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FOREWORD

Greetings!

Ultima InfoSys : Jurnal Ilmu Sistem Informasi is a Journal of Information Systems which presents scientific research articles in the field of Information Systems, as well as the latest theoretical and practical issues, including database systems, management information systems, system analysis and development, system project management information, programming, mobile information system, and other topics related to Information Systems. ULTIMA InfoSys Journal is published regularly twice a year (June and December) by Faculty of Engineering and Informatics in cooperation with UMN Press.

In this December 2023 edition, ULTIMA InfoSys enters the 2nd Edition of Volume 14. In this edition there are five scientific papers from researchers, academics and practitioners in the fields covered by Ultima Infosys. Some of the topics raised in this journal are: The Development of Web-based Sales and Inventory System for a Stationary Store; Information Technology Governance Capability at PT XYZ using COBIT 2019; Sentiment Analysis of User Satisfaction Towards Sales Promotion of Gojek Application Service Using SVM; From Tradition to Innovation: Mind Map Generation in Higher Education; Image Splicing Forgery Detection using Error Level Analysis and CNN; and Developing a Web-based Information System Information System to Enhance Operations in Hajj and Umrah Travel (Case Study: PT. Mutiara Cinta Imani).

On this occasion we would also like to invite the participation of our dear readers, researchers, academics, and practitioners, in the field of Engineering and Informatics, to submit quality scientific papers to: International Journal of New Media Technology (IJNMT), Ultimatics : Jurnal Teknik Informatics, Ultima Infosys: Journal of Information Systems and Ultima Computing: Journal of Computer Systems. Information regarding writing guidelines and templates, as well as other related information can be obtained through the email address ultimainfosys@umn.ac.id and the web page of our Journal here.

Finally, we would like to thank all contributors to this December 2023 Edition of Ultima Infosys. We hope that scientific articles from research in this journal can be useful and contribute to the development of research and science in Indonesia.

December 2023,

Wella, S.Kom., M.MSI.
Editor-in-Chief

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The Development of Web-based Sales and Inventory System for a Stationary Store

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Abstract*—The study-case method was applied in this research at a stationery store. The problems derive from an observation of a stationary store called Andesta, a micro, small, and medium-sized enterprise (MSMEs) run by individuals who engage in stationery and document procurement. The problem is that transactions are not properly recorded, preventing the store from knowing the profits and losses incurred during a certain period. As a result, the availability of stocks coming in and out is unclear. This issue will be resolved by developing an integrated sales and inventory system. The prototype method is implemented in the system development lifecycle. The system will be constructed as soon as the design is completed and accepted by the business owner. The CodeIgniter framework and MySQL databases were used to build the system. The construction of the sales and inventory system is supposed to support stores in running their business processes more efficiently.

***Index Terms*—integrated system; prototyping method; sales and inventory system; stationary store.**

I. INTRODUCTION

Many companies already implement Information Technology (IT) to support business processes. IT is a technological device that facilitates the arrangement of tasks related to data processing, information and communication to increase effectiveness and efficiency in a job [1]. Business processes are a series of activities that are linked together to solve a specific problem [2]. IT may assist the business process in an organization, which is known as Enterprise Resource Planning (ERP) on a big scale organization. ERP offer an integrated system to the company, so that the recording can be done effectively and efficiently [3]. Successful implementation requires effective implementation, environmental analysis and strategies so as to produce high performance according to the needs of the company [4]. The business process addressed in this research is part of the ERP system, specifically the sales and inventory modules, and the case study used is a MSME (Macro, Small, Medium Enterprise). MSMEs are relatively small businesses. The characteristics of MSMEs are the actual conditions contained in the company's activities, as well as the behavior of entrepreneurs who are interested in running their business [5].

The case study of this research is taken from a problem that occurred in an MSME's store called Andesta that was owned by individuals. Andesta sells a variety of stationery, computer supplies, musical instruments, and sports equipment. Andesta handles an average of 30-40 transactions per day. The process of recording and storing data of products and transactions in this store is still paper-based utilizing books and notes thus errors in writing the quantity of products or the nominal price are common. Furthermore, the sales transaction activity is also less optimal because it cannot automatically calculate the amount of sales.

Based on the existing problem, the goal of this research is to develop an integrated sales and inventory system capable of recording and storing products and transactions data, making the generation of sales reports and inventories much easier. As a result of previous research by Arnold et al. [6] and Hasanudin M. [7] that the proposed system is capable of storing all the transaction data but lacks a function to notify users of stock availability. During this research, the proposed system would include a function that notifies users of stock availability.

II. THEORETICAL BASIS

A. Literature Review

Recording is the process of recording an inventory to find out existing inventory data so that the business becomes more efficient [8]. Inventory is an asset or stock owned by a company or other business to generate the highest profit in supporting its business processes [9]. Sufficient supplies with the availability of time, quality, and the right location, have benefits, namely:

1. Minimize the risk of delay or goods exhausted from the distributor.
2. Minimize defects of new goods from distributors.
3. Minimize the risk of lost goods.

Sales is the process by which the seller meets all the needs of the buyer and hopes to provide sustainable and profitable income for both sellers and buyers [10]. Generally, purchase is interpreted as an attempt to obtain goods or services for personal purposes, in the process of manufacture or for resale [11].

Prototyping is a technique for building functions quickly but incomplete information system models using application developer tools. The construction of a system is focused on the customization carried out by the application developer tools. The prototype technology used in the study aims to give researchers an idea of the applications created during the application prototype development stage and initially evaluated by users [12].

UML (Unified Modelling Language) is part of the business process model for available organizations. UML is the design of a system of a diagram that is seen from how the system works, how the system interacts with the user, and there are features available on the system [13]. Use Case Diagram is modeling intended for the information system to be created. Use Case works to describe the type of interaction between the user in the system and his own system, by the system. Activity diagrams are used to model characters in business processes without relying on objects. Activity diagrams are used to model behavior in business processes that are independent of objects. In many ways, activity diagrams can be seen as sophisticated data flow diagrams used in conjunction with structured analysis. A class diagram is a static model that shows multiple classes and relationships between each class that have not changed in the system. Class diagrams represent classes consisting of behavior and circumstances, along with relationships between classes.

B. Previous Research

This research is based on previous studies regarding the development of a sales and inventory system. Table 1 lists three previous research that were used as references.

TABLE I. PREVIOUS RESEARCH

No.	Journal Article	Results
1	Sistem Informasi Penunjang Proses Pemesanan dan Desain Kue pada Toko Kue Artisan Online Berbasis Web Author: Wibowo, A.A., Widjaja, A.E, Wibowo, Tania Jovita, Suryasari Ultima Infosys, vol. x, no. 1, 2019	The building of a web-based system to support the ordering and design process in an online craft cake store. The use of this system helps to create order processes effectively and efficiently. The advantage of this system is that it can help the buyer to express his picture of the cake that wants to be customized using a sketch tool that is 3 dimensions that are present on the system to look more real [6].
2	Rancang Bangun Sistem Informasi Inventory Barang Berbasis Web (Studi Kasus: PT. Nusantara Sejahtera Raya) Author: Hasanudin, M. Jurnal IKRA-ITH Informatika Vol. 2, No. 3, 2018	A system builds to facilitate the recording of products [7].
3	Designing Mobile Application Interaction for School Internal Communication Using User-centered Design Author: Parahita, A.D., Lestari, D.P., Niwanputri, G.S. IJNMT, Vol. VII, No. 1, 2020	For future work and development, prototypes can be implemented as software and teacher-side applications for school internal communication should be designed and implemented too. A user-centred approach proved good to make a good application and should be used for future developments [14].

Based on the three previous research used as references in the development of the proposed system, the first and the third journal article [6][14] were used as references for the design of the system utilizing the prototype approach. The second journal article [7] was used as a reference to assist the data record process.

III. RESEARCH METHODOLOGY

A. Research Object

The objects in this study were shown for MSMEs Andesta store. Andesta store is a small business conducted by individuals but not a branch of a company owned by medium-sized businesses or large businesses. This store sells a variety of office stationery, computers, musical instruments to sports equipment. Not only that, Andesta store also sells services such as document printing, document doubling, and file volumes.

B. Data Collection

Data collection techniques are done by conducting interviews. The use of this interview technique was chosen to collect data directly from business owners. Interviews are useful to discuss in detail about the problems in the store. The creation of this system

certainly adjusts the circumstances, needs and criteria of the business owner.

C. *System Methodology*

The method used for developing the system is prototyping. One advantage of the prototyping process is that it allows the end user to quickly gain an understanding of the system [15].

1. Analysis Stage

   Based on the results of interviews with the owner of the Andesta store, a web-based sales information system will be created to assist in the recording and storage process.

2. Design Stage

   Based on the results of the interview conducted, a prototype of the system will be designed. A design that makes it easier for store owners to have an idea of the system to be created. Once the prototyping design is complete, the store owner will provide feedback in the form of input and suggestions and system design revisions.

3. Implementation Stage

   If the prototyping designed has been approved then the next step is to implement the coding in accordance with existing needs. Tools that will be used in the creation of the system, namely CodeIgniter as a framework in the creation of the system, MySQL as a database used.

4. Testing Stage

   Once the system is complete, the system will be tested by the users. The purpose of testing this system is to find out whether the parts are not appropriate or there are still errors in the system.

5. Evaluation Stage

   If there is an error or discrepancy in the system, a repair will be made immediately.

6. System Usage Stage

   The last stage, the system is ready to be used because it is in accordance with the needs of the business owner.

IV. ANALYSIS AND RESEARCH RESULT

Regarding the problems that have been obtained from the results of the interview, it was agreed that a system should be created in accordance with the existing needs. Table 2 details the requirements and the actor involved.

TABLE II. TABLE REQUIREMENT

No	Requirement	Actor	Use Case
1	Users can enter the categories of items available in the store.	Superadmin, and admin	Category of Product
2	Users can add new entered items to store inventory and can check stock availability.	Superadmin, and admin	Product Data
3	Users record in the sale of products	Superadmin, admin and cashier	Sales Transaction
4	Assist users in obtaining detailed and accurate information about the results of availability of products, sales of products at the end of the month and year, and sales profits every month.	Superadmin, and admin	Recap List
5	Admins can create access for new users.	Superadmin	Manage User
6	Admins can monitor store developments regarding stock and sale of products based on their period.	Superadmin, and admin	Graphs
7	As a reminder to users when the inventory of goods has reached a minimum value.	Superadmin, and admin	Item Notifications

A. *Use Case Diagram of the Proposed System*

The system modeling is done by creating the use case diagram and the activity diagram. Fig 1 below shows the use case diagram of the proposed system.

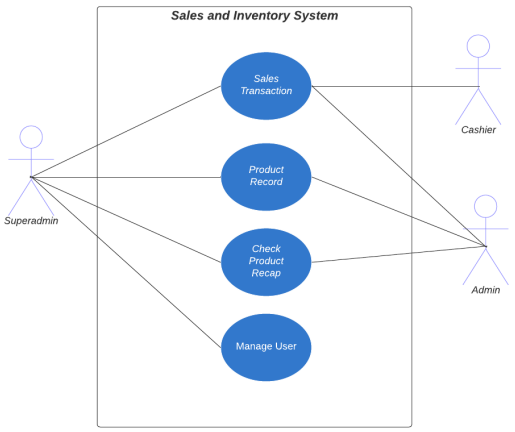

Fig. 1. Use Case Diagram of Sales and Inventory System

There are 3 actors, namely Superadmin, Admin and Cashier. There are 4 use cases in the diagram namely sales transactions, product record, check product recap, and manage user.

B. Activity Diagram of the System

There are several activity diagrams created on the modeling systems. Fig 2 describes the activity diagram of the sales transaction business processes. Sales transactions will be recorded and stored in the system. The stock of products will be automatically reduced in the system and every item out will be recorded in the report. If the stock reaches its minimum value, the system will give a notification.

The process business of sales transactions begins with the user choosing the transaction menu, then the user may input the product code. Once the entire product to be purchased is entered into the transaction process then the system will print the invoice.

Fig 3 shows an activity diagram of the recap product. All transaction activities that have been carried out for several periods and stock inventory of goods, there will be recap results.

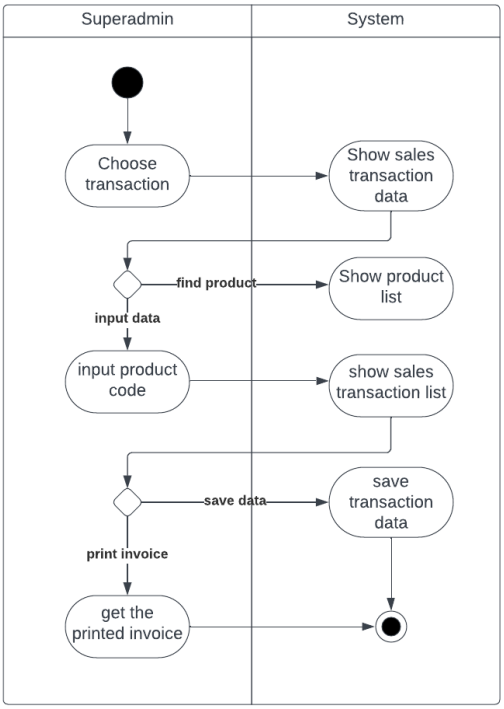

Fig. 2. Activity Diagram of Sales Transaction

The business process of checking products recap starts with the user choosing recap period by date, by month or by year.

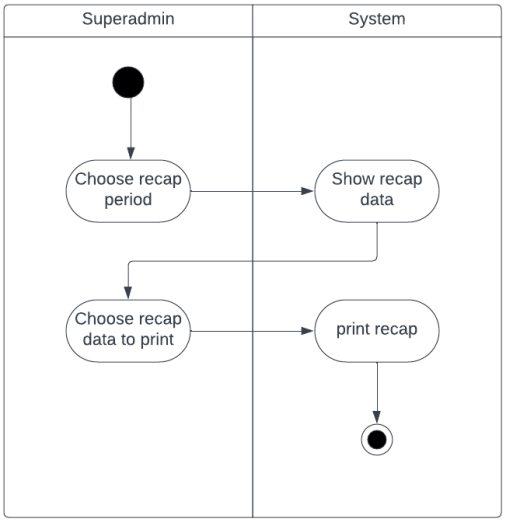

Fig. 3. Activity Diagram of Check Product Recap

Fig 4 is an activity diagram of product record. Users can do the record of products by inputting new data or editing and adding stock of products.

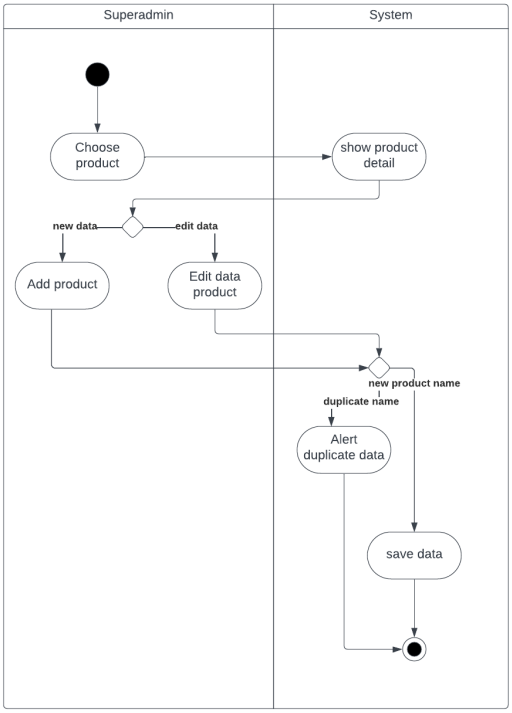

Fig. 4. Activity Diagram of Product Record

Fig 5 is an activity diagram of manage user. This diagram is to add new users such as admins and cashiers, it can only be done by Superadmin. Superadmin can also edit and set user account status

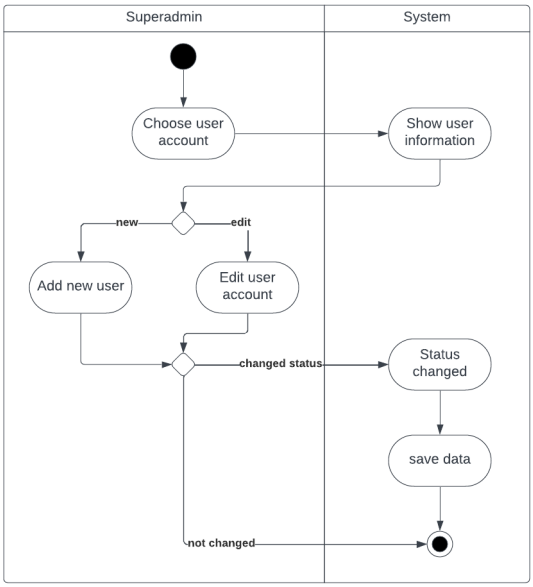

Fig. 5 Activity Diagram of Manage User

C. User Interface of the System

There are 3 views as the result prototyping that has been designed for sales and inventory system of Andesta store. The proposed system used Bahasa Indonesia. Fig 6 is the user interfaces of transaction.

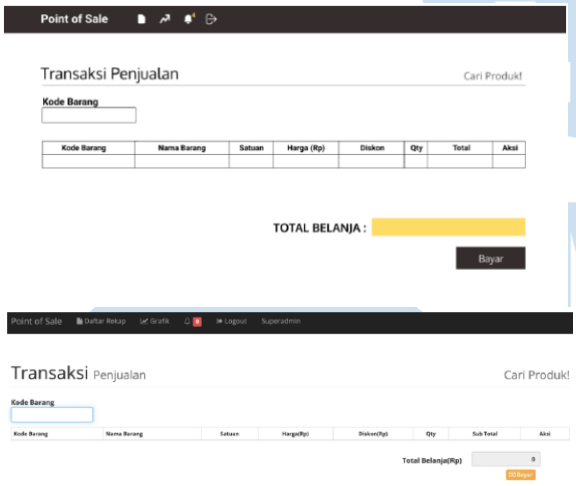

Fig. 6 User Interface of Transaction

Fig 7 below is the user interface of product. After the interface design is completed, the system prototype is tested to determine if there are still errors or bugs.

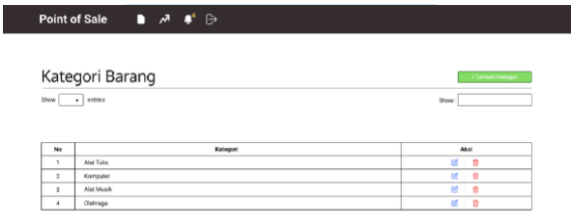

Fig. 7 User Interface of Product

D. User Acceptance Test (UAT)

Based on the system that has been created, there will be testing of the system. System testing based on User Acceptance Test (UAT) with black-box method. The system test involved 3 user access as superadmin, admin, and cashier.

The scenario for testing included feature of transaction, product category, product, product recap, user account, and sales report graphics. Table 3 shows the summary of UAT Scenario Testing.

TABLE III. UAT SCENARIO TESTING

No	Scenario Testing	Functions	Results
1	Transaction	Search, Input product, payment, save transaction	OK
2	Product Category	Add, Edit, Delete	OK
3	Product	Add, Edit	OK
4	Product Recap	Recap, Sales recap per date, Sales recap per month, Sales recap per year, recap of profit	OK
5	User Account	Add, Edit, change status, Delete user	OK
6	Sales Report Graphics	Sales graphics, sales per date, sales per month, sales per year,	OK

From the testing results can be concluded that all the functions already runs well and ready to be implemented.

V. CONCLUSION

This research is accomplished by developing several solutions in accordance with the determined objective of the research. According to user requirements, a web-based system for recording sales and inventories has been successfully developed. There are notifications on the inventory feature that might provide information about the minimal stock availability. The system can also generate sales reports and inventories based on the desired period.

There are various potential developments for the proposed system. Adding a function for recording

supplier information and shipping transactions is one option.

ACKNOWLEDGMENT

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Information Technology Governance Capability at PT XYZ using COBIT 2019

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***Abstract*— This paper introduces PT XYZ, a management consultancy company located in Jakarta. The company offers a diverse range of information technology products. Hence, an assessment was conducted to evaluate the effectiveness of information technology governance at PT XYZ. The assessment of information technology governance competency is predicated around the challenges frequently encountered by organisations, namely in the domains of project management, IT budget allocation, and the availability of proficient human resources in the field of information technology. The assessment of capability is conducted utilising the COBIT 2019 framework, employing a qualitative methodology. The utilisation of data collection techniques involving interviews and literature review is being employed. The findings from the data collection revealed that three COBIT 2019 domain processes, specifically APO06 - Managed Budget and Costs, APO07 - Managed Human Resources, and BAI11 - Managed Projects, aligned with the issues faced by the organisation. The findings of the capability assessment indicated that the three chosen domain processes, specifically APO06, APO07, and BAI11, were successfully accomplished at level 2, signifying a full achievement. Consequently, the companies received several recommendations for enhancing their information technology governance and attaining a higher level of quality.**

***Index Terms*—Information Technology, IT Governance Capability, COBIT 2019, Recommendations**

I. INTRODUCTION

Seeing the changes in this era, the rapid development of existing technology, besides relying only on it, society is also required to develop in a way that makes changes in all aspects of daily activities. That is no exception in organizations. An organization must be able to adapt with this rapidly developing information technology, it can be measured by the success of the organization in utilizing information technology as a tool to support the operational activities of the organization [1]. to support the company's goals to deal with rapid technological advances, companies must be able to utilize the use of information technology effectively and efficiently [2]. Reality the importance of information for an organization can be seen from the amount use of information systems in organizations as tools company operational support. Therefore, one of the supporters running the company's operations is IT governance.

Currently IT or information technology has a significant role in terms operation of an organization due to shifts of roles and relevance information technology in organizations that require more understanding clearly related to information technology governance [3]. As for the cause of ineffectiveness information technology governance in the organization is the occurrence of business losses such as unexpected costs, the quality of the use of information technology, to failure of information technology in providing value to organizations [4]. Therefore, organizations need to conduct remedial audits for technology governance information. Audit itself is an activity to collect data and evaluate data related information to establish and report levels conformity between existing information data with existing audit criteria its provisions [5]. Information technology governance audit essentially is a form of operational auditing, but nowadays information technology auditing is better known as a separate type of audit unit that has a purpose for improving information technology governance [6]. In its implementation, this information technology governance audit can be carried out using existing frameworks. There are many types of frameworks work that can be used to help humans conduct governance audits information technology, one of which is the COBIT framework.

COBIT stands for Control Objectives for Information and Related Technology developed by ISACA (Information Systems Audit and Control Association), which is an international professional membership association for individual interested in or working in the areas of IT audit, IT risk, and IT governance [7], [8]. The latest COBIT framework update, namely COBIT 2019, is intended to facilitate a flexible framework and its design and implementation adjusted [9]. COBIT 2019 itself has 11 design factors

and quite a lot processes, namely there are 40 processes. The many processes make COBIT 2019 to be more flexible than other versions.

Use of COBIT 2019 analysis in information technology governance has the objective of assisting organizational governance, information technology management, to risk optimization [10]. In its application, technology governance information can be put on COBIT 2019 framework which will have effect in supporting or supporting the goals of an organization. Later, the result of this information technology governance audit is in the form of recommendations of IcoreI models or processes with different priority levels and capability levels must be applied or implemented [11]. Various fields of the company can use this COBIT 2019 framework. One company that can conduct an audit with the 2019 COBIT framework on IT governance is a management consulting company located in Jakarta.

The management consulting company has been established since 2015. Until now, the company has not only provided consulting services management and information technology, but also produce products applications that heavily involve their information technology governance team. The number of products they produce cannot be separated from frequent problems times encountered such a fickle resource that causes impact on the execution of targeted projects. Problems that often occur in the company, namely the first problem faced by the company related to the budget of each project to be carried out. Sometimes teams the project developer experiences a lack of budget in the process. Second, sources Human resources owned by the company often change so that workmanship a project gets a little bogged down. Finally, regarding resources people who continue to be replaced cause an influence also on handling project because a project is not done completely on resources previous human resources and must be continued with existing human resources new. Because of these problems, can be done measuring IT governance using the 2019 COBIT framework as an evaluation company.

COBIT 2019 itself has as many as 40 processes that cover a lot of aspects of a company. In the audit conducted will be used processes that have compatibility with existing problems through stages factor design until 3 process domains are found that have compatibility with problems faced by the company. These 3 processes consist of APO06 – Managed Budget and Costs, APO07 – Managed Human Resources, BAI11 – Managed Projects

Limitations of the problems that exist in this study are measurement of information technology governance in a company management consulting using the COBIT 2019 framework and the 2019 COBIT process used in this study is APO06 – Managed Budget and Costs, APO07 – Managed Human Resources, BAI11 – Managed Projects.

II. THEORY

A. Information System

Governance is a series of relationships with processes to direct and control an organization to achieve a desired goal, Information Technology is a process where monitoring and controlling capability decisions are carried out information technology (IT) in determining a value delivery (deliver value) to key stakeholders in an organization or company [12]. In the information technology governance process, there are several data management which is an important asset for a company or organization. Technology governance Information carried out a company affects quality services on the information technology. If information technology services in a company that does not have good management, then it can impact and create problems such as operational costs that are too high so that they are not in accordance with the budget, use of assets that are less than optimal, decision making that is not appropriate, uncontrolled service, and problems others that can be detrimental to a company or organization.

Implementation of information technology governance can make the company becomes superior to the resources it has so, the company can take advantage of opportunities, product innovation, information, and have competitive advantage in the business environment. One factor that can be a sign of the progress of a company is the implementation of governance manage information technology well because it increases the value of the stakeholders' interests and produces quality performance [9]. Assessing quality information technology governance can use a variety of frameworks designed to design information technology governance and assess its maturity [13]. Each framework has a different development focus.

B. Information System Audit

Information system audit is a step-by-step process of collecting and evaluating data that becomes evidence of performance of an organization. Achievement of organizational goals is assessed from the extent organizational systems can perform data integrity and push on achieving organizational goals effectively and using resources efficiently [13]. To measure and evaluate a system information that has been designed and implemented effectively, efficient, economical, has an asset security mechanism, and establishes data integrity requires an information system audit that can measure and evaluate the degree of equivalence between business procedures and requirements users [14].

According to Gallegos, the stages and audit procedures stages are [15]. The first stage is planning which includes the main activities, namely setting the objectives and scope of the audit, understand the client's business processes, organize audit groups, review the results of previous audit findings, and prepare an audit program. This early stage involves a lot of communication with people who are concerned with the object to be audited and carry out the process analysis of the objectives, vision, mission, policies, and objectives of the audit object.

The second stage is the fieldwork or field inspection stage. In this stage, field inspection is very helpful for the auditors to carry out the analysis because at this stage the auditor works to collect information from related parties by using methods such as interviews, observation to conduct a survey to the audit object.

The third stage is reporting. At this stage the auditor will analyze and conclude the results obtained. Auditors usually provide an evaluation in the form of recommendations for improvement to the management. The stage of reporting or writing the results of these findings will clearly state the findings and their impact.

The fourth stage is follow-up. At this stage is the final stage, namely providing audit results that have been summed up and analyzed. The form of the results given is in the form recommendations for improvement from the findings found in the audit process and determining whether the audit results are reference only or directly implemented by the organization.

C. COBIT

Control Objective for Information and Related Technology or COBIT for the first time published in 1996 namely COBIT 1.0 which focus only on auditing. In 1998 COBIT published reverted to COBIT 2.0 which contains the audit and evaluation fields on the control stage, then 2 years later in 2000 COBIT to be precise re-published a new version, namely COBIT 3.0 which has orientation towards management. 5 years later in December to be exact In 2005, COBIT re-published a new version, namely COBIT 4.0 which followed by an update in May 2007, namely COBIT 4.1. Both versions are oriented towards information technology governance. Long after that, precisely in June 2012, COBIT made updates again by issuing COBIT 5.0 which is oriented towards technology governance company information [16], [17]. Finally, COBIT made a major update from previous versions in 2018, namely COBIT 2019 which published effective and efficient ways to carry out the process performance monitoring to process oriented implementation on information technology governance and technology management information. Contains how to optimize the repairs that can be done organization [18]

D. COBIT 2019

COBIT 2019 or Control Objectives for Information and Related Technologies 2019 has been published by ISACA or Information System Audit and Control Association which is the latest update from the COBIT framework type suite. COBIT 2019 which was released on November 2018 and is an update of COBIT 5 [19]. COBIT 2019 has provided an acceptable analysis model openly make combinations of organizational governance and management by providing indicators, processes, levels, to 11 Measurement of Administrative Capability Measurement is a collection of the best practices with the goal of increasing value and trust in information systems so that the organization will be helped in optimizing and improving management governance their information technology [19]. In addition, this framework also introduces the concept of a focus area, which is intended to provide focus on a particular problem-solving situation by sticking to it COBIT 2019 core model with its governance and management objectives. Measurement of organizational maturity using COBIT 2019 consists of 5 main domains which are divided into one governance destination domain management and the four domains of management objectives, namely EDM or Evaluate, Direct, and Monitor, BAI or Build, Acquire, and Implement, APO or Align, Plan, and Organize, and MEA or Monitor, Evaluate, and Assess, and DSS or Deliver, Service, and Support) [11]

E. RACI Chart

RACI or Responsible Accountable Consulted Informed is diagram used for the parties involved with the process the company's business so that it can become a resource person in a study. Each indicator on the RACI diagram has its own meaning which is described as follows [20].

1. Responsible (R)

   Responsible or responsibility means the party that has responsibility responsible for carrying ou the activities be his area of work.

2. Accountable (A)

   Accountable means the party in charge of giving directions from carrying out activities. This party has the authority to decide a problem. Simply put they have a standing as the person in charge and decision maker.

3. Consulted (C)

   Consulted means the person in charge of providing criticism and suggestions or consultation on the implementation of activities. Usually, they are called advisors.

4. Informed (I)

Informed party who obtains information related to the activity ongoing, results, and decisions taken.

III. METHOD

The method used in this study is to use a framework COBIT work 2019 which is the most recent version of the framework COBIT which has been updated by ISACA. This type of research is research qualitative which uses literature and interview methods for collecting the necessary data.

This study uses a framework in the form of an overview of the process flow of research conducted using the audit stages described by Gallegos.

1. Planning

The first step in this research is planning by first determining the object of research, namely at PT XYZ. When the research object has been determined, a pre-interview is conducted to ask for permission while simultaneously identifying the outline of areas that are a problem in the company, as well as determining the 2019 COBIT domain will be used as a focus in this study based on the results of interviews with the company.

2. Field Work

The second stage is the stage of collecting the necessary data. Researchers conduct a literature study to understand more deeply the topics and objects of this research and conduct research directly to PT XYZ to see real problems to be faced. At this stage also carried out follow-up interviews.

3. Reporting

This third stage is the stage of writing a report from the data that has been collected. Analyzing these data to get conclusions and evaluation results in the form of recommendations on the problem faced by PT XYZ.

4. Follow Up

The final stage is to report to PT XYZ so that you can use it as a reference or recommendation for improvements necessary and can be used as a reference for further audits.

This study conducted a literature study using references the 2019 COBIT book provided by ISACA (Information Systems Audit and Control Association) entitled “COBIT Framework 2019 Governance and Management Objectives” and using research journals before as a reference.

This study also requires an interview stage to collect the data needed in the research. The interview stage involves representatives of divisions in PT XYZ. Self-interview will be conducted several times both online and offline. If done by online via video conferencing via zoom meeting or google meet. However, if the interview is conducted offline the researcher will meet directly with representatives of related divisions from PT XYZ. Data collected from stage This interview will be used as a tool to measure the maturity level of governance information technology in PT XYZ.

The data analysis method used in this study is to use a measurement scale (ISO/IEC 33004) for the results of the interviews as follows.

- N – Not Achieved (0% to 15%)

  Companies have little or no evidence of achieving the attributes assessed in the defined process.

- P – Partially Achieved (>15% to 50%)

  The company has some evidence of the approach and some evidence of the achievement of the attributes assessed in the process which is defined by the aspect of achievement of the attributes being unpredictable.

- L – Largely Achieved (>50% to 85%)

  The company has evidence of a systematic approach for significant achievement of the attributes assessed in the defined process but still has some weaknesses in the assessment process.

- F – Fully Achieved (>85% to 100%)

  The company has completed and systematic evidence for the full achievement of the assessed attributes in the defined process and has no significant weaknesses in these attributes in the assessment process.

IV. RESULT AND DISCUSSION

Data collection was carried out by interviewing related parties. The earliest stage carried out in research is to decide with XYZ company to do research on the company. After that, determine the focus of the research area in the company. The areas in this research are covers IT governance in XYZ company to determine the process domains in COBIT 2019. This research was conducted to measure the capability Maturity level of PT XYZ's IT governance using the framework COBIT 2019.

The COBIT 2019 process domain was selected based on identified issues conducted at PT XYZ. The problems found are related to problems with work on several company projects that often experience delays until the workflow changes. This problem arose because of a change in human resources that often changes every several time periods. The company gives responsibility for working on several projects to their human resources are usually only apprentices stayed for 1 semester in the company. This human resource problem has sufficient impact on project completion due to the capabilities of each resource humans are very diverse. Some are very good at the language programming used and some do not

understand the language at all programming used. This causes the work process to run slow depending heavily on the ability of each individual resource the human.

Project handlers for project workflow details are also managed by interns where every change of team, of course, has a slightly different way of handling projects. The company provides a work timeline but only broadly speaking. In this case, company employees do play a role as the person in charge and mentor for the apprentices, but the limited number of employees causes one employee to handle many projects at once so you can't focus on just one project. Not to mention, the person in charge and the mentor still has to teach every apprentice who doesn't understand yet language used. Broadly speaking this problem is influenced by the way companies and resources handle the project.

In addition, there are budget and cost factors that are often needed in the process of working on projects for developer purposes such as buying domains and so on sometimes inadequate in terms of funds. Therefore, selected domains related to the problem.

Based on interviews with several IT governance parties in the company XYZ, it is found that there are 3 domains that are quite relevant to the problem that happened, namely APO06 –Managed Budget and Costs, APO07 – Managed Human Resources, BAI11 – Managed Projects.

A. RACI

The RACI in Table 1 shows the divisions involved in the 3 domains selected, namely APO06 – Managed Budget and Costs, APO07 – Managed Human Resources, and BAI11 – Managed Projects. Each division has a different role for each domain which will be described in the following tables.

TABLE I. RACI CHART

Domain	CEO	BD	HR	PM
APO06 – Managed Budget and Costs	A	R	C	I
APO07 – Managed Human Resources	A	C	R	I
BAI11 – Managed Projects	A	C	I	R

In the APO06 domain, the business development team plays an active role in preparing the company's IT budget. They design and build methods to make planning related to the required IT budget. Collaborate with the IT human resource division to assess employee and IT needs, but if you want to plan the usual allocation of funds involve the project manager as well.

In the APO07 domain, the team responsible for implementation is human resources. They work inside Recruitment of employees needed according to IT needs company. In addition, the human resource division also deals with work contracts to employee administration.

In this BAI11 domain, the person in charge is the manager project. A project manager usually plays an active role in planning and directing project execution. Project planning also involves several related parties such as: finance and human resources. A project manager oversees Monitor project implementation and be responsible for the process the process.

B. Result

The results of measuring the capability of information technology governance at PT XYZ are simplified as follows.

TABLE II. RESULT

Process Domain	Achieved Capability Level				
	1	2	3	4	5
APO06 – Managed Budget and Costs		■			
APO07 – Managed Human Resources		■			
BAI11 – Managed Projects		■			

Based on Table 2, the results of measuring the level of capability at PT XYZ company which were obtained from the results through interviews concluded that in the domains APO06, APO07, and BAI11 reached the same level, namely level 2 or it can be said (Fully Achieved)

C. Analysis Results

The interview results will be measured based on the rating scale from Table 1. The answers of each informant are categorized based on the criteria listed in the description column. The answers in each subdomain will be averaged and the value of the average is the final value obtained from each domain. A domain can be said to be successful or continue to the next level if the sub-domain of the previous level gets an average value of greater than 85% but if the domain does not reach or is less than 85% then it is declared to stop at that level and cannot continue. Assessment of the domain and its sub-domains will be described as follows.

1. APO06 – Managed Budget and Costs

TABLE III. APO06 LEVEL 2 ASSESMENT

APO06 – Level 2	
Sub-Domain	**Score**
APO06.01	77.5
APO06.02	80
APO06.03	79.25
APO06.05	85.7
Total	322.45
Average	322.45/4 = **80.6%**

Table 3 shows the results of calculations from the APO06 domain regarding how companies manage IT budgets in companies. Sub-domains are at level 2 with APO06.01 having an average value of 77.5, APO06.01 having an average value of 80, APO06.03 having an average value of 79.35, and APO06.05 having an average value of 85.7. So, the overall average for the APO06 level 2 domain is 80.6%, which means that the audit stops at level 2 and cannot continue to level 3 because the average domain has a value of less than 85%. The results of the interviews in this domain show quite good results because almost all activities in managing the IT project budget recommended by the 2019 COBIT framework are carried out by the company, but some things are still lacking and have some weaknesses.

2. APO07 – Managed Human Resources

TABLE IV. APO07 LEVEL 2 ASSESMENT

APO07 – Level 2	
Sub-Domain	**Score**
APO07.01	76.7
APO07.02	84.3
APO07.03	77.5
APO07.04	86.75
APO07.05	85
APO07.06	86
Total	496.25
Average	496.25/6 = **82.7%**

Table 4 shows the results of calculations from the APO07 domain related to human resource management in companies. Sub-domains are at level 2 with APO07.01 having an average of 76.7, APO07.02 having an average of 84.3, APO07.03 having an average of 77.5, and APO07.04 having an average of 86.75, APO07 .05 has an average of 85, and APO07.06 has an average of 86. So, the average in the APO07 level 2 domain is 82.7%, which means that the audit stops at level 2 and cannot continue to level 3 because the average domain has a value of less than 85%. The results of the interviews in this domain show good results because almost all the activities recommended by the 2019 COBIT framework related to human resources for IT have been carried out by the company, but there are still deficiencies in outsourcing arrangements and gaps in some individuals between the capabilities needed and the talent required. owned. These problems cause a lack of percentage obtained.

3. BAI11 – Managed Projects

TABLE V. BAI11 LEVEL 2 ASSESMENT

BAI11 – Level 2	
Sub-Domain	**Score**
BAI11.01	72.5
BAI11.02	87
BAI11.04	83.2
BAI11.05	90
BAI11.06	85
BAI11.07	87
BAI11.08	86
BAI11.09	85
Total	675.7
Average	675.7/8 = **84.5%**

Table 5 shows the results of calculations from the BAI11 domain related to project management in companies. The sub-domains are at level 2 with BAI11.01 having an average of 72.5, BAI11.02 having an average of 87, BAI11.04 having an average of 83.2, BAI11.05 having an average of 90, BAI11. 06 has an average of 85, BAI11.07 has an average of 87, BAI11.08 has an average of 86, and BAI11.09 has an average of 85. So, the average in the BAI11 level 2 domain is 84.5% which is classified as a high average value because it is close to 85%, but still cannot continue to level 3 because the average domain still has a value of less than 85%. The interview results in this domain show good results because almost all the activities recommended by the 2019 COBIT framework related to managing IT projects have been carried out by the company, but there are still deficiencies in the lack of training carried out and project planning which sometimes tends to be too flexible.

D. Findings and Impacts

Identify the findings and impacts based on the results of the interviews that have been conducted. These findings and impacts outline the constraints in the company. The following are the findings and impacts found.

1. APO06 – Managed Budget and Costs (Level 2)
   a. Finding: The company does not have a fixed scheme to identify all IT-related elements. Budgets tend to be flexible.
      Impact: IT needs sometimes experience delays, especially for several small matters

related to costs because the scheme changes and is not fixed, which makes it difficult for third-order funds to be needed for small needs.

b. Finding: The company does not have a specific procedure for communicating budget decisions and reviewing them with business unit budget holders.

Impact: The need for funds becomes irregular. Can cause miscommunication to the business unit.

c. Finding: The company does not maintain a formal IT budget, including all expected IT costs of IT-enabled programs, services, and assets.

Impact: Budgets become too flexible and unpredictable when companies have to issue budgets. As a result, when needed, disbursing funds is quite time consuming.

2. APO07 – Managed Human Resources (Level 2)

a. Finding: The company does not set rules for using external contract employees, third party services, and using transfers to support business needs.

Impact: One employee can sometimes work on many projects at once. Sometimes there is still dependence on one individual.

b. Finding: The company pays little attention to the gap between the required skills and the available human resources. Rarely do individual placements repeatedly.

Impact: Project work can be hampered due to a lack of skills needed to work on a project because you still have to learn it first.

3. BAI11 – Managed Projects (Level 2)

a. Finding: Companies do not provide project management training. But still considering certification for project managers.

Impact: Some of the company's goals can be hampered due to the lack of training provided by the company.

b. Finding: In maintaining the project plan along with the risk assessment, the company carries out direct follow-up with stakeholders.

Impact: Several changes to the plan could be forgotten to be conveyed to stakeholders because there was only verbal follow-up.

E. Recommendations

Provision of recommendations is made after obtaining the findings and the impact of the problems that exist in the company which is carried out through a series of interviews with the PT XYZ company and conducting a review of some data related to the selected domain. Some recommendations for improvements that can be made by the company are as follows.

1. APO06 – Managed Budget and Costs (Level 2)

a. Companies must have a fixed scheme to identify all IT related cost elements such as operational costs, hardware costs, software costs, personnel, and others. Must have clear details and calculations.

b. Companies should have a fixed procedure for communicating budget decisions and reviewing them with the company's business units and carried out regularly.

c. Companies need to have a formal IT budget or some sort of record keeping for the expected formal IT budget estimates of the programs, services, and assets that support IT.

2. APO07 – Managed Human Resources (Level 2)

a. Companies need to maximize the provision of flexible resource arrangements, such as the use of transfers, external contracting personnel, and third-party service arrangements to support changing business needs.

b. Companies need to identify the gaps between the skills needed and those available on a regular basis. Especially if the employee is an apprentice. This can be done by developing a few things, such as providing training for both technical and behavioral skills, re-deployment or rotation, and making changes to the procurement strategy. These things are to overcome the gap individually and collectively.

3. BAI11 – Managed Projects (Level 2)

a. Companies need to provide project management training as well though are considering certification for project managers. Certification should be accompanied by the provision of project management training for project managers.

Companies need to improve how to maintain project plans and dependent plans such as risk plans, quality plans and benefits realization plans. Ensure that the plan is always updated and reflects actual progress and approved material changes. Apart from carrying out direct follow-up with stakeholders, you can also always document changes in detail for every aspect of the project work process to serve as a reference document for the next team change and

ensure that communication between team members runs well to avoid miscommunication.

V. Conclusion

After measuring the level of information technology governance in a management consulting company using the 2019 COBIT framework, it was concluded based on interview results that the problem with PT XYZ was in handling the projects they had and influenced the way the company handled IT budgets and resources. possessed human resources. There are 3 domains chosen based on these problems, namely APO06 – Managed Budget and Costs, APO07 – Managed Human Resources, and BAI11 – Managed Projects. Apart from the existing problems, the domain selection is also adjusted to the RACI table which contains the parties involved in the running of a project.

In the APO06 – Managed Budget and Costs and APO07 – Managed Human Resources domain processes, the average yield is 80.6% and 82.7%. The results of these two domains are in accordance with company targets that are at level 2 in the Fully Achieved category, so there is no GAP in this process domain and in the process domain BAI11 – Managed projects get an average yield of 84.5% which is at level 2 which the company's target is level 3 so as to create a GAP in the analysis of 1.

The measurement results are obtained from the findings and impacts to obtain recommendations for the company to improve or maximize it in accordance with the recommendations given by COBIT 2019 so that the value achieved by the company can increase the level obtained by the company.

For further research, it can measure the capability again and measure the level increase made by the company.

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Sentiment Analysis of User Satisfaction Towards Sales Promotion of Gojek Application Service Using SVM

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***Abstract*— Customer satisfaction is a crucial factor for the sustainability of a company, including tech companies like Gojek. This condition exists because customer satisfaction affects the continuation of customers purchasing or reusing the company's services. Promotions or offers are commonly applied strategies by companies to enhance attractiveness among competitors and improve customer satisfaction. Therefore, this research aims to understand customer sentiments towards promotions or offers provided by the Gojek company to develop better promotional strategies by increasing customer satisfaction. The data source for this research comes from user tweets on the social media platform Twitter which has now changed to "X". The method used to determine the sentiment of this data is the support vector machine.**

***Index Terms*—user satisfaction; promotion; sales; sentiment analysis; suport vector machine;**

I. INTRODUCTION

The rapid advancement of technology has brought about significant changes across various sectors of society, including the business world. One example is the emergence of companies that embrace technology concepts, such as Gojek. Gojek is a private company that harnesses the advancement of information and communication technology to establish an app-based online transportation service business. This company has been established and has pioneered online transportation in Indonesia since 2010 [1].

Several companies now offer online transportation services like Gojek. This condition is due to the convenience and efficiency of online transportation in connecting potential passengers with transportation drivers, leading to a booming trend of using online transportation apps to support daily life within the community [2]. Therefore, Gojek must implement the right competitive strategies to compete with other competitors in the online transportation market.

According to Putra and Seminari [3], the key to winning the competition is for companies to recognize, understand, and satisfy the desires and needs of their customers. By doing this, customers will not look to or switch to other competitors offering similar products and services, which increases the likelihood of repeat purchases. Furthermore, understanding customer satisfaction can also be a benchmark and foundation for improvement in the quality of products or services and company marketing strategies [4]. One factor that can influence customer satisfaction and act as an attraction for customers includes price related elements, such as discounts [5].

This research aims to analyze the sentiments of Gojek customers regarding sales promotions in the form of discounts offered by the company. The results of this study will assist Gojek in understanding customer satisfaction from a promotional or offer perspective and help the company implement better promotional strategies to stay competitive against other competitors. The sentiment is collected from Twitter, an interactive social media platform that allows its users to voice opinions or critiques on matters in real time [6]. It's important to note that this research was conducted before Twitter changed its name to "X" so the data still references the original "Twitter" name. The sentiment analysis will be performed using the Support Vector Machine (SVM) classification method. This method has been selected for its effectiveness in high-dimensional spaces, which is typical of text data. Additionally, it can identify intricate decision boundaries through kernel functions.

II. LITERATURE

A. Customer Satisfaction

Customer satisfaction is a customer's feeling that come out by comparing what they expected with what they received, be it feelings of disappointment or happiness. There are five aspects that influence

customer satisfaction: product quality, service quality, emotions, price, and cost. Customer satisfaction is closely related to customer loyalty, profit, and market share [5].

B. Sales Promotion

Sales promotion is one of the trend tools in current marketing practices. Sales promotions are effective in grabbing the attention of customers and target markets, and can encourage them to make purchases. Sales promotions provide benefits that impact customer evaluations of a company's products or services psychologically (utilitarian benefits), such as in terms of cost savings, usefulness, and convenience, and emotionally and intrinsically (hedonic benefits), such as entertainment and the feelings of satisfaction obtained. The utilitarian benefits of this sales promotion become one of the things that can help the company achieve customer satisfaction [7].

Sales promotions for marketing new products or services can be in the form of coupons, samples, and refills. Meanwhile, for marketing old products or services, the company can give discounts. A discount or price cut is a form of price reduction given by the seller to the buyer directly for a product or service in a certain period based on policies and objectives set by the seller [8].

C. Sentiment Analysis

Sentiment analysis is an analytical approach aimed at determining the subjectivity of a text [9][10][11]. Through this analysis, the sentiment expressed from a text can be identified as positive, negative, or neutral [12][13][14]. For this research, only positive and negative sentiments were identified.

D. Support Vector Machine

The Support Vector Machine (SVM) is one of the methods of supervised machine learning and can be defined as a binary classification algorithm. SVM is a probabilistic-based binary classifier, a classifier that makes predictions based on inputs that match predefined classes. Compared to other classification algorithms, SVM classifiers are one of the most popular because of their accuracy and speed, making them most suitable for analyzing and classifying tweets based on positive and negative polarities, providing more appropriate and significant output [15][16].

The main principle of SVM is to find the hyperplane, a line in two dimensions, or a flat plane in multiple dimensions, which is best for separating two types of classes in the input space. There are three types of SVM kernel functions used for mapping the initial dimension or lower dimension of a dataset to a new dimension or higher dimension, namely the linear kernel function (1), gaussian radial basic function (RBF) (2), and polynomial (3)[17].

$$\boldsymbol{K}(\mathrm{x},\mathrm{y}) = x \,.\, y \quad (1)$$

$$\boldsymbol{K}(x_i, x_j) = \exp\left(-\frac{-\|x_i - x_j\|^2}{2\sigma^2}\right) \quad (2)$$

$$\boldsymbol{K}(x_i, x_j) = \left(\left(x_i . x_j\right) + \mathrm{c}\right)^d \quad (3)$$

III. METHODOLOGY

Based on research goals and previous studies on sentiment analysis [10][11][12]. There are five stages in this research methodology that can be shown in Fig. 1. Initially, the research will focus on Data Collection, wherein relevant data will be accumulated, ensuring a comprehensive and representative analysis. After data accumulation, Data Labeling will be carried out, where each piece of data will be classified as positive and negative. This step is crucial, as the labeling quality will significantly influence the ensuing classification model's accuracy. The third phase, Data Preprocessing, involves refining the collected data by removing noise, cleaning, and other necessary adjustments, ensuring the data's readiness for efficient model training. The next phase involves Model Training and Evaluation, where the processed data will be trained utilizing the Support Vector Machine (SVM) classification algorithm using Linear Kernel Function. Upon model training, an evaluation will be conducted to ascertain its accuracy and readiness for sentiment analysis. The results of the research will then be visualized, providing a clear and comprehensible depiction of the sentiments discovered. To streamline this entire process and guarantee seamless integration across all stages, the author has opted to utilize the Anaconda application, explicitly leveraging the Jupyter Notebook platform for its flexibility and support for various libraries essential for such research.

Fig. 1. Methodology

A. Data Collection

During the Data Collection phase, data crawling is conducted to gather tweets from Gojek application users on the social media platform, Twitter, utilizing the Twitter API. The collected data comprises tweets where users have tagged Gojek's official Twitter account "@gojekindonesia" and contain keywords such as "promo","potongan","diskon" and/or "voucher". This process uses the Twitter API to collect data from Twitter. Once the tweet data is obtained, these datasets' files will be merged. Then, all the datasets will be checked, and any duplicate tweet data identified will be removed.

B. Data Labeling

During the Data Labeling phase, tweets are labeled to categorize them as either positive or negative sentiments. Tweets categorized as positive are labeled "1" and represent tweets expressing advantages or

customer satisfaction regarding Gojek's promotional features or sales promotions. Then, tweets categorized as negative are labeled "2" and represent tweets raising questions about customer issues with the sales promotion features, as well as statements concerning the shortcomings and customer dissatisfaction regarding Gojek's sales promotions. This labeling process utilized annotation techniques carried out by author.

C. Data Preprocessing

In the data preprocessing stage, the labeled tweet data will be transformed or cleaned from irrelevant data to facilitate and enhance the accuracy of the sentiment analysis in the subsequent stage [18]. This preprocessing phase is executed utilizing several available Python libraries. The preprocessing steps include case folding, filtering, normalization, stopword removal, and stemming shown in Fig. 2.

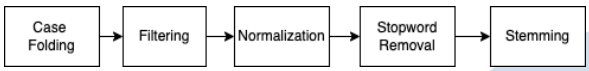

Fig. 2. Preprocessing Steps

- Case Folding

Case folding is the process of converting all letters in a dataset to lowercase. This is done to ensure that the algorithm treats different cases of the same word equally, such as "Minimum","minimum", and "MINIMUM" which should all be considered the same word.

- Filtering

Filtering is the process of cleaning text by removing components that are considered to have no meaning or relevance for sentiment analysis. These components include characters, punctuation, emoticons, and URLs. By filtering out these elements, the focus is placed on the significant parts of the text that contribute to understanding sentiment, thereby improving the quality of the analysis. The filtering process can significantly reduce noise in the data and help highlight the sentiment-bearing words.

- Normalization

Normalization is the process of converting words in the text into their standard form. In this study, the standard reference for the normalization process is the Indonesian Language Dictionary, and the author has created a list containing non-standard words along with their standard forms, which are stored in a glossary file at "normalisasi.csv" shown in Fig. 3.

```
def normalization(text):
    reader = csv.reader(open('normalisasi.csv', 'r'))
    d = {}
    for row in reader :
        k,v = row
        k = k.lower()
        v = v.lower()
        d[k] = v
    pat = re.compile(r"\b(%s)\b" % "|".join(d))
    text = pat.sub(lambda m: d.get(m.group()), text)
    return text
```

Fig. 3. Python Code for Normalization

- Stopword Removal

Stopword removal is the process of filtering out words that do not carry meaning in the text. These meaningless words include conjunctions, adverbs, affixes, and so on. This research utilizes the Python library "Sastrawi" (StopWordRemover) along with supplemental stopwords data acquired from various sources and through an analysis of tweet data. These additional stopwords are merged into a file named "more-stopwords.txt".

- Stemming

Stemming is the process of transforming words into their base form within a text [1] [19] [20]. The research uses the Python library "Sastrawi" (Stemmer) for the stemming process.

D. Model

This research data will be used to train the sentiment analysis model after the tweet data has been cleaned through the preprocessing stage. The sentiment analysis model training is carried out by classifying each word into positive or negative sentiment. Then, sentiment analysis will be conducted on each tweet containing the categorized words using the SVM classification algorithm. The research employs the SVM algorithm due to its robust capability in navigating the complex text data derived from Twitter [16] [17]. SVM stands out as it can sift through vast quantities of text data while pinpointing patterns with precision [15].

After the model training process is complete, the model is evaluated to determine its accuracy level in performing sentiment analysis. This research uses the Python libraries "NLTK" and "SKLEARN" to conduct the training and evaluation processes for this sentiment analysis model.

E. Visualization

After the sentiment analysis model has been created, the final step is to visualize the training data from the previous stages. The visualizations to be created will present the words that frequently appear in tweet data with negative sentiment to make improvements for negative sentiment. This visualization process will be conducted using Python libraries, and the results will be displayed as pie charts and word clouds.

IV. RESULT

This result part consist of data collection, data labeling, data preprocessing, model and evaluation, and visualition.

A. Data Collection

The research obtained 566 tweet data entries for this study shown in Fig. 4. The data collection period from November 12, 2022 to December 6, 2022.

0	halo @gojekindonesia apakah ini akun saya kena soft banned? Sekarang sudah tidak pernah dapet voucher goride/gofood dan tidak bisa claim kode promo. Mohon bantuannya supaya bisa nyaman dan aktif kembali menggunakan gojek. Terima kasih
1	@gojekindonesia dear gojek, ini akun aku ke suspend apa gmn si? Kok sering bgt ga dapet voucher goride\udd83d\ude2d\udd83d\ude2d
2	@gojekindonesia kenapa voucher cashback 100% 7000 goclub belum masuk ya? bulan kemarin juga gitu gak masuk \udd83e\udd72 masa bulan ini juga gak?! padahal juragan loh????? https://t.co/CmYW0eaiTj
3	@daesugua @gojekindonesia @gojekpromo Voucher gojek bisa dijual?
4	@gojekindonesia kok pasang promo di gofood tiba-tiba dibatalin mulu kenapa ya?
...	...
562	halo @gojekindonesia apakah akun saya kena soft banned? Sekarang sudah tidak pernah dapet voucher goride/gocar/gofood dan tidak bisa claim kode promo. Mohon bantuannya supaya bisa nyaman dan aktif kembali menggunakan gojek. Terima kasih
563	halo @gojekindonesia apakah ini akun saya kena soft banned? Saya tidak pernah dapet voucher goride/gocar dan tidak bisa claim kode promo. Mohon bantuannya supaya saya bisa nyaman dan aktif menggunakan gojek. Terima kasih. https://t.co/5fR0eyjbQk
564	halo @gojekindonesia, apakah akun gojek saya terkena softbanned? karena tidak mendapat voucher mingguan goride, gocar, gofood, voc cashback tiap bulan, dan jika memasukan kode voucher promo itu tidak bisa digunakan. tolong dibantu, terima kasih.
565	Halo admin @gojekindonesia, apakah akun saya kena soft banned? Karena gabisa klaim kode promo, ga dapet voucher, promo resto di gofood juga ga muncul. SUDAH SAYA INFOKAN NO HP & EMAIL AKUN SAYA MELALUI DM Tolong bantuannya agar bisa nyaman menggunakan gojek kembali, Terima kasih
566	Halo admin @gojekindonesia, apakah akun saya kena soft banned? Karena sudah jarang dapet gofood, dan kode promo yang diklaim juga tidak muncul di aplikasi. Tolong bantuannya ya agar bisa nyaman menggunakan gojek kembali, terima kasih banyak.

Fig. 4. Data Collection

B. Data Labelling

Data labelling was conducted manually from the collected tweet data, with a significant majority displaying negative sentiment. Out of 566 tweets, 49 were identified as having positive sentiment, while the remaining 517 tweets were categorized as having negative sentiment. Fig. 5 is an example of annotated tweet data labelled according to its sentiment.

Polaritas	Data Tweet
1	"hari-hari naik @gojekindonesia with voucher \udd83d\ude47\u200d\u2640\ufe0f https://t.co/GbXu3F7z6N"
1	"terbaik emang @gofoodindonesia @gojekindonesia selalu kash gua voucher ataupun hp. bangga gua sama tim gojek indonesia punya anak negeri. tak lupa terimakasih buat @waroengsteak udah ngebuat makanan ini menjadi enak \udd83d\udc4d\udd83d\udc4d\udd83d\udc4d https://t.co/DRFF4rHmq"
1	"@gojekindonesia AAAAAA SENENG DPT VOUCHER GO FOOD HUHU MAACI LOVE UUUUUUuddd3e\udef6\udd83e\udef6\udd83e\udef6\udd83e\udef6\udd83e\udef6\udd83e\udef6"
1	"Sering-sering lah buat promo cashback makasih loo. Sangat membantu anak kossan sekali ini heheh luv. .@gopayindonesia @gojekindonesia https://t.co/uIxyvRFFKm"
2	"@gojekindonesia kenapa voucher cashback 100% 7000 goclub belum masuk ya? bulan kemarin juga gitu gak masuk \udd83e\udd72 masa bulan ini juga gak?! padahal juragan loh????? https://t.co/CmYW0eaiTj"
2	"halo @gojekindonesia apakah ini akun saya kena soft banned? Sekarang sudah tidak pernah dapet voucher goride/gofood dan tidak bisa claim kode promo. Mohon bantuannya supaya bisa nyaman dan aktif kembali menggunakan gojek. Terima kasih"
2	"Makin pelit aja ngasi diskon @gojekindonesia https://t.co/xCBrvNSgUB"
2	"Ampas @gojekindonesia promo gopay payday mcd dibatalin. Jadi males deh"

Fig. 5. Python Code for Data Labelling

C. Data Preprocessing

The data preprocessing stages in this research consist of case folding, filtering, normalization, stopword removal, and stemming. Then, the labeled tweet dataset is divided into training and testing data, with a distribution ratio of 70:30. Fig. 6.,Fig. 7., Fig. 8., Fig. 9., Fig. 10., and Fig. 11, are examples of the results of several tweet data that have gone through each stage of preprocessing.

```
2|"Makin pelit aja ngasi diskon @gojekindonesia https://t.co/xCBrvNSgUB"
2|"Ampas @gojekindonesia promo gopay payday mcd dibatalin. Jadi males deh"
```

Fig. 6. Data Before Preprocessing

```
2|"makin pelit aja ngasi diskon @gojekindonesia https://t.co/xcbrvnsgub"
2|"ampas @gojekindonesia promo gopay payday mcd dibatalin. jadi males deh"
```

Fig. 7. Data After Case Folding

```
2|makin pelit aja ngasi diskon
2|ampas promo gopay payday mcd dibatalin jadi males deh
```

Fig. 8. Data After Filtering

```
2|semakin pelit saja memberi diskon
2|sampah promo gopay payday mcd dibatalkan jadi malas deh
```

Fig. 9. Data After Normalization

```
2|pelit memberi diskon
2|promo gopay payday mcd dibatalkan malas
```

Fig. 10. Data After Stopword Removal

```
2|pelit beri diskon
2|promo gopay payday mcd batal malas
```

Fig. 11. Data After Stemming

D. Model and Evaluation

After training the model using the SVM classification algorithm an accuracy rate of approximately 93% was achieved.

E. Visualization

From the tweets that were obtained, processed, and analyzed, the visualization results show that there are ten words commonly found in tweets with negative sentiment which are "promo", "voucher", "use", "minimum", "gofood", "goride", "code", "softbanned", "get", and "gocar". The the visualization result can be seen in Fig. 12.

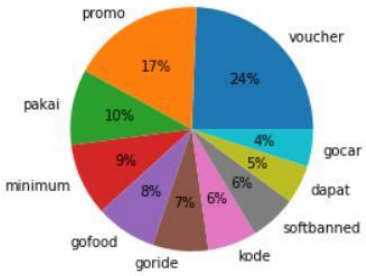

Fig. 12. The visualization results are presented as a pie chart and a word cloud.

From the obtained visualization, there are still numerous complaints about Gojek's sales promotions, particularly regarding policy, usage, and acquisition of promotions. The types of promotions most frequently discussed include those for GoFood, GoRide, and

GoCar services. To increase the efficiency of Gojek's promotions, it is essential to have transparent communication of the terms, simplify the redemption process for better usability, and put in place a strong feedback mechanism to address customer issues.

V. CONCLUSION AND RECOMMENDATION

Based on the sentiment analysis conducted on the promotional sales of Gojek's app services, it is concluded there are still numerous complaints indicating customer satisfaction still needs to be optimal. From the data obtained, the company needs to revisit its policies, usage processes, and the acquisition of promotions or discounts offered to customers and consider better promotional sales strategies for services like GoFood, GoRide, and GoCar.

Future research could add neutral sentiment category and expand the dictionary used for normalization and stopwords removal during the preprocessing phase. This would likely result in a more accurate sentiment analysis. Additionally, assessing sentiment based on service quality categories could offer deeper insights [21]. By categorizing sentiments into specific aspects of service, organizations can discern which areas are receiving negative feedback and require improvement. This approach allows for a targeted response to enhance overall customer satisfaction. It would also be valuable to explore and compare different classification algorithms in sentiment analysis to identify the most effective and precise algorithm for the scope of the research, especially in the context of service quality theory.

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From Tradition to Innovation: Mind Map Generation in Higher Education

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***Abstract*— This study conducts an in-depth survey of mind map utilization in higher education from 2003 to 2022, addressing the challenge of conveying complex topics to diverse learners. It examines the implementation of mind maps, focusing on development techniques, target audiences, objectives, and outcomes. Mind maps, recognized for enhancing memory retention, comprehension, and engagement, are used in two main scenarios: Learner-Driven for revision and understanding, and Lecturer-Driven as visual aids for content organization. The research underscores the importance of inclusivity and diverse learning preferences, advocating for mind maps as part of a comprehensive educational toolkit. It also identifies a gap in current mind map creation tools, particularly the lack of advanced technology integration like AI and deep learning. The study proposes developing an AI-based tool to facilitate lecturer involvement in mind map creation, enhancing teaching methods. Ultimately, it emphasizes the vast possibilities of integrating mind maps in academic settings, enhanced by technological progress, indicating transformative opportunities for future applications involving educational technology.**

Keywords—mind maps, educational technology, higher education, learning preferences, memory retention.

I. INTRODUCTION

Higher education, as a pivotal milestone in shaping one's intellectual and professional development, plays a crucial role in fostering a profound understanding of various academic disciplines. Students in the higher education environment exhibit increasing diversity in their learning styles, backgrounds, and academic abilities, compelling lecturers to adapt their instructional methods. Presently, the challenge lies in effectively delivering knowledge to students with varying learning preferences. In addressing this challenge, lecturers, acting as learning facilitators, continue to innovate in their approaches to delivering course materials. One increasingly popular approach is the adoption of active learning, wherein students actively engage in the learning process through discussions, collaboration, and direct interaction with course content [1]. Active learning holds the potential to enhance students' understanding of concepts and their overall engagement in the learning process.

Another long-standing tool employed to bolster the effectiveness of teaching is the visualization of course materials. Visualization aids in illustrating the relationships among complex concepts, assists students in grasping key ideas, and synthesizes crucial information. This technique is commonly referred to as mind mapping. The other technique is concept mapping [2] which represents knowledge and shows the relationships between different concepts in more structured and formal style than a mind map.

Mind mapping, introduced by Tony Buzan in the 1970s [3], is a centralized and radial visual technique that begins with a core concept from which related ideas branch out. It's predominantly utilized for brainstorming, organizing thoughts, and as a memory aid, often adopting a more personal and less structured approach [4]. Unlike other visual tools, mind maps do not typically label relationships explicitly. They are distinctively characterized by vibrant colors, imagery, and curved lines to depict and connect ideas.

Mind maps, as an educational medium, offer a visual platform for both students and lecturers to represent and communicate knowledge. They serve as a creative tool that bolsters memory and understanding [5]. With technological progress, mind maps have evolved into pivotal learning mediums across various educational stages. In higher education, they not only promote active learning, motivating students to visualize and structure their thoughts, but also aid lecturers in transmitting complex topics, curriculum design, and providing feedback. When crafted by learners, mind maps facilitate a deeper grasp of intricate subjects, emphasizing concept interconnectedness and kindling creativity in learning. Concurrently, lecturers harness this medium to enhance the teaching-learning experience, making abstract ideas more tangible and accessible [6], [7].

The highlight of this research centers on the development and assessment of the effectiveness of

mind map generation methods in aiding learners in planning, organizing, and recalling information, as previously explored in other studies [8]. This research, however, identifies an opportunity for educators to utilize mind maps to provide a comprehensive overview of topics or subjects taught, thereby encouraging students to create their own mind maps after learning sessions.

This study's primary objective is to present an exhaustive overview of research related to the creation of mind maps in higher education. It aims to uncover gaps in existing research and proposes subsequent steps for future studies to address these gaps. The method involves reviewing empirical evidence and findings that underscore the efficacy of mind maps as a learning tool in higher educational settings. This approach intends to contribute significantly to the understanding and application of mind maps in educational methodologies.

II. Research Method

The study adopted a multi-step survey methodology to examine the application of mind maps in higher education comprehensively. This approach comprised several distinct phases, each designed to ensure a systematic exploration of relevant literature.

a) Keyword Definition and Initial Search: The research began by defining the primary keyword: "*mind map in higher education*". This keyword was strategically chosen to focus the search on the most relevant studies.

b) Utilizing Elicit Platform (elicit.com): Leveraging the Elicit platform [9], which uses advanced language models like GPT-3, an initial search was conducted. Elicit's algorithms enabled efficient sifting through extensive databases, identifying studies that specifically mentioned the keyword. Elicit conducts its searches through a vast database of 200 million scholarly articles provided by the Semantic Scholar corpus, encompassing a wide range of academic fields. When pulling data from these papers, Elicit utilizes the complete text wherever accessible, or defaults to the abstract in cases where the full text is not available.

c) Inclusion and Exclusion Criteria: To refine the search results, clear inclusion and exclusion criteria were established. Studies were included if they focused on the application of mind maps within tertiary educational contexts. Works not explicitly addressing mind maps in higher education, such as those discussing mind maps in general terms or their use in primary and secondary education, were excluded.

d) Data Extraction and Categorization: Upon identifying relevant studies, key data points were extracted. This included the year of publication, the development techniques used in the studies, their primary objectives, and main findings. Each study was then categorized based on these parameters to facilitate an organized analysis.

e) Analysis and Synthesis: With the data collated, a thorough analysis was conducted, synthesizing the findings to draw out trends, common techniques, and notable outcomes in the use of mind maps in higher education.

f) Cross-Verification with Elicit: To ensure the accuracy and comprehensiveness of the findings, data was cross-verified with the results generated by the Elicit platform. This step was crucial in confirming the relevance and reliability of the studies included in the analysis.

g) Final Compilation: The final step involved compiling the findings into a coherent narrative, highlighting the application of mind maps in higher education, their evolutionary use over time, and the main outcomes reported in the literature.

III. Results

Table I presents a summary of all the papers collected for this survey. The emphasis of the survey is on the mind map generation technique, target audience, the purpose of each study, and its results, in addition to the year of research publication.

TABLE I. Summary of Collated Papers

No	Year	Techniques	Audiences	Goals	Results
1	2003 [10]	using Paper-based MM and existing Digital MM	Undergraduate students in School of Art and Design (SAD) and students in School of Computing and Information Technology (SCIT)	To investigate the idea of mind mapping and the application of MindManager software to help and enhance students' academic achievement	Because of their visual culture, SAD students were more confident in their ability to comprehend mind mapping than SCIT students were, but most students from both institutions thought it was useful, particularly for project management in group projects.
2	2007 [11]	using Paper-Based MM	Undergraduate students in Medical	To help university students learn on their own.	Most participants thought it was a useful summarizing method and that it would be interesting to investigate mind maps in more detail in future research. They also thought it helped with information memorization.

No	Year	Techniques	Audiences	Goals	Results
3	2009 [12]	using Paper-Based MM	Undergraduate students in Industrial Engineering Program	To maximize the amount of time allotted to industrial engineering departments' innovation development initiatives.	It is preferred to use integrative maps that include written and visual elements. The mind map applications that lecturers suggested were the most beneficial, and using the approach in industrial engineering education produced encouraging results, encouraging more students to attempt the method.
4	2012 [13]	using existing Digital MM tools	Undergraduate students of educational psychology	To investigate potential differences in the effects of several socially mediated mind mapping activities on variables associated with students' motivation and effort.	Students' rankings of the three mind mapping exercises revealed a range of preferences, enjoyment, and learning even though there were no average variations in perceptions based on the MUSIC model or effort. The effectiveness of all three activities in terms of student motivation was further validated by quantitative analysis.
5	2013 [14]	using existing Digital MM tools	The domain of this research article is applied in various educational contexts, such as schools, universities, and training programs.	To investigate the application of mind maps as a tool to raise educational standards and to offer information on how well mind maps work to improve student learning.	When it comes to observing constructivist learning, mind maps can be a useful substitute for concept maps, particularly in technical fields. Expert map templates outperform full expert maps as learning scaffolds, and their collective creation improves learning quality by helping students move from associative to relational thought, predicting expert ratings, and encouraging cooperative group work. These benefits are particularly evident in undergraduate engineering programs.
6	2014 [15]	using Paper-Based MM	Undergraduate students in Geography	To help undergraduates studying geography learn more creatively, collaboratively, and innovatively.	Undergraduate geography students found that mind mapping was a useful tool for encouraging creative and collaborative learning; active engagement produced a wide range of creative and inventive mind maps. Small group work facilitated more in-depth topic study, increased student self-assurance, and demonstrated a diversity of thought processes, with some groups exhibiting enhanced knowledge of particular subjects, such as cartography.
7	2015 [16]	using Paper-based MM and existing Digital MM	Undergraduate students in IT and Computing	To ascertain the results of employing DMM and the improvement in students' answers	The study indicated the use of Java 2 Micro Edition (J2ME) for mobile phone operating systems and highlighted the advantages of software-based mind maps, which demonstrated higher accuracy than student-created ones. It also detailed the technical requirements for Electronic Mind Mapping (EMM) tools, with students favoring EMM due to its speed and availability.
8	2015 [17]	using existing Digital MM tools	Master students in Education Program	To investigate the effects of electronic mind maps on instruction and learning in a course on educational research methods	Quantitative evidence indicated that students' attitudes toward research increased after using the Free Mind program, making it the program of choice. The value of teachers' approaches and knowledge transfer in boosting students' knowledge and good research attitudes was further highlighted by the qualitative findings, which also highlighted students' enjoyment of mind maps in research learning.
9	2015 [18]	using Paper-based MM and existing Digital MM	Undergraduate students in learning English as a second laguage (ESL)	To determine the subjects' views regarding creating computerized mind maps for reading comprehension as well as the possible impact of the self-generated mind maps created by college students on their reading comprehension	According to the study, students who were taught to read using computerized mind maps that they had created themselves demonstrated greater reading achievement and more positive attitudes about the teaching approach. The benefits of the method were ranked as follows: educational, mental, useful, and enjoyable. These results, which are in line with earlier studies, highlight the potential of electronic mind mapping to improve collaborative learning and reading comprehension. This makes a substantial contribution to cutting-edge teaching practices, particularly in the Gulf region.

No	Year	Techniques	Audiences	Goals	Results
10	2016 [19]	using existing Digital MM tools	Undergraduate students in Accounting Program	Present MM as a substitute for attaining the desired learning objective in accounting education. emphasizes the value of utilizing cutting-edge and interactive teaching and learning resources, particularly for students who are accustomed to using digital devices.	Most students thought iMindMap was more interesting than conventional teaching techniques, praising its ability to clearly illustrate relationships between ideas. While 49% strongly agreed that iMindMap effectively imparted knowledge in lectures, more than half thought it was interactive and engaging, and its flexibility was seen to foster critical thinking, creativity, and engagement. Multimedia components catered to a variety of learning styles and improved the quality of the educational experience.
11	2016 [20]	using Paper-Based MM	Undergraduate students in Biology	To evaluate students' capacity for original thought in a biotechnology course through mind mapping	Biology Education students were split into two teams for a study that employed mind mapping to assess students' creative thinking abilities in a biotechnology course. The majority of pupils on Team A demonstrated a notable enhancement in their creative thinking abilities, resulting in high marks. Team B, on the other hand, showed a minor improvement, with the majority of kids receiving low scores.
12	2018 [21]	using Paper-based MM and existing Digital MM	Undergraduate students in IT and Computing	To improve students' comprehension, encourage the growth of their life-wide learning mindset, and fortify their capacity for both creative and logical thought.	When used in programming language training, mind mapping strengthens students' ability to think creatively and logically, which supports their holistic knowledge and attitude to lifelong learning. It helps with practical computer language learning by strengthening software engineering ideas and stimulating creative thought. Furthermore, mind mapping facilitates ongoing learning and encourages diverse thinking, creative reasoning, and problem-solving abilities by providing a visual clarification of course content, instructional objectives, and abstract concepts.
13	2019 [22]	develop Digital MM tools (AI-based)	Undergraduate students in Environmental Engineering Program and Management and Production Program	To showcasing how digital mind maps may be used to make classrooms more visually appealing and inspire students to make their own connections and learn more.	The study demonstrates the range of respondents' attitudes four years later and the number of affirmative answers to questions.
14	2019 [23]	using Paper-Based MM	Master students in Accountancy Program	To learn how the mind map, as a process, can support professional development and identity within any field of study; and how, as a product, it provides a concrete, fundamental function upon which to construct and build additional communicative goods.	Mind maps support professional development, identity creation, and improved comprehension through peer evaluation. They are emphasized in professional communication courses in higher education, as well as the end result and the mapping process itself. Examining these maps demonstrates how students have developed their thinking, fostering work-readiness and a sense of self as future professionals. Their design can improve text comprehension, clear up misunderstandings, and provide a multi-layered, cycle of analysis that can be used to build additional communicative products in a variety of fields.
15	2019 [24]	using existing Digital MM tools	Undergraduate students in Education	Create a new teaching strategy focused on mind mapping and thinking development. This is crucial to assisting students in integrating their information and rationalizing their reasoning.	The learning outcomes of students in health fitness education were greatly improved by using a mind mapping-based teaching style. In comparison to the control group, the experimental group, who received instruction in mind mapping-based thinking development, significantly outperformed them on the post-test.
16	2020 [25]	using existing Digital MM tools	Master students in Education Program	To investigate the impact of argument mapping and software-assisted mind mapping on academic performance in higher education.	Students' academic progress and skill set were greatly improved using software-assisted mind and argument mapping tools. The results of the study were obtained through a combination of qualitative and quantitative measures, including interviews, achievement tests, self-evaluations, and reflective diaries.

No	Year	Techniques	Audiences	Goals	Results
17	2021 [26]	using existing Digital MM tools	Undergraduate students in Pharmacy	To assess the students' performance and their sense of having learned something significant in a pharmaceutical course on drug formulation design using the mind mapping approach	Students created well-structured and lucid mind maps; many preferred the two-layered "tree" style. Color-coding groups demonstrated greater interest and improved grades. Test scores were typically lower than those from mind map assignments. In terms of final course marks, the intervention group performed marginally better than the control group. The second term's scores for students in a later Large-Scale Drug Formulation course were worse than the first. In general, a sizable majority thought that concept retention might be achieved with the help of mind mapping.
18	2021 [27]	using existing Digital MM tools	Undergraduate students in Islamic Higher Education	To comprehend the advantages of mind mapping approaches in organizing ideas, comprehending subjects, and coming up with writing ideas, it is important to investigate the impact of flow mind maps on writing accuracy and learning motivation at Islamic Higher Education.	The study looked at how students at an Islamic higher education institution in Kalimantan were affected by flow mind maps in terms of writing correctness and learning motivation.
19	2021 [28]	using Paper-based MM and existing Digital MM	Undergraduate students in Science Teaching Program	Aids in the development of target audiences' thoughts about various mind mapping approaches as well as their experience in producing both paper-based and digital MM.	Participants had positive opinions on mind maps, praising their usefulness in enhancing and visualizing learning, bringing teachings to life, and being simple to use. Mind maps could be used for a wide range of subjects and contexts. Although they had technological issues, digital mind maps had advantages including simple revisions and multimedia integration. On the other hand, mind maps created on paper promoted the development of psychomotor skills and experiential learning; nevertheless, their ability to integrate multimedia and modify data was restricted. Notably, digital mind maps improved students' creativity, imagination, and engagement with both spoken and visual symbols.
20	2022 [29]	using Paper-Based MM	Undergraduate nursing students.	The significance of implementing innovative teaching strategies that promote critical thinking and learning	The pass rates of the control and intervention groups were similar prior to the intervention. The experimental group's pass rate increased to 92% after the intervention, whereas the control group's pass rate remained at 52%. In spite of this, in another measure the control group fared better than the experimental group. The mind-mapping method was well received by the experimental group, who also saw a significant relationship between it and their results. Both groups were made up of undergraduate nursing students, the majority of whom were female, and whose median age was eighteen.

A. Overview of Publication Years

This rigorous survey culminated in the collation of 20 papers spanning the years 2003 to 2022. The number of publications related to the development and implementation of mind maps in higher education has seen an increase over the years, with more recent years having a higher number of publications.

B. Techniques Used

Digital mind maps offer benefits like multimedia integration, which can enhance students' imagination, creativity, and engage them both visually and verbally. On the other hand, paper-based mind maps promote hands-on learning and psychomotor development, even though they might be limited in editing capabilities.

"*Using existing Digital MM tools*" appears to be the most common technique adopted in the surveyed papers. There's also a significant number of studies that utilize both "*Paper-based MM*". For example, students found tools like iMindMap to be more engaging than conventional teaching methods. The clarity with which mind maps show connections between points was highlighted. Over half of the students found it interactive and appealing. Its flexibility was observed to enhance creativity, engagement, and critical thinking.

C. Target Audiences

From the collected papers, the majority of target audiences hail from the fields of education and engineering. However, there is also a diverse array of additional target audiences, encompassing fields such as medicine, psychology, biology, and accounting. This indicates that mind mapping techniques have been extensively investigated across a multitude of disciplines within higher education.

Participants perceived mind maps as multifaceted and beneficial across a range of topics and contexts. They underscored the efficacy of mind maps in fortifying and illustrating learning, invigorating instructional sessions, and their inherent user-friendliness.

D. Research Goals

Based on the analysis of the results of the research papers, here are the most common keywords/themes:

- Students: This suggests that a significant portion of the research outcomes relates to the impact or benefits of mind mapping on students.
- Mapping and Maps: Both terms reinforce the central theme of the surveyed papers.
- Group: This might indicate discussions related to group activities or comparisons between groups in the studies.

From this preliminary analysis, we can deduce that a significant portion of the surveyed papers focuses on the benefits or impacts of mind mapping on students' learning processes and outcomes.

IV. Discussion

There are two common scenarios in the higher educational context when it comes to mind mapping:

- Learner-Driven Development: Here, learners (students) create mind maps after class sessions, often as a part of their revision or study routine. This helps them consolidate their understanding, identify knowledge gaps, and prepare for assessments. The process of creating the mind map can also enhance memory retention and improve comprehension.
- Lecturer-Driven Development: In this scenario, lecturers (teachers or lecturers) create mind maps to support their teaching process. These mind maps are often used as visual aids during lectures or presentations to help students understand complex topics. The lecturer uses the mind map to structure the subject matter, delineate relationships between concepts, and provide a bird's-eye view of the topic.

The majority of papers focus on the learners (students) when discussing the goals and results of their research related to mind maps. This suggests that many papers might be looking at the benefits, challenges, or practices of students creating or utilizing mind maps. Only a negligible number of papers seem to mention lecturers in the context of the results, indicating that the focus on lecturer-driven development of mind maps in the surveyed papers is limited.

This data seems to support the notion that the primary participants in the development and utilization of mind maps, as discussed in the surveyed papers, are the learners themselves. From an educational perspective:

- Lecturers might prefer concept maps due to their structured nature [2], which can aid in explaining complex topics and showing relationships between concepts. Concept maps are especially useful for curriculum planning or presenting hierarchical or interconnected information.
- Learners (students) might gravitate towards mind maps because of their flexibility and the creative freedom they offer, making them great tools for brainstorming, note-taking, and revision.

The employment of mind maps by lecturer in delivering educational material represents a beneficial approach, assisting them in planning, organizing, and visualizing concepts more effectively [30]. This not only facilitates a more structured material delivery but also enables lecturers to comprehend student perspectives and can inspire students to adopt similar techniques, enhancing material understanding and retention.

Nevertheless, the use of mind maps by lecturers should be inclusive, accommodating diverse student learning styles, and be a component of a broader teaching toolkit. In conjunction with other teaching methods, the utilization of mind maps can amplify instructional creativity and render learning more engaging and efficacious.

V. Future Research

Current research indicates that the majority of mind map design and utilization is student-driven, highlighting their role in expressing creativity and evaluating learning. However, the potential benefits of lecturers employing mind maps in teaching, particularly in material enrichment, are substantial. Mind maps are currently underutilized by lecturers in preparing lesson materials, signifying a need for a tool that can facilitate mind map generation using additional information for enrichment purposes.

Present tools for creating mind maps do not extensively utilize advanced technologies like artificial intelligence and deep learning. There is an opportunity to develop a deep learning model that can generate mind maps from various textual sources, assisting lecturers in material enrichment and effective content delivery.

The integration of advanced technology in mind map creation holds promise for automation and

personalization in the generation process. An AI-based tool could suggest conceptual connections based on academic literature or historical data, or adapt the map to suit the learning needs and preferences of students. This technological advancement can significantly augment the utility and effectiveness of mind maps in educational settings.

VI. CONCLUSION

The existing literature primarily highlights the benefits of mind maps in higher education. The integration of mind maps into active learning processes by lecturers, providing overarching views of subjects, can unlock further potential. Coupling this approach with encouraging students to generate mind maps after classes can significantly enhance understanding. The future of mind mapping in education, especially with the integration of advanced technologies, is highly promising. Leveraging these technological advancements can lead to transformative changes in teaching and learning methodologies, greatly benefiting the educational landscape.

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Image Splicing Forgery Detection using Error Level Analysis and CNN

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***Abstract*— The issue of image forgery through splicing has become increasingly relevant in the current digital era. Splicing involves the manipulation of images by combining parts of two or more different images to create a deceptive composite image. This technique can be employed for various purposes, including the dissemination of false information, damaging someone's reputation, or even creating confusion in specific contexts. Several techniques used to detect splicing involve statistical analysis, color analysis, and texture analysis. Additionally, artificial intelligence developments, such as deep learning, have been applied to enhance detection capabilities. In this study, we employed a Convolutional Neural Network (CNN) model to identify image deviations caused by splicing. Optimization was performed on the convolutional layers of the model to improve CNN performance. The integration of Error Level Analysis (ELA) was also implemented to aid in identifying splicing forgeries, where portions of one image are combined with parts of another. Areas that have undergone splicing may exhibit noticeable differences in error levels. The dataset utilized for this research was sourced from DVMM and CUISDE. The validation accuracy results for our CNN model before incorporating ELA were 61% for DVMM and 74% for CUISDE. After adding ELA, the CNN model demonstrated improved detection accuracy, achieving validation rates of 72% for DVMM and 71% for CUISDE.**

***Index Terms*—image forgery detection; splicing; error level analysis; cnn**

I. INTRODUCTION

In the contemporary digital era, the pivotal role of images in disseminating information across diverse platforms, including social media, healthcare, television, and various online applications, cannot be overstated. The ubiquitous availability of image editing tools and software on portable devices, such as smartphones and laptops, has facilitated the manipulation of images for various purposes, rendering them easily accessible. While images may undergo editing for benevolent purposes, intentional alterations with malicious intent are categorized as manipulation or forgery. Manipulative practices may involve concealing crucial information, such as obscuring individuals or objects within the image. Such manipulated images are occasionally employed as deceptive evidentiary material in legal proceedings, for financial gain through heightened engagement on social media, or for attaining popularity in the media sphere. Consequently, authenticating the integrity of images assumes paramount significance in thwarting the dissemination and endorsement of misinformation. Furthermore, validating the authenticity of images is imperative to deter the reliance on edited visual content as legal evidence [1].

Image forgery detection techniques can be broadly classified into two main categories: active and passive methods. Active techniques involve incorporating specific information into the image during its creation. This may encompass embedding watermarks or digital signatures as deliberate markers or signatures indicating the image's authenticity. The objective of active techniques is to furnish authentication or verification, thereby rendering it more challenging to forge or tamper with the image without modifying or eliminating these embedded features [2].

Passive detection techniques, such as those employed in identifying copy-move and splicing, are preferred for their efficiency. Unlike active techniques, passive methods do not require incorporating additional information into the image during its creation. Instead, they rely on analyzing the intrinsic characteristics and patterns within the image itself. This makes passive techniques quicker to execute, as they do not involve the processing overhead of adding extra information to the image. Passive methods are particularly effective in detecting certain types of image manipulations without the need for additional embedded features [3].

Image manipulation, particularly through techniques like copy-move or splicing, involves a straightforward procedure of copying and pasting elements within the image. When this pasting operation occurs, it introduces clear structural changes to the original image. The micro-texture pattern present inside the pasted area and along its boundaries undergoes modifications, creating differences and irregularities that become apparent along the edges of the altered region [4].

The Convolutional layer comprises a sequence of kernels or filters adaptable for extracting local features from the input. Each kernel performs calculations on a feature map. The Pooling layer also called the downsampling layer, reduces the resolution of the preceding feature maps. Pooling introduces invariance to minor transformations and distortions by dividing inputs into separate regions with a specified size, generating one output from each region [5]. The Fully Connected layer is typically deployed at the network's conclusion for classification purposes. Diverging from pooling and convolution, it constitutes a global operation, aggregating input from the feature extraction stages and comprehensively analyzing the output from all preceding layers [6].

Numerous studies have been conducted on image forgery detection, as referenced in [7][8][9]. The existing research indicates that the outcomes in detecting image splicing forgery remain suboptimal. Therefore, our objective is to investigate this phenomenon using the model we have developed.

This study proposes a deep learning algorithm incorporating a CNN and ELA to identify images subjected to splicing manipulation. The model is introduced and evaluated using image-splicing datasets available on the internet, including the DVMM and CUISDE datasets.

II. RESEARCH MATERIALS

A. *Deep Learning*

Deep learning is a machine learning technique that leverages neural networks. It is characterized by multiple processing layers structured to extract progressively intricate features from the data. The hierarchical architecture of deep learning networks enables them to autonomously learn and represent complex patterns and features as they progress through the layers. This characteristic makes deep learning particularly effective for tasks such as image and speech recognition, where the data exhibits hierarchical and intricate structures [10].

B. *CNN*

CNN are a type of neural network widely recognized for their exceptional accuracy in image classification tasks. CNNs are organized into several layers, comprising three key components: the Convolutional layer, the Pooling layer, and the Fully Connected layer. Tailored for tasks such as image recognition and classification, CNNs derive their effectiveness from the architectural design of these layers—specifically, the Convolutional, Pooling, and Fully Connected layers. This design plays a pivotal role in achieving high accuracy in tasks of this nature [11].

C. *Error Level Analysis (ELA)*

ELA is acknowledged as a significant method for detecting image alterations. This method involves saving the image at specific compression levels and assessing the variance resulting from the compression. When an image is initially saved as a JPEG, compression takes place, facilitated by various editing software tools such as Adobe Lightroom, GIMP, and Adobe Photoshop. ELA serves as a technique to emphasize differences between authentic and manipulated images by analyzing the error levels introduced during compression [7]. ELA is a forensic method involving the recompression of an image with a predetermined error rate after the initial compression using lossy techniques. The fundamental principle is to measure the absolute difference between the original and recompressed images under controlled error conditions. These calculated differences can reveal inconsistencies or variations that may arise during image manipulation or forgery [12].

III. RELATED WORK

Detection methods for image forgery are primarily designed to identify irregular patterns that should not be present in manipulated images. Two approaches exist for detecting image forgery: active and passive [13]. Several researchers have studied detecting copy-move and image splicing using convolutional neural network algorithms. In the paper by Mallick et al. [8]. CNN is employed with various models such as ELA, VGG16, and VGG19 to detect copy-move and splicing. The method was tested using CASIA V2 and NC2016 datasets, yielding accuracy values for the ELA model of 70%, VGG16 of 71%, and VGG19 of 72%.

In the following research conducted by Vijayalakshmi K et al. [7], ELA is employed to detect copy-paste images. The method was tested using the MICCF200 dataset. The MICCF200 dataset underwent an augmentation process in this study to maximize the image size. The dataset produced an accuracy value of 99% for detecting copy-paste images.

In a subsequent study by Pandey et al. [14], ELA was utilized to identify tampered images. The methodology was tested using the CASIA v2 dataset, and in this research, a localization process was applied to the CASIA v2 dataset. The outcomes of the dataset localization process resulted in an accuracy value of 88% for detecting tampered images.

The research conducted by Muniappan et al. [9] employed a CNN to identify copy-move and splicing occurrences. The proposed method underwent testing on the MICCF2000, CASIA V1, and CASIA V2 datasets. Specifically, on the MICCF2000 dataset, CNN was utilized to detect copy-move images, yielding an accuracy of 76%. For the CASIA V1

dataset, CNN was employed to identify splicing images, achieving an accuracy of 79%. Additionally, on the CASIA V2 dataset, CNN was utilized to detect copy-move and splicing images, demonstrating a notable accuracy of 89%.

IV. METHODOLOGY

CNN are advanced deep learning networks expertly trained for various computer vision applications. A notable advantage of CNNs lies in their adept utilization of local spatial coherence within input images, facilitating parameter sharing and reducing overall weight. Typically, a CNN consists of three key layers: the convolutional layer, the pooling layer, and the fully connected layer. Each of these layers performs a unique function in the overall processing of the network [15].

The convolutional layer consists of a sequence of kernels or filters that can be tailored to extract local features from the input. Each kernel is utilized to conduct computations on a feature map. The pooling layer, also known as the downsampling layer, diminishes the resolution of the preceding feature maps. Pooling introduces invariance to minor transformations and distortions by partitioning the inputs into distinct regions with a specified size, thereby generating one output from each region [5]. The fully connected layer is commonly employed after the network for classification purposes. Diverging from pooling and convolution, it constitutes a global operation. This layer aggregates input from the feature extraction stages and comprehensively analyzes the output from all preceding layers [6].

Building on prior research, we adopt ELA image processing [7]. This approach has exhibited a high accuracy score, prompting our interest in evaluating its performance on a model that we have developed.

This study's methodology comprises six processes: data collection, preprocessing, data splitting, modelling, model evaluation, and model optimization. Data collection involved accessing the Columbia University repository, specifically utilizing the datasets titled "Columbia Image Splicing Detection Evaluation Dataset (DVMM)" and "Columbia Uncompressed Image Splicing Detection Evaluation Dataset (CUISDE)." Subsequently, during the preprocessing stage, the dimensions of images across all datasets were adjusted to 224 x 224 pixels and converted to the .jpg format.

After preprocessing and data splitting, the dataset was divided into training, testing, and validation data. The subsequent step involved modelling the dataset. Following the modelling phase, the model underwent evaluation using the test data, and subsequent optimization was conducted to enhance the model's outcomes.

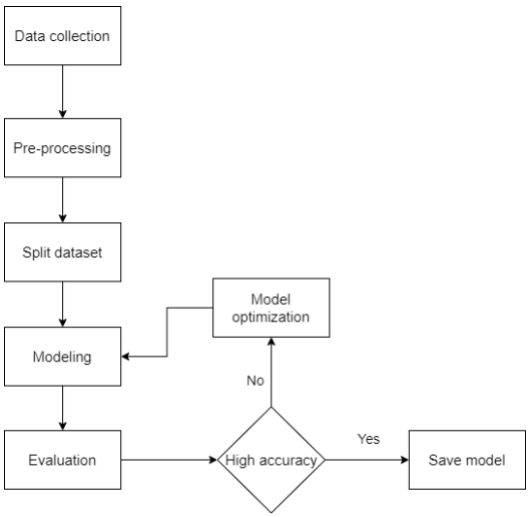


Fig. 1. Research Methodology

A. *Data Collection*

In this study, datasets were obtained from the GitHub website under the titles "Columbia Image Splicing Detection Evaluation Dataset (DVMM)" and "Columbia Uncompressed Image Splicing Detection Evaluation Dataset (CUISDE)." The dataset comprises images categorized into two groups: "Au", representing original images, and "Sp", representing images tampered with.

The DVMM Dataset includes a total of 1,845 images, with 933 being original images and 912 being tampered images. Similarly, the CUISDE Dataset comprises 365 images, with 184 original images and 181 tampered images.

B. *Pre-Processing*

The deep learning algorithm necessitates a consistent and standardized image format and size to ensure effective model training. Consequently, all datasets utilized in this research underwent a process of resizing and conversion. The images were resized to 224 × 224 pixels and converted to the .jpg format.

Augmentation was implemented for the CUISDE dataset. This decision was motivated by the limited size of the image data and the need to maximize accuracy. The augmentation technique employed involved adding horizontal flips to diversify the dataset. Before processing the data, pre-processing is essential to undergo a cleaning process to eliminate duplicate entries and rectify or remove inconsistent and incomplete data. Transformation data transformation converts or consolidates data into a predefined format [16].

C. *Split Dataset*

Additionally, the two datasets, featuring the categories 'Au' and 'Sp,' were partitioned into training, test, and validation data. Precisely, 10% of each

category was assigned to the test data, while the remaining 90% was split in an 80:20 ratio for training data and validation data, respectively.

TABLE I. SPLIT DATASET

Dataset	Number of Dataset					
	Training		Testing		Validation	
	Au	Sp	Au	Sp	Au	Sp
DVMM	587	574	94	92	252	246
CUISDE	131	129	19	18	33	33

D. Modelling

The pre-processed dataset will be utilized to construct a model compatible with the CNN architecture. CNN provides flexibility in determining the desired number of convolutional layers. The activation function employed in the CNN is the Rectified Linear Unit (ReLU). The CNN model employed in this study consists of 5 layers. There are 32 filters in the initial convolutional layer, followed by 64 filters in the second and third convolutional layers. The subsequent layer employs 128 filters in the fourth and fifth convolutional layers. The kernel size for each convolutional layer is 3x3. Additionally, the pooling window on the pooling layer is set at 2x2

TABLE II. CNN STRUCTURE MODEL

Layer	Type	Activation Function	Output Shape	Kernel Size	Total Filter
1	input	ReLu			
2	2D Convolution	ReLu	224	3	32
3	2D Max Poling	ReLu	224	3	32
4	2D Max Poling	ReLu	109	3	64
5	2D Convolution	ReLu	54	3	64
6	2D Max Poling	ReLu	52	3	64
7	2D Convolution	ReLu	26	3	64
8	2D Max Poling	ReLu	24	3	128
9	2D Convolution	ReLu	12	3	128
10	2D Max Poling	ReLu	10	3	128
11	Flatten	-	5		
12	Dropout	-	3200		
13	Dense	-	3200		

E. Evaluation

After successfully creating the model, a performance evaluation is carried out to assess the accuracy value. This evaluation involves examining various metrics, including accuracy and F1 score. The metrics are calculated using a confusion matrix and ROC curve. If the accuracy results are suboptimal, the subsequent step optimises model performance.

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} \quad (1)$$

$$f1 - Score = \frac{2 \times Precision \times Recall}{Precision+Recall} \quad (2)$$

F. Optimization Model

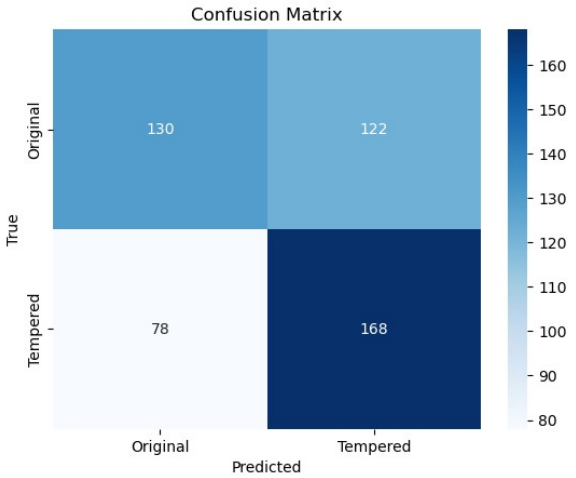
Optimization steps are implemented after creating and evaluating the model if the achieved accuracy is deemed unsatisfactory. This optimization involves making adjustments, such as adding or modifying convolutional layers, adjusting the optimizer, and tweaking optimizer parameters. Multiple simulations of various experiments in model creation are conducted to identify the optimal configuration leading to the highest accuracy value.

A low accuracy value was observed in the simulation conducted on the CNN model with four layers. In contrast, a notably improved accuracy was achieved when employing a CNN model with five layers. Consequently, the optimization strategy is focused on utilizing a CNN architecture with five layers.

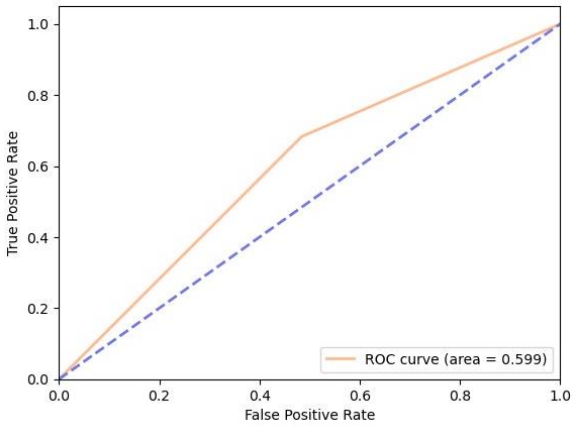
V. RESULT AND DISCUSSION

We conducted experiments using the CNN architecture to develop a model for detecting forgery in spliced images. Subsequently, we integrated CNN with ELA to assess their accuracy values following the compression of the dataset using ELA. The training of the CNN model involved using an early stopping feature, a batch size of 10, and an error level of 90%, which was applied to ELA.

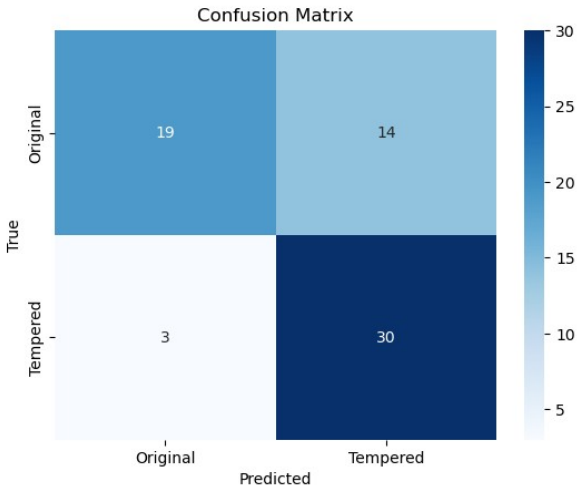
The evaluation of the generated models included assessing their performance through a confusion matrix, providing a comprehensive breakdown of the performance of each model. The confusion matrix was generated in the evaluation phase using validation data specific to each dataset.



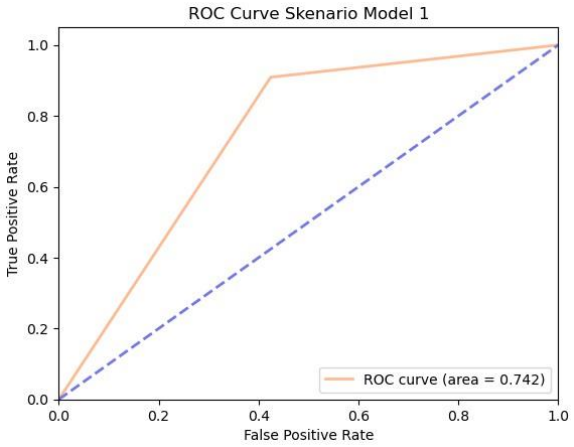
(A) DVMM



(A) DVMM



(B) CUISDE



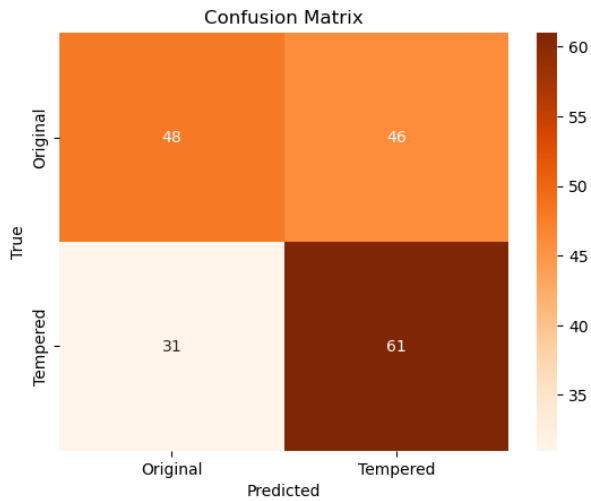
(B) CUISDE

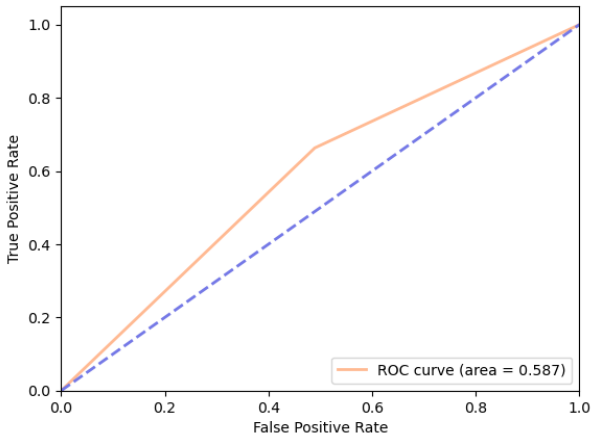
Fig. 1 Confusion matrix CNN Models for validation data of DVMM and CUISDE dataset

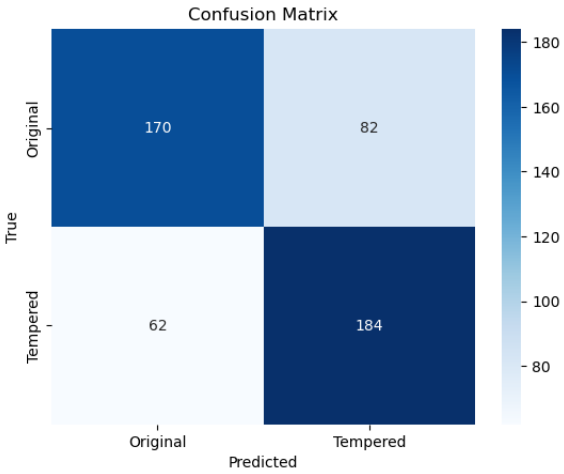
Fig. 2 ROC Curves using CNN models validation dataset

Based on the provided confusion matrix, the validation accuracy value for our CNN model is 61% for DVMM and 74% for CUISDE. The F1 score values are 0.565 for DVMM and 0.690 for CUISDE. The performance for DVMM is lower than that of CUISDE, possibly due to the DVMM dataset containing grayscale or black-and-white images. Using a small batch size can impact the training process on this dataset, potentially affecting the attainment of a high accuracy value.

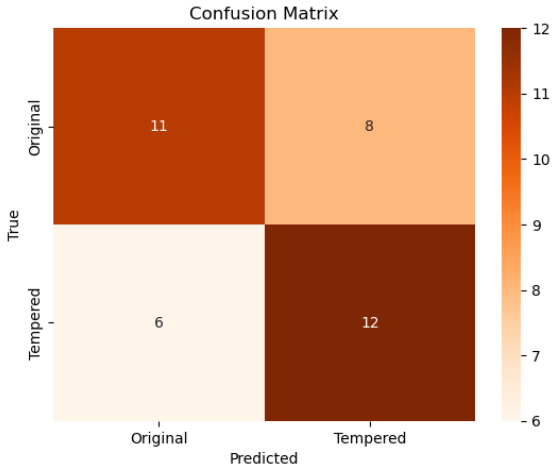
The performance of each model is also evident from the ROC curve. As depicted in the figure above, the ROC curve for CUISDE is superior to that of DVMM, consistent with the findings of the confusion matrix, which indicates higher performance for CUISDE compared to DVMM.

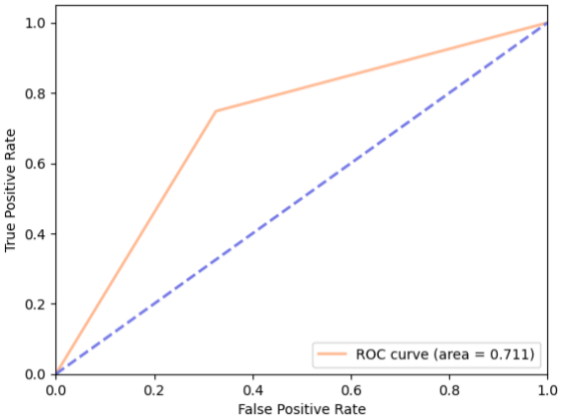




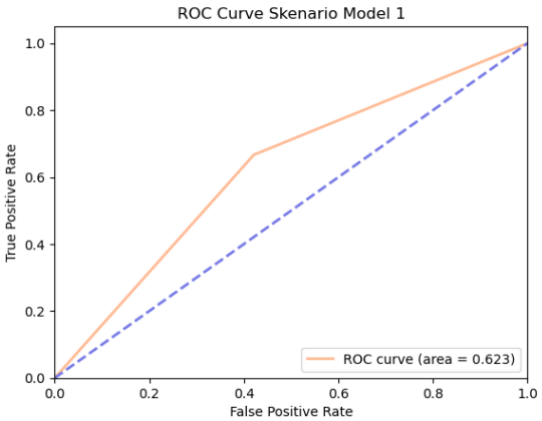


(A) DVMM





(A) DVMM+ELA



(B) CUISDE

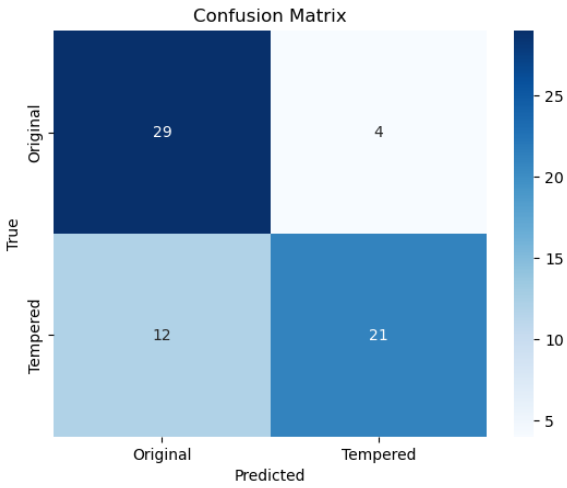
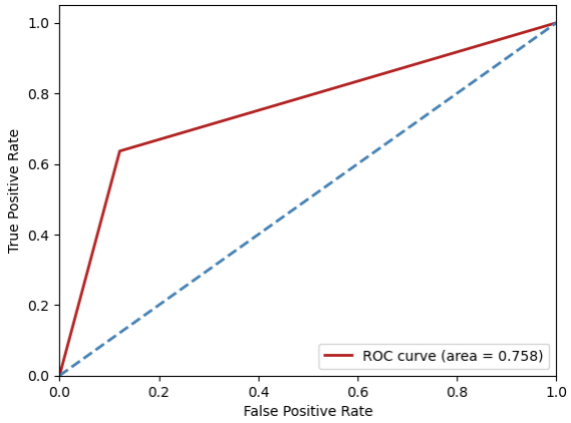
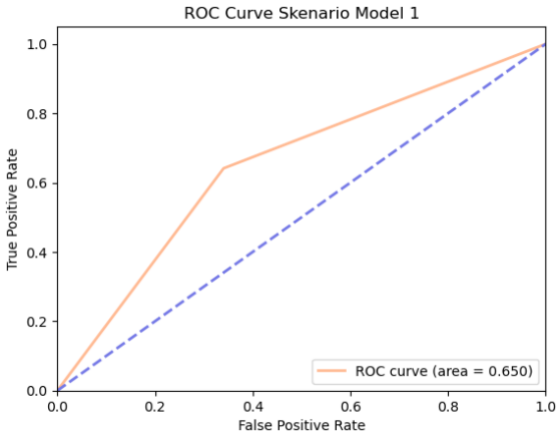


Fig. 3 Confusion matrix CNN Models for testing data of DVMM and CUISDE

According to the presented confusion matrix, the testing accuracy values for our CNN model are 59% for DVMM and 64% for CUISDE.



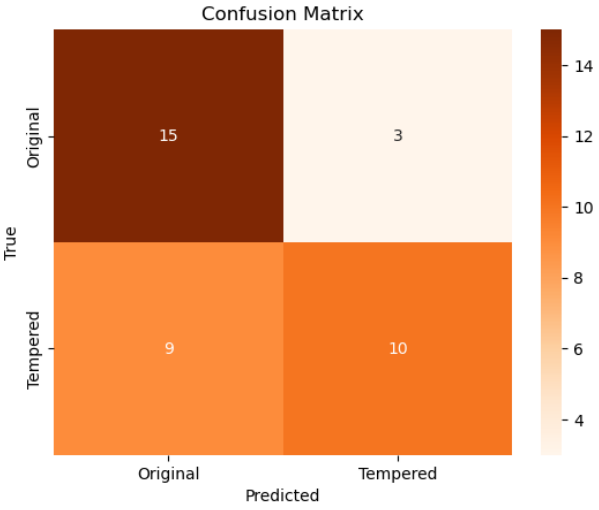
(B) CUISDE+ELA

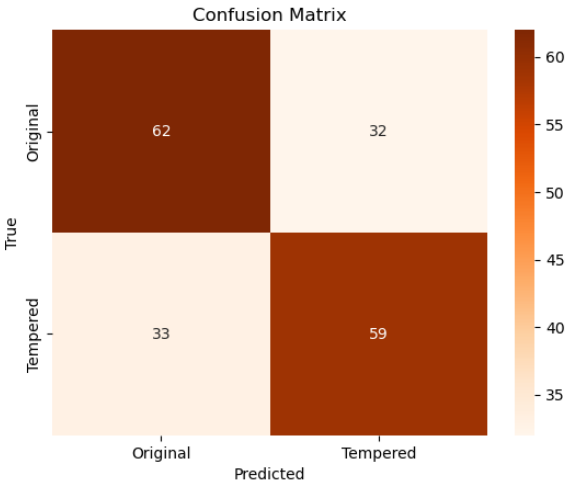


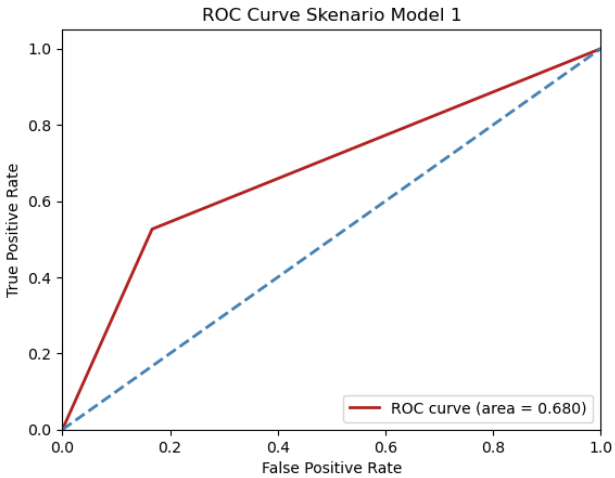
(A) DVMM+ELA

Fig. 4 Confusion matrix and ROC Curva CNN + ELA Models for validation data of DVMM and CUISDE

Based on the presented confusion matrix, the validation accuracy values for our CNN+ELA model are 72% for DVMM and 71% for CUISDE. The F1 score values are 0.702 for DVMM and 0.783 for CUISDE. In the CUISDE dataset, we implemented augmentation by enabling horizontal flip to improve the accuracy value.







(B) CUISDE+ELA

Fig. 5 Confusion matrix and ROC Curva CNN + ELA Models for testing data of DVMM and CUISDE

According to the provided confusion matrix, the testing accuracy values for our CNN+ELA model are 66% for DVMM and 72% for CUISDE. The resulting ROC curve values are 0.587 for DVMM and 0.623 for CUISDE.

TABLE III. THE PERFORMANCE RESULT OF OUR CNN MODEL

Dataset	Evaluation Metrics		
	Val Accuracy[%]	F1-Score	ROC-AUC
DVMM	61.24	0.565	0.599
CUISDE	74.24	0.690	0.742
DVMM +ELA	72.09	0.702	0.650
CUISDE +ELA	71.21	0.783	0.758

TABLE IV. THE PERFORMANCE COMPARISON OF OUR CNN MODEL AND RELATED WORK

Work	Dataset	Method	Accuracy (%)
Mallick[8]	CASIA V2 NC2016	ELA	70.00
		VGG 16	71.00
		VGG 19	72.00
Vijayalakshmi K et al[7]	MICC-F200	ELA	99.00
Pandey & Mitra [14]	CASIA V2	ELA+CNN	88.00
Proposed	**DVMM CUISDE**	**CNN**	**61.00**
		CNN	**74.00**
		CNN+ELA	**72.00**
		CNN+ELA	**71.00**

V. CONCLUSION

In this study, a CNN model augmented with ELA was developed to detect image splicing, resulting in an increased validation accuracy of 72% from the initial 61% for DVMM. For CUISDE, the validation accuracy changed slightly from 74% to 71%, with an improvement in testing results from 64% to 72%. In conclusion, this research successfully applied CNN with ELA to identify image splicing, enhancing accuracy in the DVMM and CUISDE datasets. These findings underscore the potential of deep learning models in addressing challenges associated with digital image manipulation. As research progresses, ongoing efforts will be directed towards refining and expanding the capabilities of the CNN model for more accurate and reliable image splicing detection.

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Developing a Web-based Information System Information System to Enhance Operations in Hajj and Umrah Travel (Case Study: PT. Mutiara Cinta Imani)

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***Abstract*— This research addresses the substantial challenges arising from the prolonged reliance on manual inputting methods, notably paper and Excel, within the operational framework of PT. Mutiara Cinta Imani in the context of Hajj and Umrah travel. The inherent inefficiencies, potential errors, and constraints associated with traditional data management practices have prompted a critical examination of the existing system. Recognizing the imperative for a more contemporary approach, this study focuses on the development and implementation of a Web-based Information System. The primary goal is to enhance operational efficiency, mitigate errors, and overcome the limitations inherent in manual data management. By conducting a case study on PT. Mutiara Cinta Imani, this research seeks to provide a comprehensive understanding of the challenges faced and propose a technologically advanced solution to optimize data input processes. The envisioned Web-based Information System aims to revolutionize operations, offering real-time access, scalability, and increased reliability, thereby paving the way for improved practices in the Hajj and Umrah travel domain.**

***Index Terms*—hajj; travel agency; umroh, web-based Information System.**

I. INTRODUCTION

In the context of Hajj and Umrah, information system innovation has significantly enhanced various facets of the pilgrimage journey through technological interventions [1]. A specific focus on Hajj involves a study [2] investigating the use of information and communication technology (ICT) for crowd management, presenting cutting-edge strategies and tools to improve coordination and security during the pilgrimage, offering valuable insights for the crowd management community. Another study [3] concentrates on the implementation of a website for booking Hajj, Umrah, and tour tickets using the Waterfall Method, emphasizing a systematic development approach. Additionally, a separate paper [4] introduces web-based information system Hajj simulation software, emphasizing the importance of interactive tools in facilitating Hajj learning and contributing to the broader discourse on technology in religious education.

The integration of digital tools, internet platforms, and mobile applications has revolutionized communication and pilgrimage management for both pilgrims and organizing entities [5],[9],[13]. Khan and Shambour's research [6] provides an analytical examination of mobile applications for Hajj and Umrah services, exploring their features and functionalities. Another contribution by Ilias et al. [7] discusses the development of mobile applications for monitoring and managing Hajj and Umrah pilgrimages. Furthermore, Elazhary introduces a cloud-based, context-aware mobile application and framework for Hajj and Umrah management [8]. Together, these endeavors shape the evolving landscape at the intersection of technology and religious education, enhancing the overall pilgrimage experience.

Various studies have contributed to the integration of technology in the management and enhancement of Hajj and Umrah experiences. Yamin et al. [10] discuss the integration of social media and mobile apps into Hajj management, providing insights into leveraging these platforms for effective coordination and communication during the pilgrimage. Elazhary [11] introduces a cloud-based, context-aware mobile application and framework for Hajj and Umrah management, offering a technological solution to streamline pilgrimage logistics.

Sayudin et al. [12] contribute a management analysis of Hajj and Umrah travel services, providing practical insights into the operational aspects of

pilgrimage travel. Budiawan and Afrianto [13] focus on the development of an Android-based monitoring application for Hajj and Umrah pilgrims, demonstrating the potential of mobile technology in enhancing the monitoring and management of pilgrimage activities. Kabir et al. [14] explore a virtual reality (VR)-based interactive and educative experience of Hajj and Umrah for the people of Bangladesh, showcasing the application of VR technology in religious education. Suhaimi et al. [15] contribute to the development of a Pilgrim's Automatic Counting System and Health Monitoring using Machine Learning, showcasing the potential of machine learning in ensuring the well-being of pilgrims during their journeys. Together, these studies exemplify the diverse applications of technology in optimizing various aspects of the Hajj and Umrah experiences, ranging from logistics and management to education and health monitoring.

Utilizing manual paper-based procedures and antiquated systems to manage participant data, PT Mutiara Cinta Imani, a pilgrimage travel company with operations in Gresik, Probolinggo, Madura, Pasuruan, and Lamongan, is currently facing difficulties. The business's reliance on antiquated techniques emphasizes how urgent it is to adopt technologically advanced solutions for streamlining and improving operations. Data management can be revolutionized by switching from manual to automated information systems, improving workflow overall and efficiency and precision. Upgrading to modern technologies should increase the organization's capability and guarantee a more efficient functioning. At this crucial point, PT Mutiara Cinta Imani has to embrace new information technology in order to fully realize its potential in today's digital landscape.

The need to address issues with manual entry methods—which primarily use paper and Excel—motivates this research at PT. Mutiara Cinta Imani. Acknowledging inefficiencies and possible mistakes in these conventional methods, the business actively works together to describe the participant data input procedure as it is currently implemented. The goal of the project is to present a game-changing technical solution that will improve accuracy, optimize processes, and create a more effective data management system. This modernization addresses the shortcomings of the current data input procedures and is in line with industry trends. It also highlights PT. Mutiara Cinta Imani's proactive attitude to enhancing operational capabilities and competitiveness in the changing travel industry landscape.

II. METHODS

Due to its capacity to provide high-quality solutions quickly, the Rapid Application Development (RAD) method was chosen for the proposed Information System Development. Iterative development is given priority by RAD, which enables the rapid development of working prototypes. This iterative process makes sure that the technology closely matches the unique requirements of travel operations for the Hajj and Umrah. Rapid Application Development (RAD) shortens the time to market without sacrificing the quality of the final product by placing an emphasis on collaborative involvement and constant feedback loops[16]. RAD's agility stands out as a critical component in attaining both efficiency and precision in the dynamic world of travel operations, where adaptation is essential. Through the use of the RAD methodology, this research approach ensures a dynamic and iterative approach to the Web-based Information System development, facilitating quick progress, stakeholder involvement, and ongoing modifications based on changing requirements and input from PT. Mutiara Cinta Imani.

Each stage in the RAD implementation cycle plays a crucial role in achieving the overarching goal of rapid and effective system development. Let's delve into an elaborate explanation of each stage:

1. Requirements Planning: Stakeholders, including PT. Mutiara Cinta Imani, contribute to project specifications.
2. User Design: Collaborative sessions produce mock-ups, ensuring the system aligns with user needs.
3. Construction: Programmers convert designs into usable parts, allowing for iterative modifications.
4. Testing and Integration: Components undergo extensive testing to ensure expected functionality and smooth integration.
5. Implementation: Verified modules are incorporated into the system, deployed in a controlled environment.
6. Evaluation: PT. Mutiara Cinta Imani actively assesses system performance, suggesting improvements for enhanced efficacy.
7. Feedback and Adjustments: Ongoing feedback drives refinements and quick fixes, ensuring responsiveness to changing requirements.
8. Repeat Cycles: RAD's iterative nature allows for multiple cycles, improving the system based on user input and evolving needs.

III. RESULT AND DISCUSSION

A. Current System Analysis

The current system of PT. Mutiara Cinta Imani has various flaws that require attention and improvement. Currently, the organization relies largely on manual operations, particularly data input, which is accomplished through a combination of paper-based methods and Excel spreadsheets. This manual approach creates substantial obstacles to the efficiency and accuracy of operations, particularly for Hajj and

Umrah Travel participant data.

Manual Data Input

1. Issue: The use of paper forms and Excel sheets for human data input increases the possibility of errors, delays, and inconsistencies.
2. Impact: Incorrect participant data could cause logistical concerns, processing delays, and potential travel challenges.

Limited Technological Integration

1. Issue: The current system lacks technological integration, which impedes real-time collaboration and data availability.
2. Impact: Decision-making procedures become inefficient, and a lack of fast access to important information reduces the travel agency's overall responsiveness.

Branch Management Challenges

1. Issue: With the existing decentralized structure, managing participant data across different branches (Gresik, Probolinggo, Madura, Pasuruan, and Lamongan) becomes difficult.
2. Impact: It becomes more difficult to maintain accuracy and consistency in data handling, which could result in differences between branches.

Excel Limitations

1. Issue: There may be restrictions on the scalability, data security, and collaborative features of using Excel for data management.
2. Impact: The limitations of the current system may make it more difficult to handle participant data smoothly as the firm expands, which would reduce overall operational efficiency.

Lack of Automation

1. Issue: The lack of automated procedures for managing participant data, such as passports and meningitis letters, increases the amount of labor that must be done by hand and increases the risk of errors.
2. Impact: An increase in the amount of manual labor required could cause delays and increase the chance that important participant documentation will be overlooked.

A new system was developed from the issues already present, and numerous suggestions for enhancing the current system were made. Employee registration will be facilitated by this information system, which will also reduce the likelihood of document loss brought on by the numerous paperwork needed for Hajj and Umrah journeys. In addition, employees will find it easier to manage Hajj and Umrah packages with this system; keep in mind that these packages can occasionally change to reflect current events. Employees will also be able to set the ritual schedule, handle payments, and create departure and financial reports with greater precision and accuracy.

B. Proposed Solutions

Use case diagrams are visual representations in software engineering that illustrate interactions between a system and external entities, such as users or other systems. They play a crucial role in depicting the functionality and behavior of a system, providing a high-level overview of how the system responds to various scenarios. Use case diagrams detail the specific features and functionalities a system offers and the actors (users or external systems) involved in these interactions. The Use case diagram of the proposed solutions is depicted in Figure 1 and Figure 2, meanwhile the activity diagram is depicted in Figure 3.

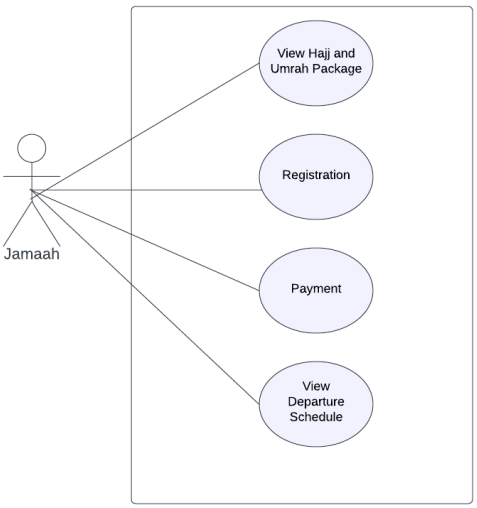

Fig. 1. Use Case Diagram

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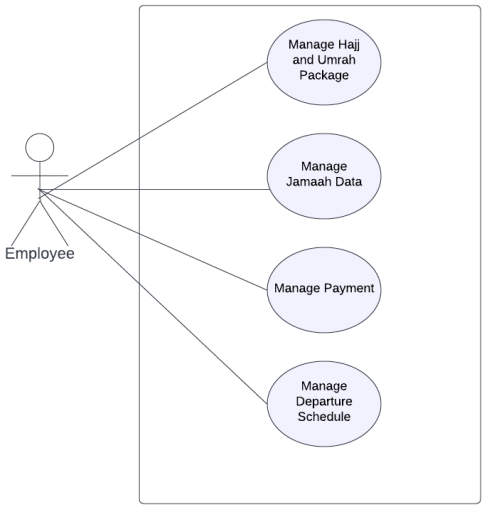

Fig. 2. Use Case Diagram (Cont')

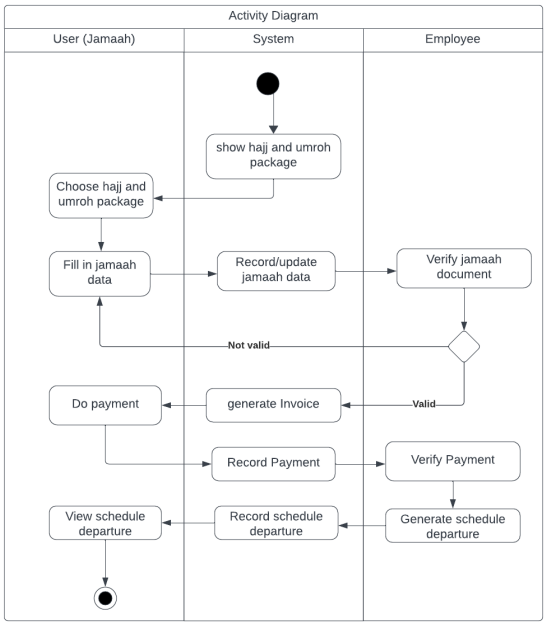

Fig. 3. Activity diagram

C. *Implementation Results*

As shown in Figure 4, the Login Page of the system presents a striking visual identity with the predominant use of PT Mutiara Cinta Imani's core colors, Red and Gold, fostering brand recognition. The design is purposefully simplistic yet elegant, prioritizing user-friendly navigation. It features a single login form indicating the page's title, two textboxes for login credentials, and two distinct buttons. The submit button facilitates the login process, while the href button serves a separate function outside the login session. This thoughtful design creates an intuitive and visually appealing entry point for admin and Admin, enhancing the overall user experience.

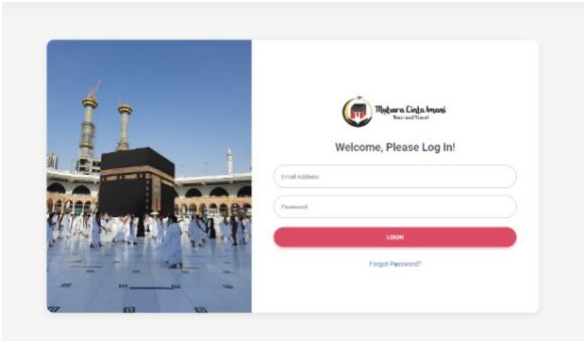

Fig. 4. Login Page

The "Paket Umroh" page serves as a centralized hub for managing and organizing Umrah travel packages. This feature empowers administrators to efficiently create, update, and delete packages, providing a streamlined and user-friendly interface as can be seen in Figure 5.

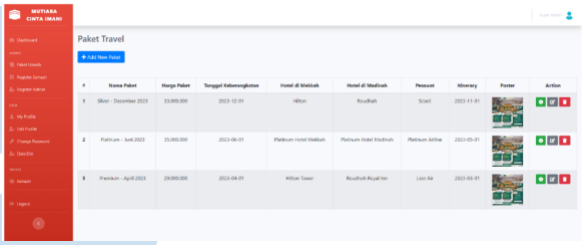

Fig. 5. Travel Package Page

The Dashboard page shown in Figure 6, serves as a personalized and informative welcome hub for users, offering a warm greeting and displaying their logged-in account name. This personalized touch enhances the user experience and establishes a connection. One prominent feature is the showcase of new Hajj/Umrah packages recently created by the admin, presented in a table format. This table provides a snapshot of essential package information, facilitating a quick overview. The user-friendly design incorporates an "Info" button for each package, allowing users to delve into comprehensive details by seamlessly redirecting to the Detail Paket page. This enhances user engagement, enabling them to make informed decisions about the available travel options. The table's structured format ensures clarity, displaying key details such as package names, itineraries, and pricing.

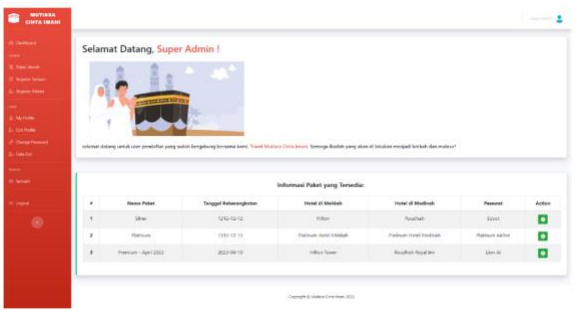

Fig. 6. Dashboard Page

Meanwhile "Register Jamaah" page as can be seen in Figure 7 has a form that the administrator can utilize to set up a new Jamaah account. The admin only needs to fill out the requirements and click the "register account" button to complete the procedure.

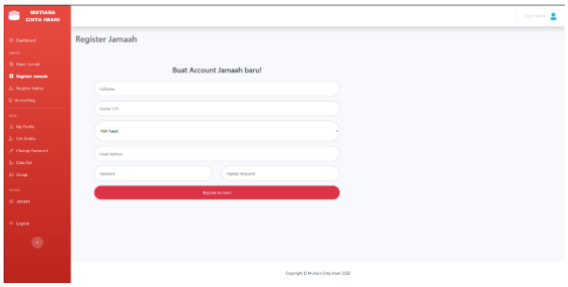

Fig. 7. Jamaah Registration Page

The "Edit Jamaah" page serves as a comprehensive platform for updating specific Jamaah data, facilitating efficient data modification (Shown in Figure 8). The page features a well-organized layout with input forms for various details, ensuring a thorough update process. Key input fields include Full Name, Package, Place and Date of Birth, Gender, Age, Sex, Mobile Phone Number, Family Mobile Phone Number, Passport Number, KTP Number, Education, Occupation, Biological Father, Biological Grandfather, Nationality, Departure Date, and various document scans such as Passport, KTP, Birth Certificate, Marriage Book, and Vaccination.

Navigation is user-friendly, with a Back button at the top for quick return to the Jamaah page. The Save button at the bottom finalizes the data modifications. The navbar and title prominently indicate the current page, enhancing user orientation within the system. This page streamlines the process of updating Jamaah data, ensuring accuracy and completeness. Its intuitive design encourages efficient navigation and seamless data management for administrators overseeing Jamaah information within the system.

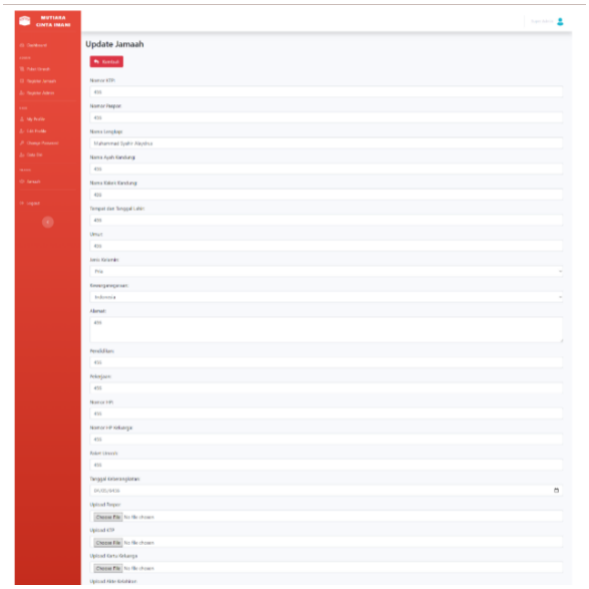

Fig. 8. Edit Jamaah Page

The Accounting Page functions as an extensive dashboard, affording administrators a centralized platform to delve into intricate financial details, as depicted in Figure 9. This feature goes beyond mere visualization, offering valuable insights and metrics crucial for informed decision-making within the business. The page likely encompasses various elements such as a summary of total Jamaah, gender-based metrics, and overall earnings. Administrators can track income per package and analyze financial performance on a monthly basis. The inclusion of detailed graphs, charts, or tables aids in visualizing financial trends, further enhancing the analytical capabilities of administrators.

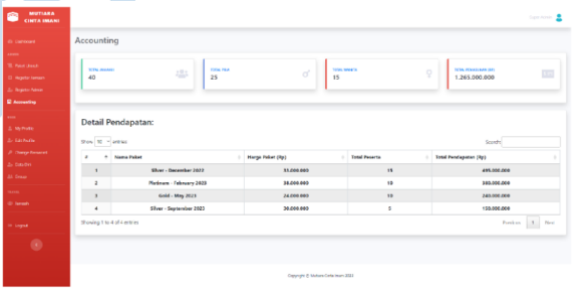

Fig. 9. The Accounting Page

System testing is carried out using black box testing techniques so that the system can function in accordance with defined display and system algorithms. The testing result related to choosing Hajj and Umrah packages is presented in Table 1.

TABLE 1. TESTING RESULT

No	Scenario	Expected Result	Actual Result
1.	User can Access Paket Umroh Page	User Access Paket Umroh Page	As Expected

2.	User can See List of Paket inside the Table	System show list of Paket data in a table	As Expected
3.	User can See the detail of the Package	User will be redirected by system to specific detail package	As Expected
4.	User can Create a new Package	System accepts and created new package	As Expected
5.	User can Update Package	System accepts and updated the package	As Expected
6.	User can Delete Package	System accepts and deleted the package	As Expected

IV. CONCLUSION

In summary, PT Mutiara Cinta Imani's Management Information System (MIS) deployment has greatly improved business facilities and operating procedures while also accomplishing its intended goals. The main objective of the research, to improve data management, has been accomplished, facilitating staff oversight and monitoring of participant and package data. The switch to a digital system has successfully reduced the amount of paper used, which has a positive environmental impact in addition to increasing efficiency and data security.

Travel package management, admin and participant account creation, and participant data management are all made possible by the MIS, which facilitates smooth administrative operations. This improves overall data security and accuracy while streamlining internal procedures. The web-based Information System interface of the system makes it easier for participants to participate and input data, making the experience more user-friendly. Moreover, users are empowered with real-time connectivity through the internet accessibility of the centralized database, which guarantees data integrity. The effective use of this research places PT Mutiara Cinta Imani at the front of technical innovation in the travel sector for the Hajj and Umrah, promoting better service delivery and opening the door for future expansion and success in the digital age.

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