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WEB APPLICATION FOR LABORATORY MAINTENANCE MANAGEMENT SYSTEM

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Abstract:
Develop and improve the Maintenance Management System for leads to the integration of maintenance operations. The maintenance unit in the college contains several departments such as inventory, computers, electronic materials, and electricity. The system is a web application, works based on the network where a package is uploaded to the internal server of the college or on the internet, the database is installed and the URL is prepared, as authorized users are logged in through it. The system provides protection and restriction of the user's permissions, each user has the authority and interfaces dedicated to accessing it, the system consists of four users where maintenance requests are transmitted sequentially between users. Each user is provided with a username and password, in addition to linking each user to the system via his university email and sending notifications of maintenance requests through it, this provides privacy for the user and ease of tracking work. The main unit in the college (the administrator) can monitor the progress of maintenance requests, three cases appear to know the stage of the request's arrival, such as (the request is under review, maintenance is underway, completed). Two strategies were relied on to manage demands and maintenance work, such as corrective maintenance and preventive maintenance, to cover all maintenance operations in the college.

Keywords: maintenance management; corrective maintenance; preventive maintenance; maintenance unit.

1. INTRODUCTION

Computer lab is a set of computers that are usually network-connected and available for public use. Computers are important for education because they make us rethink how students learn, how they are inspired and what useful information is [1]. As the number of students enrolled in universities increases, computer labs are rapidly being created, and a more modern IT infrastructure is being introduced [2]. At the same time, traditional methods of laboratory management are still approved, leading to problems in the work of scientific research and practical education [3]. Educational processes necessarily require work systems that ensure appropriate teaching in the computer labs, even when faced with certain error situations [3]. Thus, a new implementation mechanism based on the character of computer lab features is needed, so that a new work process can be built and a technical position on modern IT infrastructure [4]. With the great development in the field of information technology and computer science to reduce effort and labor costs and increase efficiency and production[5], this was the reason for establishing this project, as it previously shown that the project specializes in managing maintenance operations and transferring maintenance requests from the scientific departments to the maintenance department.
Laboratory management includes various issues such as equipment, staff, money, etc. the most important of which are machinery and equipment, fewer management staff and a large amount of work reports [6]. At the beginning of each semester, the laboratories committee needs to send different models to the scientific departments [7], if the university builds a web application that manages laboratory work as a key unit for achieving the required data sharing, this will significantly reduce the work of reports [8]. This will be explained.

2. BASE PRINCIPLE OF MANAGING MAINTENANCE LABORATORIES

The maintenance management system handles the daily activities in the computer lab of the college, university or training center, these activities include maintenance, reporting, login, and access control [9].

- The degree of control is high: The administrator can control the system in general as he can accept maintenance requests from departments, transfer the matter to the maintenance department, and add employees and laboratories to the system.
- Better reporting capabilities: It allows system administrators to receive and view maintenance reports and print information about devices and equipment that have been maintained, indicating the type of device, its serial code, the date and time the maintenance request began, and the end date.
- Maintenance and follow-up of problems: Whereas, can track the previous maintenance operations finished, current issues, and approve current maintenance requests [10].
- Store usage data indefinitely in a highly efficient database. The database helps in easy access to information at a later time, improves the quality and consistency of information, and can back up important information.

3. SYSTEM DEVELOPMENT LIFE CYCLE

System Development Life Cycle (SDLC), in which the system has gone through several organizational and sequential stages to complete the process of construction, implementation, and development. Including the planning phase that resulted in our plans to select the appropriate programming languages and technologies to work on in building the project; The analysis phase through which the system was analyzed in detail in terms of identifying the users of the system, their tasks, and responsibilities; The design and development phase, during which the system interfaces are organized and designed using the best, latest technologies and platforms; then the implementation phase, which practically takes place and prepares the system to upload it to the server; in the testing and integration phase, where it is confirmed that the system works, knowing failures and repeated attempts, and learning from the failures until they are organized; Finally, the maintenance phase, through which the best way for the authorized person to access the system is chosen and make the necessary determined.

4. SYSTEM METHODOLOGY

The first and most important step of building the system, its which a strategic plan is created, that includes the most important and latest advanced programming languages and development technologies that will be used to build and develop the system. Programming languages that use in this project (C# and JavaScript), these two languages are characterized by reliability, effectiveness, flexibility and scalability for improvement. After defining and specifying the project requirements and knowing the priorities of the work, the C-Sharp language was chosen to build the web application, due to the advanced features and characteristics it provides for this web application so that it can be modified and worked on several platforms such as web, mobile and desktop platforms in addition to providing another advantage, which is the ease of the development process. The JavaScript language was chosen to build and develop the web application because it has several features and characteristics that fit this web application, the most important of which is that works on web and mobile platforms, provides real-time data sharing between multiple devices, as it facilitates the process of sending and receiving data between users, and is used to design webpages interactive.
in this part, the methodology that was followed in the design and achievement of the work plans necessary to move to the actual programming stage will be clarified, as the use case diagrams, algorithms, flowchart, and database relationship diagrams were relied on in detail in order to clarify the workflow in the programming construction of the system. As shown below.

The use case diagram it is an important part of object-oriented design and the "software development" process where use cases and actors in use case diagrams describe what the system does and how the actors use it, but not how the system operates internally. Use case diagrams illustrate and define the context and requirements of the entire system or important parts of the system. The system consists of four users: the administrator, the manager, the supervisor and the technical. Each user has different tasks and responsibilities from the other, as shown in (Figure 1).

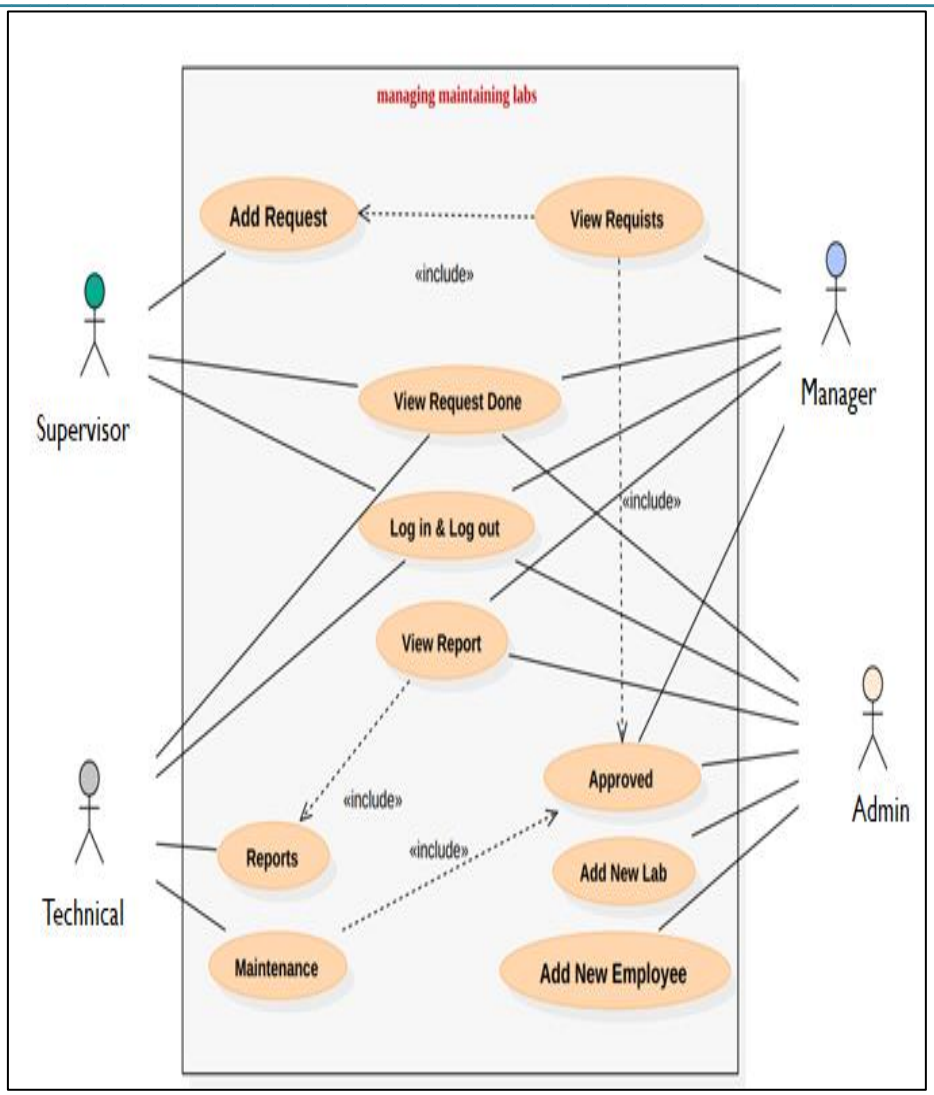

Figure 1: Use Case diagram

An algorithm is a finite sequence of instructions, explicit step-by-step procedure for solving a problem starting from a known beginning. Developing an algorithm (plan) is an essential step in solving a problem. Once we have an algorithm, we can translate it into a computer program in some programming language. Our algorithm development process consists of nine main steps, as shown in (Figure 2).

Step 1: Start.
Step 2: User login.
Step 3: If the user logged in successfully then go to the next step.
else go to the previous step.
step 4: if the user is an admin then can add new labs, employees, and departments.
view or edit labs, maintenance reports, departments, laboratory materials,
Departments Heads, Labs Supervisor and Technical Staff.
step 5: if-else the user is manager then can view or edit maintenance reports, Labs
Supervisor and Technical Staff.
step 6: if-else the user is Supervisor then can add Maintenance Request and
Laboratory Materials.
step 7: else the user is Technical then can view or edit Maintenance Request.
step 8: If the task is completed, then go to the next step else go to the user's
previous task
Step 9:End or log out.

Figure 2: Pseudo Code

A flowchart is a type of diagram that represents a workflow or process. The flowchart shows the steps as squares of different types, arranged by connecting squares with arrows. This graph shows a solution model for a specific problem. The flowchart in a web application shows the states and stages that users go through from logging in to completing tasks and logging out, as shown in (Figure 3).

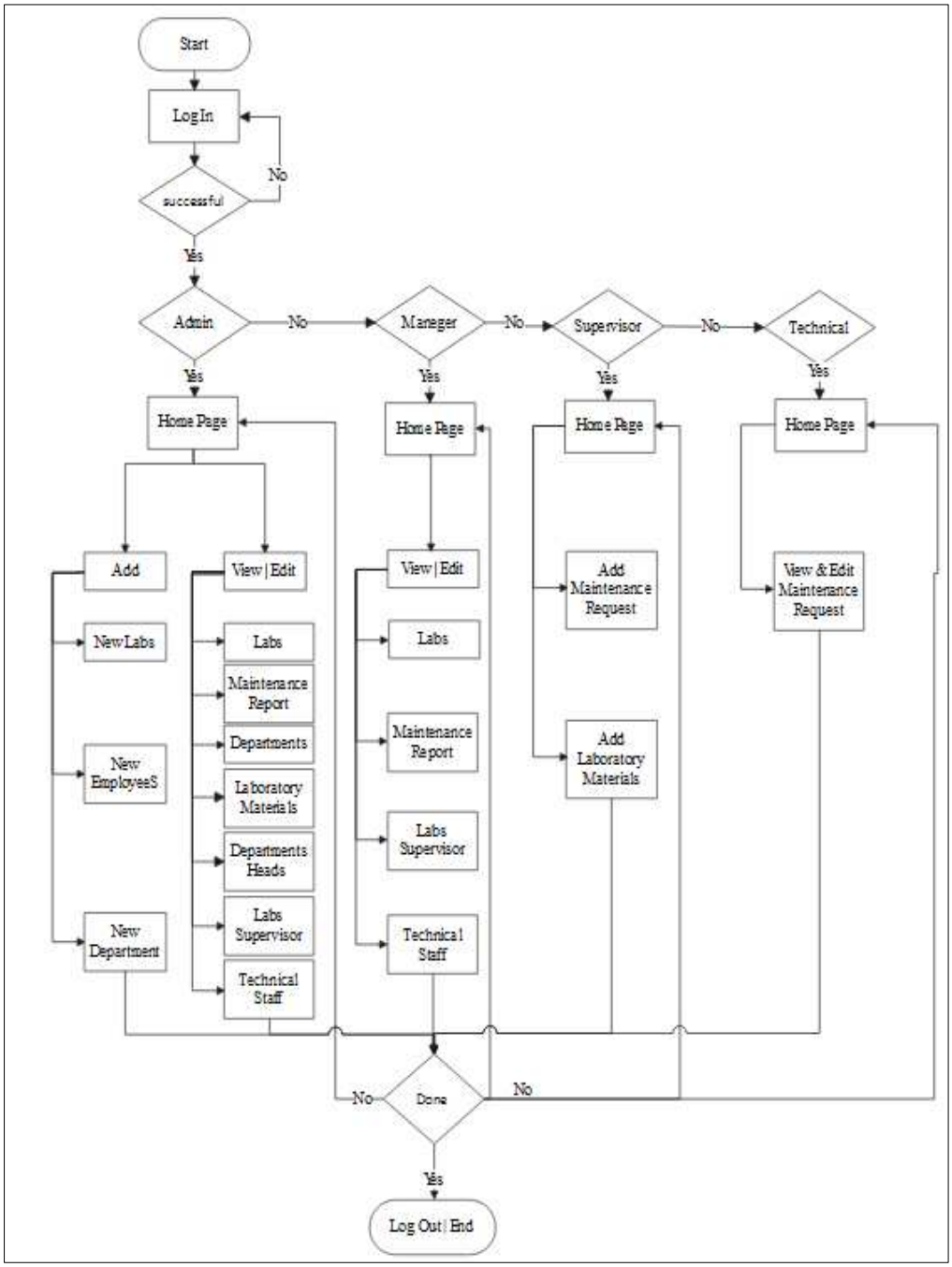

Figure 3: Flow chart diagram

An entity relationship diagram (ERD) is an object or component of data, also known as an entity relationship model, is a graphical representation that depicts the relationships between people, objects and departments within an information technology (IT) system. Where schemas are used to design or analyze relational databases used in systems. It shows the relationships between entities or database tables that include (user, job, department, lab, device, maintenance request, and status) and the type of relationship between them. As shown in figure (4).

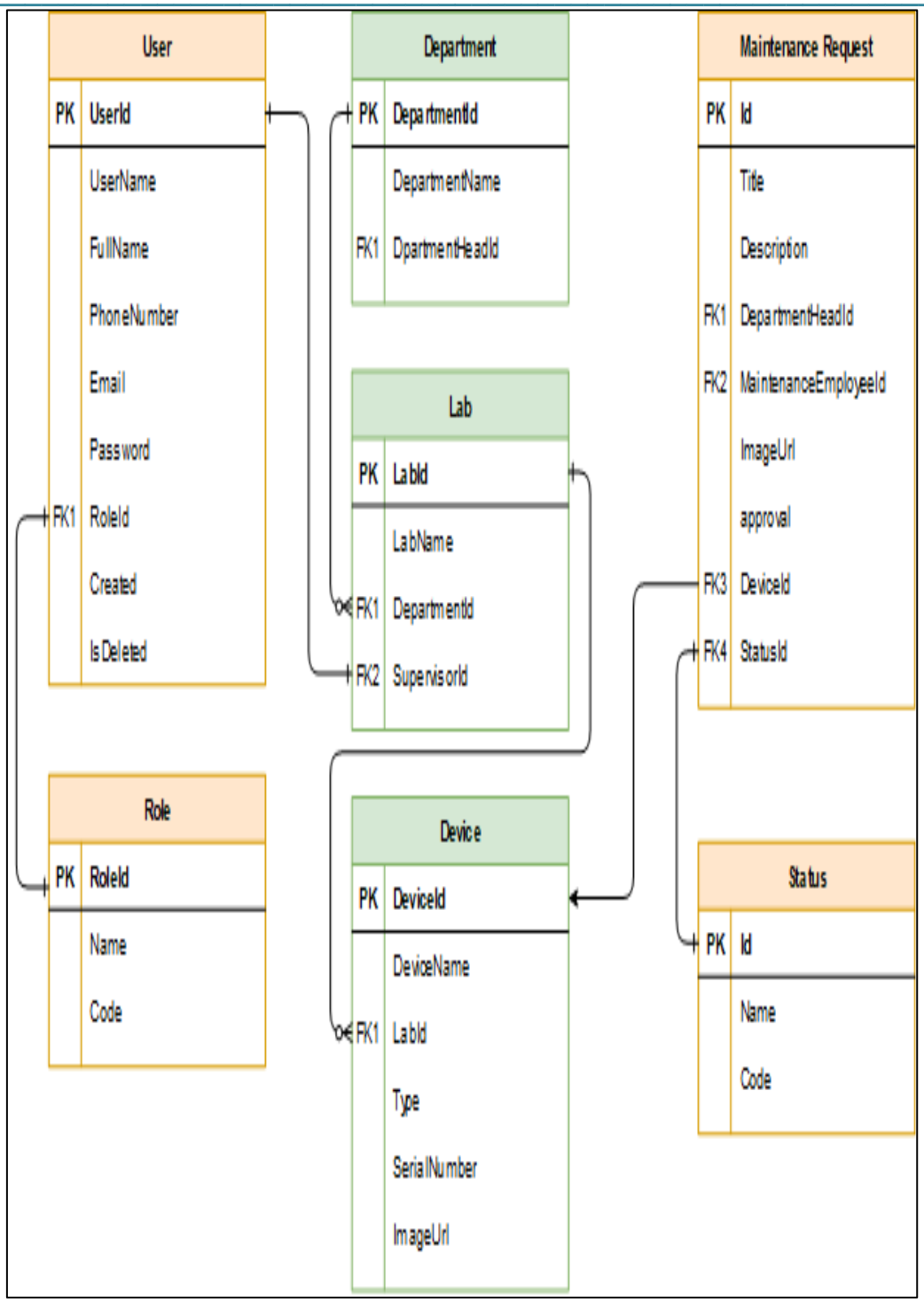

Figure 4: Entity relationship diagram

5. RESULTS AND DISCUSSIONS

The system will provide multiple capabilities in addition to the user interfaces, so will explain some of the most important functions with the interfaces. Laboratories management are displayed and added, where the name of the laboratory and its supervisor and any department connected to it are recorded, as shown in (figure 5).

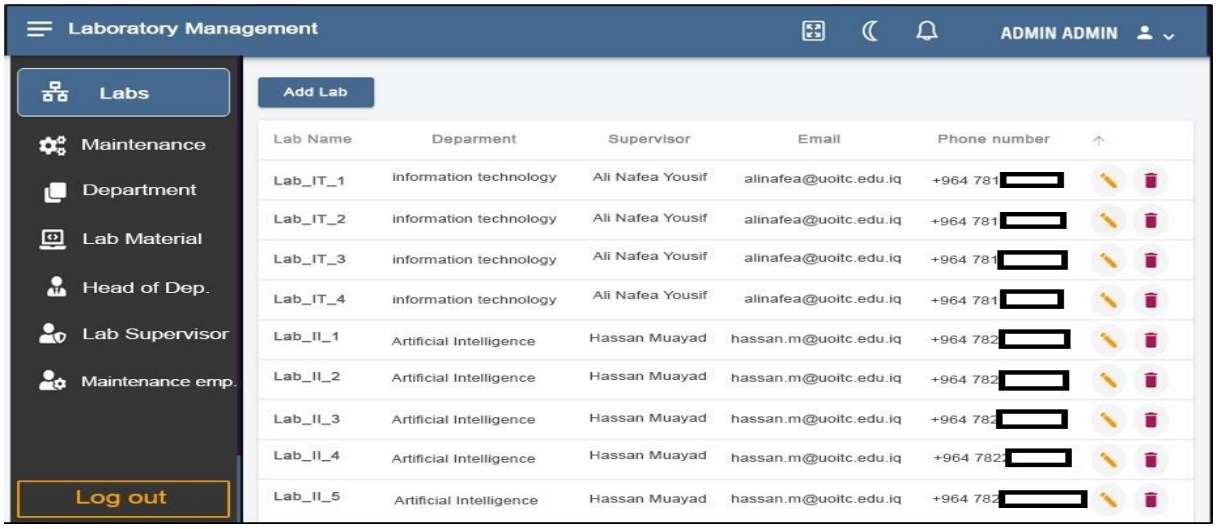

Figure 5: Laboratory Management page

The department head's page is responsible for adding the person's name, user name, e-mail, and phone number for each user. Modify or delete the current user. Here, as shown in (Figures 6, 7)

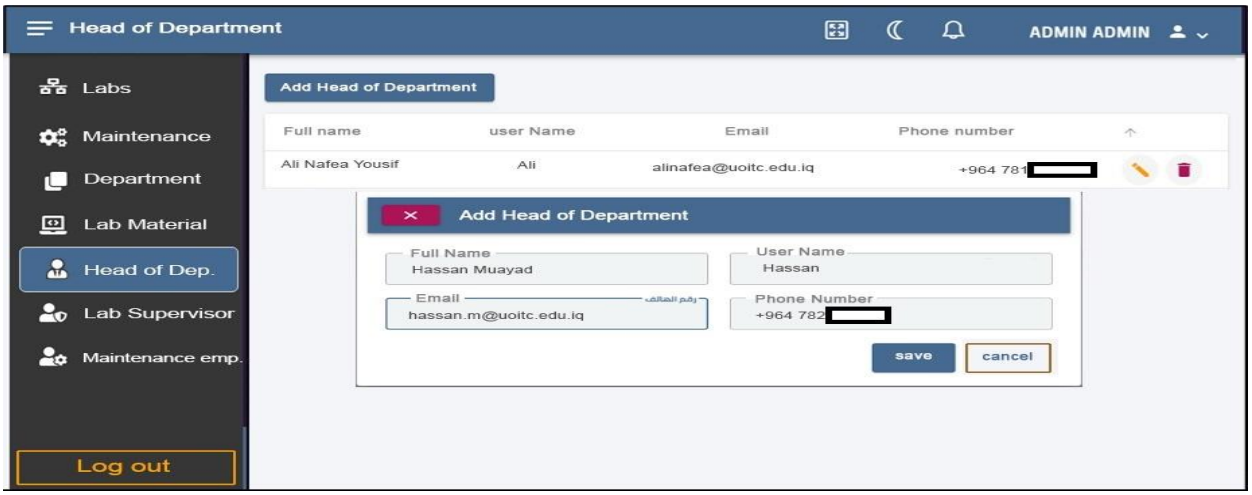

Figure 6: Create new user Type (Department Head)

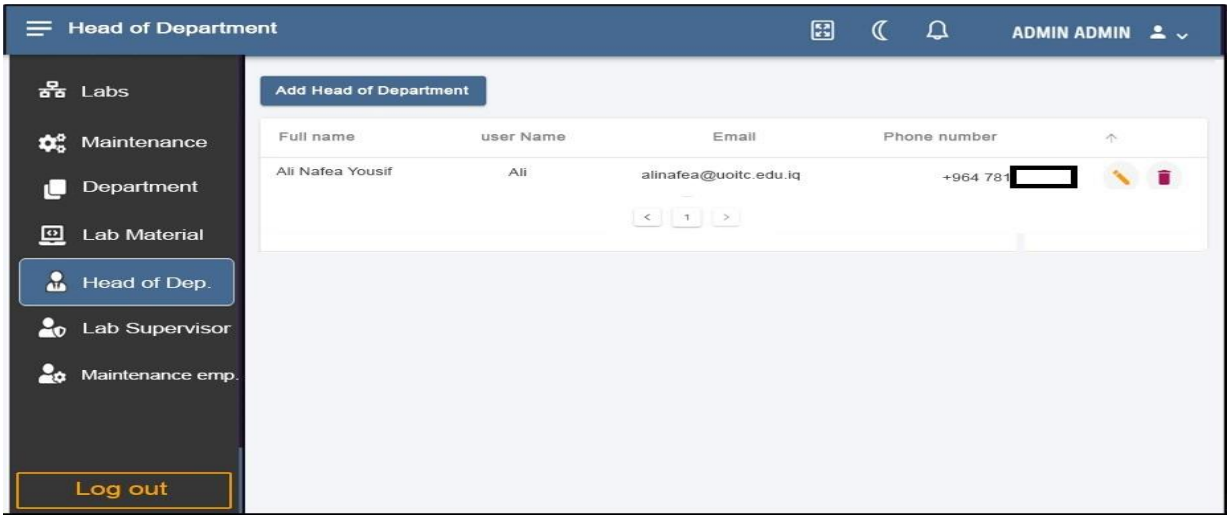

Figure 7: Department heads management page

On this page (Laboratory Supervisors) the laboratory administrators are managed and they are considered responsible for managing the laboratories and their tools, following up and ensuring the validity of the laboratory work.as shown in figure (8)

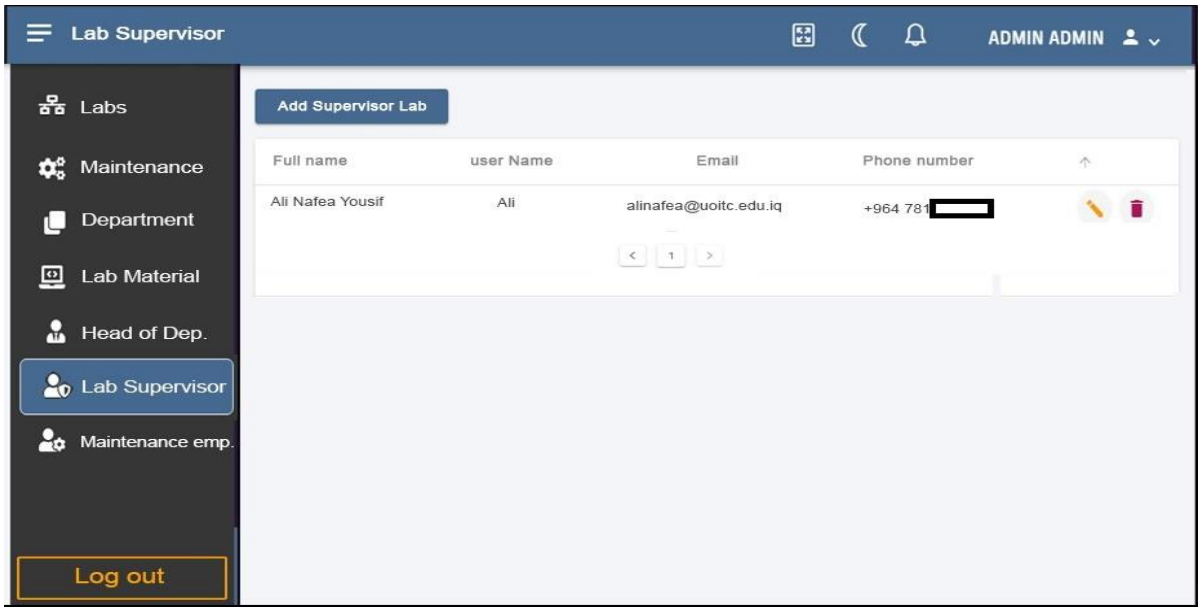

Figure 8: Labs Supervisor

In the Maintenance staff page, they are responsible for carrying out maintenance operations for laboratories, as the process of managing them and determining their validity is carried out. As shown in figure (9).

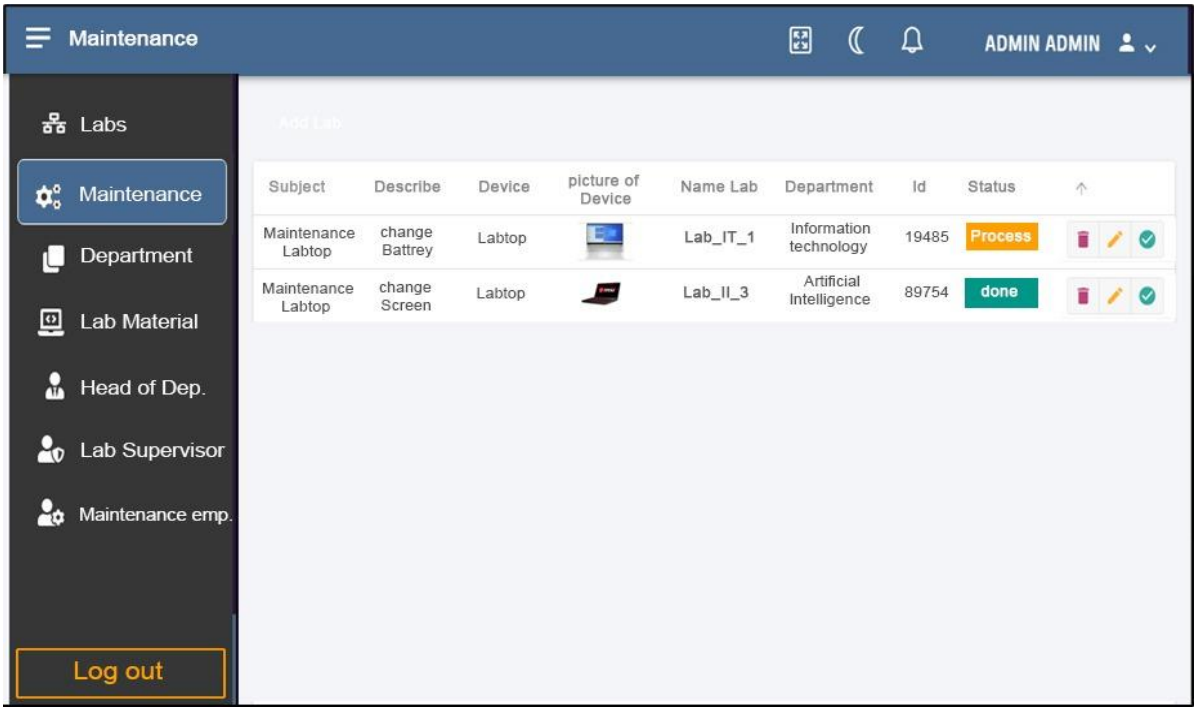

Figure 9: Maintenance Management page

6. CONCLUSION

Programming and information technology have changed the world, as a shift to digital business has increased productivity, safety, quality, and reduce the cost in the field of maintenance management. The urgent need has led to the design and construction of a system for managing laboratory maintenance operations to keep pace with the development taking place in the world and to find a solution to manage the burden of maintenance requests faced by the college departments on an ongoing basis, these problems were facing the staff, faculty members, and the presidency of the college. This is what made us look for the strategies and features of maintenance systems that have been used in several sectors and to know, uh, what suits the project, all to facilitate the management of maintenance requests in the maintenance unit and the college departments, and to facilitate communication between them, to reduce the time for dealing with faults, prevent problems, and reduce paperwork Which is used to make maintenance requests. The importance of these two maintenance strategies that were adopted in the project, the first is corrective maintenance, as this type is used during the occurrence of the problem and reported, and the second is preventive maintenance, also called scheduled maintenance, as it depends on pre-set dates in the college to address faults before they occur. These two strategies provide complete coverage of maintenance operations within the college and keep materials running for the longest time. We have adhered to the sequence of sending requests between users (starting with the supervisor and ending with the maintenance department) according to the protocols previously specified in the college. The project provided many features to help users in using the system, the most important of which is reliance on a database to centralize maintenance information and access previous maintenance operations, in addition to providing email service to users, when a new user is added, a notification will be sent to the email that includes confirmation of the random link and password.

REFERENCES

1. El Rahman, S. A. (2015, October). ElectroLab: Electronic Laboratory System. In 2015 Fifth International Conference on e-Learning (econf) (pp. 35-41). IEEE.
2. Kans, M., & Metso, L. (2020). Maintenance education in engineering programs on bachelor and master level: evidence from Finland and Sweden. In Engineering Assets and Public Infrastructures in the Age of Digitalization (pp. 465-474). Springer, Cham
3. Giridharan, M. S., Nivedha, M. A., Vinothini, M. V., Maha, M. V., & Kumari, M. M. N. (2021, January). Web Based Computer Maintenance Management System. In Journal of Physics: Conference Series (Vol. 1717, No. 1, p. 012045). IOP Publishing.
4. Youchun, T., & Jianpeng, H. (2009, July). Design of management system for computer laboratory based on ITIL. In 2009 4th International Conference on Computer Science & Education (pp. 568-571). IEEE.
5. Sanguino, T. M., De Viana, I. F., García, D. L., & Ancos, E. C. (2014). OpenGnSys: A novel system toward centralized deployment and management of computer laboratories. Computers & Education, 75, 30-43.
6. Beniacoub, F., Ntwari, F., Niyonkuru, J. P., Nyssen, M., & Van Bastelaere, S. (2021). Evaluating a computerized maintenance management system in a low resource setting. Health and Technology, 11(3), 655-661.
7. Kwa, A. Y., & Mahmud, H. I. RETOOLING NEEDS OF ELECTRICAL TEACHERS FOR THE MAINTENANCE OF ELECTRICAL LABORATORY EQUIPMENT IN TECHNICAL COLLEGES IN KANO STATE..
8. Kara, A., Ozbek, M. E., Cagiltay, N. E., & Aydin, E. (2011). Maintenance, sustainability and extendibility in virtual and remote laboratories. Procedia-Social and Behavioral Sciences, 28, 722-728.
9. Wei, C. (2020). Research on university laboratory management and maintenance framework based on computer aided technology. Microprocessors and Microsystems, 103617.
10. Alqahtani, R., Alqahtani, F., Almutlaq, F., Alomari, Y. M., & Mahmoud, M. A. (2020). Web Based System for Electronic and Electric Devices Maintenance. International Journal of Applied Engineering Research, 15(8), 804-811.