Bachelor of Science in Computer Science

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EQUIPMENT REPAIR MAINTENANCE AND COLLABORATION MANAGEMENT SYSTEM

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This thesis titled **EQUIPMENT REPAIR MAINTENANCE AND COLLABORATION MANAGEMENT SYSTEM,** prepared and submitted by **Pusa, Jeniel A., Sabocohan, Krianne B., Perido, Regine P., Cairo, Ray Marvin O., Cabalquinto, Mira T., Banquilay, Joshua.,** is hereby accepted by the School of Technology and Computer Studies, Biliran Province State University, in partial fulfilment of the requirements for the degree Bachelor of Science in Computer Science.

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INTRODUCTION

Project Context

Computerized maintenance management systems are common in today's industries and can bring a large number of benefits, which includes increased productivity, reduced costs, and effective utilization of assets. Computer laboratories gives many people access to computers. Laboratory computers are used often by people with varying degrees of computer training. This means they are at risk from viruses, corrupt files, spyware and malfunction. The researchers aims to equip maintenance that involves using maintenance methods and procedure to keep organizational equipment good working conditions. It includes both regular inspections and corrective repairs.

The need for sustainable power is steadily increasing due to the rapid rise of the human population and the spread of new electrical energy-driven technology. With a competitive market, the electrical power operator is under increasing pressure to provide a sufficient, safe, economical, and reliable supply. They are, however, limited by the inability to operate the system constantly without disruptions due to component failure and maintenance. To reduce the negative impact of these disruptions on customer satisfaction, the maintenance strategy should be resilient, match operator expectations, extend the system's life, and be meticulously implemented. A robust approach for an operator is one that ensures optimum system throughput while keeping operational costs

to a minimum. Maintenance accounts for a considerable amount of the total running costs of power systems, in addition to its impact on system performance.

As a result, it determines the revenue earned and the total investment's viability to a large extent. To summarize, the concepts of modern maintenance engineering demand not only that technical and operational goals be met, but that they be accomplished in the most cost-effective manner possible. Due to this constraint, maintenance must implement a method that results in the least amount of system output loss at the lowest possible cost.

This chapter uses a few fundamental definitions. The output per unit of time of continuous operation at the maximum safe operating speed is the potential capacity of a manufacturing process or machine. Some output is lost in any practical manufacturing setting due to factors such as shift changes, material failures, maintenance, product changeovers, and operational inefficiencies. Most process personnel use a deterministic safety factor that accounts for an acceptable amount of inevitable output loss. They create processes for a theoretical or operating capacity, which is determined by a system's maintenance efficiency.

Technicians often monitor two basic measurements of equipment or process performance in actual, day-to-day production: scheduled and actual. The output maintenance from an operation for a certain allocation of time, material, and labor is known as scheduled output, and it is usually based on a stated output rate. Actual output indicates an operation's genuine performance, including scrap and both planned and

unplanned downtime. These values are frequently expressed in terms of yield (e.g., output per unit of time or material input).

Purpose and Description

Development of Equipment Repair Maintenance and Collaboration Management System. This section encloses the benefits of the user to the system and in the way implies what it can provide to the maintenance crew or the technician.

Community. This involves students, instructors, and individuals from the staff of repairmen, and it will provide them with information and understanding about using the computer maintenance. This can also provide an immediate repair of the damage of the Computers or Personal Computer.

Student (CS and IS). This will give them knowledge and insight to what web base application are develop for, thus this development will give them idea, learning, knowledge and references towards the development of web based application.

Future Researcher/Developer. This will give them insight, information, knowledge and references regarding the algorithms and methods used in the system. The future researcher or developer can learn the algorithms used in the study and design or improvise process procedures used for future research related to the developed system.

Objectives of the Study

The main objective of the study is to analyze the corresponding hardware maintenance collaboration of an equipment in laboratories.

Specifically, this study aimed to attain the following

1. Develop a web-based application that is a user-friendly platform that runs on different gadgets such as:
    1.1. Smartphones
    1.2. Tablets
    1.3. Laptops
2. Develop a system that clients can request for repair and maintenance to admin with:
    2.1. Location
    2.2. Room Number
    2.3. Request Description
    2.4. Assigned Technician
    2.5. Remarks
    2.6. Feedback
3. Develop a system that records every transaction occurred in the system
4. Develop a system that provide printable reports and analysis through inventory of the system with:

4.1. Name of Unit

4.2. Serial number

4.3. Location

4.4. Laboratory In-Charge person

4.5. Maintenance cycle

4.6. Status

5. Evaluate the system in terms of:

5.1. Functionality

5.2. Security

5.3. Usability

5.4. Consistency

Scope and Delimitation

The goal of this study is to create a web-based application that users can easily use on a variety of electronics, including a tablet, computer, and mobile phone. Our web-based system will help in equipment maintenance for the university computer labs. Only the administrator, technician, and person in charge are allowed access to our system in laboratories. Our system's features include a maintenance record where the technician keeps track of the equipment's maintenance. Additionally, it automatically notifies the admin through the dashboard to maintain the equipment, keep track of equipment issues, and identify any equipment parts that are used, in stock. It also allows the person in charge to request equipment maintenance from the admin. The client must inform the administrator after the technician has resolved the issue for the administrator to verify that the client is satisfied with the technician's services. Each technician has an account with our system and can log in to find the laboratories that have the request.

Definition of Terms

Definition of Terms

Key performance indicators (KPIs). A set of quantifiable measurements used to gauge a company's overall long-term performance. KPIs specifically help determine a company's strategic, financial, and operational achievements, especially compared to those of other businesses within the same sector.

Equipment reliability and maintenance (ERM). Is directly linked to three important elements of competitiveness – cost, quality, and production lead time. ERM also reduces production costs by increasing uptime and decreasing the need for spare parts and retooling. Repair time often exhausts both funds and employees

Shared Maintenance. A single team is assigned to execute both preventative and corrective maintenance on a component or a set of components under this maintenance plan.

Dedicated Maintenance. Separate teams do preventative and corrective maintenance on the same group of components, as opposed to shared maintenance. This means that if the specialized maintenance team is unavailable, a failing or due for preventive maintenance component remains unattended.

CONDITION BASED MAINTENANCE – An equipment maintenance strategy based on measuring the condition of equipment in order to assess whether it will fail during some future period, and then taking appropriate action to avoid the consequences of that failure.

Set Internal Quality and Usage Standards:

This helps the staff to streamline maintenance based on the asset type, so that assets are operated in the right manner and there are less chances of misuse and downtime.

Develop Consultation Practice:

Carry out any rigorous repairs only after proper consultation from the concerned department. This helps in laying out a proper schedule for maintenance projects and determines whether there is a need for subcontracting.

Chapter II

RELATED LITERATURE

Related Studies

For a better understanding of the study, the researchers used several references relevant to Equipment Repair Maintenance and Collaboration Management System, such as books, magazines, internet searches, and other web articles, that were helpful in broadening the researchers' knowledge. Maintenance gives a positive impact in improving the reliability of the machine to ensure the sustainability of the production process.

Abdelalim Elsadany. (2020), Reliability Modelling for Multistate System with Preventive Maintenance under Customer Demand Generally, all systems and/or components will undergo an aging process before complete failure. This aging process is often modelled as a continuous and deterministic function of time. For example, the failure rate is usually depicted as a bath tub curve as a function of time. However, in most real-life situations, the failure rate depends not only on time but also on the states of the systems and/or components. Moreover, the traditional binary reliability theory assumes that there are only two states: perfect functioning and complete failure. The binary-state assumption may oversimplify the practical circumstances. A multistate degradation system may operate in an intermediate state between perfect functioning and complete failure. These intermediate states can be caused by system deterioration or peripheral factors, such as fatigue, burn-in, vibration, efficiency, failure of nonessential components, and the number of random shocks. Furthermore, the sojourn times in every state are

typically uncertain, which can result in the uncertainty of the state-dependent failure rate. Therefore, reliability modelling and evaluation of such multistate degraded systems have been impelled, some of which are discussed in the following.

Grag and Desmukh (2006) have presented various classifications of maintenance optimization models by analyzing 142 papers. A broad classification of these literatures can be devided in to six areas. These areas are: maintenance optimization models, maintenance techniques, maintenance scheduling, maintenance performance measurement, maintenance information systems; and maintenance policies. In the process, articles published in the last three decades are identified, analyzed and classified.

A Kumar, J Anand, SC Malik - International Journal of Agricultural …, (2013) This paper concentrates on the stochastic modeling of a computer system in which software and hardware components have direct independent failure from normal mode. In this model, two identical units of a computer system are taken together in which one unit is initially operative and the other is kept as cold standby. There is a single server who visits the system immediately to carry out inspection, h/w repair activities and s/w up-gradation. The unit undergoes for inspection at its hardware failure to see the feasibility of repair. If repair of the hardware in the unit is not feasible, it is replaced by new one with some replacement time. However, if there is a software failure in the unit, then only up-gradation of the software is made with some up-gradation time. Also, priority to s/w up-gradation is given over h/w inspection and repair. The distributions of failure time of hardware and software follow negative exponential while that of inspection, s/w up-gradation and h/w repair times are taken as arbitrary with different probability density

functions (pdf). Various reliability measures are obtained by adopting semi-Markov process and regenerative point technique. The results for a particular case are also evaluated to depict the graphical behavior of some measures of system effectiveness.

The complexity, interdependence and rapidity of the events in modern society have accelerated demands for more effective ways to store, process and manage information. Advantages in both computer hardware and software have provided the technology that can make it possible to effectively address many of these demands. A breakdown of such computer based systems may be costly, dangerous and may cause confusion in our society. It is, therefore, of great importance to operate such systems with high reliability. In spite of increasing development and availability of new computer technology, a little work has been dedicated to the assessment of reliability and economic measures of computer systems with independent failures of hardware and software components. Most of the research work in these areas has been limited to consideration of either the hardware subsystem alone or software subsystem alone. A few researchers including Friedman and Tran (1992) tried to establish a combined reliability model for the whole system, including both hardware and software under the assumption that h/w and s/w subsystems are independent of each other. Lai et al. (2002) proposed a model for availability analysis of distributed hardware/software systems. Recently, Malik and Anand (2010) have suggested a reliability model of a computer system with independent hardware and software failures. In this model, replacement of hardware components by new one is made in negligible time if inspection reveals that repair of hardware component is not feasible. And, in this model, only replacement of the software components is made by new one with some replacement time. Also, it can be realized that reliability and

effectively of a computer system can be enhanced by giving priority to replacement of software over repair activities of hardware.

R Rathee, SC Malik - International Journal of Statistics and Reliability (2014)

A parallel system of two identical units has been analyzed stochastically using the ideas of preventive maintenance, replacement and priority in repair disciplines. The unit has two modes-operative and complete failure. A single server attends the system immediately to repair the snags whenever occur during operation of the system. Server conducts preventive maintenance of the system after a maximum operation time‘t’ up-to which no failure occurs. However, repair of the unit is done at its complete failure. And, the failed unit is replaced by new one in case its repair is not completed by the server in a given maximum repair time. Priority to repair is given to one unit over preventive maintenance of the other unit. The unit works as new after preventive maintenance and repair. The random variables associated with failure, preventive maintenance, repair and replacement times are statistically independent. The failure time and time by which unit under goes for preventive maintenance and replacement follow negative exponential distribution while the distributions for preventive maintenance, repair and replacement rates are assumed as arbitrary with different probability density functions. The semi-Markov process and regenerative point technique are adopted to drive the expressions for some reliability measures of vital significance. The behaviour of mean time to system failure (MTSF), availability and profit functions have been observed graphically.

In most of the complex systems, parallel redundancy has been considered as one of the effective strategies not only to provide better services but also to minimize the failure risk. The deterioration rate of such systems can be reduced by conducting

preventive maintenance after a pre-specified operation time. Malik and Nanda [5] studied a cold standby system with preventive maintenance subject to maximum operation time. Further, it is more appropriate to make replacement of the failed unit by new one when server fails to get its repair in a sufficient given repair time in order to avoid unnecessary expanses on repair. Kumar et al. [2] analyzed a computer system with preventive maintenance and replacement of the unit subject to maximum operation and repair times. The idea of priority in repair disciplines has been suggested by some researchers including Malik and Sureria [4], Kumar and Malik [1] and Malik [3] to make the system more profitable. However, not much research work has been reported so far by the scholars in the subject area of reliability modeling of parallel systems with priority to repair.

Technical Background

In developing Web application, it uses a language like php, JavaScript, python or some languages that uses to create a web application, in this system Intelligent Computer and peripheral preventive maintenance and repair system the proponents use a C# as the primary programming Language. C# is a simple, modern, general-purpose, object-oriented programming language developed by Microsoft within its .NET.

Bootstrap. Bootstrap is a free and open-source front end development framework for the creation of websites and web apps. The Bootstrap framework is built on HTML, CSS, and JavaScript (JS) to facilitate the development of responsive, mobile-first sites and apps. Responsive design makes it possible for a web page or app to detect the visitor’s screen size and orientation and automatically adapt the display accordingly; the

mobile first approach assumes that smartphones, tablets and task-specific Mobile apps are employees' primary tools for getting work done and addresses the requirements of those technologies in design. Bootstrap includes user interface components, layouts and JS tools along with the framework for implementation. The software is available precompiled or as source code.

JavaScript. JavaScript is a dynamic computer programming language. It is lightweight and most commonly used as a part of web pages, whose implementations allow client-side scripts to interact with the user and make dynamic pages. It is an interpreted programming language with object-oriented capabilities. JavaScript was first known as Live Script, but Netscape changed its name to JavaScript, possibly because of the excitement being generated by Java. JavaScript made its first appearance in Netscape 2.0 in 1995 with the name Live Script. The general-purpose core of the language has been embedded in Netscape, Internet Explorer, and other web browsers.

PostgreSQL.PostgreSQL, also known as Postgres, is a flexible open-source object relational database management system. PostgreSQL can handle a huge variety of use cases, from single machines to data warehouses to web services with many concurrent users. PostgreSQL uses and extends SQL (hence the name), and is broadly extensible to a range of use cases beyond mere transactional data. PostgreSQL stores data in tables (called relations) containing the tuples representing entities (such as documents and people) and relationships (such as authorship). Relations hold fixed-type attributes representing entity properties (such as a title) along with a primary key. Attribute types can be either atomic (such as integer, floating point, or boolean) or structured (such as an array, nested JSON, or a procedure).

Cascading Style Sheets. Cascading Style Sheets, fondly referred to as CSS, is a simple design language intended to simplify the process of making web pages presentable.

CSS handles the look and feel part of a web page. Using CSS, you can control the color of the text, the style of fonts, the spacing between paragraphs, how columns are sized and laid out, what background images or colors are used, layout designs,variations in display for different devices and screen sizes as well as a variety of other effects.

CSS is easy to learn and understand but it provides powerful control over the presentation of an HTML document. Most commonly, CSS is combined with the markup languages HTML or XHTML.

Chapter III

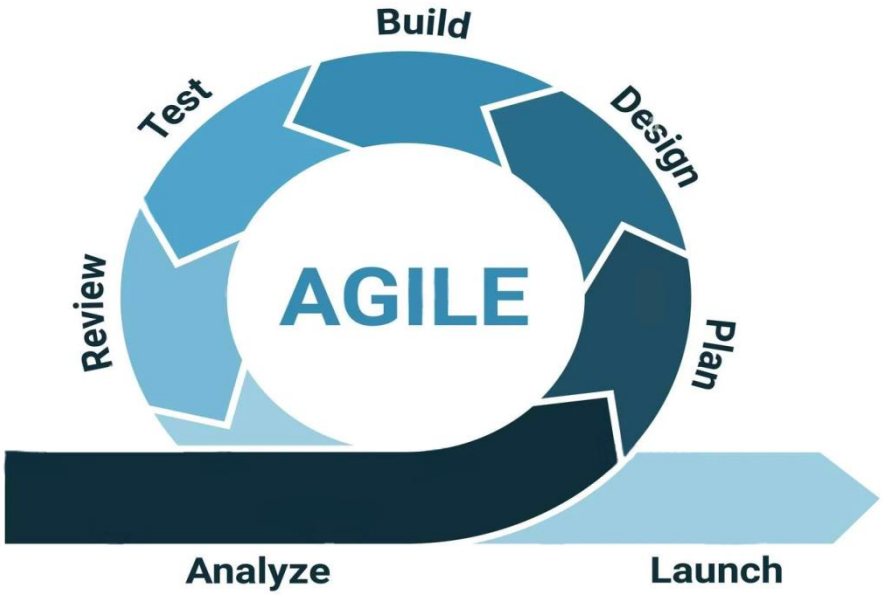
DESIGN AND METHODOLOGY

This chapter covers Methodology, Requirement Analysis, Requirement Documentation, Software Design, System Product and Processes, Development Plan, Testing Plan, Description Prototype, Implementation Plan, and Implementation Results.

Methodology

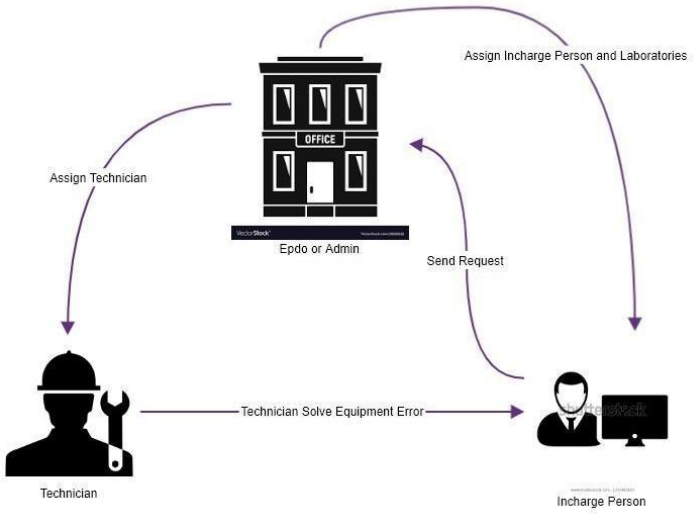
The agile method's proponents use the standard software development life cycle (SDLC) to describe and present solutions to the problems identified in this study.

As shown in Figure 1, the project was divided into phases and required constant collaboration with the target users. The agile method's core principles are defining the target users and identifying the scope of the problem, opportunities, and value to be addressed.



Requirement Analysis

In this phase, the process is to conduct interviews with the technician in Biliran Province State University. At present, PC or Personal Computer and other equipment are check by the technician manually. The one who manages the computer laboratory in each room department are required to visit technicians to determine why their equipment is no longer operational.



Requirement Documentation

The proponents were able to specify the functional and non-functional goals of the suggested web-based solution after identifying the business issue.

Functional Objectives

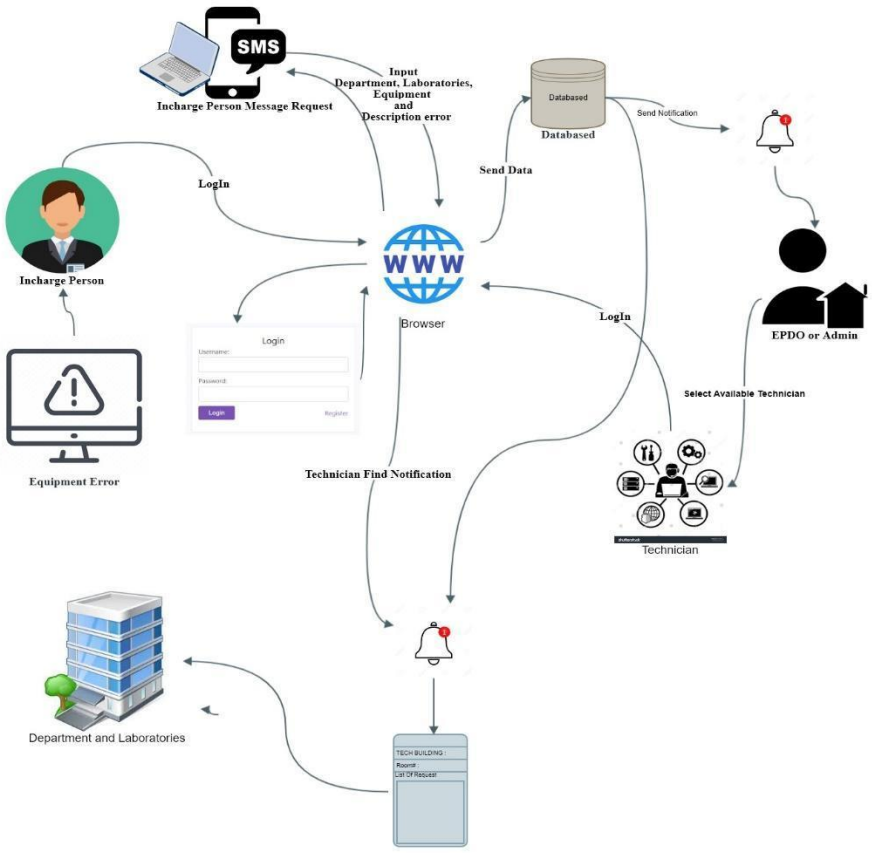
1. The system shall run and can be accessed on the different gadgets such as smartphones, tablets and laptops. This can be a user-friendly web-based

application that allows and will notify the assigned personnel and technician if there are some computers in some laboratory that need maintenance.

2. The system shall be able to connect the clients/instructor to the admin to request for repair and maintenance within their assigned location, room number, request description, assigned technicians, remarks and feedback.
3. The system shall record every transaction and maintenance occurred in the laboratories and can provide printable reports and analysis through the inventory of the system.

Designs of Systems and Processes

The development team built or implemented a computer solution after determining the application's purpose and specifications, as well as the software development needs. This comprises both the algorithm implementation and the architectural perspective. The preparation of the logical design, physical design, and user interface design will take place at this stage. There are both functional and non-functional requirements that will be represented graphically in diagrams.

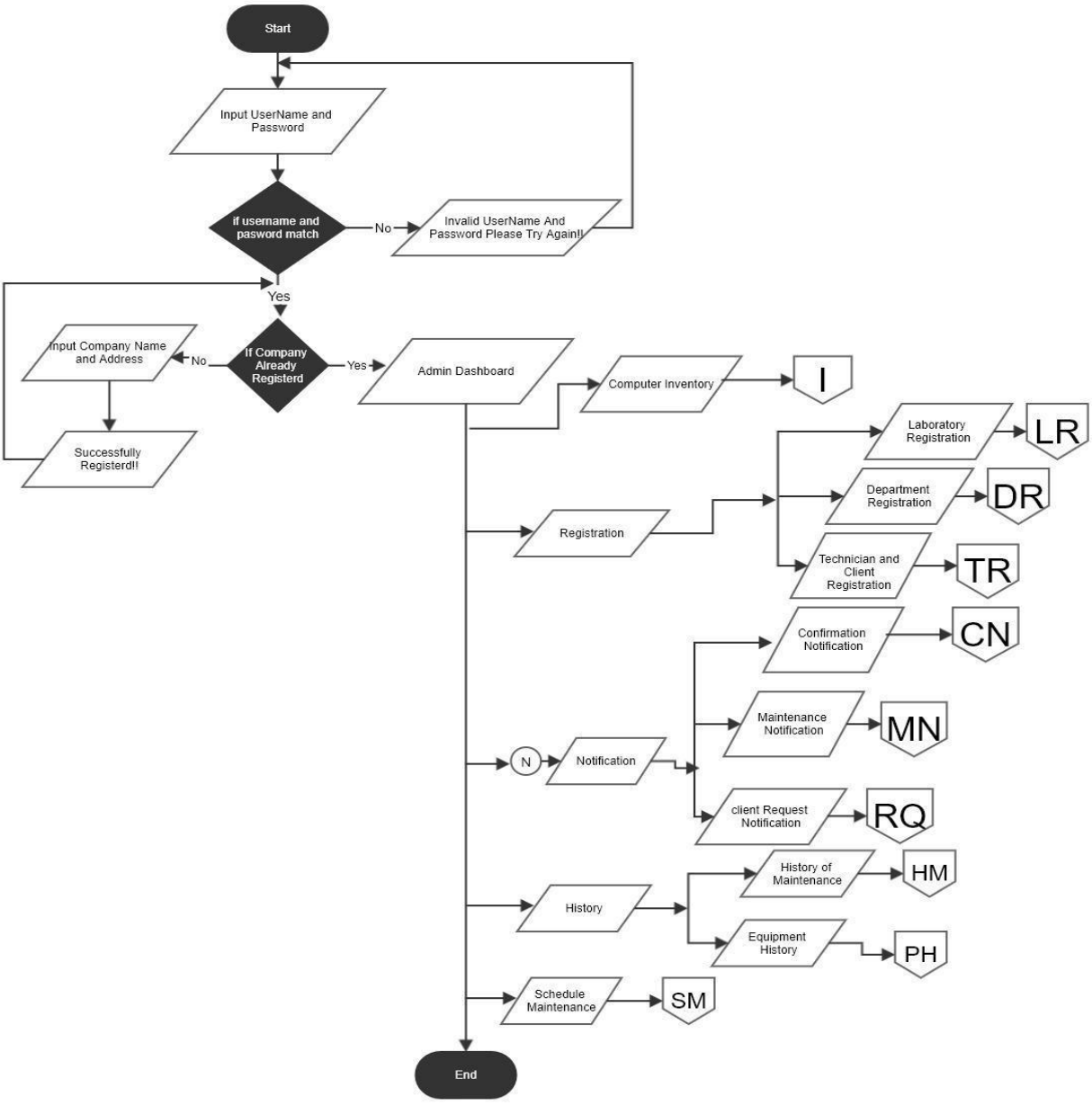


The main language for constructing this application is C#, and in order to implement it, you must start from scratch until it gradually develops over time. This web application requires a variety of tools to develop and be used in laboratories in businesses or schools and universities. For better design, we used CSS, JavaScript, and Bootstrap, this web requires the internet to be able to login and use the design to have access in laboratories, Reports, Schedule Maintenance, and Request Notification. We use database PostgreSQL so we can store data and get reports, access the system, maintenance scheduling, find the equipment, and create an account for the In charge

Person and Technician, The in charge person need to use our system to send a message if there is an issue with the equipment. In order for the in charge person and admin to communicate and repair the equipment problem, the admin should be notified that the in charge person in the laboratories has a request, This is what the admin will do: he will assign a technician who he will send to the laboratories in order to fix the problem in the laboratories, The technician is required to login using his mobile device or an Android in order to locate the building, and after the technician troubleshoots the equipment, the In Charge Person must confirm that the technician fixed the equipment problem.

FLOW CHART

System flowcharts are a way of displaying how data flows in a system and how decisions are made to control events. To illustrate this, symbols are used. They are connected together to show what happens to data and where it goes.



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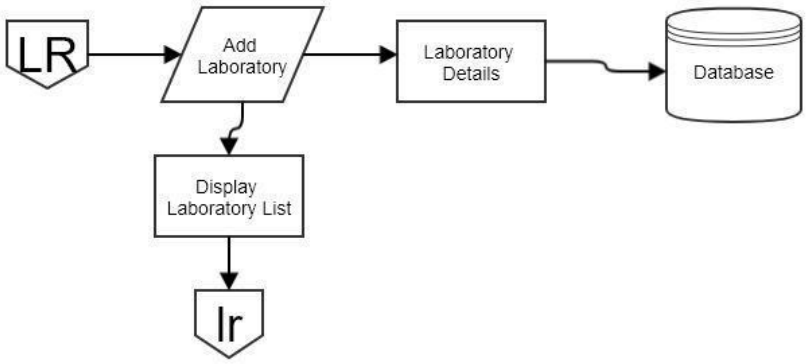

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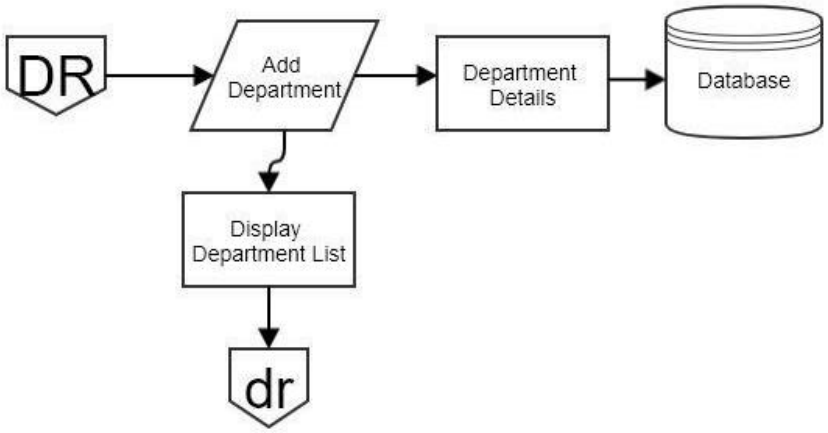

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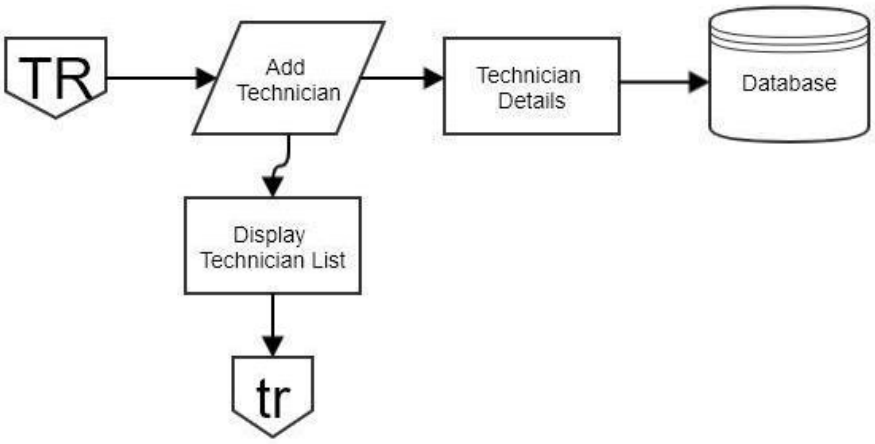

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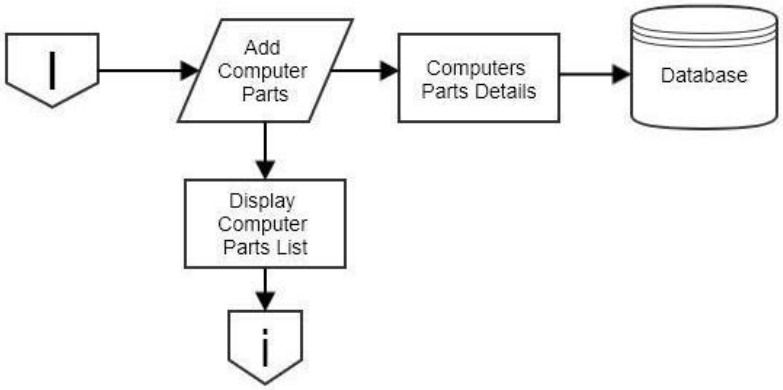

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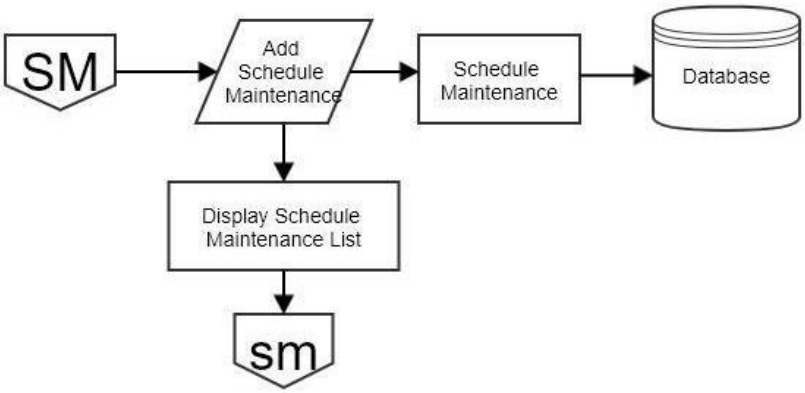

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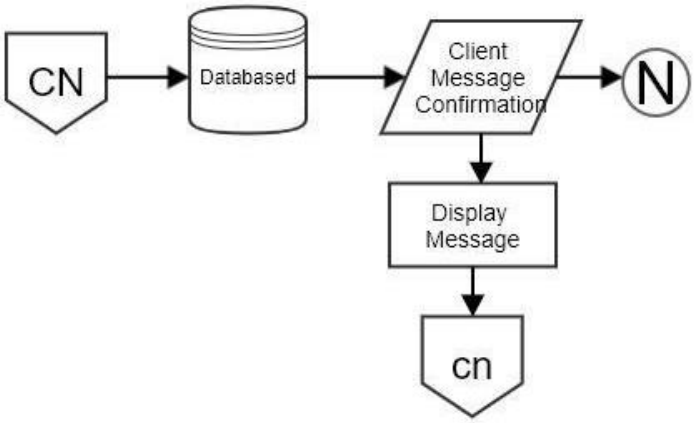

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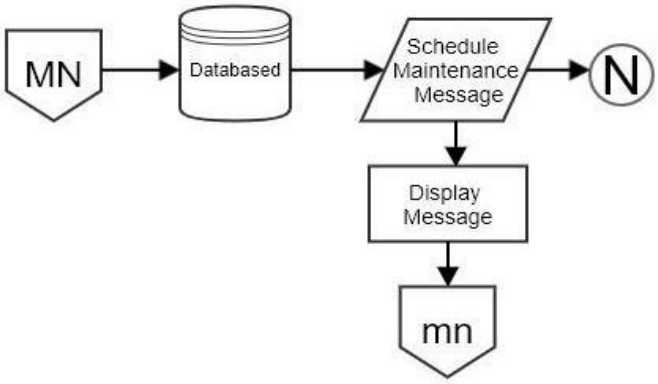

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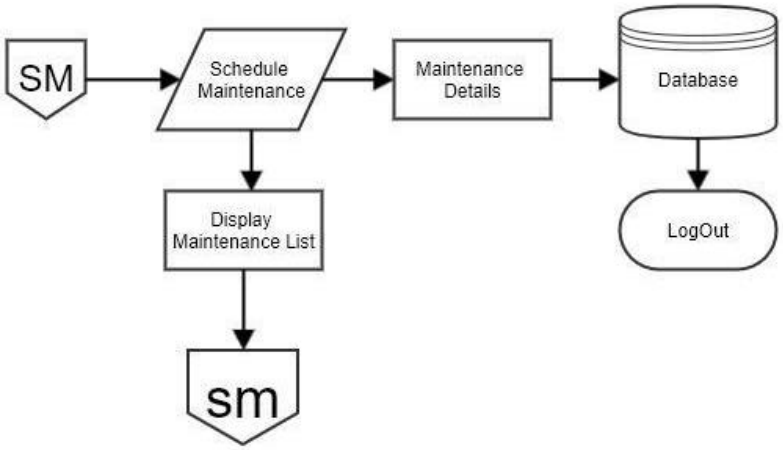

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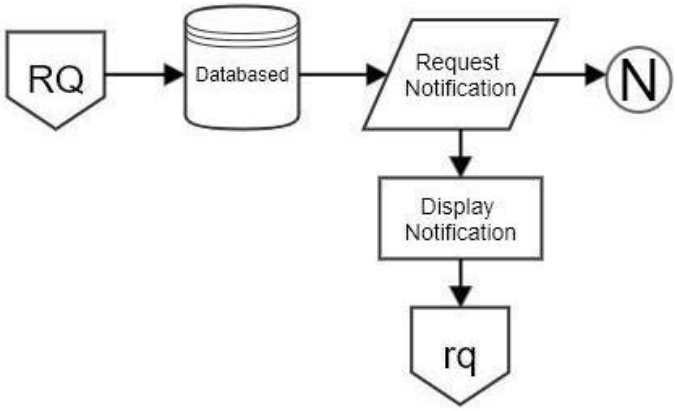

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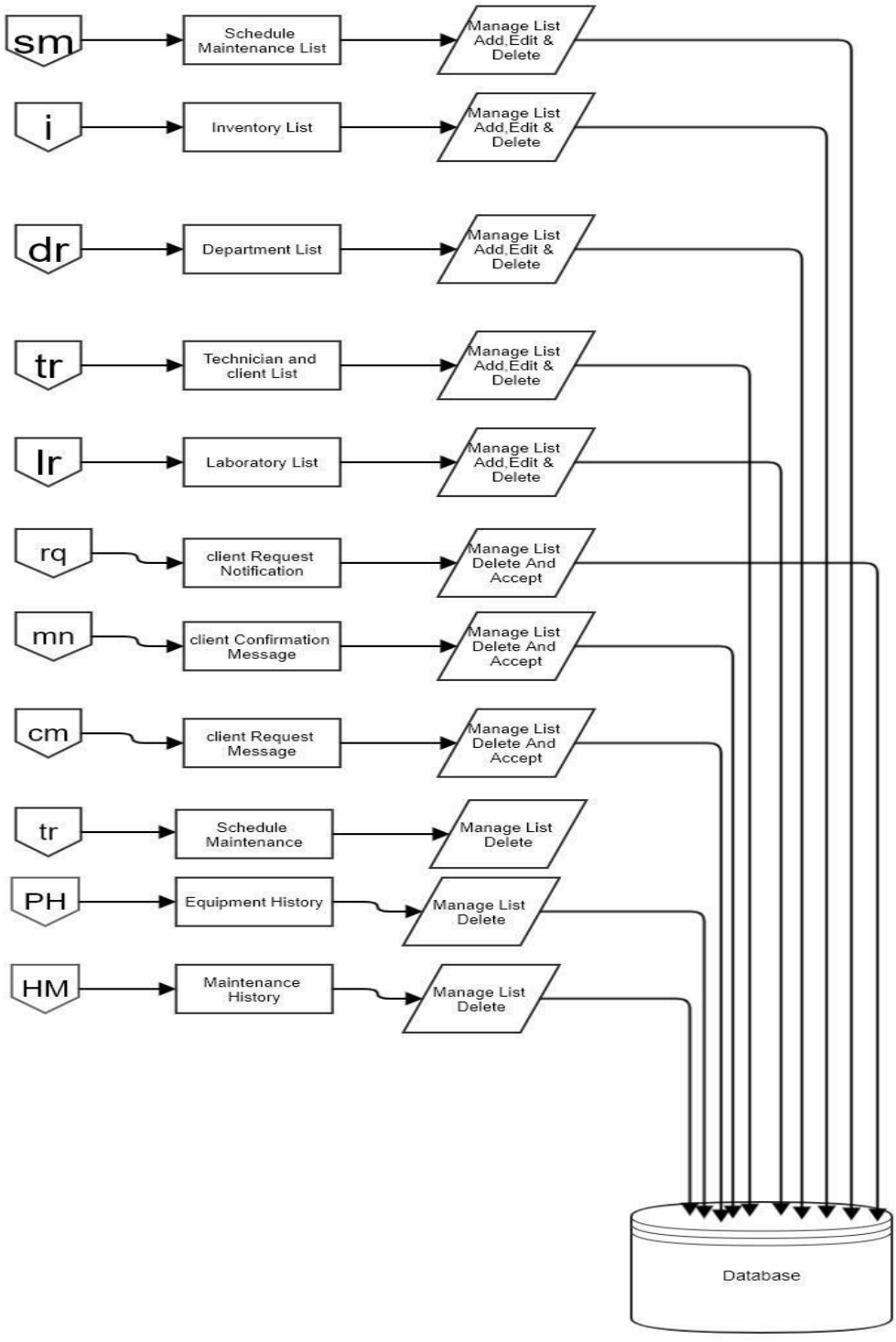
sm
Schedule Maintenance List
Manage List Add,Edit & Delete
i
Inventory List
Manage List Add,Edit & Delete
dr
Department List
Manage List Add,Edit & Delete
tr
Technician and client List
Manage List Add,Edit & Delete
lr
Laboratory List
Manage List Add,Edit & Delete
rq
client Request Notification
Manage List Delete And Accept
mn
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Maintenance History
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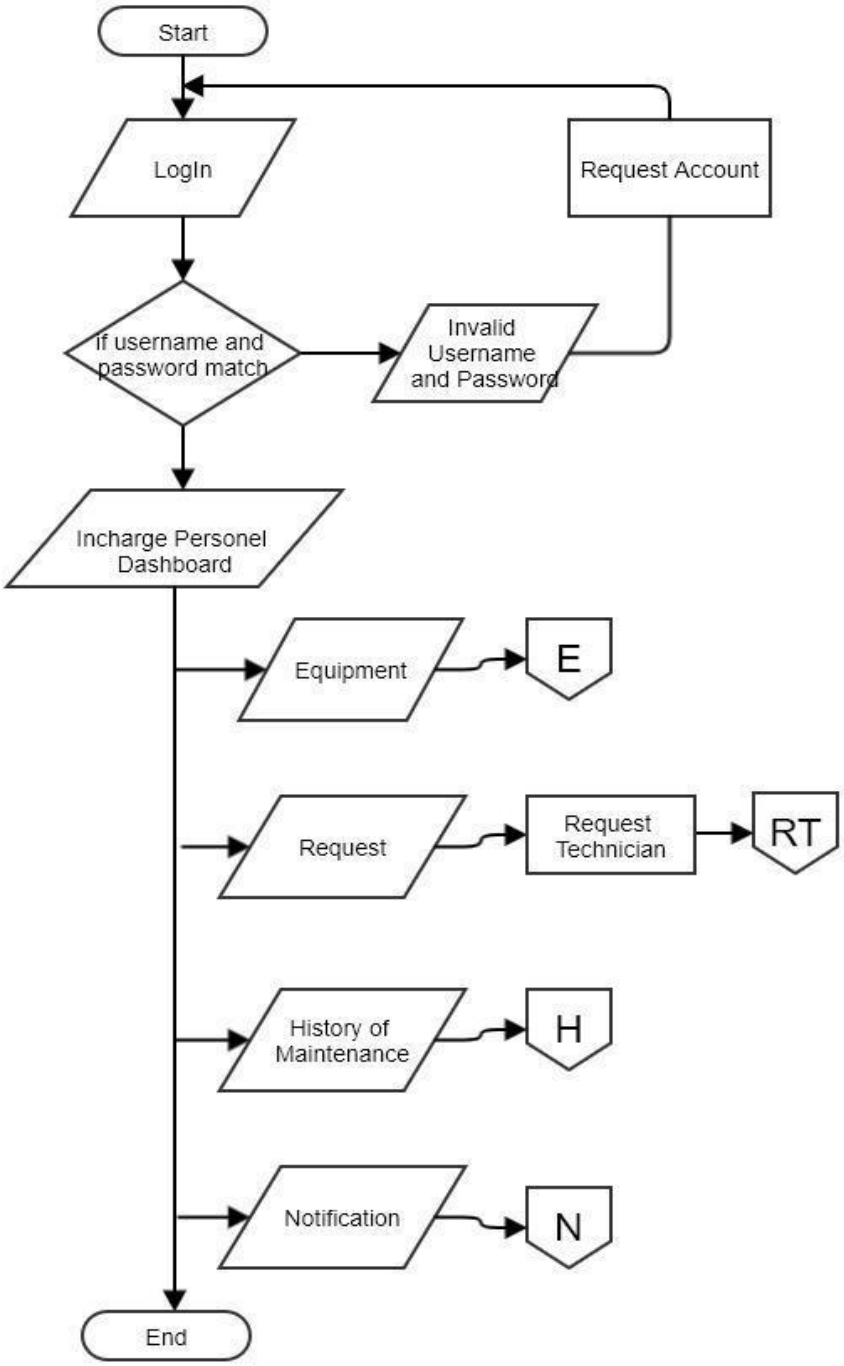
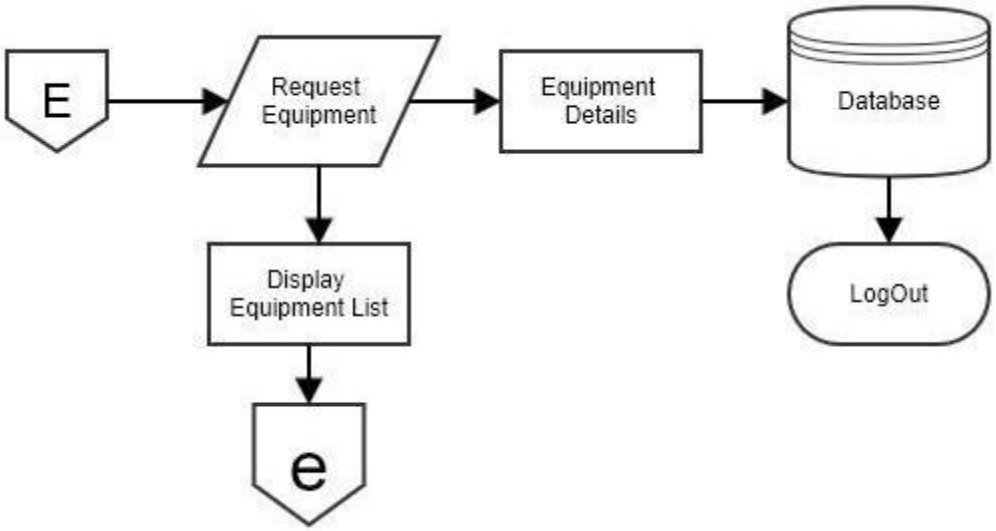


Figure Flowchart



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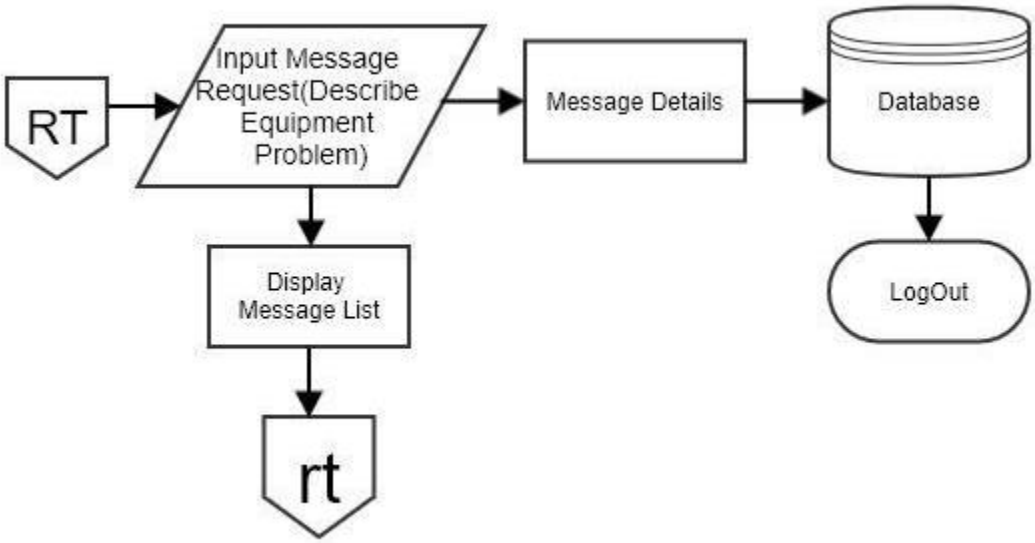

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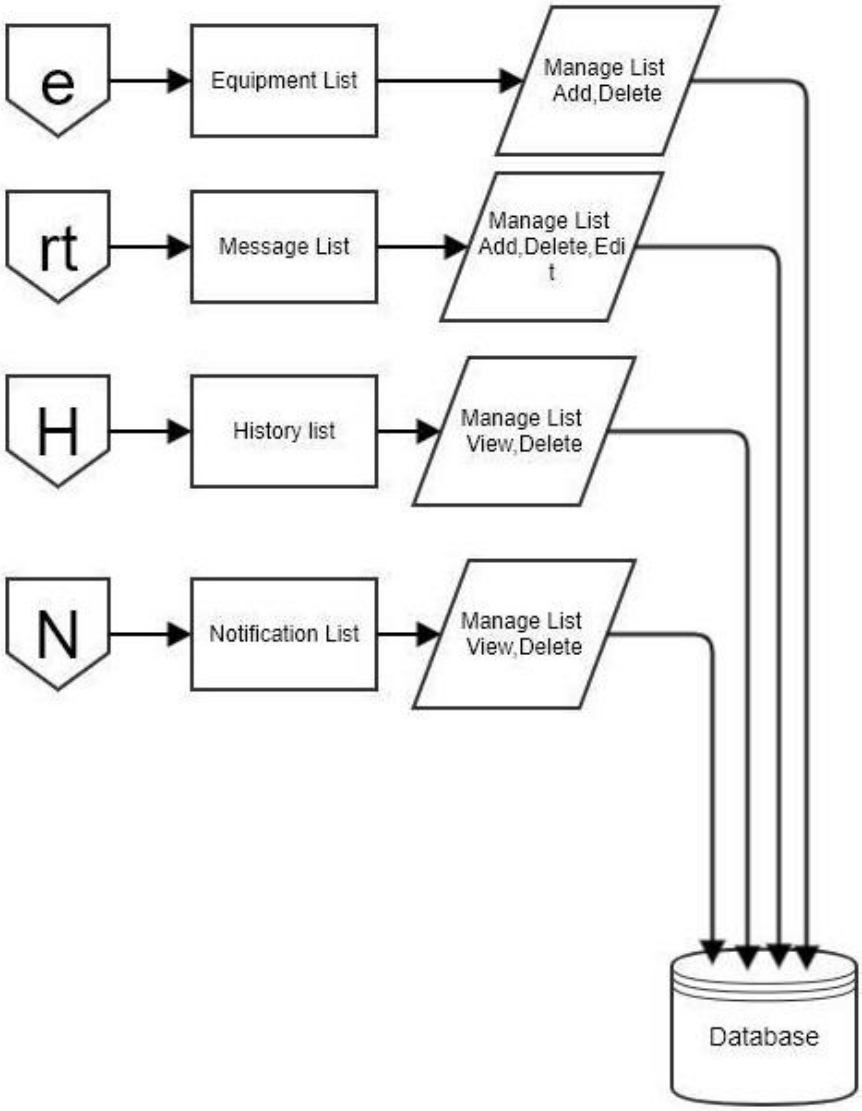

Figure Flowchart of

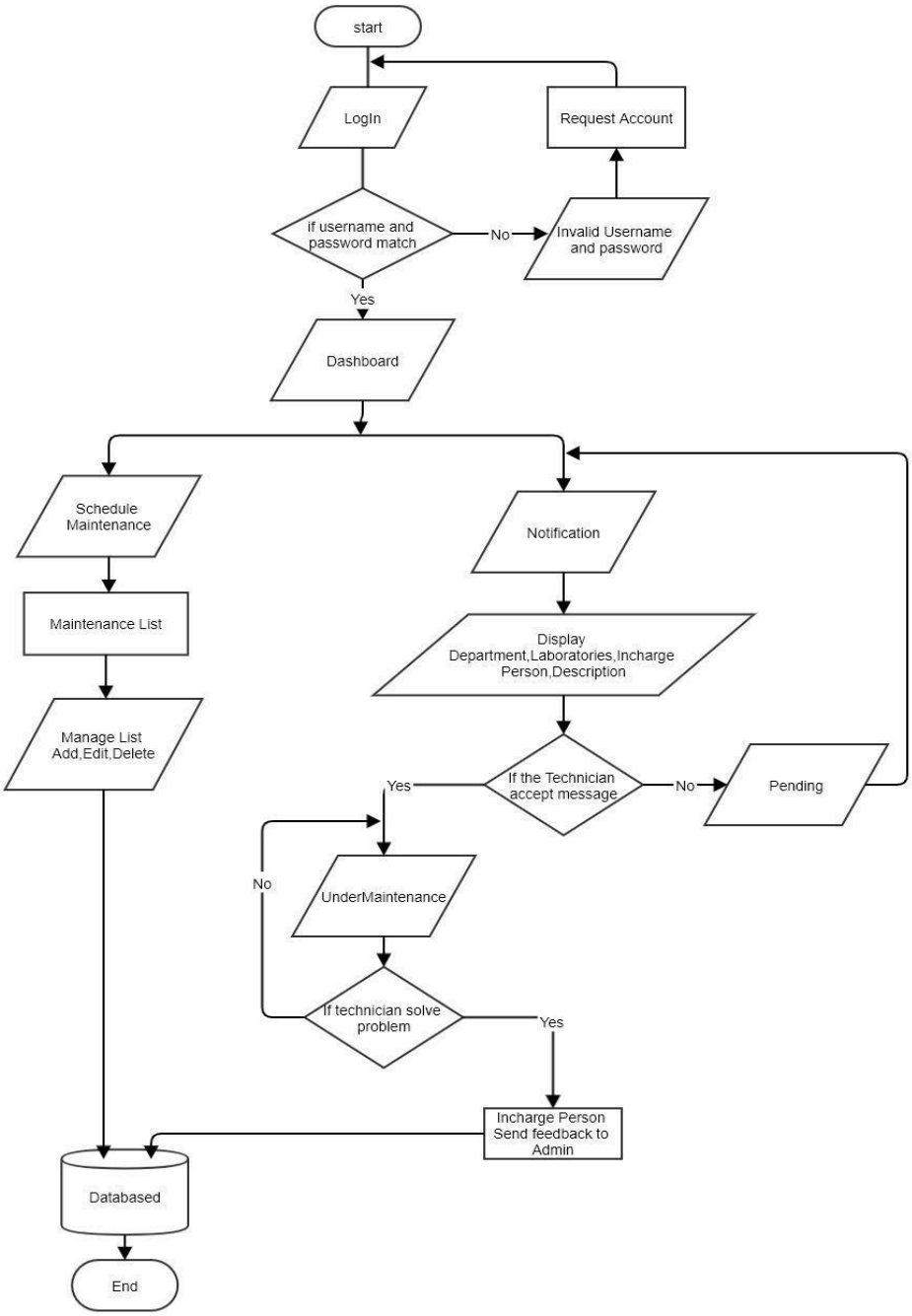

Figure Technician Dashboard

Context Diagram

This section is a Context Diagram. The Context Diagram of the proposed system showed the relationship and functions of an end-user in the system. Each user uses their account to get into the system and the user has limited access to the system. Only the admin has the full access to the system.

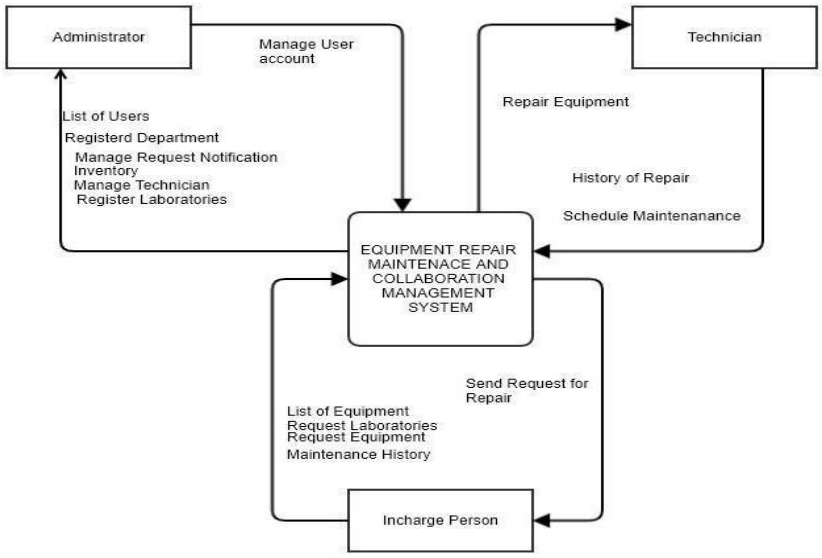

Figure Context Diagram of Equipment Repair Maintenance and Collaboration Management System

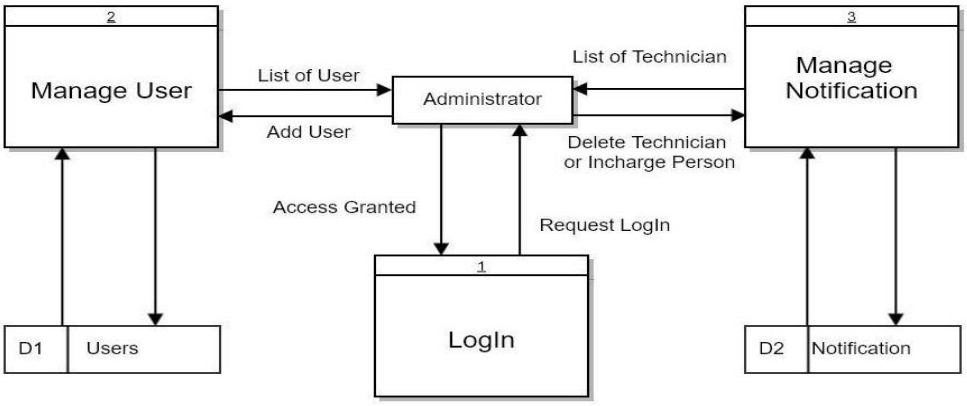

Figure Context Diagram of Administrator

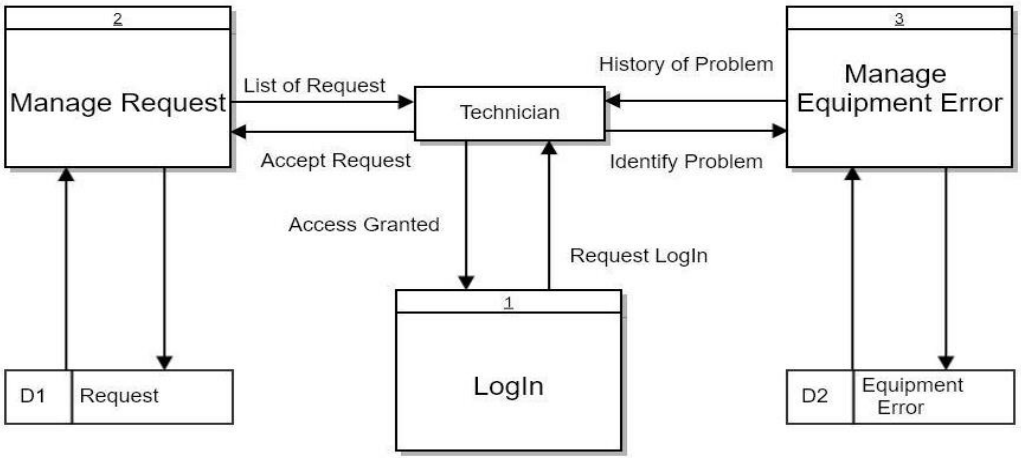

Figure Context Diagram of Technician

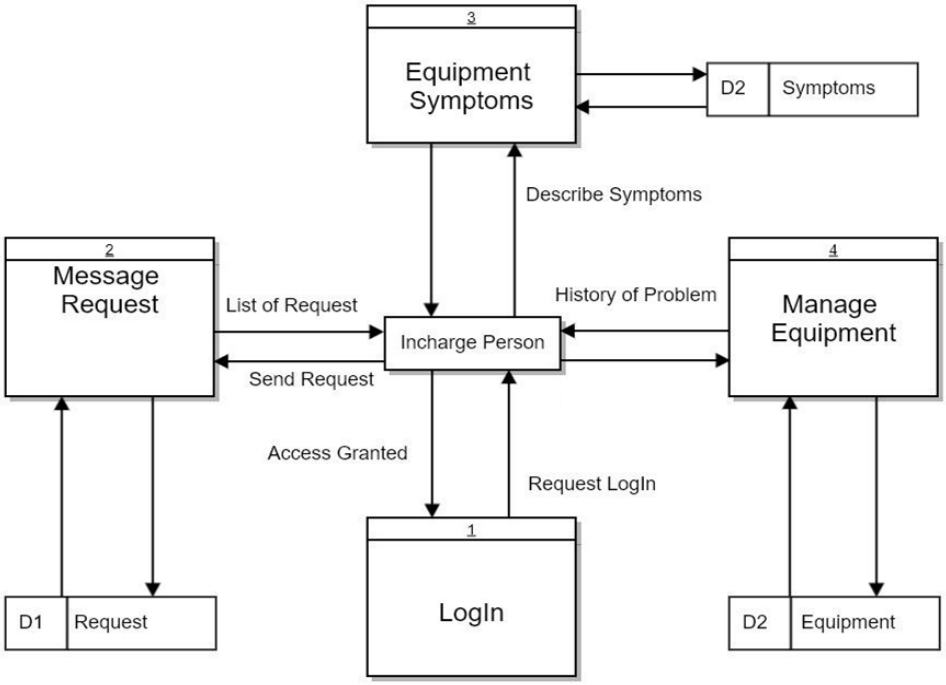

Figure Context Diagram of In-charge Personal

Database Table

Development Plan

Target	How?	Support/Resources	Target Date
To develop a System that involved Computer Inventory and Maintaining of the computer hardware and software.	-To create a system that automatically check computer risks.	-Technician -Internet -Digital world	July 25, 2022
Help software detects early faults of the computer.	- To classify symptoms and a decision tree approach in developing the system. - Fixing it ahead of time will prevent damage to the system.		
To carry out prompt emergency repair about a possible	- Improve the perfect function of the computer.		

problem of the computer.			

Testing Plan

The proponents will undertake a test to confirm that the proposed system operates correctly and efficiently. When the system is ready for deployment, the test plan will be implemented.

Testing

This phase relates to several types of system testing. The goal of testing is to catch as many faults as possible, correct them, and revalidate the solution's stability, which includes making sure that correcting one error does not result in the introduction of another. Unit testing, integration testing, system testing, and acceptance testing are the four levels of testing that must be completed.

Unit Testing. Individual units or components of software are tested at this phase of software testing. It is a strategy for determining whether or not particular units of source code are fit for use.

Testing for integration. Integration testing is a type of software testing in which individual units are combined and tested in multiple ways as a group. The goal of this level of testing is to find problems in the way integrated units interact.

System testing. Is a type of software testing that evaluates the behavior of a fully integrated software solution. This testing is primarily concerned with evaluating functional/end-user requirements.

The proponents tested the system, from the testing of the login to the recording, monitoring, updating and maintenance.

The proponents attempted to find problems or bugs in the interfaces as well as the software as a whole during these testing. The system design and behaviour were one of the factors we considered during these tests. We were ready to deploy the purposed system to the clients after finishing. Our clients can test the system to see if it is completely operational and functional; this will also help us determine if any more recommendations are needed.

Acceptance Testing is a term that refers to the process of determining if Formal testing of user needs, requirements, and other processes must be conducted to determine whether or not satisfies the acceptance criteria and to allow the user, customers, or other authorized group to determine if it is acceptable for deployment.

Implementation Plan

Implementation Result

As a result of our implementation findings, we created three potential projects, from which the panelists selected the most appropriate topic. We collect data from the internet and ask the computer technicians after the project has been approved. After gathering data, our team developed a strategy for designing our system based on what design option is available and preferred. Finally, our system's coding.