International Journal of Eco-Innovation in Science and Engineering Vol.04 (2), 2023 (13-21)
https://ijeise.upnjatim.ac.id/ E-ISSN: 2721-8775

Article

Design of Web-Based Laboratory E-Learning Information System (Case Study in UPN "Veteran" Jawa Timur Industrial Engineering's Laboratory)

Dwi Sukma Donoriyanto, Isna Nugraha* and Ario Adityawarman

Department of Industrial Engineering, Faculty of Engineering, Universitas Pembangunan Nasional Veteran Jawa Timur, Surabaya 60294, Indonesia
*Corresponding author: *isna.nugraha.ti@upnjatim.ac.id | Phone number: +6285293006434

Received: 26th November 2023; Revised: 27th November 2023; Accepted: 27th November 2023;
Available online: 28th November 2023; Published regularly: May and November

Abstract

This time, the development of technology has increase rapidly, one example of technology application in education is development the concept of e-learning. However, the Industrial Management and Statistic Laboratory (IMSL) located at UPN "Veteran" Jawa Timur in the Industrial Engineering Department does not have the supporting facilities for practicum learning such as E-Learning. In other words, the learning process between laboratory assistants and practitioners is very limited, and causes a lack of intensity in interaction between laboratory assistants and practitioners. In this research, a web-based E-Learning information system will be produced to provide easiness in practicum learning for people who related to the laboratory, and can be accessed anytime and anywhere. The research method for collecting required data is by observation and interviews. This e-Learning is designed with PHP, HTML, and SQL programming languages. And the supporting software that are Google Chrome, XAMPP, VSCode, and FileZilla. Based on the test results, it is concluded that the web-based IMSL E-Learning information system has provided easy learning to the practitioners and people who involved in the laboratory. While laboratory assistants can send announcements about practicum information and practitioners can do the revisions or acc reports to certain laboratory assistants systematically and online.

Keywords: E-Learning, Information System, Website, PHP, SQL.

1. Introduction

E-learning is a learning concept that uses computer technology, which can be distributed and accessed via computer devices. Currently, the E-learning concept can be used extensively, proving wide acceptance by the international E-learning community in educational institutions [1]. E-learning has great potential to support the realization of learning targets. E-learning has several advantages, such as overcoming the problem of distance and time, encouraging a positive learning attitude, forming a new learning atmosphere, and increasing learning opportunities, controlling the learning process, promoting renewal of teaching materials, encouraging the development of cooperative attitudes, and adapting to various learning methods [2].

The Industrial Engineering Department at Universitas Pembangunan Nasional "Veteran" Jawa Timur, has several academic activities. One of them is learning activity in the industrial management and statistic laboratory. In the laboratory, there are some practicum materials including Management Information Systems, Industrial Statistics, Industrial System Simulation, Industrial Optimization and Computer Programming. However, the industrial management and statistic laboratory does not have a facility to do online learning, therefore this laboratory requires E-learning system because E-learning is very useful for people who involved in the industrial management and statistic laboratory

for processing and facilitating the spread of learning information. Therefore, it is necessary to make an information system in the form of web based E-learning that can be accessed by practitioners, laboratory assistants, laboratory administrator, anytime and anywhere, so it can help the learning process become more effective and efficient.

2. Literature Review

2.1. Information System

Information systems are a combination of personnel, technical facilities or tools, media, programs and controls. This system is designed to manage important communication networks, handle certain routine transactions, help the management and internal or external users, and provide the foundation for making the right decisions [3]. According to [3] Information systems have six components, that are (1) input components, (2) model components, (3) output components, (4) technical components, (5) database components and (6) control components or guided components. These six components must exist to-gether and become one unit. If one or more of these components is lacking, the information system will not be able function (i.e. data processing) and will not be able to achieve its purpose (i.e. produce information that are relevant, on time, and accu-rate).

Entity Relationship Diagram (ERD) is a model to explain the relationships be-tween data in a database based on basic data objects that have connection between relationships [4]. Entity Relationship Diagram (ERD) is a design or form of activity relationship in the system that is directly link to each other and has a certain function in the process. ERD is a modeling of a relational database based on perceptions in the real world, this world always consists of a set of objects that are interconnected with one another. An object is called an entity and the connection is called a relationship. An entity must unique and has attributes that differentiate it from other entities [5].

According to [6] the context diagram is a general description of the system contained in the organization, which shows system boundaries, interactions between external entities and the system, and information that flows between entities and systems. Diagram context is a tool to analyze the system that will be developed. Symbols used internally in the Context Diagram are the same as symbols that only exist in data flow diagram.

Gane/Sarson	Yourdon/De Marco	Keterangan
External Entity	External Entity	External entity can be people/unit that interact with system but outside the system itself.
Process	Process	People/unit that using or do the data transformation. Physical components are not identified.
Data Flow	Data Flow	Data flow with specific direction from source to object
Data Store	Data Store	Data storage or a place for data is seen by processes.

Fig. 1. Entity Relationship Diagram Symbols

	ENTITY Bunch of objects or something which can be distinguished or uniquely identified
	RELATIONSHIP A relationship that occurs between an entity or more. a collection of similar relationships is called a relationship set
	ATTRIBUTE A characteristic in an entity or relationship that describes details about the set of data elements that established an entity
	CONNECTION Used as a link from entity that differentiate the entity with another entities

Fig. 2. Data Flow Diagram Symbols

The system of data flow diagrams are also called data flow diagrams (DFD). DFD is usually used to describe an existing system or a new system that will be developed logically, aside from the physical data flows environment or the physical environment in which data is stored. DFD describes the flow of data in the system in a clearly structured way [7]. Data flow diagrams are used to describe each entity and the data flow is data flow diagrams [8].

2.2. Database

A database is a collection of information that stored by the system on a com-puter so that computer programs can be used to perform inspection in order to ob-tain information from the database. The main purpose of the database

DOI:10.4186/ijeise.upnjatim.ac.id/E-ISSN: 2721-8775

system is to allow users to construct abstract views of the data. It aims to simplify the interaction between the user and the system, and database can provide different view for users, programmers, and administrators [9]. So the concept of database is a collection of data that forms a file that is interconnected (relation) in a certain way to form new data or information. In other words, database is a collection of data that are interconnected (relations) with one another organized based on a certain scheme or structure [10][11].

MySQL is an open source Relational Database Management System (RDBMS). Database software usually paired with web server programming languages such as PHP or JSP. MySQL (My Structured Query Language) is a database creation and management program or usually called DBMS (Database Management System), this DBMS is open source. In addition, MySQL is also a network database access program, so it can be used for Multi User applications [12][13].

2.3. E-Learning

According to [14] E-learning is a method for learning using the Internet and other networks or other media that aims better communicate material. The advantages of the E-learning system to save cost of administering education, for example buildings, print modules. E-learning is an effective and flexible learning medium because it can be accessed anywhere and saves more time [15].

2.4. Website

According to [16] Website, or web for short, can be inter-preted as a set of pages consisting of several pages. These pages contain information in the form of digital data, including text, images, video, audio and animation are provided via an internet connection. According to [17] A website is what you see through your browser, and a so-called website is actually a web application because it performs certain operations and helps you with certain activities. The elements of a website or site to provide the existence of a website, the supporting elements must be available, are as follows: Domain Name or URL is a unique address used to identify a website on the Internet. In other words, a domain name is the address used to find websites on the Internet. For example http://www.unm.ac.id/ and http://www.detik.com/. Domain names can be freely traded on the Internet and have an annual lease status. The domain name itself will have an identifier extension / suffix based on the interests and location of the web-site. For example, a domain name with an Indonesian location extension is co.id (the domain name of the company's website), ac.id (the domain of the educational web-site). name), go. id (domain name) government agency website) or .id (organization website domain name).

The definition of virtual host can be defined as a space that contains various data and files on the hard disk. Pictures, etc. Will be displayed on the website. The amount of data that can be entered depends on the size of the virtual host, the bigger the data that can be entered and displayed on the website. Web hosting can also be obtained by renting a hosting which is defined by the hard disk space, MB (mega-byte) or GB (gigabyte) [18].

2.5. Hyper Text Markup Language (HTML)

According to [19] HTML stands for Hypertext Markup Language, which is a markup script that is used to create and manage website structures. Some of the main tasks of HTML in building a website are determining the website layout. Format basic text such as paragraph settings, and font formatting. Make a list. Create a table. Insert pictures, videos and audios. Create a link. Create a form.

2.6. Hypertext PreProcessor (PHP)

PHP is a language specially designed for the Web. PHP is a tool for creating dynamic web pages. In the beginning, PHP stands for Personal Home Page (personal site). PHP was first created by Rasmus Lerdorf in 1995. At that time PHP was still called FI (Form Interpretation), in the form of a set of scripts for processing form data on the Web. Nowadays, PHP stands for PHP: Hypertext Pre-Processor, that is a recursive acronym, which is a way to play words that consist the abbreviation itself: PHP: Hypertext PreProcessor [20].

2.7. Structured Query Language (SQL)

According to [21] SQL is a structured language specifically used to process databases. MYSQL is an open source database management system. MYSQL is a relational database management system. This means, data that is managed in the database will be placed in several separate tables, so the data manipulation will be much faster. MYSQL can be used to manage from small to very large database [22].

3. Material and Method

In conducting research, data collection must be carried out, the data collection methods that used are as follows:

1. Doing direct interviews or debriefing with people who related with this research, in order to obtain valid informations.
2. Direct observation to the research's objects so the process can be clearly identified.

Here are the steps to solve problems in designing an e-learning information system for Industrial Management and Statistic Laboratory at UPN Veteran, East Java, Industrial Engineering department. The steps are in the image below:

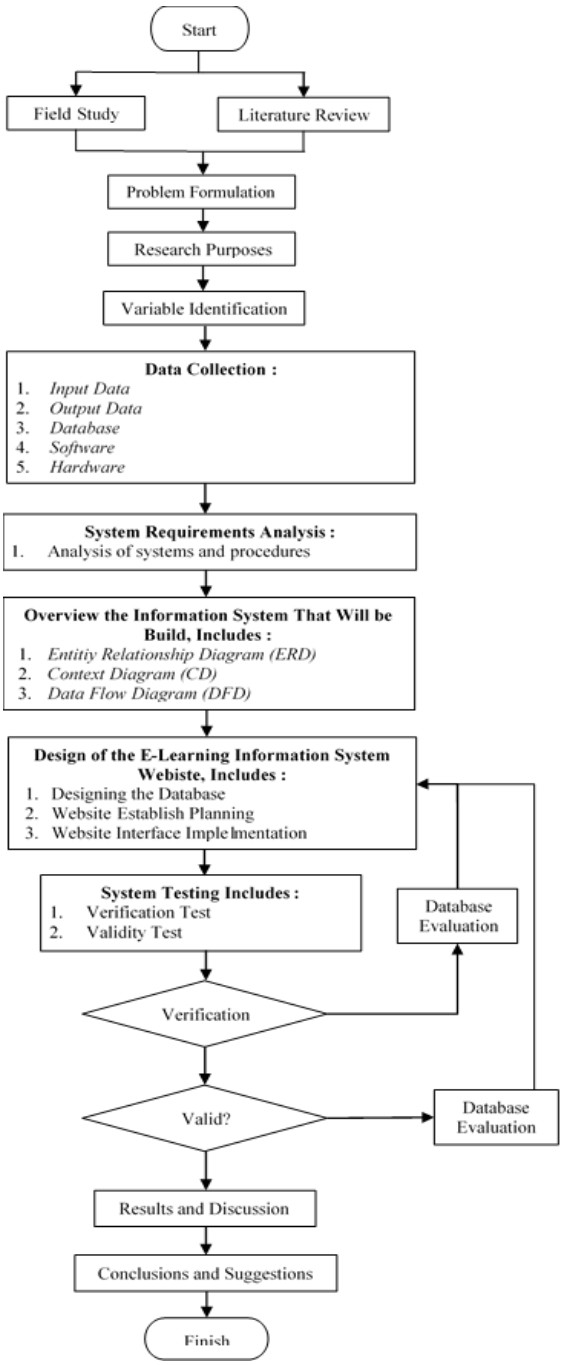

Fig. 3. Research Methodology Flowchart

4. Results and Discussion

4.1. System Flowchart

The following is a system flowchart that shows an overview of the system to be made.

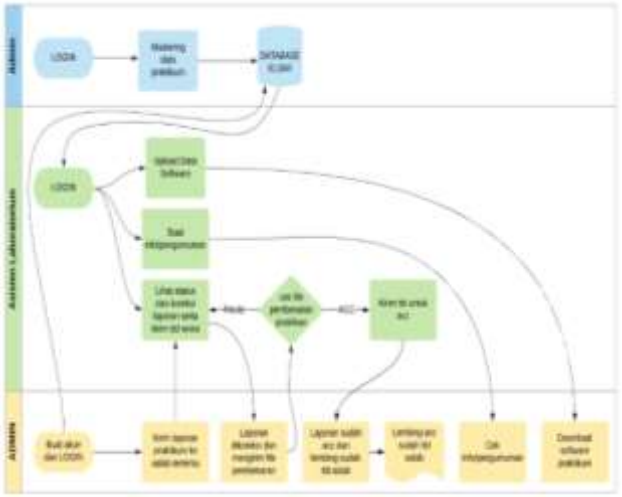

Fig. 4. System Flowchart

4.2. ERD (Entity Relationship Diagram)

The cardinality of the relationship between entities is different, the cardinality of the relationship between software entity to praktikum, the praktikan entity to praktikum, the info entity to asisten laboratorium, entity info to praktikum, entity laporan to praktikum, are many to one. The cardinality of the relationship between the modul entity to praktikum, is one to one. The cardinality of the relationship between asisten laboratorium to praktikum, praktikan entity to asisten laboratorium, are many to many. The cardinality of the praktikan entity relationship to the laporan, the asisten laboratorium entity to laporan is one to many.

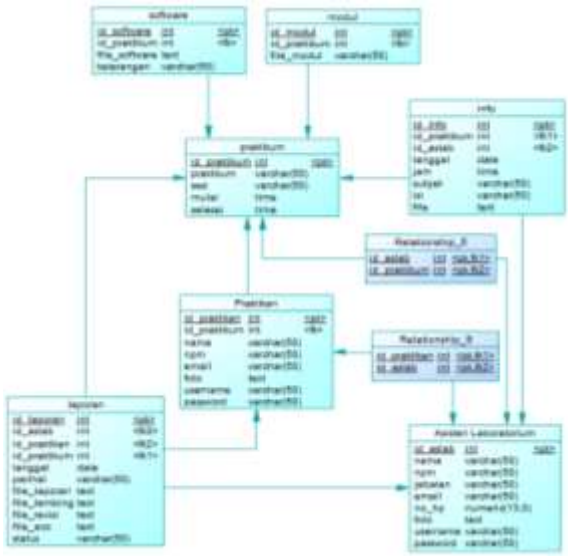

Fig. 5. Entity Relationship Diagram

4.3. Context Diagram

Here is a context diagram for designing an e-learning information system for industrial management and statistic laboratory.

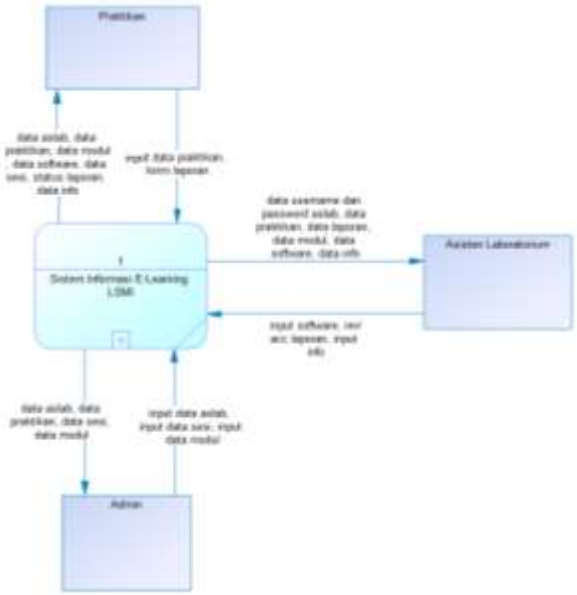

Fig. 6. Context Diagram

4.4. Data Flow Diagram

The Data Flow Diagram (DFD) is a model of the system to describe the division of the system into smaller modules.

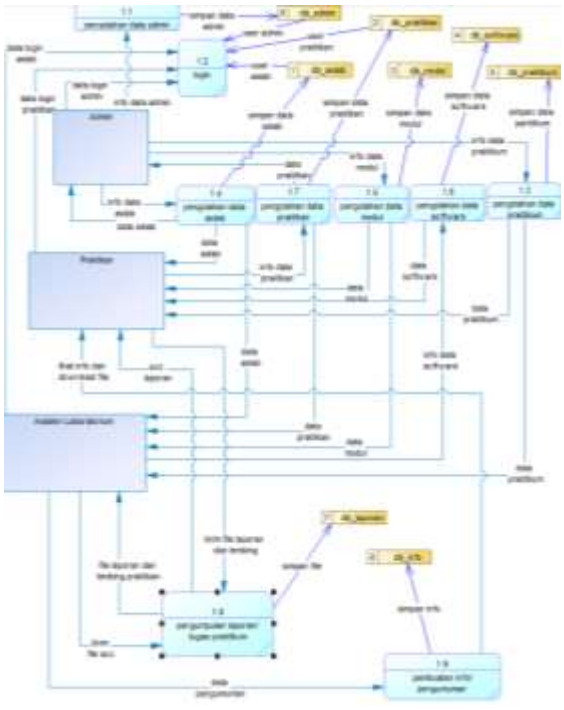

Fig. 7. Data Flow Diagram

DOI:10.4186/ijeise.upnjatim.ac.id/E-ISSN: 2721-8775

4.5. Interface Page Display

Here is the design result of the e-learning information system for industrial management and statistic laboratory are the display of the interface.

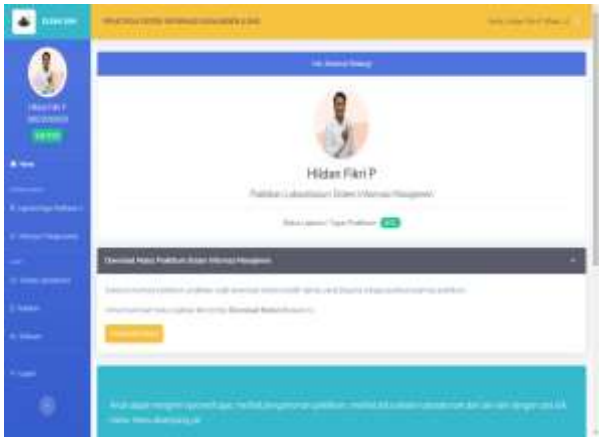

Fig. 8. Practitioners Dashboard Page View

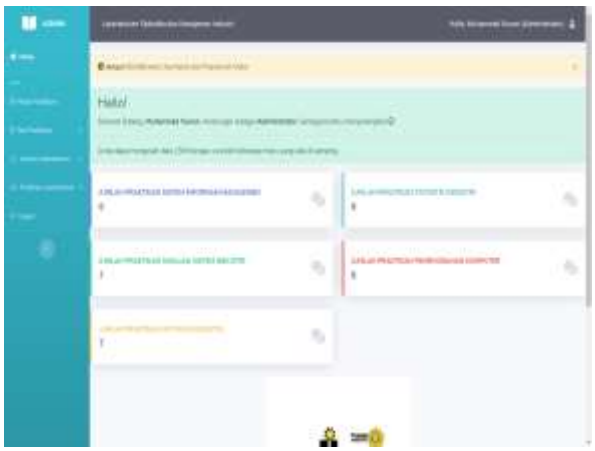

Fig. 9. Admin Dashboard Page View

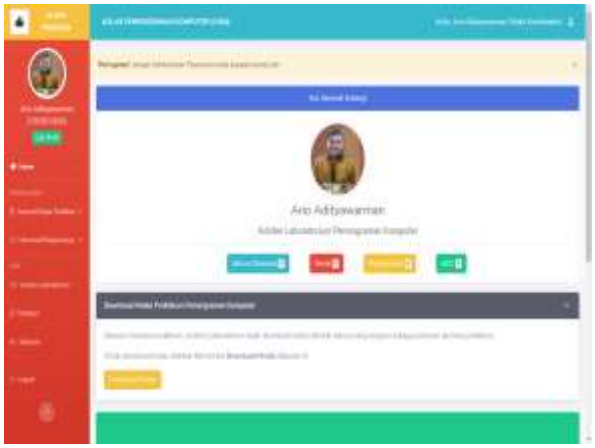

Fig. 10. Laboratory Assistant Dashboard Page View

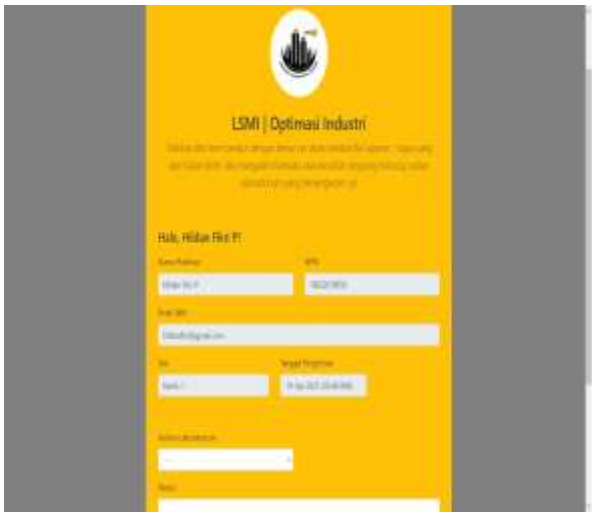

Fig. 11. Send Report/Assignment Page View

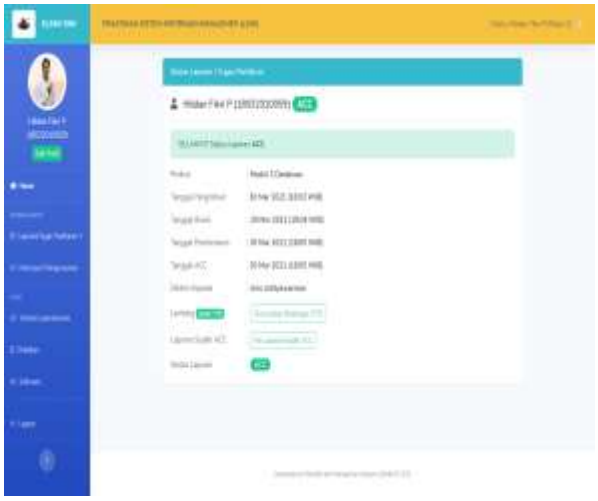

Fig. 12. Report/Assignment Status Page View

4.6. Verification and Validity Test

At this stage, a program verification and validation test is carried out in the e-learning information system for industrial management and statistic laboratory, the purpose of carrying out the verification and validation test is to examine whether a program / design that has been compiled can be executed in accordance with the provisions and procedures that have been designed before. Then in addition to check whether the program can run smoothly, the verification and validation test will see whether the e-learning information system can increase the effectiveness and efficiency of the cases being resolved. The table for verification and validation tests on the design of e-learning information systems for industrial management and statistic laboratory is as follows:

DOI:10.4186/ijeise.upnjatim.ac.id/E-ISSN: 2721-8775

Table 1. Verification and Validition Test Table

User Expectations	Status User
Data Input Process	This e-learning information system has provided forms to manage data, starting from Insert (Adding Data), Update (Changing data), Delete (Deleting Data). In addition, users can also change profiles and upload a profile Picture. .
Data Output Process	This e-learning information system successfully displaying the results of the data that has been inputted by the user, which consists of practicum report data, information / announcement data, laboratory assistant data, practitioners data, module data, and software data. Then the system successfully displays the profile of the user who logged in.
System Process	This e-learning information system has successfully performed functions for Insert, Update, Delete which aim to process data in the system. Then successfully perform the function for Login. Furthermore, the system has also succeeded in changing the usrename and password for certain users, and the user's profile picture.
Practicum Learning	This e-learning information system has succeeded in carrying out the learning process through info, laboratory assistants can send any information and can attach certain files, this system has also succeeded in carrying out the interaction process between the practitioner and the laboratory assistant through the revision process / ACC of the practicum report or assignment
Perfomance	This e-learning information system has succeeded in documenting all user-managed data automatically into the database.
System Security	This system successfully provides security by validating email and password which can only be accessed by 1 user according to each user's rights. Then the website cannot be accessed if you don't log in first. And when the user has logged out, the user's session has been erased and if you want to access the dashboard page you have to log in again.

4.7. Analysis and Discussion

This research begins from an observation that has been made in industrial manage-ment and statistic laboratory that do not have online learning tools or what is com-monly called e-learning, this research will produce a systematic and practical e-learning information system. This e-learning system for industrial management and statistic laboratory is an information system that aims to provide easy learning for practitioners and the people who involved in this laboratory [23]. Where laboratory assis-tants can learn and deliver information online to practitioners. In the system, labora-tory assistants and practitioners can interact through the revision process and acc to the practicum report/assignment that sent by the practitioner to certain laboratory assistants. This information system is website-based where the first step collecting data of practicum material, laboratory assistants data, days and practicum hours (sessions) data, modules and software data, practitioners data. After the data is ful-filled, data processing is carried out starting from database design, website establish planning, web interface

implementation, and system testing. The system that has been created has several outputs that can facilitate the learning process in the labora-tory, starting from sending learning information that can be created by laboratory assistants and can be seen by the practitioner, carrying out the revision process and report acc, and all that is done online. From the verification testing process and validation testing, which testing every feature in this e-learning information system, it can be concluded that the system or website is running as desired, all tools and menus can run properly according to user or the website user expectations of this e-learning information system, management industrial and statistic laboratory.

5. Conclusions

From the results described in this paper, the conclusion is this website-based e-learning information system for management industrial and statistic laboratory has provided easy learning to the practitioner and the people who involved in this labor-atory. Where laboratory assistants can send practicum information through the announcement form and it can attached files, then the practitioner can view the info and download the attached file, after that the practitioner can send the practicum report/assignment to certain laboratory assistants to carry out the revision and acc process online and systematically. That way, the system that has been created can be said to have the efficiency of carrying out the practicum learning process in this in-dustrial management and statistic laboratory.

References

[1] H. M. T. Tran, F. Anvari, and D. Richards, "Holistic Personas and the Five-Dimensional Framework to Assist Practitioners in Designing Context-Aware Accounting Information System e-Learning Applications," in *Context-Aware Systems and Applications, and Nature of Computation and Communication*, Springer, 2017, pp. 184–194.

[2] V. Arkorful and N. Abaidoo, "The role of e-learning, advantages and disadvantages of its adoption in higher education," *Int. J. Instr. Technol. Distance Learn.*, vol. 12, no. 1, pp. 29–42, 2015.

[3] S. A. Asri, I. Sunaya, E. Rudiastari, and W. Setiawan, "Web Based Information System for Job Training Activities Using Personal Extreme Programming (PXP)," in *Journal of Physics: Conference Series*, 2018, vol. 953, no. 1, p. 12092.

[4] P. Kashmira and S. Sumathipala, "Generating entity relationship diagram from requirement specification based on nlp," in *2018 3rd International Conference on Information Technology Research (ICITR)*, 2018, pp. 1–4.

[5] Y. Liu, X. Zeng, K. Zhang, and Y. Zou, "Transforming Entity-Relationship Diagrams to Relational Schemas Using a Graph Grammar Formalism," in *2018 IEEE International Conference on Progress in Informatics and Computing (PIC)*, 2018, pp. 327–331.

[6] F. Schmalenberg and R. Vandenhouten, "An advanced data processing environment based on data flow diagrams with a flexible triggering and execution model," in *2016 IEEE 14th International Symposium on Applied Machine Intelligence and Informatics (SAMI)*, 2016, pp. 159–164.

[7] B. J. Berger, K. Sohr, and R. Koschke, "Automatically extracting threats from extended data flow diagrams," in *International Symposium on Engineering Secure Software and Systems*, 2016, pp. 56–71.

[8] A. Lutfi, "Sistem Informasi Akademik Madrasah Aliyah Salafiyah Syafi'iyah Menggunakan Php Dan Mysql," *J. AiTech*, vol. 3, no. 2, pp. 104–112, 2017.

[9] D. L. Saraswati *et al.*, "Development of web-based and e-learning media for physics learning materials in senior high school: A pilot study," in *Journal of Physics: Conference Series*, 2018, vol. 1114, no. 1, p. 12025.

[10] N. Bakanova, T. Atanasova, and A. Bakanov, "Applying Machine Learning to Data from a Structured Database in a Research Institute to Support Decision Making," in *International Conference on Distributed Computer and Communication Networks*, 2020, pp. 712–722.

[11] A. Andaru, "Pengertian database secara umum," *OSF Prepr.*, vol. 2, 2018.

[12] M. Dawodi, M. H. Hedayati, J. A. Baktash, and A. L. Erfan, "Facebook MySQL performance vs MySQL performance," in *2019 IEEE 10th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON)*, 2019, pp. 103–109.

[13] A. Josi, "Penerapan Metode Prototiping Dalam Pembangunan Website Desa (Studi Kasus Desa Sugihan Kecamatan Rambang)," *J. Teknol. Inf. Mura*, vol. 9, no. 1, 2017.

[14] M. K. Hussein, R. I. Saheel, and A. J. Ali, "Implementation of E-Learning Functions With the Use of Information Systems Architecture," *J. Cases Inf. Technol.*, vol. 23, no. 2, pp. 12–25, 2021.

[15] B. Sus, O. Bauzha, S. Zagorodnyuk, and I. Revenchuk, "Virtual laboratory as custom e-learning implementation and design solution," in *CEUR Workshop Proceedings*, 2021, pp. 177–187.

[16] Y.-C. Cho and J.-Y. Pan, "Design and implementation of website information disclosure assessment system," *PLoS One*, vol. 10, no. 3, p. e0117180, 2015.

[17] W. Aditya, Y. G. Sucahyo, and A. Gandhi, "Bridging the. id Domain Purchase Intention with Website Channels: Factors Analysis Approach," in *2020 International Conference on Advanced Computer Science and Information Systems (ICACSIS)*, 2020, pp. 323–328.

[18] C. Hou and C. Li, "The Design and Implementation of Web-Based E-Learning System," in *Frontier and Future Development of Information Technology in Medicine and Education*, Springer, 2014, pp. 2321–2324.

[19] O. Y. Sowunmi, S. Misra, N. Omoregbe, R. Damasevicius, and R. Maskeliūnas, "A semantic web-based framework for information retrieval in e-learning systems," in *International Conference on Recent Developments in Science, Engineering and Technology*, 2017, pp. 96–106.

[20] I. M. Sudana, N. Qudus, and S. E. Prasetyo, "Implementation of PHPMailer with SMTP protocol in the development of web-based e-learning prototype," in *Journal of Physics: Conference Series*, 2019, vol. 1321, no. 3, p. 32027.

[21] N. O. Oluwaniyi, B. O. Afeni, and O. O. Lawal, "Development of an Asynchronous Web Based E-Learning System," *J. Comput. Commun.*, vol. 3, no. 12, p. 84, 2015.

[22] G. Ongo and G. P. Kusuma, "Hybrid database system of MySQL and MongoDB in web application development," in *2018 International Conference on Information Management and Technology (ICIMTech)*, 2018, pp. 256–260.

[23] E. Ongko and P. Napitupulu, "E-Learning Information System Model at SMK Raksana Medan," in *Journal of Physics: Conference Series*, 2018, vol. 1114, no. 1, p. 12070.