Design and Analysis of Mail Management Information System using PIECES Method: A Case Study at Faculty of Mathematics and Natural Sciences of Udayana University

Made Pasek Agus Ariawan[1], Putu Bagus Indra Sukadiana Putra[2], Putu Arya Mertasana[3]

[1][2] Study Program of Magister of Electrical Engineering, Faculty of Engineering, Udayana University
[3] Study Program of Electrical Engineering, Faculty of Engineering, Udayana University
e-mail: pasekagusariawan38@gmail.com

***Abstract*— Information is needed by agencies, companies, organizations, institutions and the environment having no access to the system. Mail is an important means of communication for agencies. The faster the distribution of the mail the faster the information can be obtained by people or agencies. The increasing number of incoming and outgoing mail gives rise to some problems in mail management. From review of some researches, it can be said that the information management system can help handle the problem faced in mail data processing, mail filing, and mail searching. However, there are some drawbacks in the researches, among others the researches reviewed do not explain how the system works in the mail distribution, verification, signing, classification, and prioritization. This research aims to analyze and design an information system of incoming and outgoing mail management using the PIECES analysis. The advantages of the system are among others, it can help computerize data; the process of mail distribution can be real time with mail notification; the incoming mail data can be classified using the classification method; outgoing mail can be made using the SPK method and the mail signing can be made using the barcode system.**

***Index Terms*— information system design, mail, PIECES analysis.**

I. INTRODUCTION

Information is needed by agencies, companies, organizations, institutions and the environment having no access to the system. Information is very important because it can increase knowledge, reduce uncertainty and risk of failure, and help leaders in taking an effective and efficient conclusions and decisions[1].

Mail serves as an important means of communication for organizations. The faster the distribution of the mail the faster the information can be obtained by people or agencies. Incoming or outgoing mail is not only used for communication, but also as an authentic piece of evidence [2]. Therefore, a system that can handle the incoming and outgoing mail process is required.

The increasing number of incoming and outgoing mail may result in some problems in managing the incoming and outgoing mail, among others the buildup of mail to be distributed, the long process of mail documentation, a lot of space needed for mail archiving, and difficulties in prioritizing mail to be distributed first.

At the present time, the mailing procedure applied is still manual in terms of the reception, filing, preparation, documentation, verification and distribution. Documentation for incoming and outgoing mail is done by recording it on the mail book. Meanwhile, archiving is done by storing the mail in the form of hardcopy. Searching for an old document may take some time as old documents should be opened one by one. Other challenges may include difficulties in reporting incoming and outgoing mail, lost and damaged documents, difficulties in determining the status of mail that cannot be monitored by the person requesting of the mail, and long time spent in making outgoing mail or distribution sheets.

The purpose of this study is to analyze and design an incoming and outgoing mail management information system using the PIECES analysis to identify the weakness of the system that has been running.

II. LITERATURE REVIEW

A. Development of Management Information System Incoming and Outgoing Letter In General Section Regional Secretariat of Pacitan Regency.

Muhammad Luqman [3] in his study entitled Development of An Incoming and Outgoing Mail Management Information System in the General Affairs Division of Regional Secretariat Office of Pacitan Regency, mentioned that the development of the Incoming and Outgoing Mail Management Information System, is expected to produce applications that can manage incoming and outgoing mail based on the determined flow of distribution. Mail archiving is done electronically by storing the softcopy, and the documentation of incoming and outgoing mail is done both per day and per period. In addition, this application also helps monitor the mail distribution at the verification stage.

B. Design a letter management information system

Jati Sasongko and Dwi Agus Diartono [4] in their study titled Design of Mail Management Information System state that the advantage of this system is that it is able to manage mail, both incoming and outgoing which enable a quick search of the mail at any time when needed.

C. *Information Management System Incoming Letter And Letter Out In Unit Technical Technical Training Kindergarten And Primary School Pringkuku Sub-district.*

Siska Wahyu Kartikasari [5] in her study titled Information System of Incoming and Outgoing Mail Management in Technical Unit of Kindergartens and Primary Schools in Pringkuku Sub-regency mentions that the advantage of her research is that the incoming and outgoing mail processing system that she proposed uses a computerized information system so as to enable faster search of data on incoming and outgoing mail since the data are safely and structuredly stored and there is no longer delay in data searching.

From the result of the reviewed researches, it can be said that the information management system can help handle the problem of mail data processing, mail archiving, and mail data search. However, the researches have some drawbacks, among others, they do not explain how the system works in the mail distribution, verification, signing, classification, and prioritization.

III. METHODOLOGY AND RESEARCH

A. Analysis of the old system on incoming and outgoing mail process

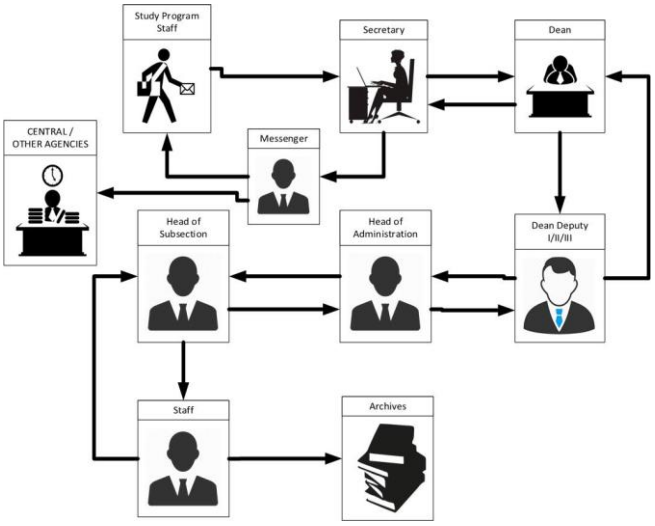

Fig 1. Flow process Incoming mail And outgoing mail In the Faculty of Mathematics and Natural Sciences UNUD

Fig 1 describes the flow of incoming and outgoing mail process at the Faculty of Mathematics and Natural Sciences of Udayana University. It can be seen that in the mail processing, there are many phases that must be passed through. The mail is firstly received by the secretary before it is forwarded to the verifiers (Dean, Vice Dean, and Head of Administration Unit) respectively, and it is then received by the relevant division or Using the Template

B. PIECES Method of Analysis

In order to identify the weaknesses of the system, the analysis consists of six aspects commonly known as PIECES, namely the analysis of Performance, Information, Economy, Control, Efficiency and Service (Whitten & Bentley, 2007). In the mail system that has been used,

- Performance (Performance Analysis) Performance Aspects are used to measure performance in a business process.
- Information (Information Analysis) Information is a crucial commodity for end users. Evaluation of the ability of information systems in generating useful information needs to be done to address the opportunities and deal with emerging problems.
- Economic (Economic Analysis) Economic reason is the most common motivation for a project. The foothold for most managers is the cost or the rupiah. Economic issues and opportunities related to cost issues.
- Control / Security (Security Analysis) Controls installed to improve system performance, prevent, or detect system errors, ensure data security, and requirements.
- Efficiency (Efficiency Analysis). Efficiency involves generating as much output as possible with the smallest possible input [11].

C. Generate digital authentication

A bar code is a collection of code in the form of lines and spaces, where the thickness of each line and space differs according to the content of the code. Information that can be read by machines in a visual format can be easily stored, transferred, processed, and validated. The linear bar code refers to the way of encoding numbers and letters in sequence of bars and spaces of various widths so that they can be read, retrieved, processed, and validated using a computer[6]. Bar codes can be used as digital authentication replacing manual authentication. Bar codes can be created from the unit code in the Faculty of Mathematics and Natural Sciences of Udayana University where each unit has a different code.

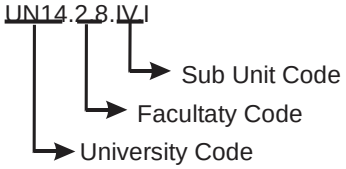

Fig 2. Explanation of Unit Code In Faculty of Mathematics and Natural Sciences UNUD

Fig 2 describes the unit code of Udayana University, where UN14 is the code of Udayana University, 2.8 is the code of the Faculty of Mathematics and Natural Sciences, and IV.I is the code of subunits under the Faculty of Mathematics and Natural Sciences of Udayana University.

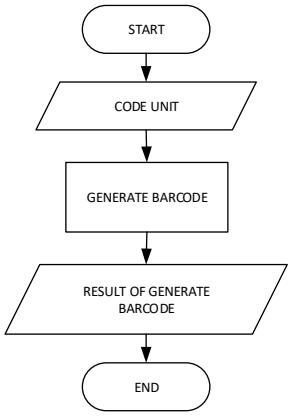

Fig 3. Flowachat generate barcode

Fig 3 is the process of generating bar codes based on the unit and sub unit codes in the Faculty of Mathematics and Natural Sciences of Udayana University used as digital authentication in the design of mail management information system.

D. Determination of the priority of mail making

The technique of determining the priority of mail making is done by entering the values of the mail criteria. The values are then processed using the simple additive weighting (SAW) method. The SAW method is seeking a weighted summation of the performance rating for each alternative on all attributes [7]. SAW method requires a decision matrix normalization process to a scale that can be compared with all the ratings of existing alternatives [11].The information presented is the ranking of the mail that will be prioritized in the process. Fig 4 determining the priority of each of the alternatives

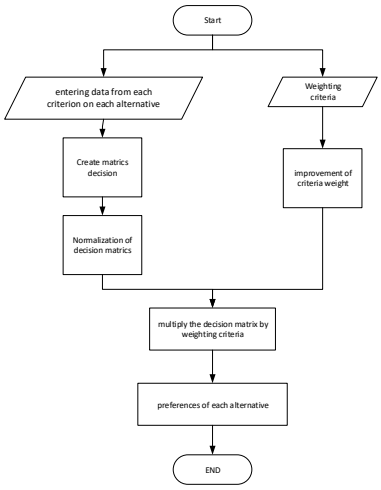

Figure 4. Flowachat priority of letter making

E. Classification of incoming mail

Data Mining is the process of discovering information in large data sets through the use of algorithms and methods at the intersection of statistics, machine learning, and database systems [8].

Data Mining (DM) is the process of analyzing data from multiple perspectives and summarizing it into useful information, in which the information can be used to increase revenue or to cut costs or both[10]. The evolution of Data Mining starts since the data is firstly collected for business applications and bioinformatics stored on the computer and continued with the improvement of data access technology. The stages of Data Mining [9] are shown in fig 5:

- Data cleaning (to remove inconsistent data and noise)
- Data integration (to merge data from multiple sources)
- Data transformation (the data is converted into the appropriate form for data mining)
- Application of Data Mining techniques
- Evaluation of patterns found (to find interesting/valuable patterns)
- Presentation of knowledge (with visualization techniques)

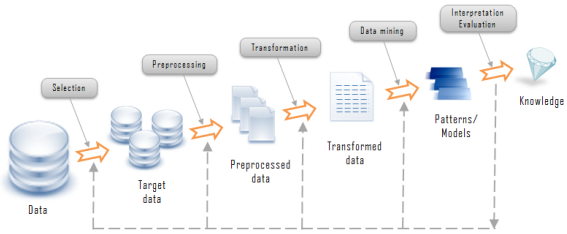

Fig 5. Stages of data mining

F. Method of collecting data

The type of data used in this study is secondary data. The data are in the form of data input from incoming and outgoing mail. The method of collecting data used is non-participant observation method, by inputting the data contained in mail, such as mail code, mail type, mail status, mail date, mail deadline and others.

IV. RESULTS AND DISCUSSION

A. Analysis of the weaknesses of the system

The method used to analyze the weaknesses of the system is the PIECES method. It is found out that the weaknesses occur because the system used is still manual where the data are processed manually which results in longer mail processing. The PIECES method may also provide suggestions to deal with the weaknesses of the existing system. Following the analysis of the weaknesses of the existing system, the proposed system can also provide solutions for improvement. Table 1 shows an analysis of the PIECES method.

TABLE I. PIECES analysis

Types of Analysis	Weakness of the Old System	The proposed system
Performance	1. The letter distribution system is still manual and lasts longer 2. The verification process lasts longer	1. The process of distributing letters will take place quickly because through the internet network 2. The verification process will take place

	due to waiting for the relevant officials 3. The process of signing the letter lasts long due to wait for the signatory officials	quickly because the letter notification will be realtime through the official email 3. The mail signing process will use a digital signature system 4. The process of receiving letters will be classified based on the level of urgency 5. The process of making and delivering outgoing mail is based on priority.
Information	1. The process of retrieving letter information takes a long time because recording is done manually.	1. Mail information search process will be faster because it uses search feature on the system. 2. Mail search process will be faster because the letter will be classified based on urgency
Economic	1. In the long term the cost required in the documentation will be great because the mail is physically documented 2. In the long term transportation costs will be great for the distribution of letters	1. In the long run the cost of documentation will be cheaper because the mail data will be stored on the database. 2. In the long term the cost of transportsi will be cheaper because the mail delivery within the agency intern through the internet
Control	1. Manual mail system will have difficulty controlling incoming or outgoing mail due to processing 2. Performed by humans so the possibility of human error is very large.	1. Computer-based system will facilitate the control of the mail because many processes will be done olelh system so that it can reduce the occurrence of human error.
Efficiency	1. Manual mail system is less efficient because many states go through in processing an incoming or outgoing mail so that the processing time will be long in case of process kerterlambatan on existing state.	1. Computer-based systems are more efficient because the process is centralized to the system so that the processing time will be faster.
Services	1. Services distribution, information search and recording of letters still lasts long	1. Services in distribution, information search and mail recording will increase as the process is done by the system.

B. Analysis of the system design

a) Diagram Context

In this research, the system that will be designed has three types of users: Staff, Secretary, and Verifier. Staff has access to the making of outgoing mail that has been ranked based on mail delivery priorities, the mail distribution and the access to view the list of mail that have been classified. Meanwhile, the secretary has access to input incoming mail, mail distribution and to view the list of mail that have been classified. On the other hand, verifiers have access to verify and do the follow-up on the mail distribution. The system overview can be seen in figure 7.

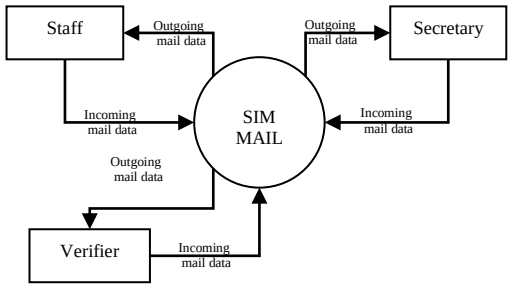

Fig 6. Context Diagram

b) DFD Level 0

Fig 7 shows DFD level 0 that explains the general concept of the design of the mail management information system. This system has 5 important sub-systems namely input incoming mail, mail distribution, viewing mail data, scheduling mail making and printing outgoing mail.

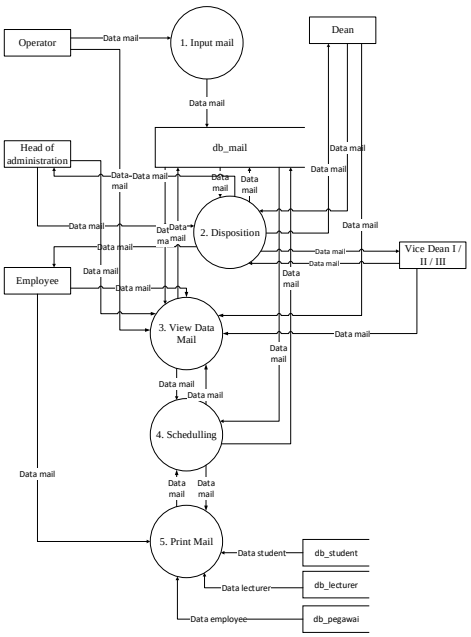

Fig 7. DFD level 0

C. Generate bar codes

The process of mail signing is done digitally using a barcode system by generating the code contained in the unit and sub unit in the Faculty of Mathematics and Natural Sciences of Udayana University. Table 2 displays the result of a generated bar code.

D. Determine Mail Priorities

In the mail-making process, the mail that should be prepared first must be prioritized. The following are the stages of the process of mail-making prioritization.

Table II. Barcode code of each unit in the faculty of Mathematics and Natural Sciences

UNIT NAME	UNIT CODE	BARCODE UNIT
FMIPA	UN14.2.8	UN14.2.8
VICE DEAN I	UN14.2.8.I	UN14.2.8.I
VICE DEAN II	UN14.2.8.II	UN14.2.8.II
VICE DEAN III	UN14.2.8.III	UN14.2.8.III
CHEMISTRY STUDY PROGRAM	UN14.2.8.IV.1	UN14.2.8.IV.1
BIOLOGY STUDY PROGRAM	UN14.2.8.IV.2	UN14.2.8.IV.2
PHYSIC STUDY PROGRAM	UN14.2.8.IV.3	UN14.2.8.IV.3
MATHEMATICS STUDY PROGRAM	UN14.2.8.IV.4	UN14.2.8.IV.4
PRODI INFORMATIKA	UN14.2.8.IV.5	UN14.2.8.IV.5
PHARMACY STUDY PROGRAM	UN14.2.8.IV.6	UN14.2.8.IV.6
PHARMACIST STUDY PROGRAM	UN14.2.8.IV.7	UN14.2.8.IV.7
CHEMISTRY MASTER STUDY PROGRAM	UN14.2.8.IV.8	UN14.2.8.IV.8
BIOLOGY MASTER STUDY PROGRAM	UN14.2.8.IV.9	UN14.2.8.IV.9
ADMINISTRATION DIVISION	UN14.2.8.V	UN14.2.8.V
SUB DIVISION OF EDUCATION AND COOPERATION	UN14.2.8.V.1	UN14.2.8.V.1
SUB DIVISION OF GENERAL AND FINANCIAL	UN14.2.8.V.2	UN14.2.8.V.2
SUB DIVISION OF PLANNING AND INFORMATION SYSTEM	UN14.2.8.V.3	UN14.2.8.V.3
SUB DIVISION OF STUDENTS	UN14.2.8.V.4	UN14.2.8.V.4

Table III. Alternative values on the criteria

Alternative	Criteria		
	C1	C2	C3
thesis examiner decree	10	7	1
Letter of appointment of the committee	15	2	3
thesis supervising decree	8	7	1
Training assignment letter	12	3	2

$$\begin{vmatrix} 0.80 & 0.29 & 0.33 \\ 0.53 & 1.00 & 1.00 \\ 1.00 & 0.29 & 0.33 \\ 0.67 & 0.67 & 0.67 \end{vmatrix}$$

Fig 13. Normalization matrix

TABLE IV. letters ranking results

Alternative	Result
thesis examiner decree	0.501
Letter of appointment of the committee	0.813
thesis supervising decree	0.581
Training assignment letter	0.667

Table IV shows the results of the mail ranking where the determined mail will be prioritized in making outgoing mail.

V. CONCLUSION

From the results of research that has been conducted, it can be concluded that:

1. The mail management information system using the PIECES analysis can help analyze the weaknesses of the existing system and provide solutions to the problem. The mail information system is expected to be able to reduce problems in dealing with mail data.
2. The digital signing system using the bar code method based on the code from each sub-unit can speed up the signing process.
3. The Simple Additive Weighting (SAW) method can help provide recommendations in determining the priority in mail-related work and based on required criteria, the recommendations have been in accordance with the needs of the system users.

REFERENCES

[1] Wijaya, I, S., Siswanto, Agus. (2016). Prototype Pengembangan Aplikasi E-Information Menggunakan Metode User Centered Design Di Stikom Dinamika Bangsa Jambi. Seminar Riset Teknologi Informasi (SRITI) tahun 2016.

[2] Syaban, M, R., Bunyamin, H. (2015). Pengembangan Sistem Informasi Pengelolaan Surat Masuk Dan Surat Keluar Berbasis Web Di Dinas Sosial Tenaga Kerja Dan Transmigrasi Kabupaten Garut Menggunakan Framework PHP. Jurnal Algoritma Sekolah Tinggi Teknologi Garut. Vol. 12 No. 1 2015.

[3] Luqman, M. (2013). Pembangunan Sistem Informasi Manajemen Surat Masuk dan Surat Keluar Pada Bagian Umum Sekretariat Daerah Kabupaten Pacitan. Journal Speed – Sentra Penelitian Engineering dan Edukasi. Volume 5 No 3 – 2013.

[4] Sasongko, J., Diartono, A, D. (2013). Rancang Bangun Sistem Informasi Manajemen Surat. Jurnal Teknologi Informasi DINAMIK. Volume XIV, No.2, Juli 2009.

[5] Kartikasari, W, S. (2011). Sistem Informasi Pengelolaan Surat Masuk Dan Surat Keluar Pada Unit Perlaksanaan Teknis Taman Kanak – Kanak Dan Sekolah Dasar Kecamatan Pringkuku. Journal Speed – Sentra Penelitian Engineering dan Edukasi. Journal Speed – Sentra Penelitian Engineering dan Edukasi. Volume 3 No 1 – 2011.

[6] Gao, Z, J., Prakash, L., Jagatesan, R. (2007). Understanding 2D-BarCode Technology and Applications in M-Commerce Design and Implementation of A 2D Barcode Processing Solution. 31st Annual International Computer Software and Applications Conference(COMPSAC 2007).

[7] Bentley, Lonnie D. & Jeffrey L. Whitten. (2007). Systems Analysis & Design for the Global Enterprise.McGRAW-HILL International Edition.
[8] Taruna, S., Hiranwal, S. (2013). Enhanced Naïve Bayes Algorithm for Intrusion Detection in Data Mining. International Journal of Computer Science and Information Technologies. Vol. 4 (6) , 2013.
[9] Marisa, F. EDUCATIONAL DATA MINING (KONSEP DAN PENERAPAN). Jurnal Teknologi Informasi Vol. 4 No. 2.
[10] Peling, I, B, A., Arnawan, I, N., Arthawan, I, P, A., Janardana, I, G, N. (2017). Implementation of Data Mining To Predict Period of Students Study Using Naive Bayes Algorithm. International Journal of Engineering and Emerging Technology. Vol. 2 No. 1, 2017.
[11] Suyono, A, A., Indianiati, U, N., Rizki, E, M., Hamidah, S and Jannah, E, N. (2016). Analisis Aplikasi Integrated Postal Operations System (IPOS) Pada PT. Pos Indonesia (Persero) KPRK Jombang Menggunakan Metode PIECES. Jurnal Ilmiah Teknologi Sistem Informasi, Januari 2016, Volume 2, Nomor 1.