Digitalization of Academic Service and Process in the Automation Laboratory Website

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Abstract: This research has combine about the fundamental principles involved in the digitalization process with design an effective website for academic service and process in automation laboratory. Finding some key concepts such as, defining digitalization, examining pathways, introducing the notion of 'fit for purpose', and assessing archival concerns and dissemination compression techniques. Using PHP programming to design web then using prototype method to finish it. Scanning files, convert files to digital form, and import files to link address are some of digitalization process before upload to the website. Although there are drastic changes in digital technology, academic service, staff training, manpower, and infrastructure are serious problems to be tackled before attempt for digitalization website. There are five aspects that are assessed and all of them showed after digitize lab web is better than before digitized. Aspect of performance (88), speed of access (90), completeness (91), benefits (92) and process errors (40).

1 INTRODUCTION

Today's technological advances are very rapid and cover all disciplines. Especially in computer technology, the use of computers in everyday life cannot be separated from lifestyle. Almost every activity or work that is done is greatly helped by the presence of a computer. Technological advances always aim to help human life become more comfortable. But there are still many people who still do not take advantage of technology, for example the closest to our lives is digital technology.

Digital technology has been widely used in various fields, both felt and not felt. Digitalization (digitization) is the process of transferring media from printed, audio, and video forms to digital forms. Likewise for laboratory digitization, which is a system developed using an approach based on the use of digital technology that is integrated with a data processing mechanization system as a provider of information to support aspects of activities related to laboratory administration and operations. Each laboratory has a system for storing all data related to laboratory equipment and administration. So far, this

is still done manually in the laboratory, which can take a long time and possibly cause errors in the process of recording and searching data.

The information contained in traditional print materials like books, journals, reports, published works, minutes of the important meetings, manuscripts, cannot be preserved forever for a number of reasons. As years pass by, the information contained in them gets faded out; the medium becomes brittle and finally becomes unusable. Unless we have alternatives arrangement for recapturing and reproducing it another format important will be lost forever. Fortunately, technological advances have provided us with suitable alternatives for preserving such valuable information; information technology has brought tremendous changes in the way of the life of the human being. Publication industry is no exception to it. To have wider access and long-term preservation policy of scholarly human knowledge many of the professional organisations and publication houses are moving towards the electronic publication of their print resources.

Discussed capabilities of digital technology digitization it's importance and various steps involved in the digitization process and efforts to

preserve, manage, and provide access to scholarly information digitization prerequisites and also discusses the practical experience of digitization (Koganuramath etc, 2010).

Preservation Committee of the Canadian Council of Archives (2002) discussed technological approaches digitization encourages preservation by limiting the handling of original records, access strategy and impact of a digitization program on the institution's other public service activities. Report has been discussed the design of the new digital collection will be determined by the goals of the institution, its functions, and intended users. As digital collections and projects grow over time, it is useful to contemplate the future development and interaction with other collections from the same or other institutions, preservation of the digital collection and also recommends some useful recommendations regarding digitization and preservation.

2 LITERATURE REVIEW

Previous research that has been done is the digitization of the laboratory consumables service system using the form. This digitization increases the competence of the public service sector. In addition, the implementation of the actualization also provides benefits for student, lecturer and technician, namely providing a model of administrative services during the Covid-19 pandemic with a dynamic digital system. (Nurabika, 2020). Research on the design of a document digitization system using the visible watermark method, where in this digitization system a digital file is added with a visible watermark to maintain the security of the file. (Saifudin, 2018). Research of digitizing system to manuscripts and thesis of the FIB library, University of Indonesia as an evaluation of planning and implementation. A case study approach where data is collected and analysed using standard activity theory for digitalization projects. (Undari, 2009). Vocational Factory Indonesia (VFI) in an effort to embrace vocational education in producing certified MSMEs through digitizing competency certification and facilities in vocational education and the digitization stage consisting of supplement, complement, integrated and finally the infusion stage.

Besides that, research on the design of the web-based UIN Malang laboratory management information system using the CMS (Content Management System) method (Almais, 2008). Research on designing a web-based mental health

care using the prototype method, is a method that synchronizes needs users with system developers so that a system meets expectations is produced (Widharma, 2021).

2.1 Digitalization

Digitalization is a process to capture an analog signal into digital form. This paper, the term 'digitalization' is a shorthand phrase that describes the process of making an electronic version of a 'real world' object or event, enabling the object to be stored, displayed and manipulated on a computer, and disseminated over networks and/or the World Wide Web. Image may be captured using a scanner or a digital camera and to optimize the clarity, OCR software may be employed to the electronic image. The numerical system used by computers is called binary and is made up of a series of ones and zeros. These ones and zeros are commonly referred to as 'bits' of information. A fundamental point to note from any digitization process is that the binary or digital channels are relatively narrow, and only a partial representation of an analogue object can ever be rendered in digital form. In other words, the digital object can ever only be a version of the real thing. The digitizer therefore has to make informed decisions about what level of detail is required in the digital version of an object, for that digital version to serve its intended purpose.

Aim of the digitization is to enhance access and improve preservation. By digitizing their collections, such as libraries can make information accessible that was previously only available to a select group of researchers. Digital projects allow users to search collections rapidly and comprehensively from anywhere at any time. Machines are includes Hardware i.e. system, scanner and storage devices, and Software i.e. OCR software (Abby Fine Reader).

Before start the scanning its needs to know the which type document you going to scan and what is the conditions of the document and how much resolution is required minimum 200 dpi is required for the OCR (300 dpi is recommended), which mode of scanning is required i.e. Colour/Grayscale/Block-and-white, brightness of the scanned Image, page size etc.

2.1.1 Digitalization Process

To be able to carry out this digitization process, hardware is needed which is also the main component that supports the implementation of this project. In

addition to the basic computer hardware, CPU, printer and hard drive, you will also need:

1. Scanner for document attachment sheet
2. Scanner for books
3. Scanner for transparencies or microfilm
4. Digital camera

In addition, for a high-quality computer it maximizes processor speed, RAM and storage capacity (disk space). In addition to the existing hardware, further appropriate software is needed to support the implementation of this project. Digital documents that have been scanned with a scanner require software or software that can edit or display these results. The software needed to carry out the digitization process can be adjusted according to needs. The required software, namely:

1. Adobe Acrobat reader
2. Omni page Software (OCR software)

In addition to computer equipment to store data, a network is needed that makes the computer accessible to other computers on a particular network. Meanwhile, to achieve maximum performance you must have servers that support data transfer and storage, namely:

1. Database server
2. Web Server
3. FTP server
4. Mail server
5. Printer server
6. Proxy servers

In this digitization process, two types of servers are used, namely a server connected to the intranet, containing all metadata and full text material that can be accessed by all users in a local area network (LAN). While the other server is a server that is connected to the internet, containing metadata and digitization results.

2.1.2 Digitalization Workflow

The challenge is best faced with the assistance of what are called workflow systems. Assigning and systematizing file names is another aspect of workflow. Workflow system is consist of:

1. Document Selection

Documents to be digitized are first selected by the team. Documents that are still good are scanned with a scanner and then converted into digital form. Then the old documents that are not good for scanning, are photographed with a digital camera to get the digital file.

2. Procurement of Goods

Procurement of goods, either the purchase or rental of equipment and supplies needed for the purpose of carrying out the digitization process, such as computers, CD-DVDs, scanner machines, and other equipment.

3. Network Installation

The network installation involved in this activity is the maintenance of the equipment needed to support this digitization project into a wider network system, such as setting up network cables for LAN, Hub, Catalyst and server computers.

4. Digital System Installation

Digital system installation is integrating a digital system into a PC and installing digitizing software such as Adobe Acrobat Professional version 6.0-8.0 and Omni page Pro 14.

5. Digitization Training

Document editing training that will be carried out in the next process to students and laboratory staff/technicians in the automation laboratory as well as other members of the digitization team deemed necessary to follow.

6. Document Scan

Documents that are still good can be obtained in digital format by using a scanner machine and saving the scanned files to CDs and flash disks.
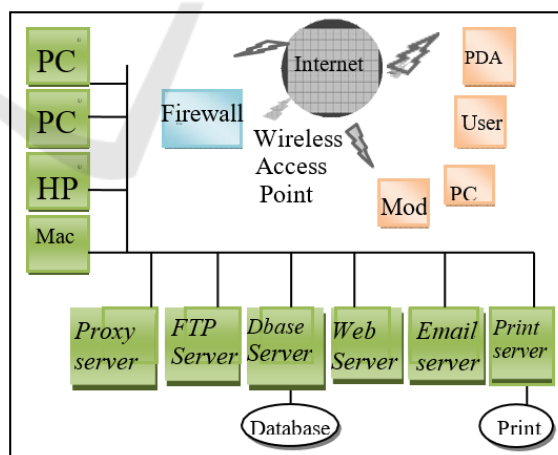

Figure 1: Infrastructure of Digitalization Workflow.

7. Document and Laboratory Equipment

Old documents that are not in good condition to be scanned are taken with a digital camera to get the digital files. Likewise, shooting the equipment in the Automation Laboratory to get the digital files.

8. Media Transfer (Microfilm to Digital)

Laboratory documentation stored in microfilm will be converted into digital format using existing conservation equipment.

9. Translating Equipment Manual

In order to be able to obtain abstract summaries and descriptions of the equipment manuals, it is necessary to translate the contents of the equipment manuals.

10. Manual Description Creation

After translating and analyzing the contents of the existing manual, further descriptions of the manual can be made by filling out the worksheets provided.

11. Subject Analysis and Data Validation

Making equipment categories, types and brands of equipment, equipment codes, and data validation are activities included in this process, and are carried out by students in collaboration with laboratory assistants/technicians.

12. Digital File Editing

Digital file editing is done by students which includes adding watermarks or bookmarks, security, header-footers, as well as subject analysis and saving edited digital files.

13. Input and Upload Data

Manual descriptions of equipment that have gone through the editing process are entered one by one through the worksheet. After being filled in completely, the data along with the edited digital files are uploaded together.

14. Label Making and Installation

The process of attaching labels to documents and equipment in an automation laboratory. The label on the practicum equipment is written with reference to the code before.

15. Back Up Data

All digital files that have gone through the editing process are backed up in several places, such as CD-DVDs, and external disks.

2.2 Prototyping Method

A protoype is a sample implementation of the system. It provides limited and main functional capabilities of the proposed system, consists of build on earlier versions, determine objectives, develop, refine, demonstrate, test, and implement. The waterfall model is the traditional lifecycle model in which the lifecycle phases are executed in a sequential manner.

Figure 2: Prototyping Method.

The difference with the waterfall model is the fact that each phase is completed fully before you start the next. It is harder to change something that was not discovered in your concept stage, consists of requirement analysis, design, development, testing, deployment, and maintenance. [Fig. 2]

2.3 Designs the System

To get an idea of the system being used today, an analysis of the system is carried out and a model is made using functional model. The process and data model of the system is described by Entity Relationship Diagram (ERD), Use Case Diagram, Activity Diagram, Sequence Diagram, dan Class Diagram.

a. Entity Relationship Diagram (ERD)

The entity relationship diagram (ERD) is a graphical representation of a problem domain being modeled. The ERD assists the database designer in identifying the data and the rules that will be represented and used in a database.

Figure 3: Entity Relationship Diagram (ERD).

The ERD is an implementation independent representation of aproblem domain and it facilitates communication between the end-user and the analyst. The basic components of the ERD are entities, properties of entities called attributes, and relationships between entities.

  b. Use Case Diagrams

To identify the process of the old system or the current system, use case diagrams are used. With this use case diagram, it can be seen the processes that occur in laboratory activities. This diagram also shows the functions used by the current system. The use case image can be seen below (figure 4). There are several use cases with different functions according to the actor and their needs:

The use case of the Head of Laboratory data serves to record the data needed from the Head of the Laboratory to be stored in the database, also change the data of the Head of the Laboratory.
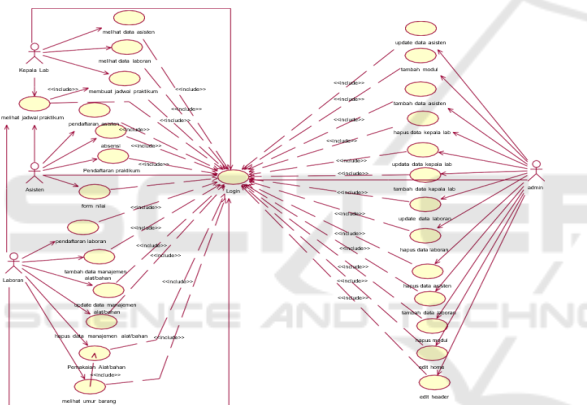
Figure 4: Use Case Diagram Current System.

The use case data for the Laboratory Assistant serves to record the required data from the Laboratory Technician to be stored in the database. Use case data Assistant serves to record the required data from the new laboratory assistant to be stored in the database. The Practicum Schedule use case is used to view the practicum schedule. The Add Module use case is for the modules that we want the user to access. Use case Form This value is used to control who are the members of the laboratory assistant and the absence of the laboratory assistant.

  c. Activity Diagram

This activity diagram is included by other use cases. This use case keeps the system safe from people who are not entitled to access the data on the system. In other words, login is the key to whether or not someone can enter this system.

The following is an activity diagram for the login use case.
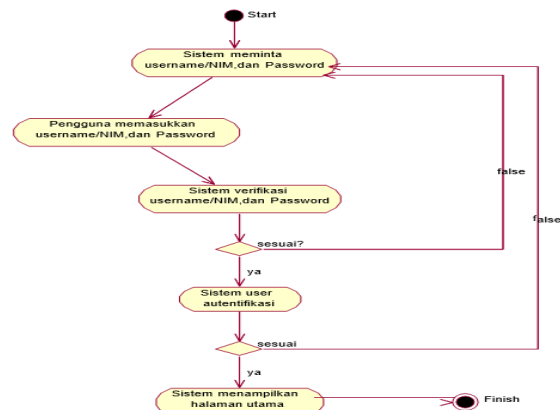
Figure 5: Activity Diagram.

This activity diagram is used to find out the flow of how to make the practicum schedule.

  d. Sequence Diagrams

Sequence diagram for login use case. The login use case is included by all actors, the processes that occur in it are as follows:

• SystemUser enters the fields in the login form
• The interface will send the input from the login form to the loginManager (which functions as a control) to check the validity of the login
• loginManager checks the validity of the login by sending data from the login interface to the user entity contained in the system database
• After the login is valid, the SystemUser will go to their respective main pages, if the login is not valid then the system will display an error message to SystemUser
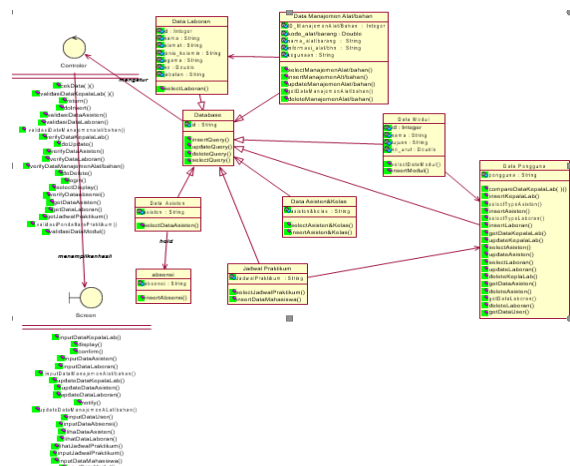

Figure 6: Sequence Diagram.

3 RESULT AND ANALYS

There are three results and analysis of this research, i.e. digitalization process, laboratory web design process and upload digitalization result to the web process.

3.1 Digitalization Process

The implementation of the digitization of documents and practicum equipment experienced quite a lot of delays due to several factors, including the process of digitizing documents which was quite complicated, along with practicum schedule that used equipment, to network constraints that did not support this process.
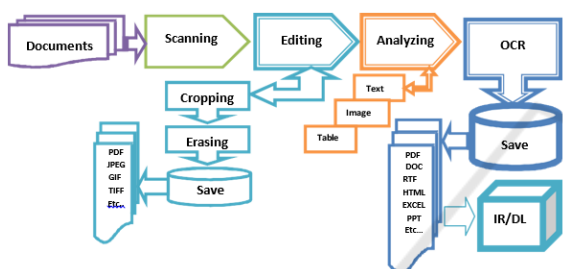
Figure 7: Digitalization Workflow.

Technically, the document selection process, procurement of goods, and digitalization training did not encounter any significant obstacles. The same applies to the process of scanning documents, making and installing labels, backing up data, as well as subject analysis and data validation. For the description of the equipment module, it is quite difficult because there is being used.
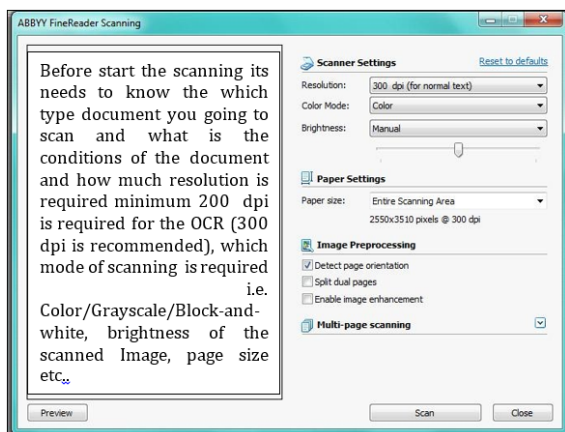
Figure 8: Digitalization process with OCR.

There are several significant obstacles during the process of digitizing documents and practicum equipment which are quite disturbing, including:

The network capacity of the laboratory is not sufficient to accommodate data exchange in large capacities such as manual book documents.

3.2 Automation Lab Web Design

The results of product development in the form of a laboratory management website. The website design developed includes website menu display, login menu display, profile management, Laboratory SOP, practicum guide, inventory management, virtual lab, and operational management (the process of borrowing and returning tools).

In the following, the results of the development of online laboratory management products which include the initial laboratory menu display, the initial menu display including the tool inventory menu, material inventory, and inventory of goods, are presented as follows.
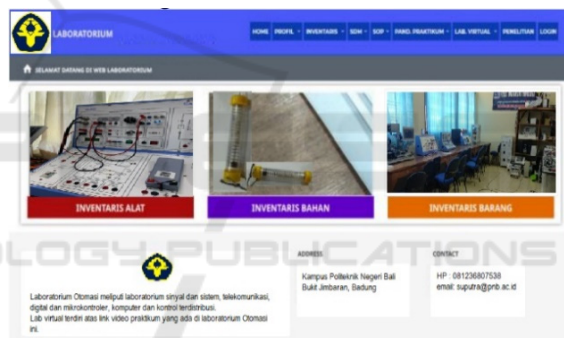

Figure 9: Home Menu of Lab Web.

Meanwhile, the login display for entering data on materials and goods is as shown in Figure 10 below.

Figure 10: Login Menu Display.

The profile menu shows the identity data of the laboratory manager which includes the head of the

laboratory, laboratory assistant and technician. The practicum guide menu is needed to store and display various practicum guides, so that both students can access them easily without having to photocopy them. An inventory menu of tools, materials, and goods is needed to assist teachers in preparing practicum activities by looking at the availability of practical tools and materials.

The practicum will be easier to understand after students watch the selected video according to the type of practicum or guide via the link on the virtual lab menu. The existence of a virtual laboratory is intended as a place to store various forms of video documentation of practicum activities that have been carried out to help students.
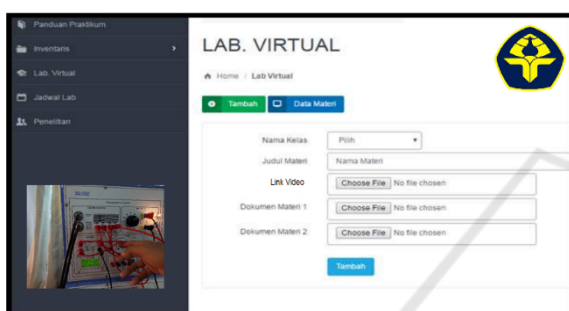

Figure 11: Virtual laboratory menu.

The schedule management is needed so that the implementation of activities in the laboratory between one class and another can be well controlled. The SOP menu shows the display of various types of SOPs needed to support ideal laboratory management.

Table 1: Link SOP of Colleges

No	Link Subject of College	Notes
1	MSK 0412 SAP Sensor dan Transduser - Google Drive	Learning sensor & transducer applied reasoning
2	MSK 0309 Arsitektur Komputer - Google Drive	Evolution, module design, build up computer
3	MST 0504 Mikrokntroller - Google Drive	Micro controller & interface, applied technology
4	MST 0402 Pemrograman Komputer - Google Drive	Programming C++ and exercises

After completing the three processions, an assessment was carried out involving technicians and students in the laboratory. There are five aspects that are assessed through the questionnaire, namely aspect of performance, speed of access, completeness, benefits

and process errors. The average results of these assessment are shown in the following curve.
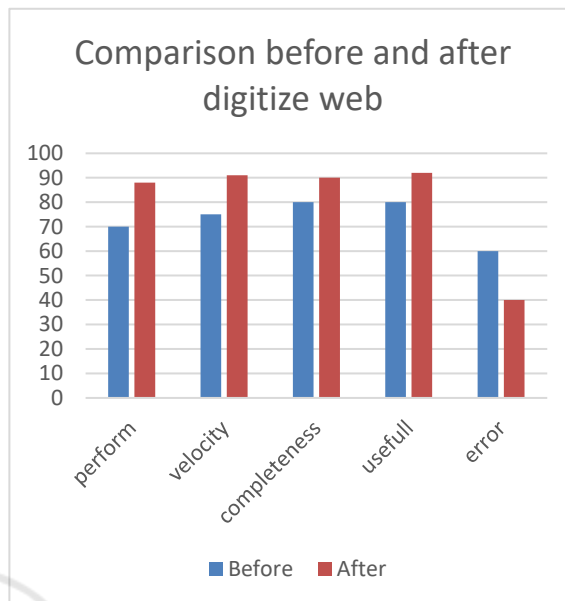

Figure 12: Comparison assessment before and after digitalization of automation laboratory web.

4 CONCLUSIONS

After finish the research, there are five conclusion obtained:

1. Digitization process is needed computer hardware, CPU, printer and hard drive, scanner, digital camera, adobe and software, also servers

2. Digitalization workflow is consists of document selection, procurement of goods, network installation, digital system installation, digitization training, document scan, document and laboratory equipment, media transfer (microfilm to digital), translating equipment manual, manual description creation, subject analysis and data validation, digital file editing, input and upload data, label making and installation, and back up data

3. Prototyping method is a sample implementation of the system. It provides limited and main functional capabilities of the proposed system, consists of build on earlier versions, determine objectives, develop, refine, demonstrate, test, and implement

4. To get an idea of the system being used today, an analysis of the system is carried out and a model is made using functional model. The

process and data model of the system is described by Entity Relationship Diagram (ERD), Use Case Diagram, Activity Diagram, Sequence Diagram, dan Class Diagram.

5. There are five aspects that are assessed through the questionnaire, namely aspect of performance (88), speed of access (90), completeness (91), benefits (92) and process errors (40).

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