft skills and hard skills will greatly affect the time needed to develop MVP applications.
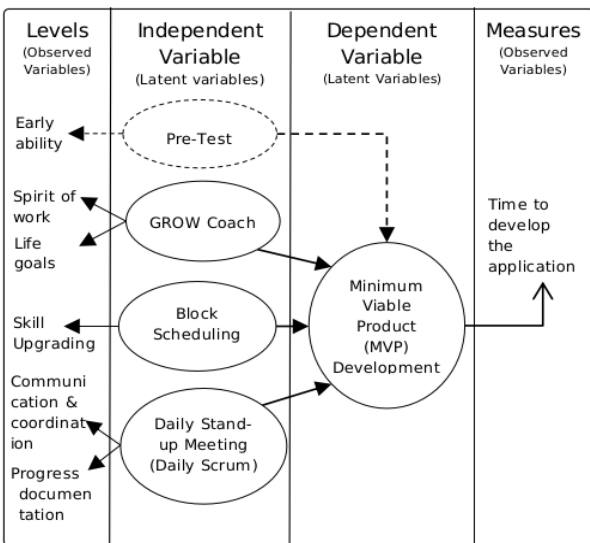
Figure 1. Theoretical Model

The approach in this research combines three methods. Where these three methods include strategies for strengthening the mentality of tenants, increasing their knowledge and skills in developing software, as well as managing discussions and communication between team members. Therefore, there are 3 independent variables in this study, namely GROW coaching, block scheduling, and daily scrum. of the three independent variables will later affect the dependent variable, namely when the tenants

build the minimum version of the software, or minimum viable product (MVP).

Pre-Test

In this research, the experimental method is used, where the measurement uses pre-test and post-test. A pre-test is used to measure the skill level of the tenants in developing software. The list of questions at the time of the pre-test is as shown in table 1 below:

Table 1. List of Question Pre-Test

No.	List of Question
1.	what software products have been made?
2.	how long did the software product take to build?
3.	do you understand machine code algorithms and logic?
4.	do you understand the Request for Comments (RFC) standard that governs how web servers and web browsers work?
5.	Do you already know your learning style? If you don't know, please fill out the learning style questionnaire available at https://akupintar.id/tes-gaya-belajar

The answer to pre-test number 5, namely the learning style of each tenant will greatly affect the curriculum structure at the training stage. In addition, the trainer's teaching style will also follow the learning styles of the tenants who are studying. If most of the tenants have a visual learning style, the trainer will provide teaching materials that contain illustrations. If most tenants have a kinesthetic learning style, the trainer will provide an example program for the tenants to practice. However, if most of the tenants have an auditory learning style, the trainer will lecture a lot.

After the pre-test, the next step is to carry out the pre-incubation process. For pre-incubation activities to run optimally, the researcher provides a set of frameworks. The schematic framework proposed in this study looks like Figure 2 below:
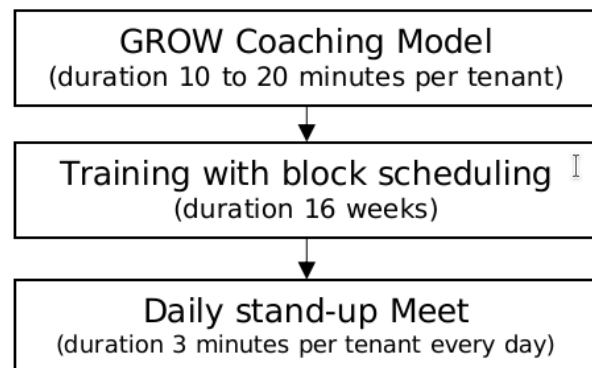
Figure 2. Pre-Incubation Framework [16]

GROW Coaching Model

In this study, the researcher acts as a coach, and the tenant who is the object of the research acts as a coachee. A coach is in charge

of giving questions to the coachee. The coach's job is only to ask questions, he is not allowed to make statements other than asking questions.

GROW stands for Goals, Reality, Options, Will. Where in practice a coach will give questions to coachee. Where the purpose of the question was to lead the coachee (tenant) to find his/her potential and in the end there will be a mental strengthening of the coachee concerned. The list of questions given by the coach to the tenants (coachees) is as follows :

Table 2. List of Question GROW Model [17]

No.	Step	List of Question
1	G-Goals	What are your obsessions or life goals? In your opinion, what are your values?
2.	R-Reality	To achieve that obsession, what have you been doing so far?
3	O-Options	What's the problem? To continue to achieve your obsession, but there are obstacles that you experience. What alternative steps can you take? From the alternative steps, what would you do first?
4	W-Will	When do you take alternative steps?

The Curriculum of Block scheduling

The second stage of this research is training. All tenants will be allowed to improve their abilities and skills in terms of software development. So that the concentration of the tenants is not disturbed and the focus of the subject matter is neatly arranged, the researchers developed a curriculum based on block scheduling.

Broadly speaking, the curriculum structure of startup software is as follows:
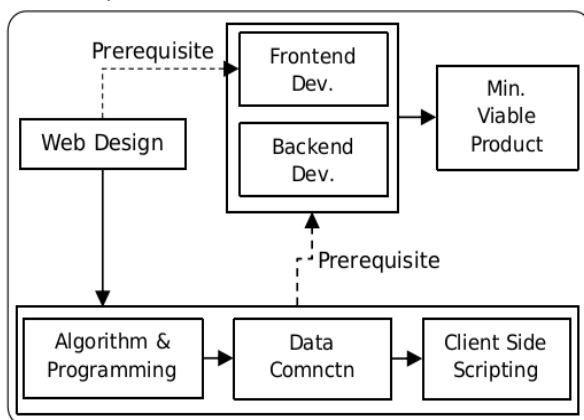
Figure 3. Curriculum Structure

The length of the study is 16 weeks (4 months), and the study schedule starts from Monday to Friday every week. Each day they are given 7 hours of study time, with the following division of time: (1) discussion with the team for 15 minutes, (2) studying the material given by the trainer for 4 hours, and (3) writing down the material they have learned for 1.5 hours to 3 hours.

The curriculum model is arranged based on block, with block scheduling arranged as listed in table 3. All tenants are required to study each block of material in full until it is completed, according to the block order. So tenants are not allowed to study other materials before the entire material on this block is complete.

At the faculty of computer science and information technology, the main courses presented are programming languages and their environment. Therefore, the content, form, and teaching methods must be adapted to the contemporary state of the programming language, methods, and developments of the programming language. Algorithms and programming are early learning materials in that faculty [13].

However, for students who have a visual learning style, the material on algorithms and programming is not interesting. This is because the material for algorithms and programming cannot present a good appearance. Therefore, in the block scheduling curriculum arrangement, the initial material presented is web design. After the web design block has been finished, it is continued with the discussion of algorithms and programming.

As for students who have a kinesthetic learning style, the web design lesson which contains how to create Hyper Text Markup Language (HTML) and Cascade Style Sheet (CSS) is very suitable for their learning style. Some examples of HTML and CSS scripts they can practice immediately so that they can quickly understand what the purpose and objectives of the lesson are. Students who have an auditory learning style, will usually quickly adapt to their environment.

Giving material on algorithms and programming alone is not enough. Due to the fact at the moment, currently, the majority of computer technology is based on websites and mobile apps. To understand in-depth, the technology of websites and mobile apps, students also need to understand data communication technology that runs on internet network protocols (TCP/IP protocols). Website applications require a web server and a web browser. Where the web server and web browser are built from socket programming. Therefore, the third block in this

curriculum is studying data communication technology based on the TCP/IP protocol.

After understanding algorithms, programming, and data communication technology, a basic knowledge of programming languages has been obtained. Then the next block of material arranges to develop software by current technological developments. Therefore, the last block of this block scheduling structure is fullstack development which consists of discussing the javascript programming language (client side scripting), frontend development using the ReactJS framework, and backend development using NodeJS.

Table 3. List of Block Scheduling

Weeks	Material Block	Teaching Materials
1st to 2st week (10 days)	Web Design	https://bit.ly/ekoheri-web-design
3st to 5st week (15 days)	algorithms and programming	https://bit.ly/ekoheri-algoritma-pemrograman
6st to 8st week (15 days)	Data Communication	https://bit.ly/ekoheri-web-server
Week 9 (5 days)	Client Side Scriptng	https://bit.ly/ekoheri-ajax
10st to 12st week (15 days)	Frondend Development	https://bit.ly/ekoheri-reactjs
	Backend Development	https://bit.ly/ekoheri-backend-development
13st to 16st week (20 days)	Minimum Viable Product (MVP) Development	-

In this second stage, researchers act as trainers and tenants act as training participants. The task of the trainer in this activity is to deliver learning materials in accordance with the established curriculum. Another trainer's task is to provide time for tenants to consult and ask questions related to subject matter that has not been mastered.

Daily Scrum

The third stage of the research process is the daily stand-up meeting or daily scrum. The daily scrum mechanism is that each tenant is given a maximum of 3 minutes to discuss everything related to the learning process. For the discussion to be structured, the discussion material is arranged into a list of questions as shown in Figure 2 below.

1. What did you do yesterday?
2. Has the target been achieved yesterday?
3. What are the obstacles?
4. Has it been discussed with team members? Who is invited to the discussion?
5. What will you do today?

Figure 2. Daily Scrum Questionnaire [16]

In this second stage, the researcher acts as a scrum master. Where the task of the scrum master is to control the meeting, regulate who has the right to speak, and control the time of the speaker so as not to exceed the time limit of 3 minutes per person. Another task of the scrum master is to write down the results of the agreed meeting in the form of a to-do list. Where the to-do list is finally written on the Kanban board diagram.

RESULTS AND DISCUSSION

This section presents the results for prior knowledge (pretest performance), training effort during the pre-incubation phase and achievement (post-test performance).

Pre-Test Phase

From the results of direct questions and answers with tenants, the results of the pre-test are as follows: for the first question, all tenants answered that they had built a website or personal portfolio weblog. As for the answers to the second pre-test, they need one semester (5 to 6 months) to build a weblog application, according to the demands of the coursework. As for the third and fourth questions, none of the tenants could explain them.

To answer the fifth pre-test question, namely knowing their learning style, the tenants answered the test questions available at https://akupintar.id/tes-gaya-belajar. After taking the test, the results obtained from 14 people that 8 people have a visual-kinesthetic learning style, 5 people are visual-kinesthetic and 1 person is auditory-kinesthetic.

Coaching Phase

The students tested in this study were all over 17 years old (adult age). The learning model for adults is different from that of immature humans. For adults, time is very valuable. They also prefer to be given specific topics rather than general topics. From the social aspect, almost all adult learners have diverse life experiences [14]. The learning process of adults can be controlled when the content of teaching is related to the experiences they have experienced. Taking this into account, the learning process that connects

life experiences with learning content will provide an interesting understanding for them [14].

The life experience of an adult human determines his obsession with himself. When learning new things, adult humans will have a high enthusiasm for learning if what they learn is in accordance with the obsession to be achieved. So a coach needs to explore the obsessions of his students. In this study, the method used to explore the potential of students is the GROW coaching model.

In this coaching activity, the coach provides time for personal questions and answers with tenants. Each tenant is given 10 minutes to 20 minutes. Where the number of tenants is 14 people, the total time provided by the coach is 140 minutes to 280 minutes. Each tenant was asked by the trainer according to the list of questions in table 2 [17].

To document this coaching activity, researchers used a voice recording device, namely a cellphone. Of course, this voice recording data becomes a data asset that is very confidential and is not published to everyone. Only the tenant concerned can copy this data. This voice recording data try all things related to the identity of the tenant, including the disgrace regarding his self-esteem.

From a series of trial processes, it turns out that the GROW coaching model shows positive things. All tenants are proven to be able to find their potential. All the problems experienced so far, it turns out that their solutions can be found from the thoughts of the tenants themselves. In fact, in this GROW coaching model, the coach only asks questions, without ever providing any solutions to the tenants. The GROW coaching model is one of the most suitable methodologies to help students recognize their potential. From the test results, there is evidence that within 10 minutes to 20 minutes, the tenants are more confident that their obsession can be achieved.

Training Phase

Basically, the training material given in the pre-incubation activities is the same as the material they have learned in the regular class. The difference is that the material in the regular class uses the the Indonesian National Qualifications Framework based on a college credit of unit system [18], while in this pre-incubation activity a block scheduling system is used.

If using the "a college credit of unit" system, the curriculum arrangement as shown in figure 4, requires study time for 8 semesters (48 months). This happens because one subject is usually a prerequisite for another lesson. So not all lessons

can be given at the same time, waiting for the prerequisite lessons to be learned. An example of a curriculum arrangement that uses the Indonesian National Qualifications Framework (Kerangka Kualifikasi Nasional Indonesia/KKNI) is as follows in figure 4.
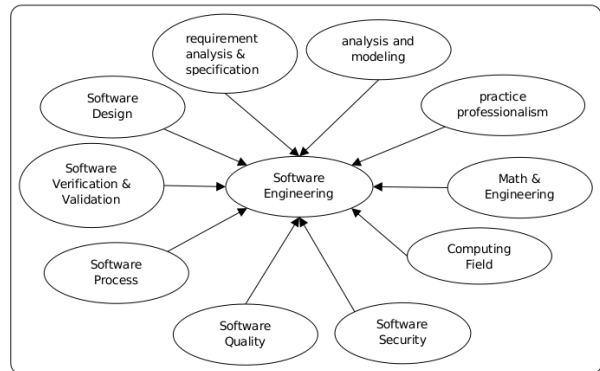
Figure 4. College Unit of Credit System [18]

In figure 4, it takes 16 meetings to discuss one subject. If the meeting is held once a week, it will take 16 weeks to discuss the material. The computing field (algorithm and data structure, discrete mathematic, etc.) lessons take 16 weeks to complete. Meanwhile, in other conditions, object oriented programming lessons are impossible to learn if the material on algorithms and data structure has not been completed. Because algorithms and data structure lesson is a prerequisite for object oriented programming lessons.

This condition creates a gap between university education and business incubators. Software development at the start-up requires a fast time. Meanwhile, the education process at the university is running slowly. This is evidenced by the pre-test results which show that tenants need one semester (5 to 6 months) to build a website application. The website application created is a personal portfolio website (weblog).

The comparison between the Indonesian National Qualifications Framework and block scheduling is shown in Figure 5 below. In the Figure 5, part a describes the block scheduling-based curriculum model. Meanwhile, Figure 5, part b, explains the "college of unit" system-based curriculum model [18]. Students ideally do the learning process for 8 hours per day. With block scheduling, students will receive one-course material within 8 hours. While in the Indonesian National Qualifications Framework, students will receive more than one subject matter within 8 hours.
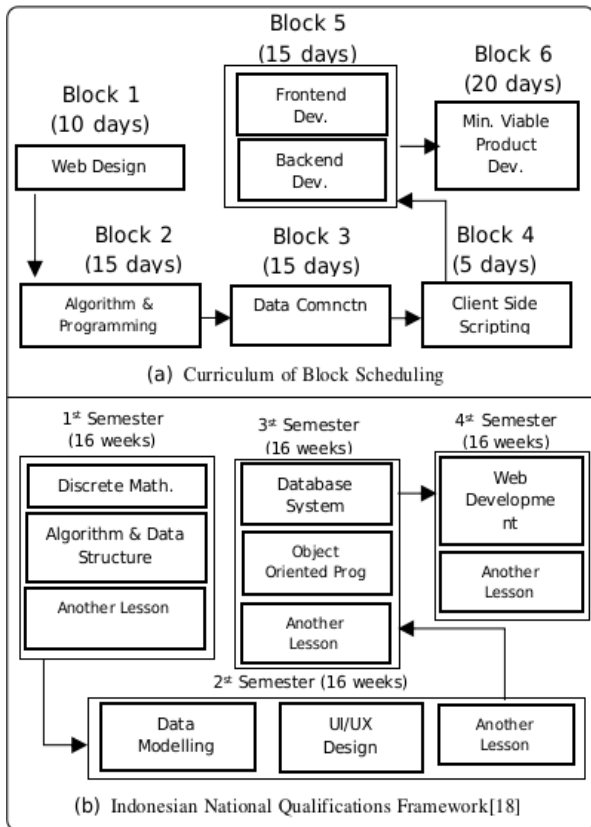
Figure 5. Comparison of Curriculum

The lesson on block scheduling as in table 3, is the same as the lesson on Indonesian National Qualifications Framework based on a college credit unit (Satuan Kredit Semester/SKS). Block scheduling also applies pre-conditions. The only difference is the learning schedule. With this block scheduling, it is proven that the tenants can learn more purposefully. There are not many lessons to be learned every day. Therefore, mastery of knowledge and skills can also be improved in a short time. It is proven that after participating in pre-incubation for 60 days (September 15, 2021 - December 31, 2021), the tenants can create website applications in just 1 week to 4 weeks (January, 2022). Even though the website application that was built was already utilizing the technology studied in the last material, namely frontend development and backend development.

The block scheduling system is proven to be able to speed up the learning process for students. In addition, students are also more focused on learning subjects from one another, because the process of studying the material is one by one. The acceleration of this training process has been proven to significantly affect the process of making software which is the object of their startup business.

Post-Test Phase

The results of their work and the duration of the process of their work are recorded in table 5 below :

Table 5. List of Products Created by Tenants

Team Name	Work Duration	URL's
Kriyathor (5 members)	Jan 3, 2022-Jan 7, 2022 (5 days)	https://kriyathor.com
Wlijo (5 members)	Jan 3, 2022-Jan 28, 2022 (20 days)	https://wlijo.com https://mitra.wlijo.com
Kudhung (4 members)	Jan 3, 2022-Jan 21, 2022 (15 days)	https://kudhung-stylesapp.herokuapp.com/

The Kriyathor team consists of 5 students. Their software product is an online shop that helps craft entrepreneurs to market their products online. This kriyathor's website is connected to a database on the shopee's marketplace (https://shopee.co.id). The appearance of this kriyathor website looks like the following in figure 5.
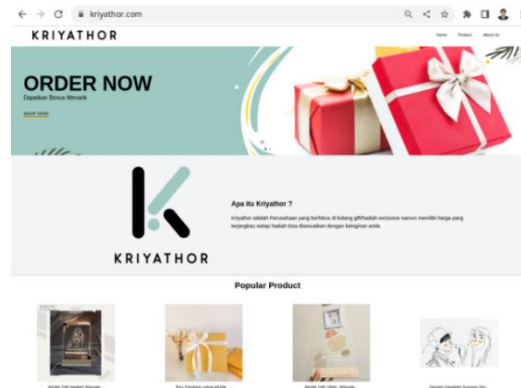
Figure 5. Appearance of Kriyathor's Website

The Frontend application on the Kriyathor Website is built using ReactJS technology. While on the backend using ExpressJS technology. Data scraping technology is used to retrieve data from shopee (https://shopee.co.id). While the database engine uses MySQL.

The Wlijo's team consists of 5 students. Their software products are mobile apps that help greengrocers market their products to their customers. The appearance of the Wlijo's website looks like the following in figure 6.

The Wlijo's team used ReactJS to build the frontend app and ExpressJS to build the backend app. While their database engine uses MySQL.
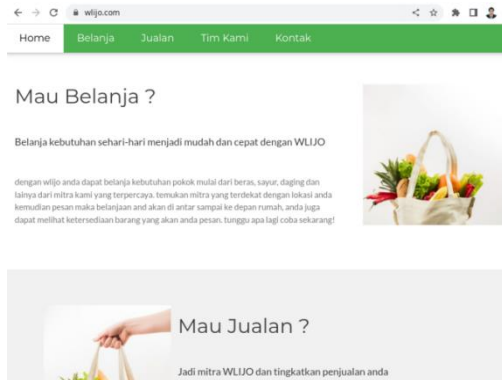
Figure 6. Appearance of Wlijo's Website

The Kudhung's team consists of 4 students. Their software product is an online store application that helps Muslim fashion traders to market their products to their customers. The appearance of the Khudung's website looks like Figure 7 below.

The Kudhung's team used ReactJS to build the frontend app and ExpressJS to build the backend app. While their database engine uses SQLite.
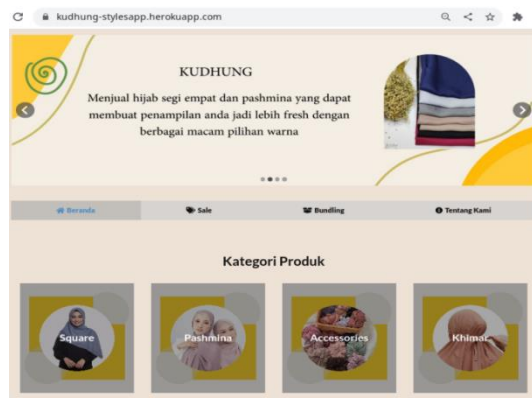
Figure 7. Appearance of Kudhung's Website

Daily Scrum Phase

When they work with their team, communication and coordination between them must be well established. The communication and coordination process is regulated by the daily stand-up meeting mechanism, another term is the daily scrum. The daily scrum mechanism is carried out every morning before learning activities are carried out. The daily scrum mechanism is that each person must present everything that has been done yesterday and will be done later. Presentation time for each person is a maximum of 3 minutes [16]. So if a team consists of 5 people, then the time needed for this daily scrum is 15 minutes. Their presentation

material is the answer to the daily scrum questionnaire in Figure 2.

Daily stand-up meetings are a proven good method of making communication between team members. In just 3 minutes per person or 15 minutes per team, every day the team members will participate in intensive discussions to find obstacles and at the same time find solutions to their obstacles.

In order for the documentation of the daily performance to be well written, the list of work agreed upon in the daily scrum will be written on the Kanban board diagram. Likewise, the results of their work progress will also be neatly documented on the Kanban board diagram. An example of a Kanban board diagram as a result of their activities is shown in Figure 8 below.

Scrum frameworks are usually combined with kanban board diagrams. While scrum manages team management, Kanban manages work schedule management. When these scrum and kanban boards are combined, they are statistically proven to lead to successful project development. The merger of scrum and Kanban is hereinafter called agile scrum [15]. In this study, the daily scrum mechanism must be followed by neat documentation. To produce neat activity documentation, the scrum framework is combined with a Kanban board diagram.
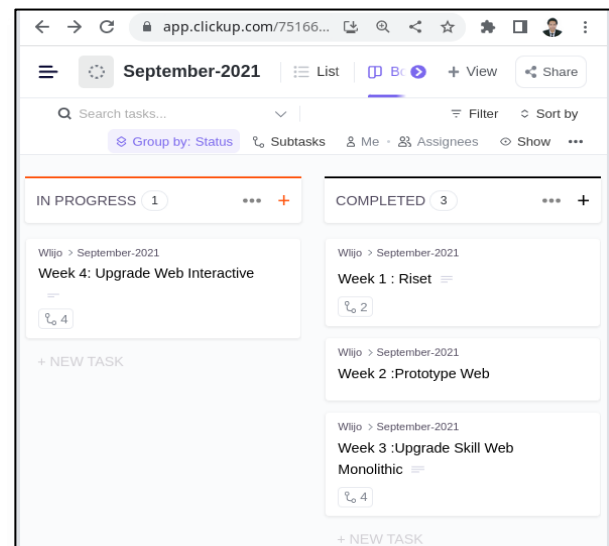
Figure 8. Kanban Board Diagram

From a series of trial processes, it turns out that the daily scrum mechanism has a positive value to maintain communication and coordination of tenants in each of their teams. It is evident from the documentation of the progress of each tenant's performance that can be seen every day through the Kanban board diagram. Even the

obstacles they experienced and the solutions they found, can also be seen in the comments section of the kanban board diagram. Not only the tenants, but the trainers can also see directly their performance progress reports through the kanban board diagram.

CONCLUSION

The conclusion that can be drawn from this research is that the pre-incubation software startup framework has proven to be effective in improving the soft skills and hard skills of the tenants. In the standard Indonesian national qualification framework, the curriculum content mostly only regulates the standardization of hard skills. Not found specifically how the standard to improve soft skills. Whereas for adult learning (andragogy), soft skill learning has a very strong influence. The GROW coaching model and daily scrum methods are proven to be able to improve the quality of soft skills. Just to apply these two methods, teachers need to work more. In this study, it has not been discussed how the strategies of several teachers (team teachers) to apply these two methods in team teaching.

In the standards of Indonesia's national qualification framework, especially in the fields of informatics and computers, the scope of learning materials is too broad. As a result, the material that students learn is also too much. This has created a gap between education in university and the needs of industry, especially business incubators. Simplification of subject matter and material delivery strategies using block scheduling have proven to be very effective in improving the quality of students' hard skills. the limitation of this research, the scope of the material in the curriculum is only taken a few lessons core. For other supporting subjects, it is not applied to this block scheduling curriculum.

ACKNOWLEDGMENT

REFERENCES

[1] Dag Håkon Haneberg and Lise Aaboen, "Incubation of technology-based student ventures: The importance of networking and team recruitment", Technology in Society, Elsevier LTD, 2020.

[2] M. Wright, D.S. Siegel, P. Mustar, "An emerging ecosystem for student start-ups", J. Technol. Tran. 42 (4) (2017) 909–922

[3] Stan Custers, "The impact of the pre-incubation program on competences of future entrepreneurs: Case study of a Dutch pre-incubator", Master Thesis Innovation & Entrepreneurship - Business Administration Nijmegen School of Management, Radboud University, 2019

[4] Saul W. Brown and Anthony M Grant, "From GROW to GROUP: Theoretical issues and a practical model for group coaching in organisations", Coaching: An International Journal of Theory, Research and Practice Vol. 3, No. 1, March 2010, 30-40

[5] Mary Devine at all, "How can coaching make a positive impact within educational settings?", Elsevier LTD, Social and Behavioral Sciences 93 (2013) 1382 – 1389

[6] C.O. Okorie et all, "Zoom-based GROW coaching intervention for improving subjective well-being in a sample of school administrators: A randomized control trial" Elsevier, https://doi.org/10.1016/j.invent.2022.100549

[7] K. Mattox at all, "The Effect of Block Scheduling on Middle School Students' Mathematics Achievement", NASPP Bulletin, Vol. 89 No.642 March 2005

[8] Noor Hisham Jalania, "Efficiency Comparisons between Example-Problem-Based Learning and Teacher-Centered Learning in the Teaching of Circuit Theory"Elsevier LTD, Social and Behavioral Sciences 204 (2015) 153– 163

[9] Dawood AlHamdani, "Exploring Students' Learning Style at a Gulf University: A Contributing Factor to Effective Instruction", Elsevier, Procedia -Social and Behavioral Sciences Volume 176, 20 February 2015, Pages 124-128

[10] Kresna Dwi Prasetya at al, "Effectiveness Analysis of Distributed Scrum Model Compared to Waterfall approach in Third-Party Application Development", Elsevier, Procedia Computer Science 179 (2021) 103-111

[11] Howard Lei at all, "A statistical analysis of the effects of Scrum and Kanban on software development projects", Elsevier, Robotics and Computer-Integrated Manufacturing Volume 43, February 2017, Pages 59-67

[12] Viktoria stray at al, "The Daily Stand-Up Meeting: A Grounded Theory Study", The Journal of Systems & Software (2016), doi: 10.1016/j.jss.2016.01.004

[13] Natalya Prokofyeva, "Introductory Programming Training of First Year Students", Elsevier, Procedia Computer Science 104 (2017) 286 – 293

[14] Kahirol Mohd Salleh at all, "Competency of adult learners in learning: Application of the Iceberg Competency Model", Elsevier LTD, Social and Behavioral Sciences 204 (2015) 326 – 334

[15] Hrafnhildur SifSverrisdottir, "The Role of the Product Owner in Scrum-comparison between Theory and Practices", Elsevier, Procedia - Social and Behavioral Sciences, Volume 119, 19 March 2014, Pages 257-267

[16] Dan Radigan, "Introducing Lean Canvas Model Adaptation in the Scrum Software Testing", 2020. [Online]. Available: Atlasian, https://www.atlassian.com/agile/scrum/stand ups. [Accessed Oct 10, 2020]

[17] Eval Wari, "Coaching dan Mentoring dengan GROW Model untuk Peningkatan Kinerja Tim Anda", February 27, 2021. [ONLINE] Avaliable:Leadership Resources, https://leadershipresources.co.id/business/co aching-dan-mentoring-dengan-grow-model-untuk-peningkatan-kinerja-tim-anda. [Accessed February 27, 2021]

[18] Tim Kurikulum KKNI APTIKOM, *Pengembangan Kurikulum KKNI Berdasarkan OBE Bidang Ilmu Informatika dan Komputer*, Tim Kurikulum KKNI APTIKOM, Jakarta, 2019

MUZAKI BEHAVIOR IN PAYING ZAKAT THROUGH THE APPLICATION OF THE UNIFIED THEORY MODEL ACCEPTANCE AND USE OF TECHNOLOGY IN JAKARTA PROVINCE

Tukhas Shilul Imaroh[1], Lasmi Indaryani [1*], I Putu Doddy[1], Anita Setyastuti[1]
[1]Department of Management Science, Universitas Mercu Buana, Indonesia

ABSTRACT

This paper investigated the intents and behavior of muzakki who pay zakat through e-zakat using the Unified Theory of Acceptance and Use of Technology (UTAUT). In DKI Jakarta, the study was done. This article utilizes sampling convenience. The research data were collected using a questionnaire-based survey. Using SmartPLS 3.0, route analysis serves as a statistical instrument for evaluating hypotheses. . The findings indicated that neither the performance expectation variable nor the social influence variable substantially affected the desire to use e-zakat. The variable business expectation had a substantial beneficial impact on both the willingness to use e-zakat and the conditions that allow for a substantial beneficial impact on e-zakat use behavior.

Correspondence:
Lasmi Indaryani,
Department of Management Science,
Universitas Mercu Buana, Indonesia
Email : mangkikit03@gmail.com

INTRODUCTION

Internet expansion in Indonesia is now having a good effect. The increasing number of internet users each year is evidence of this. Internet use in Indonesia increased from 132.7 million in 2016 to 143.26 million out of a population total of 262 million [1]. In Indonesia, the number of Internet users rises yearly. Twenty million Indonesians used the Internet in 2007. From 2008 to 2017, the number of internet users in Indonesia drastically rose, reaching 143,26,000,000 out of a total population of 262,000,000. Internet is consequently one of the most important channels for providing services like zakat [2].

The advancements and creations of this technology will eventually influence and transform the lives of individuals. The substantial usage of an online zakat system, often known as e-zakat, represents one of the most significant lifestyle effects of the widespread use of technology. E-Zakat is a website that enables payers to update zakat-related data, compute zakat amounts, pay zakat, and track zakat payments. [3].

Currently, goods and services based on IT are reaching different societal levels. Companies and IT developers are now battling for a position in customers' hearts [4]. In the age of globalization, the growth of information technology (IT) and science has partnered with and permeated many

sectors of knowledge. Utilizing information technology is necessary for a business to fulfill its objectives [5].

With the commercialization of the internet, the concept of connection has taken on a new meaning, since technology is no longer limited to certain parts of the globe. Multinational and transnational firms of the twenty-first century are transforming the competitive environment. To maintain their existence, local businesses must embrace modern technologies, at least in terms of connecting with customers and business partners locally and abroad. [6].

Therefore, it is very important to recognize the behavior of muzakki when doing zakat using an online system called E-Zakat. The behavior of an individual or group is the interpretation and manifestation of that individual's personal or community's attitude toward a (situation and condition), environment (culture, ecology, or techno). The study of consumer behavior consists of concepts and judgment processes connected with the purchase, use, and receiving of goods, services, and concepts. The payment of zakat enables a muzaki to fulfill his duties as a Muslim concerning his property.

The desires of a person also affect their actions. In contrast, the theory of planned behavior proposes that there are several drivers of desire,

such as attitudes, subjective standards, and behavioral control [8]. The Technology Adoption Model (TAM), which asserts that technology adoption is determined by perceived utility and perceived ease of use, is often used in the study of technology adoption [9]. The presence of performance expectations, commercial expectations, social influences, and facilitation factors affects the development of an interest in utilizing the system [10].

According to the hypothesis, four elements influence an individual's adoption and utilization of technology (user Intention): The expectation of Results (the degree to which an individual believes that adopting the system will help him reach peak performance), Effort Expectation (the user's degree of comfort with the system), Social Influence (awareness of others or the environment using the system), and Facilitating Condition (the belief that other people support the system). In other studies, however, contemporary ideas like the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh, Morris, Davis, and Davis are often used (2003). In seventy percent of prior studies [12], this approach has also been effective. Therefore, Allah commanded the Muzakis who are eligible for zakat to give a particular quantity of money to those who are eligible.

The notion of zakat asserts that others have rights, particularly the rights of the poor. People with extra assets will be more fortunate if part of their holdings is given in addition to will undoubtedly aid in the reduction of poverty [13]. Zakat, as one of the fiscal tools to attain the goals of socio-economic justice and the distribution of wealth and income, is seen as an integral aspect of Islamic moral philosophy and is founded on a firm commitment to human brotherhood [14] based on the Islamic economic system.

Zakat has both a religious and a charitable component. Performing zakat is a religious responsibility resulting from adherence to Allah SWT's instructions, and its utilization may assist in resolving economic difficulties (muamalah) facing society [15]. Zakat is an obligation that must be fulfilled in accord based only on the wishes or inclinations of the individual obligated to give zakat. In light of this, the stipulations of sharia governing the types of assets that must be penalized under Islamic law, including nishab, haul, mode of payment, and management patterns, must be followed. Islamic law has outlined the standards for the types of assets that must be held responsible. [16].

In this period of rapid development, many transactions are conducted without the need for real currency. There are several alternatives to alternative paper-based (checks and crossed checks), card-based (credit cards, ATMs, and debit), and electronic-based transactions (E-Money). Internet technology is one of the technologies behind non-cash transactions. The Internet may aid in the facilitation of human activities. There are already services that assist muzakki in zakat distribution so that it may be properly administered without the recipient having to go directly to the institution. The National Amil Zakat Agency (BAZNAS) is one of the entities that allow muzakki's of zakat and infaq using non-cash means [17].

LITERATURE REVIEW
Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT is among the most recent versions for the adoption of technology developed by Venkatesh, V., Morris, MG., Davis, GB., and Davis, FD. [18]. UTAUT is a unified theory that synthesizes derived qualities by integrating eight different theories. UTAUT integrates eight major theories: causal theory (TRA), technology acceptance model (TAM), motivation model (MM), theory merging TAM and TPB, theory of planned behavior (TPB), a theory that TPB is behavior, PC use model (MPCU), innovation diffusion theory (IDT), and social cognitive theory (SCT). It has been proven that UTAUT is more effective than the eight previously mentioned theories, which together can explain 70% of user variation.

In each model, Venkatesh identified seven characteristics that were significant predictors of behavioral intention or behavior usage. This construct consists of performance expectations, business expectations, social impact, ease of use, attitudes toward technology usage, and self-efficacy. Following the preceding test, it was determined that there are four key components that each play a crucial function as a direct driver of behavioral purpose and usage. Those designs include performance requirements, commercial requirements, moral sense, and comfort. The impact of another structure as a direct driver of behavioral intention was shown to be minimal additionally, four moderators, including gender, age, voluntary activity, and experience, mitigate the effects of the four core components. During the present age of modernization, the organization's style of thinking has experienced substantial changes as a consequence of advancements in information technology. Performance and productivity have benefited greatly from the development of information technology. The advancement of this technology is crucial, and its effect will be enormously helpful to the future

---

functioning of humanity. In this context, a substantial number of researchers are necessary to examine the feasibility of different technologies.

There have been two elements that contribute to a person's receptivity to new technology, according to a study [18]. Their first consideration is the perceived value of the technology, and their secondary consideration is perceptions of the simplicity of usage (perceived ease of use). These two views may be used to create the Theory Acceptance Model, often known as TAM. Then, [19] created TAM with a new variant designated TAM 2. Therefore, TAM 2 does not represent the most current use of this technology. Then, what is known as UTAUT [12] was created.

This concept, the Unified Theory of Acceptance and Use of Technology, incorporates eight previously established theories of technology acceptance. The following hypotheses are held:
1. Theory of Reasoned Action
2. Technology Acceptance Model
3. Motivational Model
4. Theory of Planned Behavior
5. combines the Technology Acceptance Model and Planned Theory
6. PC Utilization Model
7. Innovation Diffusion Theory
8. Social Cognitive Theory

Seven constructs are always relevant as direct effects on the intention or use of one or more adoption models that comprise UTAUT. However, only four significant constructs have an influence. The four components are performance expectation, effort expectation, social influence, and enabling circumstances.
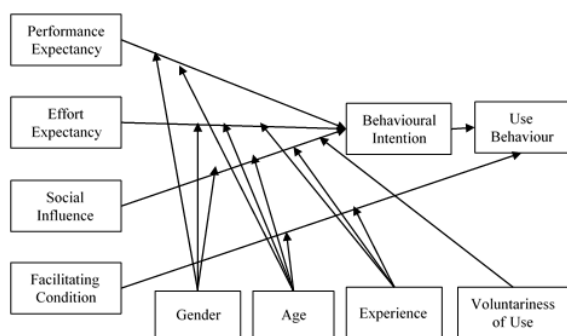
Figure 1. Integrated Theory Methods of Acceptance and Use of Technology

Structural Equation Modeling (SEM)

The type of analysis known as structural equation modeling, or SEM, allows for the simultaneous examination of a rather complex collection of relationships. There may be complex correlations between an independent factor or several independent factors and one or several control variables. Any number of response variables is acceptable. Each variable may take the form of components or structures composed of several indicators. This may be the situation. Combining factor analysis and route analysis, the structural equation model (SEM) is a statistical approach. SEM uses statistical techniques to show data to achieve research goals, and it is capable of using different models to offer a response to the formulation of the research topic. [5].

In the Based approach, the stages of SEM data analysis consist of 1) testing for dependability (similar to factor analysis), 2) Validating the variable-relationship model (path analysis), and 3) confirmation model (SEM). Generally, the SEM method includes the following steps:

Based on the prior theory or theory, the basic model is developed.
1. Model Specification: before estimating, this phase focuses on the construction of an initial structural equation model.
2. Identification: on the evaluation of the likelihood of getting a unique value for each model parameter and the probability of simultaneous equation with no solution.
3. Estimation: focuses on model estimating to obtain parameter values using one of the various estimate techniques. Frequently, the choice of estimate model is governed by the nature of the variables under study.
4. Match Test is a suitability test between the model and the data on several goodnesses of this (GOF) criteria.
5. Respecification relates to the respecification of the model results of the preceding stage's model compatibility evaluation.

E-Zakat

As previously mentioned, a practical definition of an information system is a component that gathers, filters, organizes, and distributes information to facilitate organizational decision-making, coordination, and control. Online zakat transactions are a good example of internet commerce. Electronic commerce, sometimes known as e-commerce, refers to the distribution, acquisition, sale, and selling of goods and services through electronic networks such as the Internet, television, and other computer networks. Common e-commerce applications include data management systems, information on shipment and orders, local and international payment services, e-commerce, and mobile banking. The following elements are essential to the successful operation of an e-commerce firm [12]:
1. Provide competitive services.

2. Provide responsive, fast, and friendly service.
3. Provide complete and clear information on goods and services.
4. Provides many payment methods.
5. Facilitate payment or trading activity.

In contrast, online zakat (e-zakat) is the procedure of zakat payment that is conducted via a computerized system, where the zakat donor does not interact directly with amil zakat while making zakat payment. Through e-zakat, muzaki can record their payment procedures and operations without physical advancement. E-Zakat is a chance to reduce expenses and energy consumption while maximizing the use of muzaki. E-Zakat minimizes the cost of travel and labor, enhances the adaptability of muzaki, and improves the quality of services based on electronic technology [12].

RESEARCH METHODS

This research employs a quantitative strategy and survey methodology. The description of the suggested model to anticipate behavioral intents to make digital zakat payments is a key advantage of this strategy. This research used the UTAUT model. Individuals' performance expectations are stated as how they feel utilizing the system will aid them in developing and implementing tasks [19]. The respondents' performance expectations in this research are based on their belief that paying zakat payments online would boost their job productivity. According to earlier research, performance expectations impact behavioral intentions [20]. Consequently, the following theories have been developed:

H1: Performance Expectations have a positive and significant effect on Intention to Use E-Zakat
H2: Business Expectations have a positive and significant effect on Intention to Use E-Zakat
H3: Social influence has a positive and significant effect on intentions to use E-Zakat
H4: Facilitation conditions have a positive and significant effect on the behavior of using E-Zakat.
H5: Intention to use has a positive and significant effect on the behavior of using E-Zakat.

This quantity satisfies the PLS-SEM minimum sample size requirement, which states that the sample size at baseline must be ten times the number of lines on the observed variables in the PLS-SEM model [17]. This exceeds the basic requirements for statistical power and result size. The minimal sample size for this research is 38 since the R2 projection is at least 0.5 and the

minimum number of arrows linked with the variables is 3.

RESULTS AND DISCUSSION

This study utilizes SMARTPLS 3.0 and the Partial Least Square (PLS) technique as an alternate analytic method.

Assessing the Outer Model or Measurement Model

Convergent Validity, Discriminant Validity, and Composite Reliability are the three criteria for evaluating the outer model utilizing data analysis procedures with SmartPLS. Using PLS software, the correlation between item and component scores is calculated to establish the convergence validity of the measurement model using reflexive indicators. Individual reflexive scores/components are deemed to be strong if their correlation with the being examined construct exceeds 0.70. This research makes use of the Partial Least Square (PLS) approach as an alternate analysis tool using SMARTPLS 3.0.

Assessing the Outer Model or Measurement Model

Building dependability may be evaluated using composite reliability. A construct is deemed dependable if its overall dependability value exceeds 0.70, as shown in Table 2. These results demonstrate the composite dependability of each component, including performance expectations (0.924), social influence (0.919), enabling conditions (0.913), behavioral intents (0.938), and comprehension of zakat (0.938). (0.923). The number of composite reliability value variables exceeds 0.70, surpassing the criterion for composite reliability.
.

Table 1. Outer Weight

	Original Sample	Sample average	Standard Deviation	T-Stats	P-value
x1.1 <= Do Hope	0.339	0.338	0.030	11,466	0.00
x1.2 <= Do Hope	0.412	0.419	0.041	10,181	0.00
x1.3 <= Do Hope	0.315	0.310	0.036	8.703	0.00
x2.1 <= Business Expectations	0.326	0.326	0.014	23,651	0.00
x2.2 <= Business Expectations	0.367	0.365	0.019	19,790	0.00
x2.3 <= Business Expectations	0.363	0.388	0.016	22.849	0.00
x3.1 <= Social Influence	0.386	0.402	0.042	9.255	0.00
x3.2 <= Social Influence	0.403	0.335	0.035	11,455	0.00
x3.3 <= Social Influence	0.339	0.445	0.039	8,789	0.00

x4.1 <= Facilitating Condition	0.438	0.355	0.049	8,954	0.00
x4.2 <= Facilitating Condition	0.353	0.337	0.022	15,715	0.00
x4.3 <= Facilitating Condition	0.342	0.485	0.022	15,290	0.00
y1.2 <= Intention	0.485	0.565	0.016	31,061	0.00
y1.3 <= Intention	0.565	0.437	0.020	28,124	0.00
y2.1 <= Behavior	0.432	0.437	0.059	7.296	0.00
y2.2 <= Behavior	0.373	0.375	0.019	19,539	0.00
y2.3 <= Behavior	0.331	0.326	0.029	11,532	0.00

Using the information presented in the above image, the following analysis is performed on the outer weight results:

1. Judging from the original sample estimate that the t-statistic value is positive and large > t-count 1.985, the indicators X1.1, X1.2, and X1.3 have a positive and significant effect on shaping the performance expectation variable.
2. Judging from the original sample estimate that the t-statistical value is positive and large > t-count 1.985, the indicators X2.1, X2.2, and X2.3 have a positive and significant effect on shaping the business expectation variable.
3. Judging from the original sample estimate that the value of the t-statistic is positive and large > t-count 1.985, the indicators X3.1, X3.2, and X3.3 have a positive and significant effect on shaping the social influence variable.
4. Judging from the original sample estimate that the t-statistic value is positive and large > t-count 1.985, the indicators X4.1, X4.2, and X4.3, have a positive and significant effect in forming the facilitating condition variables.
5. Judging from the original sample estimate, the t-statistic is positive and large > t-count 1.985, the indicators Y1.2, and Y1.3 have a positive and significant effect on forming the intention variable.
6. Judging from the original sample estimate that the t-statistic value is positive and large > t-count 1.985, then the indicators Y2.1, Y2.2, and Y2.3 have a positive and significant effect in shaping behavioral variables.

Structural Model Testing (Inner Model)

To assess the nature of the relationship between the constructs, data suggests, and R-squared of the research model, the inner model or modeling of structural equations was evaluated. For the dependent construct of the t-test in structural model analysis, the R-square statistic was utilized. Additionally, the significance of

structural route parameter coefficients was examined.
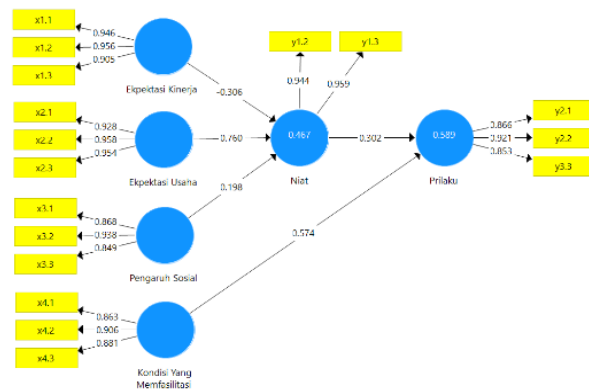
Figure 2. PLS Analysis Output Results

Testing the R-Square value for each hidden dependent variable is the first stage in evaluating a model using PLS. Table 2 displays the SmartPLS R-Square estimate results.

Table 2. R Square

Matrix	R Square	R Square Customized
Meaning	0.467	0.450
Behavior	0.589	0.581

Using the table, the R-square value for E-zakat Intention (Y1) is 0.467, and that for E-zakat Usage Behavior (Y2) is 0.589. This demonstrates that the constructs of performance expectations, business expectations, and social influence may explain 46.7% of the desire to use e-zakat, whereas 53.3% can be described by elements not included in the model. As for behavioral components including the usage of e-zakat, the constructs of enabling conditions and intents to use e-zakat may explain 58.9 percent, while the remaining 41.1% can be compensated for by factors not included in the model hypothesis. Testing.

Table 3. Path Coefficient

	Original Sample	Sample average	Standard Deviation	T-Stats	P-value
Do Hope => Intention	-0.306	-0.315	0.162	1,894	0.059
Business Expectations => Intentions	0.760	0.751	0.237	3.207	0.001
Facilitating Condition => behavior	0.574	0.578	0.091	6.325	0.000

Intention =>Behavior	0.302	0.303	0.072	4.206	0.000
Social Influence => Intention	0.198	0.222	0.168	1183	0.237

The following may be deduced from the findings of the route coefficient shown previously:

1. The P-Variable of Performance Expectations for Intention to Use E-zakat is 0.059 (5.9%). The results showed that the P Values were above 5%, which indicates that the performance expectation variable does not affect the intention to use e-zakat.
2. The P-Value of Business Expectations on Intention to Use E-zakat is 0.001 (0.1%). The results showed that the P Values were below 5%, this indicates that the business expectation variable has a significant effect on the intention to use e-zakat.
3. The value of the P variable that facilitates the intention to use e-zakat is 0.000 (0%). The results showed that the P Values were below 5%, this indicates that the facilitating condition variable has a significant effect on the intention to use e-zakat.
4. The P value of intention to behavior using e-zakat is 0.000 (0%). The results showed that the P Values were below 5%, which indicates that the intention variable has a significant effect on the intention to use e-zakat.
5. The value of the P Values Social Influence variable on the intention to use e-zakat is 0.237 (23.7%). The results showed that the P Values were above 5%, which indicates that the social influence variable does not affect the intention to use e-zakat.

CONCLUSION

This study demonstrates that business expectations and favorable conditions have a strong positive influence on the use of e-zakat and that the intentions factors have a substantial effect on e-zakat behavior. In addition, the research revealed that the variable of purpose has a considerable beneficial influence on e-zakat behavior. This indicates that confidence in the usage of e-zakat is exactly proportional to confidence in the system's future advantages. In addition, the research demonstrates that performance expectations and social influence factors have little impact on e-zakat engagement. This study discovered that corporate expectations have a major impact on the tendency to deploy e-zakat and that enabling condition components have a sub-element impact on e-zakat behavior. It might be seen as using e-zakat strengthens one's

belief that the system would give immense benefits in the future, hence minimizing one's effort in the form of energy and time spent on tasks. It is anticipated that additional studies will include characteristics such as age and gender as moderating variables to be investigated in the UTAUT model.

REFERENCE

[1] Ahmad, NN, Tarmidi, M., Ridzwan, IU, Hamid, MA, & Roni, RA (2014). Implementation of the Unified Theory of Acceptance and Use of Technology (UTAUT) for Predicting the Use of the Online E-Zakat System. International Journal of Science and Research (IJSR), 3(4), 63–67.

[2] Aini, ZN, Budi, S., Yuli, C., & Hakim, R. (2018). Muzakki's Behavior in Paying Zakat Through Non-Cash Transactions at the Indonesian Zakat Initiative Institute (IZI) Surabaya. Journal of Islamic Economics Iqtishodia, 3(1), 39–57.

[3] Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50, 179–211.

[4] APJII. (2018). BULETINAPJII EDITION 23 April 2018 (pp. 1–7). pp. 1–7. Association of Indonesian Internet Service Providers.

[5] APJII. (2019). APJII EDITION January 33, 2019 (pp. 1–11). Thing. 1–11. Association of Indonesian Internet Service Providers.

[6] Bachmid, G., Salim, U., Armanu, & Djumahir. (2012). The behavior of muzakki in paying zakat mal (phenomenological study of muzakki experience in Kendari City). Journal of Management Applications, 10(2), 425–436.

[7] Chen, QL, & Zhou, ZH (2016). The unusual superoxo heptaoxomolybdate formation of peroxo molybdate. Communication of Inorganic Chemistry, 67(3), 95–98.

[8] Davis, FD (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. Quarterly MIS: Management Information Systems, 13(3), 319–339. https://doi.org/10.2307/249008

[9] Davis, FD, Bagozzi, RP, & Warshaw, PR (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. Management Science, 35(8), 982–1003.

[10] Handayani, T., & Sudiana, S. (2017). Analysis of the Application of the Utaut Model (Unified Theory of Acceptance and Use of Technology) on Information System User Behavior (Case Study: Academic Information System at Sttnas Yogyakarta). Angkasa:

Scientific Journal of Technology, 7(2), 165. https://doi.org/10.28989/angkasa.v7i2.159

[11] Jati, NJ, & Laksito, H. (2012). Analysis of Factors Affecting Interest in Utilization and use of E-ticket System (Empirical Study on Travel Bureau in Semarang City). Journal of Accounting Diponegoro, 1(2), 1–15.

[12] Yusuf, KO (2011). Integrated marketing communications: A catalyst for the growth of E-business management. Social Sciences, 6(2), 64–73.

[13] Gaddafi, M., Heikal, M., & Falahuddin, F. (2014). Intention to Pay Commercial Zakat: Application of the Revised Theory of Planned Behavior. Journal of Economics and Behavioral Studies, 6(9), 727–734.

[14] Mustaqim, R., Kusyanti, A., & Aryadita, H. (2018). Analysis of Factors Influencing Intention to Use XYZ E-Commerce Using the UTAUT (Unified Theory Acceptance and Use Of Technology) Model. Journal of Information Technology and Computer Science Development, 2(7), 2584–2593. Retrieved from http://j-ptiik.ub.ac.id/index.php/jptiik/article/view/1653/608

[15] Oktaviana, LD, Rifa, Z., & Utami, K. (2017). Analysis of the Application of the Online KRS System for STMIK Amikom Purwokerto Students Using the UTAUT Method. Citisee, 2, 258–263.

[16] Prasetyo, DY (2017). Application of the UTAUT Method in Understanding Acceptance and Use of the LPPM UNISI KKN Website. Journal of SYSTEMS, 6(2), 26–34.

[17] Thompson, RL, Higgins, CA, & Howell, JM (1991). Personal computing: Towards a conceptual model of utilization. Quarterly MIS: Management Information Systems, 15(1), 125-142.

[18] Venkatesh, V., Morris, MG, Davis, GB, & Davis, FD (2003a). Human Acceptance of Information Technology. International Encyclopedia of Ergonomics and Human Factors, Second Edition - 3 Volume Set, 27(3), 425–478. https://doi.org/10.1201/9780849375477.ch230

[19] Venkatesh, V., Morris, MG, Davis, GB, & Davis, FD (2003). User Acceptance of Information Technology: towards a united view. Microvascular Research, 27(3), 425–478.

[20] Wulandari, A., & Yadnyana, I. (2016). Application of the Unified Theory of Acceptance and Use of Technology Model in Denpasar City. E-Journal of Accounting, 14(2), 1270–1297.

THE INFLUENCE OF TILT ANGLE ON THE PERFORMANCE OF SOLAR PANELS AS A SMART HELMET POWER SUPPLY IN A MOTORCYCLE SAFETY SYSTEM

Muhammad Sekal Maulidan[1*], Rahmat Hidayat[1], Ridwan Satrio Hadikusuma[1], Ibrahim Lammada[1]
[1]Department of Electrical Engineering, Universitas Singaperbangsa Karawang, Indonesia

ABSTRACT

The performance of a solar panel module is strongly influenced by its orientation and tilt angle. Tests have been carried out to track variations in the performance of the solar panel module and electrical parameters at various angles of inclination in the conditions of Karawang and Bogor. There are two experimental modes: 1) a varying slope module under a constant irradiance level, 2) a varying irradiation intensity at the optimal tilt setting. For the former schematic, the irradiation levels were carried out at 2 different locations, and for the later setup, the angle of inclination of the module was varied from 90° and 180° by using a single axis tracer At 90° tilted angle in Karawang test place at rest condition, morning experiment give the result of 5,69V on average while in Bogor the experiment gives 5,46V on average. At 180° tilted angle in Karawang test place at rest condition, morning experiment give the result of 5,49V on average while in afternoon experiment afternoon 3.026V on average. In Bogor test place morning experiment give solar panel 5,2V on average and 3,33V at afternoon experiment. In the electrical parameters of the module, the open circuit voltage, short circuit current, maximum power point voltage and maximum power point current decrease substantially with increasing slope angle, while the charge factor decreases somewhat gradually. Tests in both Karawang and Bogor in the afternoon and afternoon confirmed that the optimal tilt angle on cloudy on with UV index between 1-2 in the morning and 3-4 in the afternoon on average is 180° tilted and directing the solar panel module at this angle will maximize the captured solar energy and thereby improve its performance.

Correspondece:
Muhammad Sekal Maulidan,
Department of Electrical Engineering,
Universitas Singaperbangsa Karawang,
Indonesia,
Email : sekalmaulidan33@gmail.com

INTRODUCTION

The Internet of Things (IoT) technologies offer unique opportunities for organizations to improve their performance, innovativeness and as a result pursue competitive advantages [1]. Where the motorcycle security system is able to provide real-time information and is integrated into a web server via the internet, so that motorcycles can be monitored remotely. Seeing these problems, the author made a digital helmet as a security system on a motorcycle that can detect the location of a motorcycle, turn on and turn off the motorcycle engine, and sound a motorcycle alarm to provide a notification signal to the surrounding environment when the motorcycle is in an unsafe condition. controlled via a web server with a solar panel module as a standalone power supply. a motorcycle security system designed to be integrated with a Digital Helmet that uses Bluetooth to connect to a motorcycle.

The smart helmet system is equipped with solar cells for charging. Then it will be stored in the battery. The battery capacity used is 1000 mAh which is estimated to last about 24 hours when used in driving when the system is active. In the event of theft or use of a motorbike outside the owner's permission, website technology that has been designed and connected to a motorbike can turn off the motorbike engine and turn on the alarm on the motorbike and it will show the position of the motorbike. Basically this tool will detect when the Digital Helmet is far from the motorbike. If

the distance between the helmet and the motorbike is 20 meters, the motorbike will stop instantly, then after that this tool will also be connected to the internet to be able to stop the engine and the vehicle owner can turn on the alarm via the website and the alarm will sound repeatedly so that the thief becomes panicked and can attract more attention from the surroundings. This system provides a fairly good level of security for motorcycle users from theft.

Since sunlight is the only fuel for the solar panel module system, it is important that the solar panel module is installed properly to receive maximum sunlight and avoid partial shade. To capture the maximum irradiance intensity module must face normal to the incoming sunlight [2-3]. One of the best solutions to maximally intercept solar energy is to apply a solar tracking system to follow the sun's trajectory continuously across the sky [4]. However, the module tracker is a complex system; it is expensive and requires repair and maintenance; hence, not always suitable for applications [5]. Therefore, fixed PV installations with well-engineered tilt angles are still prevalent in the PV industry [6].

Several previous researchers have tried to explore the optimal slope angle relationship, where some researchers found that the installation location is one of the important factors that should be considered in this exercise [7]- several theoretical models for optimal slope have also been proposed. Most of the proposed models are designed for specific locations in the field maximizing solar panel output is strictly an engineering problem defined for each solar panel site and system. Among others, Ebrahimpour. [8], Riyanto [9], Wirajati [10], as: the choice of inclination angle must be between the latitude of the location (φ) and (φ - 15°). This approximation of the combined maximizing angle in the range of ±15° results in a small loss in the total output (below 5%). In addition to the technical perspective, a study also focuses on: the economic perspective of the optimal tilt angle orientation of the solar panel system [11]. Hardiyanto et al. [12] studied the techno-economic optimization of a grid-connected solar panel system, where electricity rates were found to reduce as a result of maintaining an optimal slope. [13] determined optimal orientations for four pricing conditions in Ontario, Canada. The authors found that a slope of 7 to 12° less than the latitude yielded optimal returns in all conditions [14], [15].

RESEARCH METHOD

System Design On Smart Helmets

This section contains the system model by describing the circuit schematic (Solar Panel, Charge Module, Battery, Bluetooth Module HC-06, USB Doctor, Voltmeter, Battery Indicator, 2 Way Switch, Switch) on the helmet system. The block diagram of the interconnection between components is shown in Figure 2.
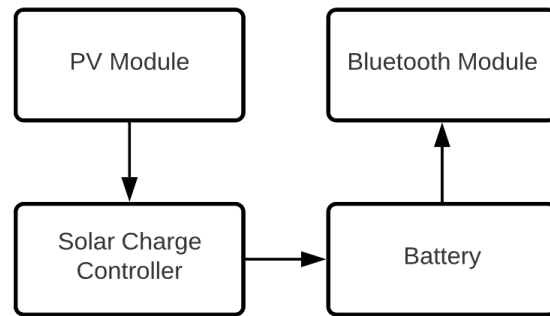
Figure 2. Block Diagram of the System

The system model on the helmet is shown in the schematic circuit drawing on the helmet. The work process on the helmet has 3 parts, namely power input, storage and load. The power input section comes from the solar panel which will later charge the battery via the charge module, then the storage process section which functions to store the power generated by the solar panel which can be monitored via the battery indicator which will then provide power supply to the load, namely the Bluetooth module. The HC-06 will perform wireless serial communication which converts the serial port to bluetooth and will connect the helmet to the motorcycle. Which will later function to control the motor as shown in Figure 3.
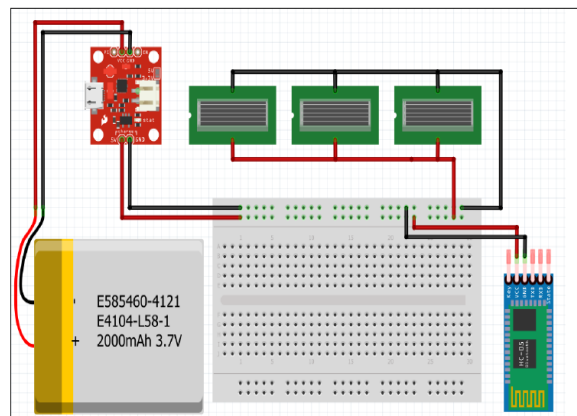
Figure 3. Electronic System Design

Smart Helmet Prototype

Figure 4. Smart Helmet Prototype

This smart helmet uses a box measuring 10 x 10 x 5 cm for the placement of components on the back of the helmet. There are connectors A and B which have a function to supply power to this smart helmet, connector A is where the power input uses a voltage of 12V while connector B is where the power input uses a voltage of 5V.

Data Retrieval

Data collection was carried out in 2 different locations, which are in Karawang and Bogor at 2 different times, in the morning and evening. Tests are only carried out at 90° and 180° angles tilted. Outdoor experiments were carried out on different cloudy sunny days at different tilt angle conditions with the same mono-crystalline silicon (m-Si) solar panel module. Solar radiation, module electrical parameters and different temperature data were collected non-stop from 8:00 WIB in the morning test and 16:00 WIB in the afternoon test. In Karawang test place, from the weather report on climeradar.com, in five-time morning experiment the average of the UV index is 4. From the same source of data, the evening time experiment is being held while the UV index is 2. In Bogor test place, the UV index in morning experiment is 3 on average and 1 in evening experiment.

Then, the data collected daily were carefully screened for irregular and asymmetric irradiation intensity and only reasonable values were considered every 30 min interval. Therefore, the corresponding recording parameters (ambient and module temperature and module electrical parameters) are curated based on specific radiation values, such as for 200, 300, 400 … up to 1000 W/m2. That is, after filtering and curation, the parameters measured at a certain angle of inclination are set and assigned to nine specific radiation levels (200 to 1000 W/m2 at 100 W/m2 intervals). For all slope angles, data were collected and structured in the same way provided

that the trend curve of the ambient temperature on the experimental day nearly corresponded to the representative day (the first day of the experiment). In this way, an even distribution of solar irradiance and ambient temperature on different experimental days can be maintained. However, wind speed and humidity on different days are not essentially the same and errors resulting from these variations are ignored in the performance evaluation.

RESULTS AND DISCUSSION

The effect of the variation of the slope of the module on the electrical parameters of the solar panel and the temperature of the solar cell has been explored in this research experiment. Experimental studies both indoors and outdoors have been carried out to make comparisons between the results. Another objective of the outdoor study is to experimentally determine the effect of the optimal tilt angle for the conditions of Karawang and Bogor.

Testing of Solar Panels on Rest Conditions in Karawang

Table 1. Testing of Solar Panels with 180° Tilling Angle

Experiment	Place	Time	Tilt Angle	Sun Direction	V Out	A Out
Experiment 1	Karawang	Morning	180º	East	5.60	2.5
Experiment 2	Karawang	Morning	180º	East	5.62	2.6
Experiment 3	Karawang	Morning	180º	East	5.34	2.8
Experiment 4	Karawang	Morning	180º	East	5.48	2.7
Experiment 5	Karawang	Morning	180º	East	5.42	2.6

Voltage and current on the solar panel test located in Karawang in the morning and at rest, the experiment was carried out 5 times with a tilt angle of 180°. the graph of the test results obtained from the data in table 1, namely the solar panel test located in Karawang in the morning and at rest, with a tilt angle of 180° can be seen in figure 5.
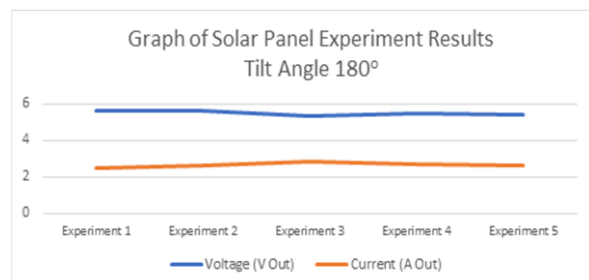

Figure 5. The Effect of Angle on Voltage and Current in the Morning

Table 2. Testing of Solar Panels with 90° Tilling Angle

Experiment	Place	Time	Tilt Angle	Sun Direction	V Out	A Out
Experiment 1	Karawang	Morning	90º	East	5.72	3.5
Experiment 2	Karawang	Morning	90º	East	5.70	3.4
Experiment 3	Karawang	Morning	90º	East	5.65	3.5
Experiment 4	Karawang	Morning	90º	East	5.70	3.3
Experiment 5	Karawang	Morning	90º	East	5.68	3.4

Table 2 above is a table of the results of measuring voltage and current on the solar panel test located in Karawang in the morning and in a state of silence, experimented 5 times with an angle of 90° facing east. a graphic image of the test results obtained from the data in table 2, namely the solar panel test located in Karawang in the morning and at rest, with an angle of 90° facing east, can be seen in Figure 6.
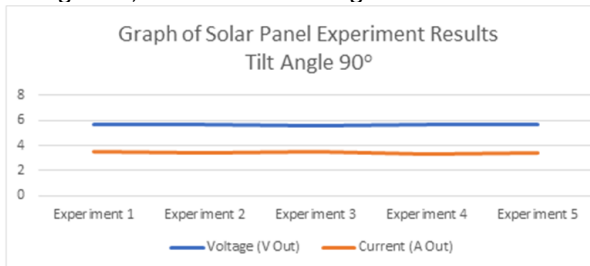

Figure 6. The Effect of Angle on Voltage and Current in the Morning

Table 3. Testing of Solar Panels with 180° Tilling Angle

Experiment	Place	Time	Tilt Angle	Sun Direction	V Out	A Out
Experiment 1	Karawang	Afternoon	180º	East	3.04	2.4
Experiment 2	Karawang	Afternoon	180º	East	3.05	2.3
Experiment 3	Karawang	Afternoon	180º	East	3.00	2.1
Experiment 4	Karawang	Afternoon	180º	East	3.03	2.0
Experiment 5	Karawang	Afternoon	180º	East	3.01	2.1

Table 3 above is a table of the results of measuring voltage and current on the solar panel test located in Karawang in the afternoon and in a state of silence, experimented 5 times with a tilt angle of 180°. the graph of the test results

obtained from the data in table 3, namely the solar panel test located in Karawang in the afternoon and at rest, with a tilt angle of 180° as shown in Figure 7.

Figure 7. The Effect of Angle on Voltage and Current in the Afternoon

Testing Solar Panels on Rest Condition in Bogor

Table 4. Testing of Solar Panels with 180° Tilling Angle

Experiment	Place	Time	Tilt Angle	Sun Direction	V Out	A Out
Experiment 1	Bogor	Morning	180º	East	5.23	2.5
Experiment 2	Bogor	Morning	180º	East	5.15	2.6
Experiment 3	Bogor	Morning	180º	East	5.18	2.5
Experiment 4	Bogor	Morning	180º	East	5.20	2.3
Experiment 5	Bogor	Morning	180º	East	5.26	2.5

Table 4 above is a table of the results of measuring voltages and currents on the solar panel test located in Bogor in the morning and in a state of silence, the experiment was carried out 5 times with a tilt angle of 180°. the graph of the test results obtained from the data in table 4, namely the solar panel test located in Bogor in the morning and at rest, with a tilt angle of 180° can be seen in Figure 8.

Figure 8. The Effect of Angle on Voltage and Current in the Morning

Table 5. Testing of Solar Panels with 90° Tilling Angle

Experiment	Place	Time	Tilt Angle	Sun Direction	V Out	A Out
Experiment 1	Bogor	Morning	90º	East	5.40	3.3
Experiment 2	Bogor	Morning	90º	East	5.39	3.1
Experiment 3	Bogor	Morning	90º	East	5.52	3.2
Experiment 4	Bogor	Morning	90º	East	5.46	3.3
Experiment 5	Bogor	Morning	90º	East	5.55	3.1

Table 5 above is a table of the results of measuring voltages and currents on the solar panel test located in Bogor in the morning and in a state of silence, experimented 5 times with an angle of 90° facing east. a graphic image of the test results obtained from table 2 data, namely the solar panel test located in Bogor in the morning and at rest, with a tilt angle of 90° facing east can be seen in Figure 9.

Figure 9. The Effect of Angle on Voltage and Current in the Morning

Table 3. Testing of Solar Panels with 180° Tilling Angle

Experiment	Place	Time	Tilt Angle	Sun Direction	V Out	A Out
Experiment 1	Bogor	Afternoon	180º	East	3.33	2.4
Experiment 2	Bogor	Afternoon	180º	East	3.21	2.3
Experiment 3	Bogor	Afternoon	180º	East	3.4	2.3
Experiment 4	Bogor	Afternoon	180º	East	3.25	2.2
Experiment 5	Bogor	Afternoon	180º	East	3.46	2.5

Table 6 above is a table of the results of measuring voltages and currents on solar panel testing located in Bogor in the afternoon and at rest, experimented 5 times with an angle of 180°. the graph of the test results obtained from the data in table 6, namely the solar panel test located in Karawang in the afternoon and in a state of silence, with an angle of 180° as shown in Figure 10.
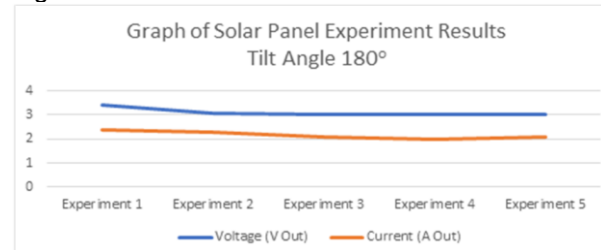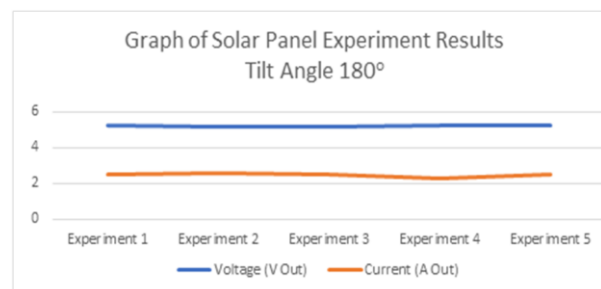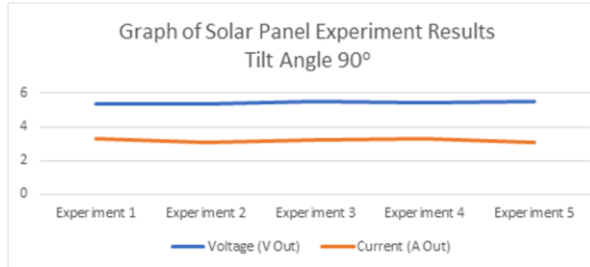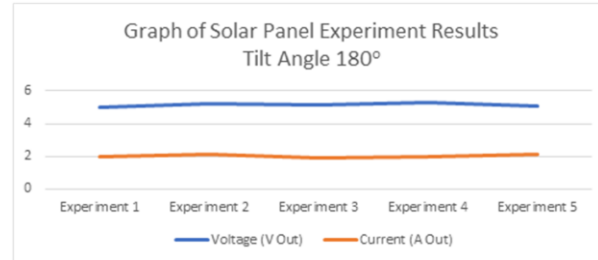

Figure 10. The Effect of Angle on Voltage and Current in the Afternoon

CONCLUSION

Solar power generation depends on many factors, among which the slope of the module is very important. The operative intercept of solar radiation plays an important role in the performance of the solar panel system, where the tilt angle works as one of the control parameters. The effect of tilted angel is less significant. At 90° tilted angle in Karawang test place at rest condition, morning experiment give the result of 5,69V on average while in Bogor the experiment gives 5,46V on average.

At 180° tilted angle in Karawang test place at rest condition, morning experiment give the result of 5,49V on average while in afternoon experiment afternoon 3.026V on average. In Bogor test place morning experiment give solar panel 5,2V on average and 3,33V at afternoon experiment.

REFERENCES

[1] C. Eleanor, P. Marina, T. D. Claudia M, and B. David. "Internet of Things: Aspiration, implementation and contribution." Journal of Business Research. vol. 139, pp. 69-80, February 2022. DOI 10.1016/j.jbusres.2021.09.025.

[2] P.D. Lund, "Data for global power demand and solar PV output matching", Data in Brief, vol. 19, pp. 1694–1715, August 2018. DOI. 10.1016/j.dib.2018.06.054

[3] S. Wendlandt and F. Popescu "Photovoltaic Energy Yield Prediction Using An Irradiance Forecast Model Based On Machine Learning

For Decentralized Energy Systems", 36th EU PVSEC France, September 2019.

[4] S. A. S. Sidik, B. V. Taringan and G. Gusnawati. "Pengaruh Besar Sudut Cermin Terhadap Efisiensi Panel Surya." Jurnal Fisika: Fisika Sains dan Aplikasinya, vol. 7(1), pp. 56-63, 2022.

[5] X. Liu, Q. Tan, Y. Niu and R. Babaei "Techno-economic analysis of solar tracker-based hybrid energy systems in a rural residential building: A case study in South Africa." International Journal of Green Energy, p. 1-20, February 2022. DOI. 10.1080/15435075 .2021.2024545

[6] C. Rodrigo, S. Elissandro, L. Lutero and B. Natasha. "Study Comparison of the Efficiency of a Photovoltaic System with Fixed Panels and with Solar Tracker in the Northwest of Brazil." International Journal of Advanced Engineering Research and Science. vol. 9, pp. 183-189. DOI. 10.22161/ijaers.94.21.

[7] M. J. Yun, Y. H. Sim, S. I. Cha, S. H. Seo, and D. Y. Lee. "3-Dimensional dye sensitized solar cell sub-module with oblique angled cell array for enhanced power and energy density output utilizing non-linear relation in cosine law of light incident angle." Solar Energy, vol. 177, pp. 355-363, January 2019. DOI. 10.1016/j.solener.2018.11.023.

[8]. A. Ebrahimpour , "Calculate optimum solar cell angle based on maximum solar intensity and minimum solar cell temperature" SSRN, p. 15, March 2, 2022. DOI. 10.2139/ssrn.4047979 [Online]. Available SSRN, https://ssrn.com/abstract=4047979

[9]. S. D. Riyanto, Supriyono and F. Hazrina, "Optimizing of Electric Power Solar Cell by Various Angle Using the Activator Panel Based on the Timer and Light Sensor," 2018 International Conference on Applied Science and Technology (iCAST), 2018, pp. 109-114, October 2018. DOI. 10.1109/iCAST1.2018.8751564.

[10]. Wirajati, I. G. A. Bagus, and I. M. A. K. Natha. "Pengaruh sudut kemiringan dan arah penempatan terhadap daya keluaran pada modul panel surya." Journal of Applied Mechanical Engineering and Green Technology vol. 2.1, pp. 5-9, 2021.

[11]. S. Hariyanto. "Rancang Bangun Reflector Untuk Mengoptimalkan Daya Serap Matahari Pada Panel Surya Dengan Variasi Sudut Guna Menghasilkan Daya Optimal." Jurnal Ilmiah Telsinas Elektro, Sipil dan Teknik Informasi, vol. 4(1), pp. 41-45, 2021.

[12]. D. L. Hardianto and A. A. Hasyim. "Analisis Keluaran Energi Listrik Pada Panel Surya 60 WP Ditinjau dari Sudut Kemiringan Terhadap Pengaruh Suhu dan Iradiasi Matahari" Dr. dissertation, Dept. Electrical., Univ. Muhammadiyah Surakarta., Surakarta, 2022.

[13]. M. J. Mayer and G. Gróf. "Techno-economic optimization of grid-connected, ground-mounted photovoltaic power plants by genetic algorithm based on a comprehensive mathematical model." Solar Energy, vol. 202, pp. 210-226, May 2020. DOI. 10.1016/j.solener.2020.03.109.

[14]. H. Z. Al Garni, A. Awasthi and David Wright, "Optimal orientation angles for maximizing energy yield for solar PV in Saudi Arabia." Renewable Energy, vol. 133, pp. 538-550, April 2019. DOI. 10.1016/j.renene.2018.10.048.

[15]. M. Kouhestani, F. Byrne, J. Johnson, D. et al. "Evaluating solar energy technical and economic potential on rooftops in an urban setting: the city of Lethbridge," Canada. Int J Energy Environ Eng , vol 10, pp. 13–32, March 2019. DOI. 10.1007/s40095-018-0289-1

THE COMPARATIVE STUDY ANALYSIS
LOGICAL FILES RECOVERY AND LOW LEVEL FILES RECOVERY USING DIGITAL FORENSIC METHODS

Rahmat Hidayat[1], Marza Ihsan Marzuki[2], Yuliarman Saragih[3], Ibrahim[4], Edmund Ucok Armin[5], Safrian Andromeda[6], Imam Budi Santoso[7], Suroyo[8]

[1]Department of Electrical Engineering, Universitas Singaperbangsa Karawang, Indonesia
[2]Department of Master of Electrical Engineering, Universitas Mercu Buana, Indonesia
[3]Department of Electrical Engineering, Universitas Singaperbangsa Karawang, Indonesia
[4]Department of Electrical Engineering, Universitas Singaperbangsa Karawang, Indonesia
[5]Department of Electrical Engineering, Universitas Singaperbangsa Karawang, Indonesia
[6]Department of Electrical Engineering, Universitas Singaperbangsa Karawang, Indonesia
[7]Faculty of Law, Universitas Singaperbangsa Karawang, Indonesia
[8]Faculty of Management, STIE Tribuana, Indonesia

A R T I C L E   I N F O

ABSTRACT

The development of application and network technology is currently so rapid. This technology is widely used as a solution to overcome data inspection problems in the field of Digital Forensics. The importance of Digital Forensics as evidence, especially on computers and mobile devices, is increasing, along with the rapid use of these mobile devices in daily communication. Data and files on computers and smartphones can be deleted intentionally or unintentionally. To recover the data, it is necessary to have Files Recovery. Furthermore, Logical Files Recovery can be made through password encryption, obtained through hack/attack password applications such as Password or even hacked with the "RecoveryMyFile" application. In addition, a search with a file that has a password description can be done. One of the file recovery applications that can be used is the Agent ransack search application, which is more powerful and convenient than Windows Search, which is more complicated if you need to search faster, indexing needs to be done, and restarts. By using Files Recovery analysis, the development of file or data deletion crimes can be overcome with increasingly rapid and advanced information technology, in this case through applications that can be used for file recovery and to restore deleted files.

Correspondece:
Rahmat Hidayat,
Department of Electrical Engineering,
Universitas Singaperbangsa Karawang,
Email :
rahmat.hidayat@staff.unsika.ac.id

INTRODUCTION

Along with the development of the era, digital technology is currently developing rapidly. At the same time, the development of hardware and software to provide mobile forensics investigation has been achieved. The development of application and network technology is currently very rapid. This technology is widely used as a solution to overcome data inspection problems in the field of Digital forensics [1]. The importance of Digital forensics as evidence especially files recovery related to the deletion of files or data to eliminate evidence of the crime is increasing, along with the rapid use of computer and mobile devices in communication and work tasks [2].

In cases involving computers and smartphones, investigators need to carry out computer and mobile forensics. Computer and Mobile forensics is a branch of digital forensics that studies how to recover evidence from computers and smartphones. Investigators will conduct a forensic analysis of smartphone devices using forensic tools with a methodology that has been forensically tested so that the analysis results are valid before the law and can be used as evidence [3].

In general, Digital Forensics is defined as the analysis of data, such as audio, and video which is obtained after the examination of electronic devices, to assist legal proceedings. Nowadays, with the advancement of technology, electronic devices are increasingly diverse such as tablets, flash memory, and memory cards. At the same time, the storage capacity of devices is increasing day by day. People use these devices extensively in many areas such as facilitating their work and keeping up with social circles. It is a critical issue to properly store and analyze this increased data in an electronic environment [4, 5].

Digital forensics aims to examine these devices and data to assist legal proceedings. When a forensic analysis is performed, the data on the device must be evaluated as unchanged and not destroyed. The results obtained can be used in the judicial process under these conditions. Digital forensics is divided into sub-disciplines as given among them are a) Computer Forensics, b) Mobile Forensics, c) Memory Forensics, d) Network Forensics, e) Malware Forensics, and f) OS (Operating System) Forensics [6-8].

The investigation process in Digital forensics is modeled with 4 main steps, including, 1) Assess which consists of Notifying and acquiring Authorization, reviewing policies and law, identifying team members, conducting assessment, Prepare for evident acquisition. 2) Acquire which consists of Build Investigation toolkit, Collect the data, Store, and achieve. 3) Analyze which consists of analyzing network data, analyzing host data, Analyze storage media. 4) Reporting which consists of gathering and Organizing, Write the report [9, 10]. This investigation process can be done in Files Recovery [11, 12].

Various kinds of tools that can be used to help the file recovery process include agent ransack, autopsy, RecoveryMyFile, recovered. wonder share, cleaner, clever files, and many more. These tools are tools to help uncover files that were intentionally deleted or deleted by individuals who intentionally deleted them to eliminate evidence of a crime.

Files Recovery in question aims to restore deleted data or files. In this all-digital world, many criminals delete data or files of evidence of their crimes to avoid punishment and lawsuits. Therefore, there is a need for a file recovery method or process to handle criminal cases in the digital world. However, the drawback of this method is that every deleted file, either on a computer or other device, has a period that is difficult to analyze and serve as data. Therefore,

an investigator must carry out further analysis of the data obtained so that the data obtained becomes valid as evidence in the trial and can be brought to court [13].

Therefore, there is a need for a comparative study analysis of logical file recovery and low-level file recovery using digital forensics methods. Files Recovery, in the world of digital forensics and computers, is a branch of forensic and computer science that aims to identify, analyze, preserve, and recover valid digital evidence on computers, smartphones, as well as other devices and applications. The Files Recovery method can also be used as a process that can reveal evidence from a criminal case [14].

RESEARCH METHOD

The digital forensic method is a digital process by using analysis using software or applications to search for evidence directly and validly, in this case, the data sought can use the Files Recovery process. File Recovery in question aims to restore deleted data or files. In this all-digital world, many criminals delete data or files of evidence of their crimes to avoid punishment and lawsuits. Therefore, there is a need for a file recovery method or process to handle criminal cases in the digital world [15].

However, the drawback of this method is that every deleted file, either on a computer or other device, has a period that is difficult to analyze and serve as data. Therefore, an investigator must carry out further analysis of the data obtained so that the data obtained becomes valid as evidence in the trial and can be brought to court. In addition, the method in this study, there are several conditions and scenarios used in searching for data, namely analysis of logical files recovery and Analysis of delete/lost/low-level files recovery delete/lost/low-level files recovery.

Analysis of logical files recovery
1) Protect and encrypt your word document.
2) Save the file on the USB.
3) Search for files on the USB using the index in the window using the keywords listed in the word. Search for the keywords you are looking for so that they can be detected
4) Do a file search on the USB if you use an application, for example, agent ransack? https://www.mythicsoft.com/agentransack/
5) The password can be detected, so it is necessary to open the protected word file first. Can use the application: password recovery kit from pass ware https://www.passware.com/kit-basic/freedemo/

6) 6) Make comparisons in determining the results between using the index window and the transact agent.

Analysis of delete/lost/low-level files recovery delete/lost/low-level files recovery

Analysis of delete/lost/low-level files recovery delete/lost/low-level files recovery, is with the following steps:

a. Backup data on your USB
b. Performing data deletion on the USB with three levels:
   1) level 1 only deletes all files by doing a quick format on the USB
   2) level 2, by removing using a low format
   3) level by deleting using third-party apps to delete permanently.
c. Perform the analysis using one of the following applications;
   1) http://www.recovermyfiles.com/data-recovery software-download.php
   2) https://www.ccleaner.com/recuva
   3) https://www.cleverfiles.com/data-recovery-software.html
   4) https://recoverit.wondershare.com https://www.autopsy.com/
   5) Comparing the difference in the recovery results based on the three different levels mentioned above.

RESULTS AND DISCUSSION
Performing logical file recovery analysis

a. With word files that are encrypted or protected with a password, the file search results either with windows search or with the agent ransack application, the file cannot be found/detected, as shown in figure 1 for windows search and figure 2 with the agent ransack application.
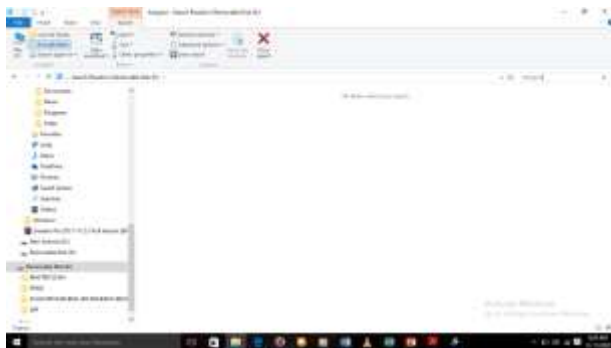
Figure 1. Search using Window search.
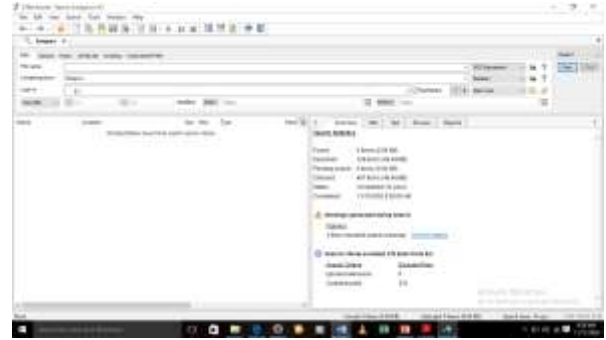
Figure 2. Search using the agent ransack application

a. Password encryption cannot be found by the "password recovery" application using the free version of the Password application, you may have to use a paid application. figure 3 shows the password cannot be detected using the free version of the Password application.

Figure 3. Password cannot be detected using the free version of the password application

b. Assuming Password can be described, file search can be continued as before, search with Windows and with Agent ransack application file can be found, as shown in Figure 4 for searching using windows search and figure 5 for searching using agent ransack application.

Figure 4. Search using windows

Figure 5. Search using the Agent ransack application

From figure 4 and figure 5, the results of the analysis are as follows: 1) Encrypted file search cannot be detected either with windows search or with transack agents, 2) In this experiment, it is said that the passware application used cannot hack password encryption in word files, maybe because it uses the free version of the application. Maybe you have to use a paid application, 3) It is assumed that the password has been described, then the search for files with the keywords contained in the word file can be done with windows search or with Agentransack, 4) Agentransack is more convenient to use because there is no need for indexing compared to windows search, so the display also displays more search results on Agentransack than on Window search.

Analyze delete/lost/low-level files recovery

Level 1: Lost files with Quick Format File Recovery with the "RecoveryMyFile" application or with "Recuva": File results can be recovered and can be opened even though the password is encrypted, as shown in the following screenshot:

Figure 6 and Figure 7 show the analysis and capture results with RecoveryMyFile.

Figure 6. The result of the recovery lost files with a quick format using the RecoveryMyFile application (a)

Figure 7.The result of the recovery lost files with a quick format using the RecoveryMyFile application (b)

Figure 8 shows the analysis and capture with Recuva.

Figure 8.The results of recovery lost files with a quick format using the Recuva application

Level 2: Lost files with Low Format: File Recovery with the "RecoveryMyFile" application which can be seen in figure 9 or with "Recuva": The result of the file cannot be recovered which can be seen in figure 10.
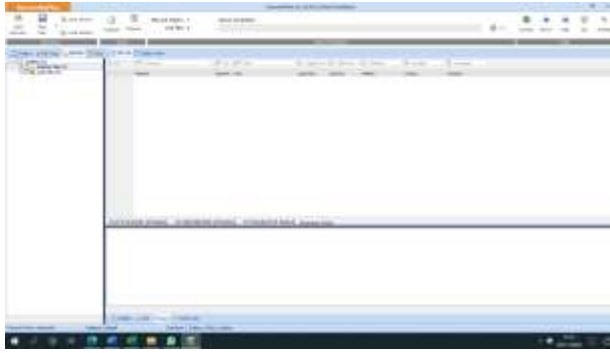
Figure 9.The result of recovering lost files with low format using the RecoveryMyFile application

Figure 10.The result of recovering lost files with low format using the RecoveryMyFile application

Level 3: Lost files by erasing using the "super eraser File Recovery" application with the "RecoveryMyFile" application which can be seen in figure 11 or with "Recuva": File results cannot be recovered which can be seen in figure 12.
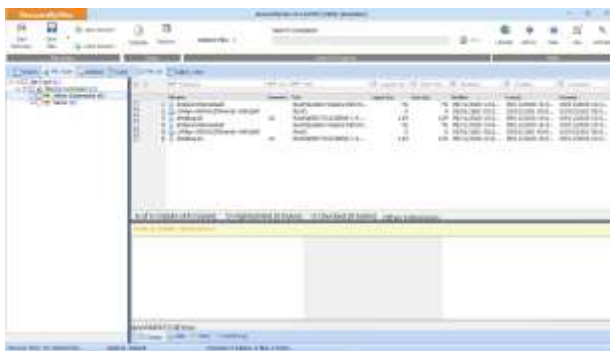
Figure 11.Super eraser File Recovery display with RecoveryMyFile Application

Figure 12.Display Results Files cannot be recovered in the Recuva application

From Figure 11 and Figure 12, the results of the analysis are as follows: 1) By using the RecoveryMyfile application, deleting files with level 1, namely Quick Format, files can be recovered and opened even though the file is encrypted, so RecoveryMyFile can simultaneously recover files and hack encryption passwords. 2) At Levels 2 and 3, the RecoveryMyFile application cannot recover deleted files.

CONCLUSION

the results of logical files recovery analysis, Files that are encrypted or protected with a password, will not be detected by searching for files either in Windows Search or with the Agent ransack application. Furthermore, Logical Files Recovery can be done through password encryption, which can be obtained through hack/attack password applications such as passware or even hacked with the "RecoveryMyFile" application. In addition, a search with a file that has a password description can be done.

One of the file recovery applications that can be used is the Agent ransack search application, which is more powerful and convenient than Windows Search, which is more complicated if you need to search faster because indexing needs to be done and needs to be restarted. Deleted files can be recovered only at level 1, namely Quick Format, while level 2 and Level 3 deleted files cannot be recovered, even with the recoveryMyfile application. It is hoped that by using File Recovery analysis, the development of the crime of deleting files or data can be overcome with increasingly rapid and advanced information technology, in this case through applications that can be used for file recovery and to restore deleted files.

REFERENCES

[1] T. E. Bracewell and C. Jones, "The use of simulated crime scenes in teaching undergraduate forensic sciences: Implementing an active learning approach to forensics," Science & Justice, 2022, doi: 10.1016/j.scijus.2022.08.003.

[2] R. Buyya, C. S. Yeo, S. Venugopal, J. Broberg, and I. Brandic, "Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility," Future Generation computer systems, vol. 25, no. 6, pp. 599-616, 2009.

[3] T. Holt and D. S. Dolliver, "Exploring digital evidence recognition among front-line law enforcement officers at fatal crash scenes," Forensic Science International: Digital Investigation, vol. 37, 2021, doi: 10.1016/j.fsidi.2021.301167.

[4] Y. Azzery, N. Dwi Mulyanto, and T. Hidayat, "Memory Forensic Development and Challenges in Identifying Digital Crime : A Review," Teknokom, vol. 5, no. 1, pp. 96-102, 2022, doi: 10.31943/teknokom.v5i1.73.

[5] F. Holz, M. F. Saulich, A. S. Schroder, C. G. Birngruber, M. A. Verhoff, and S. Plenzig, "Death abroad: Medico-legal autopsy results of repatriated corpses: A retrospective analysis of cases at the Department of Legal Medicine in Frankfurt am Main," Forensic Sci Int, vol. 310, p. 110257, May 2020, doi: 10.1016/j.forsciint.2020.110257.

[6] G. Horsman, "Digital evidence and the crime scene," Sci Justice, vol. 61, no. 6, pp. 761-770, Nov 2021, doi: 10.1016/j.scijus.2021.10.003.

[7] C. Shi, J. C. Dumville, H. Juwale, C. Moran, and R. Atkinson, "Evidence assessing the development, evaluation and implementation of digital health technologies in wound care: A rapid scoping review," J Tissue Viability, Sep 27 2022, doi: 10.1016/j.jtv.2022.09.006.

[8] G. Tutt and S. Hoffmann, "Forensics in motion - Historic vehicles, genuine or fake," Forensic Sci Int Synerg, vol. 4, p. 100218, 2022, doi: 10.1016/j.fsisyn.2022.100218.

[9] S. Park et al., "A comparative study on data protection legislations and government standards to implement Digital Forensic Readiness as mandatory requirement," Digital Investigation, vol. 24, pp. S93-S100, 2018, doi: 10.1016/j.diin.2018.01.012.

[10] A. O. Philip and R. K. Saravanaguru, "Smart contract based digital evidence management framework over blockchain for vehicle accident investigation in IoV era," Journal of King Saud University - Computer and Information Sciences, vol. 34, no. 7, pp. 4031-4046, 2022, doi: 10.1016/j.jksuci.2022.06.001.

[11] D. Seddiki, S. G. Galán, J. E. M. Expósito, M. V. Ibañez, T. Marciniak, and R. J. Pérez de Prado, "Sustainable expert virtual machine migration in dynamic clouds," Computers and Electrical Engineering, vol. 102, p. 108257, 2022/09/01/ 2022, doi: https://doi.org/10.1016/j.compeleceng.2022.108257.

[12] M. Arif, A. K. Kiani, and J. Qadir, "Machine learning based optimized live virtual machine migration over WAN links," Telecommunication Systems, vol. 64, no. 2, pp. 245-257, 2017.

[13] D. Scheffer et al., "Active mixture of serum-circulating small molecules selectively inhibits proliferation and triggers apoptosis in cancer cells via induction of ER stress," Cell Signal, vol. 65, p. 109426, Jan 2020, doi: 10.1016/j.cellsig.2019.109426.

[14] M. Aiash, G. Mapp, and O. Gemikonakli, "Secure live virtual machines migration: issues and solutions," in 2014 28th International Conference on Advanced Information Networking and Applications Workshops, 2014: IEEE, pp. 160-165.

[15] F. Xu, F. Liu, L. Liu, H. Jin, B. Li, and B. Li, "iAware: Making live migration of virtual machines interference-aware in the cloud," IEEE Transactions on Computers, vol. 63, no. 12, pp. 3012-3025, 2013.

CHARACTERISTIC TESTING OF THE GROUND CABLE USING TAN DELTA (TD) TEST METHOD ON TWO SEGMENTS OF THE MEDIUM VOLTAGE CABLE MENTENG AREA

Christiono[1], Miftahul Fikri[1], Iwa Garniwa[1], Dani Maula Sattar[1], Andi Amar Thahara[1]
[1]Department of Electrical Engineering, Institut Teknologi PLN

A R T I C L E I N F O

ABSTRACT

This research is based on the existence of underground cable problems due to rainfall in certain areas, especially the Central Jakarta area results in an increase in soil moisture that can degrade the dielectric strength of the SKTM and potentially SKTM interference. Therefore, Tan Delta testing method is carried out as a predictive step to analyze the cable health condition and an early method to determine the good/bad of the test cable. After testing tan delta, it was obtained that the acquisition of segment 1 data results were in good condition because the average value of delta tan in all three phases was 1.0, with the differential results being 0.0 and deviation standard 0.0. Action to segment 1 is periodic maintenance of 5 years. Then in segment 2, the data obtained the average value of tan delta phase R 70.6, phase S 143.9, and phase T 83.92. For differential of phase R 161.7, phase S 33.7, and phase T 135.08. Finally, deviation standard at phase R 4.57, phase S 20.14, and phase T 2.43. From IEEE 400.2-2013 standard, it can be concluded that segment 2 is in poor condition and need action as soon as possible of PD Tests and cable replacement.

Correspondece:
Christiono,
Department of Electrical Engineering,
Institut Teknologi PLN,
Email : christiono@itpln.ac.id

INTRODUCTION

Disruptions in the process of distributing electrical energy both in the scope of transmission and distribution are the most avoided things by the company, because of course it will harm the company with no energy sold or just lost. According to[1, 2], disturbances that occur, especially in medium voltage cable lines (SKTM) can be temporary such as abnormal currents and permanent disturbances that are difficult to localize the point of interference. Then, several permanent disturbances occur, some of which are caused by environmental factors ranging from water content, temperature, and high humidity in areas prone to flooding or with high rainfall so that the cable can feel environmental pressure (environmental stress). In addition, from internal cable factors such as water treeing, stress control, and aging (reduced life time) due to the long enough ground cable (SKTM) to operate [3, 4].

Testing of ground cables (SKTM) is one way to see how the condition of the cables is considering the difficulty of detecting interference points so that preventive maintenance must be carried out to prevent SKTM interference [3]. The test guidelines on ground cables based on research journals[5] refer to IEC 60502 – 2 in which one of the tests on ground cables (SKTM) is Tan Delta (TD). Tan Delta (TD) testing on cables serves to measure the magnitude of dielectric losses by looking at the extent of the delta angle shift, because the more the value of Tan Delta, the greater the dielectric losses on the cable and the faster the insulation of the cable undergoes aging [6, 7].

According to the disturbance data "Detailed Report of the Se 004 Disturbance Code Unplanned Outage of the Menteng Area Distribution Group", the disturbance that occurred in the Menteng Area in November – December 2021 where 8 out of 9 or 89% of disturbances that occurred in jointing were caused by indications of wet cables with weather conditions at the time the disturbance occurred, namely cloudy or conditions after rain and overcast, namely cloudy or cloudy or rainy. Meanwhile, 11% of it occurred in termination due to design errors in the indoor cubicle. For this problem, the title "Testing the Characteristics of Ground Cables with the Tan Delta (TD) Testing Method on Two Segments of Medium Voltage

Cable Lines at PT PLN (Persero) Menteng Area" was raised to see the characteristics of the tan delta test and how the influence of soil moisture levels can affect the value of tan delta and on the insulation of the cable.

The isolation system that experiences a failure is certain to occur due to a penetrating voltage before being influenced by factors that cause insulation failure, both internal and external factors. Breakdown voltage is a voltage that has a minimum value to damage the insulation system, so that if the cable specification has a system voltage of 20 kV – 24 kV and then gets an abnormal voltage or impulse above the system voltage, the event can result in insulation failure. The standard in the Tan Delta test on SKTM is to use IEC 60502-2 (2005-02) for cables with a rating of 1 kV with Um = 1.2 kV to 30 kV with Um = 36 kV.

The isolation failure is an event that occurs if the function of the insulator as an insulating material does not work properly, namely separating the voltage or conductor part of one from another conductor that has different potentials or separating one conductor from the ground point. Self-isolation has the function of dielectric and mechanical characteristics. The meaning of the characteristics of the dielectric is that the cable must be able to withstand the working voltage or system voltage and impulse voltage in accordance with the specification rating of the cable. As for the mechanical characteristics, an isolation system must have attraction or other mechanical functions such as being flexible in ground cables to strengthen resistance in the SKTM line [8].

The insulating material can be said to be translucent if electrons flow in the material. If the insulating material continuously flows electrons, it will cause a leakage current on the insulating surface. This will result in the electrical pressure in the insulation which for a long time the electron pressure cannot be held by the dielectric so that it changes properties to be conductive and a voltage translucent occurs [9].

Water treeing as a result of cable insulation degradation is a form of poor insulation quality due to such high soil moisture. In a cable laid underground, the external thermal resistance of soil accounts for more than 70% of the temperature rise in cable [1, 10]. This phenomenon occurs because when high rainfall causes the soil to become wet so that the water content can enter the insulating pores of the cable and is destructive so that there is the potential for SKTM interference.

One form of insulation failure in SKTM is in the form of visualization of cable insulation marked by water treeing. Water treeing is a process that can result in degradation of cables, especially in the XLPE type and cause a reduction in the life time of ground cables. There are several factors that can cause this water treeing, namely there are contaminants in liquid substances to cable insulation materials, mechanical pressure, and environmental humidity.

RESEARCH METHOD

SKTM cable testing is one way to analyze the condition / health of ground cables, especially medium voltage cable lines that have been applied to big cities. The 20 kV SKTM cable testing carried out by this company is called cable assessment as a preventive maintenance measure to prevent consequences if the cable is in poor condition and avoid SKTM interference either in terms of jointing, termination, or the SKTM line itself [8]. Cable assessment carried out on SKTM uses 2 methods, namely partial discharge and Tan Delta (TD) testing with each test using a different tool [8]. The Tan Delta test is one of the test methods on the ground cable (SKTM) to find out the condition of the cable and that way we can estimate the remaining life of the cable as well as the top priority in terms of cable replacement to maintain the reliability of the 20 kV electrical system[11].

Tool

Tan Delta testing itself uses the TDM45 tool where there are several steps of data retrieval before tan delta testing or voltage firing on the ground cable (SKTM) such as finding out how long the SKTM line segment is from substation A to the opposing substation.

Figure 1. TDM45 for TD Test

Methods

1. Bending Test

Bending Test is one of the tests carried out to determine the feasibility of a cable in terms of installation later. Testing is carried out by doing some bending on the cable body to find out whether there are cracks in the cable after testing.

Based on iec 60502-2 standard, the bending test is carried out in a place or medium in the form of a cylinder which later the cable will be rolled at room temperature conditions for 1 reel. Testing was carried out 3 times. Seetlah the test is carried out the calculation of the diameter of the cable being tested. For the bending test standards, namely:

20 (d + D) ± 5%, for core cables 1 d = diameter of the conductor of the wire, and

15 (d+D) ± 5%, for 3D core cables = external diameter of the cable.

2.   Heating Cycle Test

Heating Cycle Test or heat sikuls test is one of the test methods for conditioning the cable later when used, because when it is operated later there will be heat from the current flowing in the cable. Test the heat sikuls on the wires by spreading the wires above the floor and injecting current into the cable conductors for heating. Current induction uses a current transformer that is adjusted to the magnitude of the diameter of the cable being tested. The test was carried out for 8 hours with the first 2 hours for the heating process, the next 2 hours for the stable temperature process at a maximum temperature of 100°C and the last 4 hours for the cooling time until the initial condition. This 8-hour cycle is carried out for 20 times using a thermocorder tool[10, 12, 13].

3.   PD Test

PD Test is a test to determine the discharge or dischage that appears and disappears during the firing process of a voltage of 1.73 U0 which is 21 kV. Such voltages will be seen PDEV and PDIV in the software. The test uses an OWTS tool and uses a DAC voltage which is used to energize the cable system at a frequency of 50 Hz-1.5 kHZ. OWTS consists of 2 main units: OWTS analyzer unit and OWTS coil unit. The OWTS analyzer unit consists of HV supply and data processing &control unit. HV supply is used to energize cable systems using damped AC (DAC) voltage. The data processing & control unit is used to process the measurement data and control the entire measurement process. There are several recommendations for the results of tests carried out according to the type of cable tested, whether pilc or XLPE insulation cables[11, 14, 15].

4.   Tan Delta Test

Tan Delta testing is a test of cable characteristics in terms of their insulation resistance by looking at the value of tan delta or angular deviations that occur in the cable to be tested. If there is an increase in the value of tan delta, it will be ascertained that there is a defect or degradation of the cable insulation. Determination of the good or bad condition of a cable by conducting tan delta testing is seen in several categories for data analysis.

Insulation, which is a separator between the voltage and the non-voltage part, if there are contaminants, defects in the cable insulation, water treeing, and air humidity, then the resistance in the cable insulation will be reduced [14].
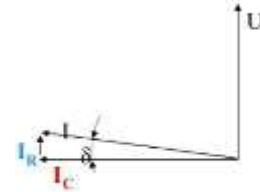

Figure 2. Phasor Diagram of Tan Delta

The tested value of angle shift or phase difference will determine how poor the insulation quality of the cable is or how large the level of contaminants in the insulation is. When measuring the IR / IC (Tangent) value, it will be seen how much the angle shift is and in terms of insulation quality. The Tangent value for the δ angle will show how good or bad a cable insulation is[14]. Under normal circumstances, a good insulation will show an angular value of δ close to zero (0). The greater the shift or deviation of the angle of the δ, it will indicate that the insulation of the cable is irrigated resistance current and means the poor quality of an insulation due to contaminants or pollutants. To determine how big the deviation of the angle or value of Tan Delta is, there are 3 criteria that will be used as an analysis of the determination of the results of the Tan Delta segment test, namely the average value of Tan Delta, the Change in The Value of Tan Delta (Differential), and the deviation of Tan Delta to Standard (Stability TD)[14].aaA

The voltage injected with 3 times and different voltage ratings will show how much the delta tan value is and its effect on the dielectric strength of the cable. If when firing the voltage is up to 3 times and there is no increase in the value of tan delta, the strength of the dielectric or cable insulation system is still good. However, if there is an increase in the value of the delta tan during the voltage injection, then there is a decrease in the insulation quality of the ground cable being tested. Tan Delta (TD) ground cable (SKTM) testing method is a test to see the angular deviations that occur in the insulation of the upper cable loss of dielectric strength because basically the cable can be likened to a capacitor that has a phase difference in voltage and current of 90° [4]. Voltage injection is carried out by regulating the value of the working voltage phase to ground (U0) which is 0.5 U0, U0, and 1.5 U0[14].
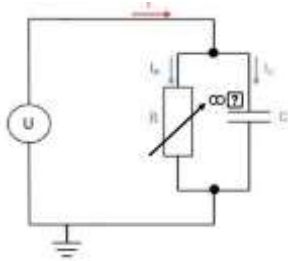
Figure 3. Wired Equivalent Circuit

This Tan Delta test uses the VLF (Very Low Frequency) method, which uses an AC signal with a frequency range of 0.01 Hz to 1 Hz. If the cable cannot withstand the firing voltage for a specified period of time with several firing times, it is certain that the cable is at an alarming level or there may be an isolation failure and even interference in a short period of time. This VLF method is used to test cables with existing insulation media as well as with a go and no-go system[14]. VLF AC testing allows the cable not to cause space charge so that it does not damage the cable itself (no repeated and frequent testing is carried out). Because the cable is likened to a capacitor that has a capacitance of several microfarads, VLF is used to test high-voltage AC cables.

As for the process of taking tan delta testing data which is carried out for data processing methods and analysis with observation methods carried out so that test data are obtained as follows.

1.   Cable Measurement

Cable measurements are carried out to determine the length of the SKTM cable segment to be tested and find out the number of jointings of each segment using the TDR (Time Domain Reflectometry) tool. The use of TDR tools is so useful, especially on ground cables that are not visible to the naked eye so that a tool is needed that can read cables planted underground without having to dig on the SKTM line. TDR is connected to sktm indoor cables in each phase and sends a signal to be read by the tool itself. The TDR tool display displays the length of the cable segment to be tested by including information such as the signal given, the operating voltage of the cable, and others. If the tool reads a significant increase in signal then in that area there is a cable jointing between the 2 segments tested. Then the beginning and end of the segment there is also a sinusoidal wave indicating that it is the termination point of the cable as shown below.

Figure 4. TDR Display

Cable measurements using TDR cannot always be done for certain types of cables, because the TDR tool itself has its range. For example, the TDR used by researchers has the disadvantage of not being able to take measurements if the distance of the cable or segment is too close (less than 20 meters). Therefore, a higher series of tools is needed to overcome these problems if encountered in the field.

2.   Data Entry

SKTM specification data starting from the name of the supplier, the length of the segment to be tested, the type of cable insulation, etc. will be entered into the software on the PC for further processing. In this data input process requires high accuracy because it must be precise in entering the specifications of the distribution substation, cubicle, and SKTM that are tested so that there are no errors when they have been tested. The process of entering data that takes place must be in harmony between the officers at the substation and in the place of data input so that the data entered is data that actually exists in the field. The data entered uses the "Start TDM" software and proceeds for the next step to choose the Near End or Far End Station for the name of the distribution substation and owner for the UP3 PLN area.

Figure 5. Start TDM Display

The picture above is a display during the process of entering the distribution substation specification data, the name of the supplier, the

UP3 area where the substation is tested, SKTM data, etc.

3. Calibration

In this calibration process, it uses a calibration tool that is used to adjust the test equipment which will later be tested on the SKTM cable for XLPE insulation. This calibration uses a 0.1 Hz signal in accordance with the specifications of the test equipment used so that the data results obtained are in accordance with the standards of the tool and regulate the capacitance used by the tool which is adjusted to the magnitude of the capacitance value by the SKTM cable. The calibration process does not take a long time, however, this process is still an important step so that the data or test results obtained are real or not far from the standard TDM45 tool.

4. Cable Testing

The last step is testing the delta tan on the SKTM cable. Testing or measurement using the TDM45 tool where it uses the VLF voltage to produce a voltage of 0.5 to 1.5 U0 so that we can know the characteristics of the delta tan value as different test voltage levels are given. This tan delta test is carried out automatically because it uses a go / no-go system, namely through the TDM Start software and will automatically be carried out voltage firing 3 times according to the test voltage level.
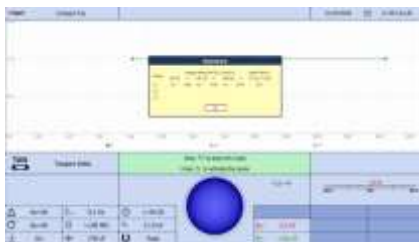

Figure 6. TD Test Result Display

The picture above is a display of the results of tests that have been carried out for each phase. After firing the voltage 3 times according to the test voltage level, results or data will be obtained as shown, namely there is a graph of the effect of the test voltage on the value of tan delta along with the average value of tan delta, standard deviation, and differential tan delta. The raw data will later be exported into a file which is then carried out data analysis to draw conclusions in the form of good or bad conditions of the SKTM cable.

The data analysis method used in this final project research is an inferential statistical analysis technique. This technique is one of the methods used to draw conclusions in the form of predictions (in the case of this study in the form of preventive

steps from periodic maintenance) by analyzing test variable data compared to the standard.

Table 1. Standard IEEE 400.2-2013

Condition Assesment	VLF-TD Time Stability (VLF-TDTS) measured by standard deviation at U_0, $[10^{-3}]$	Differential VLF-TD (VLF-DTD) (difference in mean VLF-TD) between 0.5 U_0 and 1.5 U_0, $[10^{-3}]$	Mean VLF-TD at U_0 $[10^{-3}]$
No Action Required	< 0.1	< 5	< 4
Further Study Advised	0.1 to 0.5	5 to 80	4 to 50
Action Required	> 0.5	> 80	> 50

The data that has been obtained on the test results will be adjusted to the IEEE 400.2-2013 standard and will be analyzed and conclusions drawn according to the condition of the cable being tested whether the cable is in good or bad condition so that follow-up can be carried out on the results.

RESULTS AND DISCUSSION

The Tan Delta (TD) test carried out is on XLPE-insulated cables and has 3 conductor cores (three-cores). The following are the results of cable measurements at the P90P – B29C and P90P – P88 substation barrel refinery ketapang substations according to the SLD listed in the attachment using the TDR tool according to the way the data was collected in the previous chapter to be included in the "Start TDM" software including the name of the supplier, the name of the distribution substation, the length of the cable, the number of jointing's, and the type of cable insulation.

SKTM Cable TDR Measurement Results

Cables tested on 2 SKTM segments (top-down direction substations) in 1 supplier showed that there was a difference in cable length and the number of joints. The length of a cable will determine how much the capacitance value of the cable is, the longer a cable is, the less the capacitance value will decrease along with the decrease in the resistance value of the cable for the time of the cable that has been aged. Furthermore, Tan Delta (TD) testing will be carried out for each segment and each phase.

Table 2. Cable Measurement Result

Feeder	Substation Segment	Cable Lenght	Number of Jointing	Cable Insulation
Feeder Gentong	P90P – B29C	605 m	6 (cold shrink)	XLPE
	P90P – P88	838 m	8 (cold shrink)	XLPE

Tan Delta (TD) Test Results

In the Tan Delta (TD) test conducted using the TDM45 tool to obtain some test result data which will later be adjusted to the IEEE 400.2-2013 standard according to the category in order to get the results or condition of the cable tested. As for the test results of the first segment of Tan Delta (TD), namely the P90P – B29C distribution substation, it is as follows.

Table 3. P90P – B29C Segment Test Results Phase R

Phase	L1		
Temperature & Moisture	30°C & 66% (Dry)		
Voltage	8.2 kV	16.3 kV	24.4 kV
Factor U_0	0.5	1.0	1.5
Capacitance	89.0 nF	89.0 nF	89.0 nF
Resistance	100.0 MΩ	100.0 MΩ	100.0 M Ω
Mean (10^{-3})	1.0	1.0	1.0
Deviation (10^{-3})	0.00	0.00	0.00
Tan δ (10^{-3})	1.0; 1.0; 1.0; 1.0; 1.0	1.0; 1.0; 1.0; 1.0; 1.0	1.0; 1.0; 1.0; 1.0; 1.0

The first segment data for phase R show when the voltage is raised according to the factor U0 that when 0.5U0, 1.0U0, and 1.5U0 are seen average capacitance values of 89.0 nF and an average resistance of 100.0 MΩ with a cable length of 605 meters. As for the deviation value, it looks 0.00 and the value of tan δ shows an average of 1.0 for 3 times voltage firing.

Table 4. P90P – B29C Segment Test Results Phase S

Phase	L2		
Temperature & Moisture	30°C & 66% (Dry)		
Voltage	8.2 kV	16.3 kV	24.4 kV
Factor U_0	0.5	1.0	1.5
Capacitance	89.0 nF	89.0 nF	89.0 nF
Resistance	100.0 MΩ	100.0 MΩ	100.0 M Ω
Mean (10^{-3})	1.0	1.0	1.0
Deviation (10^{-3})	0.00	0.00	0.00
Tan δ (10^{-3})	1.0; 1.0; 1.0; 1.0; 1.0	1.0; 1.0; 1.0; 1.0; 1.0	1.0; 1.0; 1.0; 1.0; 1.0

The data of the first segment for phase S showed the same results as the previous R phase, that is, when the voltage was increased according to the factor U0 that when 0.5U0, 1.0U0, and 1.5U0 it was seen that the average capacitance value was 89.0 nF and the average resistance was 100.0 MΩ with a cable length of 605 meters. As for the deviation value, it looks 0.00 and the value of tan δ shows an average of 1.0 for 3 times voltage firing.

Table 5. P90P – B29C Segment Test Results Phase T

Phase	L3		
Temperature & Moisture	30°C & 66% (Dry)		
Voltage	8.2 kV	16.3 kV	24.4 kV
Factor U_0	0.5	1.0	1.5
Capacitance	91.0 nF	91.0 nF	91.0 nF
Resistance	100.0 MΩ	100.0 MΩ	100.0 M Ω
Mean (10^{-3})	1.0	1.0	1.0
Deviation (10^{-3})	0.00	0.00	0.00
Tan δ (10^{-3})	1.0; 1.0; 1.0; 1.0; 1.0	1.0; 1.0; 1.0; 1.0; 1.0	1.0; 1.0; 1.0; 1.0; 1.0

The first segment data for phase T showed almost the same results as the previous R and S phases, that is, when the voltage was raised

according to the factor U0 that when 0.5U0, 1.0U0, and 1.5U0, the capacitance value was seen that was different from the previous data, namely an average of 91.0 nF and an average resistance of 100.0 MΩ with a cable length of 605 meters. As for the deviation value, it looks 0.00 and the value of tan δ shows an average of 1.0 for 3 times voltage firing.

Furthermore, for the Tan Delta (TD) test data in the second segment, namely the P90P – P88 distribution substation by conducting tests obtained by the data results of each phase as follows.

Table 6. P90P – P88 Segment Test Results Phase R

Phase	L1		
Temperature & Moisture	26ºC & 88% (Wet)		
Voltage	8.2 kV	16.3 kV	24.4 kV
Factor U_0	0.5	1.0	1.5
Capacitance	1.556 nF	1.556 nF	1.556 nF
Resistance	75.0 MΩ	75.0 MΩ	75.0 M Ω
Mean (10^{-3})	4.0	70.6	165.67
Deviation (10^{-3})	0.00	4.57	4.8
Tan δ (10^{-3})	4.0; 4.0; 4.0; 4.0; 4.0	67.8; 72.2; 64.6; 78.2; 70.0	160.0; 161.0; 165.1; 170.2; 172.0

The data above is the result of tan delta testing from segment 2 for phase R where it shows that the capacitance value of the cable with a segment length of 838 meters is 1,556 µF with a resistance value of 75 MΩ. Then for the value of Tan Delta has a number of differences at the time of 3 times the firing of the voltage is carried out to take its average value at the time of 1.0 U0 and the differential of tan delta between 1.5 U0 and 0.5 U0.

Table 7. P90P – P88 Segment Test Results Phase S

Phase	L2		
Temperature & Moisture	26ºC & 88% (Wet)		
Voltage	8.2 kV	16.3 kV	24.4 kV
Factor U_0	0.5	1.0	1.5
Capacitance	1.555 nF	1.555 nF	1.555 nF
Resistance	15.6 MΩ	15.6 MΩ	15.6 M Ω
Mean (10^{-3})	129.8	143.9	163.5
Deviation (10^{-3})	10.66	20.14	22.79
Tan δ (10^{-3})	146.2; 136.2; 128.8; 122.5; 115.5	173.0; 149.9; 153.9; 125.1; 117.6	200.6; 178.5; 153.5; 145.0; 140.0

In the data of the second segment of phase S shows the value of the capacitance of the cable with a segment length of 838 meters is 1,555 µF with a resistance value of 15.6 MΩ. Then for the value of Tan Delta has a number of differences at the time of 3 times the firing of the voltage is carried out to take its average value at the time of 1.0 U0 and the differential of tan delta between 1.5 U0 and 0.5 U0.

Table 8. P90P – P88 Segment Test Results Phase T

Phase	L2		
Temperature & Moisture	26ºC & 88% (Wet)		
Voltage	8.2 kV	16.3 kV	24.4 kV
Factor U_0	0.5	1.0	1.5
Capacitance	1.245 nF	1.245 nF	1.245 nF
Resistance	100 MΩ	100 MΩ	100 M Ω
Mean (10^{-3})	2.4	83.92	137.48
Deviation (10^{-3})	0.68	2.43	9.00
Tan δ (10^{-3})	1.0; 2.7; 2.7; 2.7; 2.7	82.4; 82.0; 82.2; 82.6; 88.4	120.8; 140.4; 136.0; 144.4; 145.8

The above is the test result for the second segment with phase T which shows the magnitude of the capacitance value of the cable with a segment length of 838 meters is 1,245 µF with a resistance value of 100 MΩ. Then for the value of Tan Delta has a number of differences at the time of 3 times the firing of the voltage is carried out to take its average value at the time of 1.0 U0 and the differential of tan delta between 1.5 U0 and 0.5 U0.

DATA ANALYSIS

The analysis process as a form of data processing results for testing or data collection that has been carried out on the Tan Delta (TD) test uses the IEEE 400.2-2013 standard as a reference for the process of drawing conclusions from the good or bad condition of the cable tested in the presence of 3 indications, namely the mean or average value of tan delta at the time of 1.0 U0, then the differential value of tan delta when the test conditions are 1.5 U0 and 0.5 U0, and from the magnitude of the deviation value against the standard.

This Tan Delta (TD) test uses the TDM 45 series of tools which performs voltage firing 3 times automatically with a go / no-go system for different voltage ratings in order to see how the insulation resistance characteristics of the Tan Delta factor on the cable tested or assess the dielectric strength of the XLPE isolation SKTM cable in two segments so that it can be classified according to quality / condition.

The data classification table for each of the average parameters of tan delta, differential tan delta, and standard deviation according to the IEEE 400.2-2013 standard from the test results of the SKTM cables isolated xlpe is as follows.

Table 9. TD Test Result Classification

Cable Indicator	Segment P90P – B29C			Segment P90P – P88		
	Line R	Line S	Line T	Line R	Line S	Line T
Mean TD at 1.0 U_0 (10^{-3})	1.0	1.0	1.0	70.6	143.9	83.92
Differential TD at 1.5 U_0 – 0.5 U_0 (10^{-3})	0.0	0.0	0.0	161.7	33.7	135.08
Standard Deviation at 1.0 U_0 (10^{-3})	0.0	0.0	0.0	4.57	20.14	2.43

The test result data on the parameters used above will be compared with the parameters of the IEEE 400.2-2013 standard to determine the condition of the tested cable. Based on table 3.1 of the IEEE 400.2-2013 Standard, then for the determination of the good and bad of the tested cables can be classified which will be marked with color. If the results of the field data show a good indication of the average value of tan delta,

differential tan delta, and the standard deviation value at the No Action Required level, we can mark it in green stating that there is no need for execution on the cable. Then if the cable we are testing gets the average value of tan delta, differential tan delta, and its standard deviation value at the Level of Further Study Advised, then we will give a yellow color equivalent to the condition that the cable needs to be studied further. Furthermore, when the test results we obtain show that the cable has an average value of tan delta, differential tan delta, and its standard deviation value at the Action Required level, then we give a red color which means that the condition of the cable is bad and needs to be executed next.

In the data above for the first segment, namely the distribution substation segment P90P – B29C, it shows that the cables tested for all three phases indicate Good or No Action Required because for the average value of tan delta has a value of 1.0 (below 4) and is flat for each phase. Then for the differential value of tan delta has a value of 0.0 because the current value of tan delta is 1.5 U0 and 0.5 U0 is 1.0. the last for the standard deviation value in the first segment is 0.0 because for tan delta as measured on the observation data it is 1.0 for all test results. This means that by looking at the indicators/parameters of the standards used, making the P90P – B29C segment a cable with good condition.

In the second segment data, namely P90P – P88, it shows that in phase R, it can be seen that the average value of tan delta is 70.6. Because this value is greater than 50, according to the standards used, it will be given a red color. Then for the differential value of tan delta shows 161.7 (Action Required) because it ranges from 5 to 80. Finally, the standard deviation value in phase R indicates that the phase is in an Action Required state because it ranges above 0.5, which is 4.57. then in phase S experienced a fairly high deterioration looking at the test data obtained, namely the average value of tan delta and the standard deviation was at the Action Required level of 143.9 and 20.14, while for the differential value of tan delta was at the Further Study Advised level of 33.7. The last data in the second segment of testing, namely in phase T, showed the same results as the previous R and S phases, namely at the Action Required level because the average value of the resulting delta tan was 83.92, with a differential value of tan delta of 135.08 and a measured standard deviation of 2.43.

Then in terms of the resulting graph for the influence of the voltage applied to the value of the resulting delta tan on segment 1 is as follows.
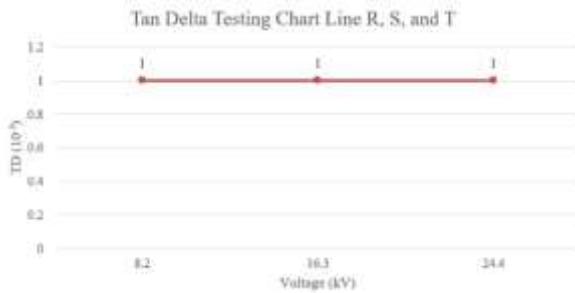
Figure 7. Tan Delta Testing Chart Segment 1

In the tan delta segment 1 test graph above, it shows that as the voltage increases given using a frequency of 0.1 Hz, the resulting delta tan value remains constant/significant. Each increase in voltage applied to the test cable, the value of the delta tan obtained for all three phases remains at 1. This means that there is no aggravation in the SKTM cable insulation system that was tested and there is no moisture judging from field conditions that have dry and not wet soil so as not to make the cable potentially disturbed in the future. The SKTM cable in segment 1 can be concluded that it is in good condition (No Action Required) because it is also resistant when given voltage at a condition of 1.5 U0.

Furthermore, the tan delta test chart to determine the condition of the dielectric strength in the SKTM cable in segment 2 for all three phases is as follows.
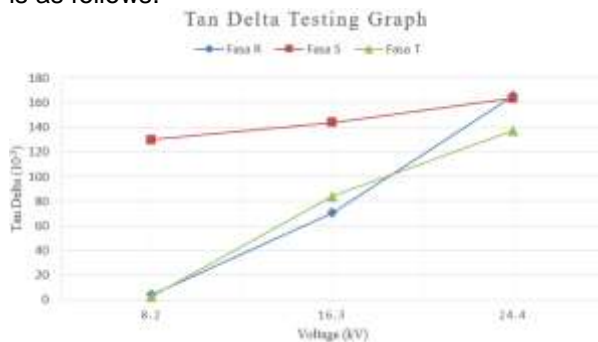

Figure 8. Tan Delta Testing Graph Segment 2

In the tan delta test graph for segment 2, almost all three phases show quite the same results, namely in the graph of the test voltage used against the measured delta tan value, which is increasing the test voltage from 0.5 U0, 1.0 U0, and up to 1.5 U0, it can be seen that there is also an increase in the value of tan delta. It can be concluded that there was a deterioration in the insulation of the cables tested because the insulation resistance on the cables decreased as seen in the increase in the value of the tan delta obtained. In addition, we can conclude that the segment 2 cable is in poor condition or Action Required.

The durability of the SKTM cable tested is seen from its dielectric strength when firing voltage with 3 different ratings. If during firing the first voltage (8.2 kV) to the third, which is 24.4 kV, there is an increase in the value of the tan delta, it can be ascertained that the dielectric strength of the cable tested is poor. Next, it will be seen how the value of the soil moisture level can affect the test results of the tan delta value. As for the table along with a graph of the relationship of soil moisture levels to the results of the tan delta test, it is as follows.

Table 10. Soil Moisture Value At The Time Of Tan Delta 2 Segment Testing

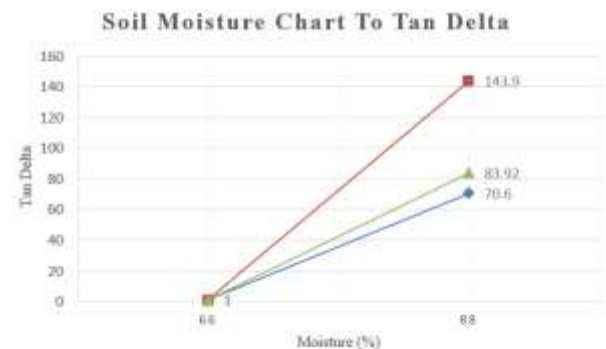| Segment	Line	Mean Tan Delta at 1.0 U_0 (10^{-3})	Soil Moistute
P90P – B29C	R	1.0	66%
	S	1.0	
	T	1.0	
P90P – P88	R	70.6	88%
	S	143.9	
	T	83.92	

Figure 9. Soil Moisture Chart To Tan Delta

From the data and graphs above, results can be obtained that the higher the soil moisture value, it will increase the cable delta tan value seen when the humidity is 66% or dry conditions, the stable delta tan value is low at number 1. However, in wet conditions with soil moisture of 88% the value of tan delta increases at 70.6 in phase R, 143.9 in phase S, and 83.92 in phase T. So it can be ascertained that if soil moisture is high, it will increase the potential for an increase in the value of tan delta in the cable which will reduce the quality of insulation of the cable.

The results of the delta tan test carried out will get treatment recommendations or follow-up in accordance with the condition of the cable where repeated maintenance will be carried out within 5 years for cables with No Action Required conditions and maintenance in the form of PD Tests and cable replacement if action required conditions on the cables are indicated after tan delta testing. Therefore, this tan delta test is a predictive maintenance to determine the condition of the cable whether it needs further maintenance or not.

CONCLUSION

Based on research that has been carried out by analyzing data from Tan Delta (TD) testing in 2 segments that have been previously presented, it can be concluded that:

The delta tan test method is carried out as an early method of determining the condition of the SKTM cable and as a reference to carry out further maintenance such as PD tests and detection, because if it only directly leads to a PD test without tan delta testing, it will not be known whether the cable was initially in poor condition or good the insulation system and also would not be as accurate as determining the location of the cable. As well as for which segment indicators will be the recommendations for conducting PD tests as well as cable replacement, because if the PD is high without being noticed by the delta tan, it cannot be fully trusted or valid data. Therefore, tan delta testing is carried out first as an early predictive method of determining the condition of the cable. The characteristics of the delta tan value in segment 1 which has a good result (No Action Required) are that it has an average tan deltaketiga phase which is 1.0, a standard deviation of 0.0, and a differential tan delta of 0.0. Then for bad results with the recommendation of Action Required has the characteristics of the average value of tan delta in phase R of 70.6, phase S 143.9, and phase T of 83.92. Differential values of phase R 161.7, phase S 33.7, and phase T 135.08. Finally, the standard deviation values at phase R 4.57, phase S 20.14, and phase T 2.43. Thus, the data from segment 2 show that under adverse conditions according to the category in the IEEE 400.2-2013 standard.

Soil moisture data of 66% (dry condition) shows a delta tan value of 1.0. As for soil moisture, 88% (wet conditions) shows that the tan delta values in the R, S, and T phases are 70.6, 143.9, and 83.92 respectively. Thus, the higher the level of soil moisture in the SKTM line, it will increase the potential value of tan delta and water treeing so that it will reduce the dielectric strength or insulation quality of the cable itself. The follow-up that must be done according to the recommendation table from IEEE 400.2-2013, namely for cables with No Action Required results is to retest within 5 years. Meanwhile, the test results of segment 2 with action required conditions are to carry out follow-ups in the form of PD tests and cable replacement.

REFERENCES

[1] A. Hadi and M. Susantok, "RANCANG BANGUN LOKALISIR GANGGUAN SALURAN KABEL TEGANGAN MENENGAH (SKTM) BERBASIS SMS," *ABEC Indonesia,* vol. 9, pp. 702-709, 2021.

[2] S. Park *et al.*, "A comparative study on data protection legislations and government standards to implement Digital Forensic Readiness as mandatory requirement," *Digital Investigation,* vol. 24, pp. S93-S100, 2018, doi: 10.1016/j.diin.2018.01.012.

[3] B. Liu, X. Zeng, and K. Yu, "A novel method for accurate ground parameter estimation in MV networks," *International Journal of Electrical Power & Energy Systems,* vol. 125, p. 106341, 2021.

[4] S. Ghanbari, M. K. Hafizi, M. Bano, A. Ebrahraimi, and N. Hosseinzadeh, "An enhanced GPR-based data processing approach for detecting subsurface utilities in urban distribution networks," *Journal of Applied Geophysics,* p. 104831, 2022.

[5] I. Nurhadi and M. Djaohar, "Analisis Partial Discharge Pada Saluran Kabel Tegangan Menengah 20 kV (Studi Assesmen SKTM di PT. PLN (Persero) UP3 Menteng)," *Journal of Electrical Vocational Education and Technology,* vol. 5, no. 1, pp. 32-39, 2020.

[6] A. Syakur, G. Susilowati, A. Satyagraha, and A. P. Siregar, "PENGUJIAN TAN δ PADA KABEL TEGANGAN MENENGAH," *Transmisi: Jurnal Ilmiah Teknik Elektro,* vol. 11, no. 2, pp. 107-112, 2009.

[7] C. Shi, J. C. Dumville, H. Juwale, C. Moran, and R. Atkinson, "Evidence assessing the development, evaluation and implementation of digital health technologies in wound care: A rapid scoping review," *J Tissue Viability,* Sep 27 2022, doi: 10.1016/j.jtv.2022.09.006.

[8] A. N. Jahromi, P. Pattabi, J. Densley, and L. Lamarre, "Medium voltage XLPE cable condition assessment using frequency domain spectroscopy," *IEEE Electrical Insulation Magazine,* vol. 36, no. 5, pp. 9-18, 2020.

[9] K. Gillani and J.-H. Lee, "Comparison of Linux virtual machines and containers for a service migration in 5G multi-access edge

computing," *ICT Express,* vol. 6, no. 1, pp. 1-2, 2020, doi: 10.1016/j.icte.2018.12.001.

[10] C. Sun, W. Liu, and T. Ma, "The temperature and mechanical damage investigation of shale with various dielectric properties under microwave irradiation," *Journal of Natural Gas Science and Engineering,* vol. 90, p. 103919, 2021.

[11] N. Tichelkamp *et al.*, "COMPARISON OF ON-SITE PARTIAL DISCHARGE MEASUREMENTS USING VLF-, DAC-AND SLOPE-VOLTAGE FORMS AND DISSIPATION FACTOR MEASUREMENTS ON SERVICE-AGED MEDIUM VOLTAGE CABLES," 2021.

[12] A. Jamali-Abnavi, H. Hashemi-Dezaki, A. Ahmadi, E. Mahdavimanesh, and M.-J. Tavakoli, "Harmonic-based thermal analysis of electric arc furnace's power cables considering even current harmonics, forced convection, operational scheduling, and environmental conditions," *International Journal of Thermal Sciences,* vol. 170, p. 107135, 2021.

[13] J. Zheng and A. S. Namin, "A survey on the moving target defense strategies: An architectural perspective," *Journal of Computer Science and Technology,* vol. 34, no. 1, pp. 207-233, 2019.

[14] Y. Liu and X. Cao, "Insulation performance evaluation of HV AC/DC XLPE cables by 0.1 Hz tan δ test on circumferentially peeled samples," *IEEE Transactions on Dielectrics and Electrical Insulation,* vol. 24, no. 6, pp. 3941-3950, 2017.

[15] F. H. Rahman, S. H. S. Newaz, T.-W. Au, W. S. Suhaili, M. A. P. Mahmud, and G. M. Lee, "EnTruVe: ENergy and TRUst-aware Virtual Machine allocation in VEhicle fog computing for catering applications in 5G," *Future Generation Computer Systems,* vol. 126, pp. 196-210, 2022, doi: 10.1016/j.future.2021.07.036.

ABOUT THIS JOURNAL

TEKNOKOM : Jurnal Teknologi dan Rekayasa Sistem Komputer with frequency 2 (two) times a year, ie in March and September. The editors receive scientific writings from lecturers, teachers and educational observers about the results of research, scientific studies and analysis and problem solving closely related to the field of ICT and System Computer.

Topics of interest include, but are not limited to:

1. Computer Organization & Architecture
2. Computer Networks & Wireless Communication
3. Embedded System
4. Mobile Computing
5. Internet of Thing (IoT) Technology
6. Cloud Computing
7. Smart System
8. Information Technology (IT) Automation
9. Network Security
10. Cryptography
11. Computer Security
12. Routing-Switching System & Technology
13. Parallel and Distributed System
14. Robotic Intelligence
15. Biometrical Application
16. Digital Image Processing
17. Machine Learning
18. Data science
19. Data Mining
20. Big Data
21. Marketing Management Information System
22. Strategic Management of Information System
23. Project & Change Management of Information System
24. Business Process & Organization of Information System
25. IS Security & Risk Management of Information System
26. Business Intelligence System

Paper Submission

The authors should submit only papers that have been carefully proofread and polished. Manuscripts are accepted with the understanding that they are original or extended versions of previously published papers in conferences and/or journals and that, if the work received an official sponsorship, it has been duly released for open publication. Before submission please make sure that your paper is prepared using the journal paper template.

The authors must refer to TEKNOKOM format and style based Author Guidelines Template. The authors should send a Cover Letter as a Supplement File in the submission step as well. This will ensure fast processing and publication.

The journal writing format, explained as follows:

The title of the manuscript should be no more than 12 words, accurately describe the content.
Authors (and co-authors) names are written below the title of the manuscript, without including their titles or degrees.

Authors' affiliations are written below the names; email of the corresponding author is written below the affiliations.
The abstract consists of 150-200 words written in a single paragraph. It should be clear, informative, descriptive, and provide a clear statement of the problem, the proposed approach or solution, and point out major findings and conclusions.
Keywords consist of words or phrases which are important, specific, or representative to the article.
The introduction should provide a clear background, a clear statement of the problem, the relevant literature on the subject, the proposed approach or solution, the new value of research, and end with the purpose of the study.
The method includes research chronological, including research design, research procedures, instruments, and analysis techniques used in solving problems.
Results and Discussion should be an objective description of the results and should be in relation to the purposes of research.
References should at least consist of 15 most pertinent and up-to-date sources. 80% of the references must be from reputable international journals published in less than 5 years.