Laboratory management: digital laboratory information system (DLIS) concept

I Fushshilat[1*], A Rahmat[2], Y Somantri[1] and E Haritman[1]

[1]Departement of Electrical Engineering Education, Universitas Pendidikan Indonesia, Bandung, Indonesia
[2]Departement of Mechanical Engineering Education, Universitas Pendidikan Indonesia, Bandung, Indonesia

*imanf@upi.edu

Abstract. Laboratory has an important role in the process of education and learning, they are a lot of data inside laboratory, such as: Information and condition of goods, inventory of Laboratory instrument, component and devices, logbook, lending, scheduling, etc. Nowadays there are many laboratories are currently still using conventional methods in managing laboratory data, in this paper will discuss a concept for managing laboratory data digitally using a computer system which integrated with the Internet of Things (IoT) system, this concept is called Digital Laboratory Information System (DLIS), this concept offers many advantages for user or the administrator of laboratory data manager. DLIS concept makes data more flexible to changes, easier to update and upgrade data. DLIS allows access from outside the laboratory using the IoT method, so that users can access laboratory data without being constrained by distance and time.

1. Introduction

Industrial Revolution 4.0 era demands systemic and overall changes in various fields in life [1], the whole system is transformed into a digital computerized process from a conventional system which is still processed manually. Laboratory is an important component in the development of science, the existence of laboratories is spread in various types of education institutions both public and private starting from the basic level to higher education, research institutions, up to the Industry [2][3].

Computer use for data processing provides many advantages if compared to using conventional methods, data management becomes easier, more accurate, safe and reduces the risk of data loss. The role of the Internet in a computerized system function make enhancement in feature and allows integration of various computerized systems with large amounts of data (Big Data). The concept of Internet of Things (IoT) allows a system to be accessed remotely and real-time by users, so it can overcome limitations for distance and time on a system [4].

As one of the centers of learning and research, the laboratory has many archive databases related to information and inventory of instruments, equipment, component, infrastructure, logbook, booking and other data [5]. There many laboratories still manage data information conventionally and use manual data recording, which has technical deficiencies such as difficult for managing data includes additional and reductions data (updates), data search, then from the aspect of access which requires someone who will access laboratory information should come to the laboratory during laboratory working hours [6].

In this article discusses the concept of digital laboratory information data management using a computerized system that is called Digital Laboratory Information System (DLIS), this system planed for replacing conventional laboratory data management concept. DLIS will be integrated with remote desktop applications, so users can access DLIS anytime anywhere via Electronic Gadgets like notebook, smartphone or tablet which connected to internet network.

2. Description of DLIS

There are various kinds of information data in the laboratory, including data inventory of tools/instruments, devices, materials, infrastructure, then visit data or laboratory use, booking, scheduling etc., the data is needed by users or stakeholders. In ideal condition, users and stakeholders should be able to access the information as easily as possible, anytime, anywhere without constrained by distance and time, DLIS allows it to be realized. DLIS works in digital mode, so that it can reduce paper usage as is done with conventional laboratory management system.

DLIS is actually a system that is realized in a computer software, that created using a specific programming language, formed from languages: C, C ++, C #, Java, Basic, Pascal, html, php or other programming languages, form a Graphic User Interface (GUI) as a user interface with a system that is made as beautiful as possible (user friendly) to access electronic data storage (Database) like: My SQL, Ms Access, etc., that contain data on laboratory information stored on a server in the form of a Personal Computer or Portable Computer, then DLIS is integrated with the internet network with the Internet of Things (IoT) platform which is a study that is currently becoming a trending topic among science and engineering researchers, through remote desktop application DLIS can be accessed by the user from outside laboratory with real-time anytime anywhere without limited distance and time as long as user connected to the internet through an electronic gadget like: smartphone, Tablet, Notebook, PC or other electronic gadget that support to remote desktop application in server. Detail about DLIS Concept is shown in figure 1.
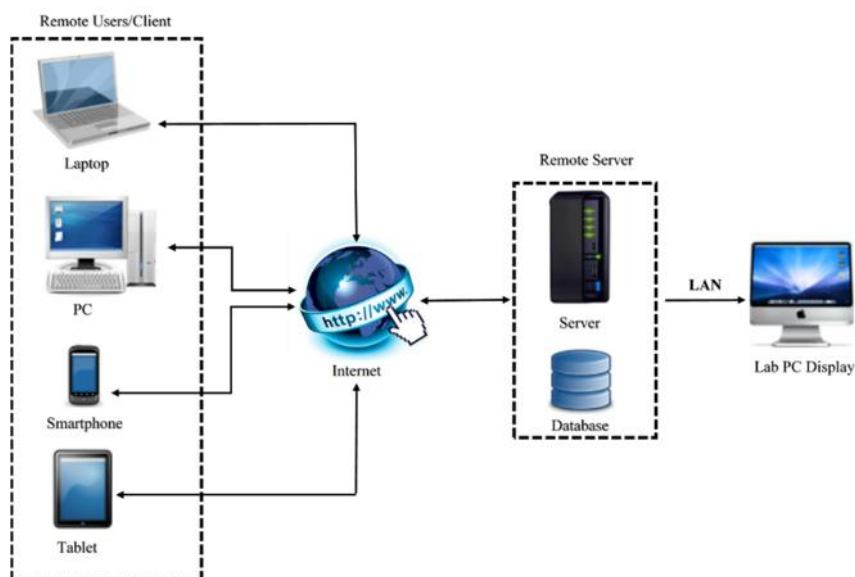

Figure 1. DLIS Topology

3. Design and Development of DLIS Concept

DLIS is a system that consists of a combination from GUI, database and internet. Design of DLIS concept that was initiated began with a GUI built from an integrated development environment (IDE) program to develop console applications, desktops, based on the Pascal language, that is namely Delphi.

The DLIS concept is designed has 2 displays, Display for Admin and Display for users, which both have differences in accessing DLIS features.

In user mode it has some limitations in accessing features compared to admin mode. In user mode, features that can be accessed is condition information and lab inventory such as: Component, materials, devices, instruments, lab infrastructure, booking, logbook, borrower list info and Print/export to .pdf file report data. In user display mode there are 2 types of display for condition information feature, laboratory inventory, table display types and display types based on information items. Figure 2 shown about design and development of DLIS.
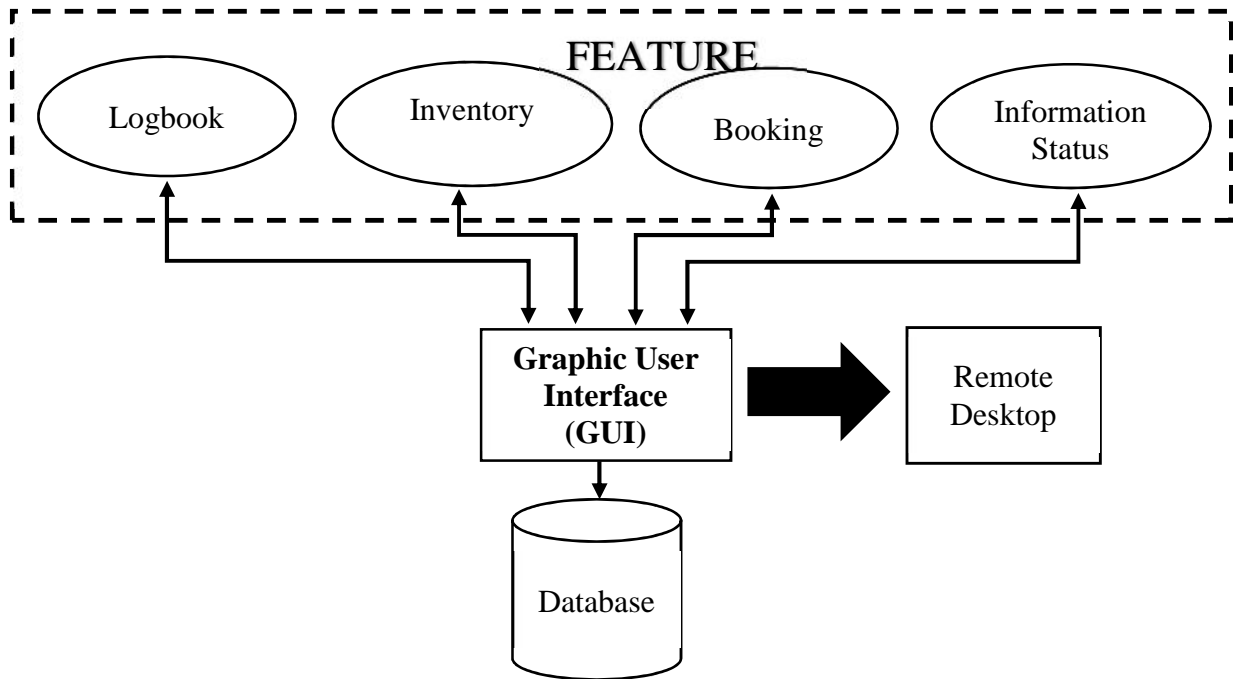

Figure 2. Design and Development of DLIS Concept

In admin display mode, besides able to access features that can be accessed by the user, admin can also access some additional features such as: make changes data condition and inventory of items in the lab, laboratory devices booking approval, changing data account (User Name and Password), changing information header on the DLIS application, it's means that can update and manage data is admin.

In condition information feature and inventory of devices, allows users to see detailed information of conditions, availability and status of items such as quantities, good condition, bad condition and readiness of devices or component, and then user can know about historical, usage and photographs of devices. The booking feature serves to order lab items to be borrowed, through this feature user can choose the items and then mark them as items to be borrowed, and then user can print the loan proof of devices or components to be submitted to the laboratory officer, then the officer can confirm the booking of borrowing devices or component that have been ordered by the user. There is also a list of borrower features, through this feature user can see a list of people who borrow items in the laboratory along with the details of the loan items, while the Logbook feature serves to digitally record laboratory visits, users who come to the laboratory and use laboratory facilities are required to access the Logbook feature.

By using a DLIS remote desktop application embedded on a server in the laboratory, DLIS and all its features allow it to be accessed by many users from outside laboratory everywhere, every time without limited time and space.

4. Conclusion

DLIS is a software system that which can be installed by electronic gadgets with function to facilitate all data management information on laboratory with digitally use computerized system, so it has many advantages over conventional laboratory information management systems, DLIS is expected to be applied to replace conventional laboratory information management systems for better laboratory management.

References

[1]   Keliang Zhou, et al. 2015 *Industry 4.0: Towards Future Industrial Opportunities and Challenges* (IEEE 2015 12th International Conference on Fuzzy Systems and Knowledge Discovery (FSKD)).

[2]   Qiang Liu, et al. 2012 *Design and Exploitation of Integrated Management System in University Laboratory* (IEEE 2nd International Conference on Consumer Electronics, Communications and Networks (CECNet)).

[3]   I Fushshilat, D Barmana. 2018 *Low Cost Handheld Digital Oscilloscope* (IOP International Symposium on Materials and Electrical Engineering (ISMEE) 2017).

[4]   Hyeonwoo Kim, et al. 2017 *Chemical Laboratory Safety Management Service Using IoT Sensors and Open APIs* (IEEE 2017 KICS-IEEE International Conference on Information and Communications with Samsung LTE & 5G Special Workshop).

[5]   Lu Ang, et al. 2010 *An Open Laboratory Automatic Management System Based on RFID* (IEEE 2010 The 2nd International Conference on Computer and Automation Engineering (ICCAE)).

[6]   Yang Chenghui, Chang Sheng. 2010 *A Design of Laboratory Information Management System* (International Forum on Information Technology and Applications).