

A project report on

**SYNTHESIZED MANAGEABLE
STANDARDIZED JURISDICTION FOR
TRANSFUSION-CONSTRAINED**

Submitted in partial fulfillment for the award of the degree of

Bachelor of Technology

by

GOLLENA RUSHWANTH (20BCN7163)



**SCHOOL OF COMPUTER SCIENCE AND ENGINEERING
(SCOPE)**

MAY, 2024

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DECLARATION

I hereby declare that the thesis entitled “SYNTHESIZED MANAGEABLE STANDARDIZED JURISDICTION FOR TRANSFUSION-CONSTRAINED” submitted by me, for the award of the degree of Specify the name of the degree VIT is a record of bonafide work carried out by me under the supervision of Dr. Sheela Jayachandran. I further declare that the work reported in this thesis has not been submitted and will not be submitted, either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university.

Place: Amaravati

Date: 20/05/2024

Signature of the Candidate

A handwritten signature in blue ink, appearing to read "G. Raghav", with a horizontal line underneath it.

18th May 2024

INTERNSHIP COMPLETION CERTIFICATE

This is to certify that **Mr. Gollena Rushwanth** (Reg. No. 20BCN7163) Student of **B.Tech(Computer Science and Engineering) Vellore Institute of Technology, Amaravati** has successfully completed the Internship in **Java** from **January 2024 to May 2024** in our company. During the period, he had been exposed to different processes and found to be Punctual, Hard Working and Inquisitive.

We wish him every success in life and career.

For **Shiash Info Solutions Private Limited**

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CERTIFICATE

This is to certify that the Internship titled “SYNTHESIZED MANAGEABLE STANDARDIZED JURISDICTION FOR TRANSFUSION-CONSTRAINED” that is being submitted by GOLLENA RUSHWANTH (20BCN7163) is in partial fulfilment of the requirements for the award of Bachelor of Technology, and is a record of bonafide work done under my guidance. The contents of this Project work, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for the award of any degree or diploma and the same is certified.



Dr. SHEELA JAYACHANDRAN

Internal Guide

The thesis is satisfactory/unsatisfactory

Internal Examiner1



Internal Examiner2

Approved by

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ABSTRACT

In our project, we embark on a transformative journey to revolutionise the agricultural sector by introducing a versatile array of fuel paper cell batteries. These cutting-edge batteries are custom-engineered to meet the unique energy requirements of essential agricultural machinery, ranging from tractors to water pumps, and even larger vehicles like cars and buses. Our primary focus is not only on the development of these innovative power sources but also on the critical aspect of their continuous monitoring and in-depth analysis. In the dynamic landscape of modern agriculture, a reliable and sustainable energy source is paramount. Thus, our system's core function is to provide real-time monitoring and a comprehensive analysis of the paper fuel cell batteries used in this context. We delve into multiple facets of their performance, which include assessing power consumption, monitoring water pump output, tracking cycle times, measuring pressure levels, and continuously evaluating the battery's current condition. To accomplish this multifaceted analysis, we have strategically incorporated the Principal Component Analysis (PCA) algorithm into our system. PCA is renowned for its capacity to distil complex data into actionable insights by identifying underlying patterns and relationships within the dataset. By leveraging PCA, we gain a deeper understanding of the battery's performance metrics, enabling us to make informed decisions regarding maintenance, optimization, and replacement. This groundbreaking system represents a significant leap forward in the realm of sustainable energy solutions for agriculture. It not only ensures that essential machinery receives a consistent and dependable power supply but also aligns with the broader global initiative towards environmental sustainability.

ACKNOWLEDGEMENT

It is my pleasure to express with a deep sense of gratitude to Dr Sheela Jayachandran, Assistant Professor Sr.Grade-1, SCOPE, VIT-AP, for her constant guidance, continual encouragement, understanding; more than all, he taught me patience in my endeavour.

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Date:20/05/2024

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CONTENTS

| | |
|--|-----------|
| LIST OF FIGURES..... | 9 |
| LIST OF TABLES..... | 10 |
| 1. INTRODUCTION..... | 11 |
| 1.1. INTRODUCTION TO PROJECT..... | 11 |
| 1.2. PURPOSE OF THE PROJECT..... | 13 |
| 2. SYSTEM ANALYSIS | 14 |
| 2.1. INTRODUCTION..... | 14 |
| 2.2. ANALYSIS MODEL..... | 14 |
| 2.3. SDLC PHASES..... | 15 |
| 2.4. HARDWARE & SOFTWARE REQUIREMENT..... | 18 |
| 2.5. INPUT AND OUTPUT..... | 27 |
| 2.6. LIMITATIONS | 28 |
| 2.7. EXISTING SYSTEM..... | 28 |
| 2.8. SOLUTION OF THESE PROBLEMS IN THE PROPOSED SYSTEM | 29 |
| 3. FEASIBILITY REPORT..... | 30 |
| 3.1 TECHNICAL FEASIBILITY | 30 |
| 3.2 OPERATIONAL FEASIBILITY..... | 30 |
| 3.3 ECONOMIC FEASIBILITY | 30 |
| 4. SOFTWARE REQUIREMENT SPECIFICATIONS | 32 |
| 4.1. FUNCTIONAL REQUIREMENTS | 33 |
| 4.2. NON-FUNCTIONAL REQUIREMENTS | 33 |
| 4.3. PERFORMANCE REQUIREMENTS | 34 |
| 5. SYSTEM DEVELOPMENTENVIRONMENT | 35 |
| 5.1 INTRODUCTION TO JAVA | 35 |
| 5.2 SERVLETS, JSP | 38 |

| | | |
|------------|--|-----------|
| 5.3 | JDBC | 49 |
| 5.4 | HTML..... | 51 |
| 5.5 | JAVA SCRIPT. | 53 |
| 6. | SYSTEM DESIGN | 54 |
| 6.1. | INTRODUCTION | 54 |
| 6.2. | SYSTEM ARCHITECTURE | 55 |
| 6.3. | E-R DIAGRAM | 61 |
| 6.4. | FLOW DIAGRAM | 62 |
| 6.5. | DFD SYMBOLS..... | 63 |
| 6.6. | DATA FLOW DIAGRAM | 67 |
| 6.7. | USE CASE DIAGRAM..... | 68 |
| 6.8 | CLASS DIAGRAM..... | 69 |
| 7. | OUTPUT SCREENS | 70 |
| 8. | CODING..... | 73 |
| 9. | SYSTEM TESTING AND IMPLEMENTATION..... | 82 |
| 9.1. | INTRODUCTION | 82 |
| 9.2. | STRATEGIC APPROACH OF SOFTWARE TESTING | 82 |
| 9.3. | UNIT TESTING | 83 |
| 10. | SYSTEM SECURITY | 86 |
| 10.1. | INTRODUCTION..... | 86 |
| 10.2. | SECURITY IN SOFTWARE..... | 87 |
| 11. | CONCLUSION & FUTURE ENHANCEMENT | 89 |
| 12. | REFERENCES | 91 |

List of figures:-

| Figure.No | Description | Page.No |
|------------------|--|----------------|
| 1 | SDLC Phases | 15 |
| 2 | Scientific principles and methods to develop a software product | 19 |
| 3 | Software Evolution | 20 |
| 4 | SoftwareParadigms | 22 |
| 5 | Software Development Life Cycle | 26 |
| 6 | Compiling and interpreting Java source code | 36 |
| 7 | The primary purpose of the ERD is to represent data objects and their relationships. | 61 |
| 8 | Dataflow diagram | 67 |
| 9 | Use Case diagram | 68 |
| 10 | Class diagram | 69 |

List of Tables:

| Table.No | Name | Page.No |
|-----------------|--|----------------|
| 1 | HARDWARE AND SOFTWARE REQUIREMENTS | 18 |
| 2 | LOOP TESTING | 85 |

1. INTRODUCTION

Project Objective

The primary objective of this project is to revolutionise the agricultural sector by developing and deploying versatile fuel paper cell batteries tailored for essential agricultural machinery. These include tractors, water pumps, and larger vehicles like cars and buses. The project aims to ensure the reliability and sustainability of these batteries through continuous monitoring and advanced data analytics, specifically using the Principal Component Analysis (PCA) algorithm. By enhancing battery performance, manufacturing efficiency, and environmental sustainability, the project seeks to contribute significantly to clean and efficient energy solutions in agriculture, aligning with global sustainability initiatives.

Project Scope

1. Development of Fuel Paper Cell Batteries:

- Design and produce fuel paper cell batteries suitable for various agricultural machinery and larger vehicles.
- Focus on versatility, cost-effectiveness, and environmental sustainability.

2. Real-Time Monitoring and Data Analytics:

- Implement continuous monitoring systems for battery performance metrics, including power consumption, water pump output, cycle times, and pressure levels.
- Utilize PCA and other advanced data analytics techniques to derive actionable insights from performance data.

3. Enhancing Manufacturing Processes:

- Integrate data analytics into the manufacturing process to uncover hidden insights.
- Improve manufacturing efficiency, reduce resource utilization, and enhance cost-effectiveness.

- Incorporate predictive analytics to proactively address manufacturing issues and minimize downtime.

4. Sustainability and Environmental Impact:

- Develop solutions that contribute to environmental sustainability in the agricultural sector.
- Align project goals with global environmental initiatives and standards.

Problem Statement

Current agricultural practices heavily rely on conventional batteries and machinery that often lack efficiency, sustainability, and real-time monitoring capabilities. These limitations result in high operational costs, frequent downtimes, and suboptimal performance, which collectively hinder productivity and environmental sustainability. Additionally, the manufacturing processes for these batteries are often inefficient, leading to wasted resources and higher costs.

To address these challenges, there is a critical need for innovative fuel cell solutions that provide reliable and sustainable power for agricultural machinery. This requires the integration of advanced monitoring systems and data analytics to optimize performance and manufacturing processes. By developing fuel paper cell batteries with real-time monitoring and leveraging data analytics, we can unlock new levels of efficiency, predict and prevent issues, and significantly reduce environmental impact. This project aims to bridge these gaps, transforming the agricultural sector with cutting-edge, sustainable energy solutions.

1.2 PURPOSE OF THE SYSTEM

- ✓ Processing client requirements can be done efficiently.
- ✓ Report generation can be done immediately after the calculation of the amount of materials required for processing client data.
- ✓ Testing ionic stability, thermal stability and mechanical stability can be done very easily.
- ✓ Processing data for fillers can be efficiently done in the production process which is crucial in the part of production.
- ✓ Very little time is needed to go through the information for approval of reports for production.

2. SYSTEM ANALYSIS

In our project, we aim to revolutionise the agricultural sector by introducing a versatile array of fuel paper cell batteries tailored for essential machinery, ranging from tractors to water pumps and larger vehicles like cars and buses. Our focus extends beyond mere development; we prioritise continuous monitoring and in-depth analysis of these batteries to ensure reliability and sustainability in modern agriculture. By incorporating real-time monitoring and leveraging data analytics, including the Principal Component Analysis (PCA) algorithm, we seek to provide comprehensive insights into battery performance metrics such as power consumption, water pump output, cycle times, and pressure levels. This transformative approach extends to fuel cell manufacturing, where we aim to enhance efficiency, cost-effectiveness, and environmental sustainability by unlocking hidden insights within manufacturing data. By addressing existing limitations, such as limited data utilization and resource inefficiency, our proposed system integrates predictive analytics to anticipate and address issues proactively, thereby minimizing downtime and enhancing overall reliability. Through these advancements, our project strives to make substantial contributions to clean and efficient energy solutions, particularly in vital sectors like agriculture, while aligning with global initiatives towards environmental sustainability.

2.2 ANALYSIS MODEL

SOFTWARE DEVELOPMENT LIFE CYCLE

INTRODUCTION:

The System Development Lifecycle framework is designed to outline a complete development and implementation process suitable for developing complex applications. SDLC is a process followed for a software project, within a software organization. It consists of a detailed plan describing how to develop, maintain, replace alter or enhance specific software. The life cycle defines a methodology for improving the quality of software and the overall development process.

- Business – legislation regulatory requirements, policy, SOPs, guidelines etc.

- Process – how the business is implemented
- Data – the core business data elements collected for the business
- Application – the gate to the business collecting
- Infrastructure- the servers, network, workstations, etc.

Figure:-1(2.3 SDLC Phases):



Stage 1: Scheduling and Requisite Investigation:

Requirement analysis is the most fundamental stage in SDLC. It is performed by the senior members of the team with inputs from the customer, the sales department, market surveys and domain experts in the industry. This information is then used to plan the basic project approach and to conduct a product feasibility study in the economical, operational, and technical areas.

Planning for the quality assurance requirements and identification of the risks associated with the project is also done in the planning stage. The outcome of the technical feasibility study is to define the various technical approaches that can be followed to implement the project successfully with minimum risks.

Stage 2: Significant necessities:

Once the requirement analysis is done the next step is to clearly define and document the product requirements and get them approved by the customer or the market analysts. This is done through SRS.. Software Requirement Specification document which consists of all the product requirements to be designed and developed during the project life cycle.

Stage 3: Scheming the product design:

SRS is the reference for product architects to come out with the best architecture for the product to be developed. Based on the requirements specified in the SRS, usually, more than one design approach for the product architecture is proposed and documented in a DDS - Design Document Specification.

This DDS is reviewed by all the important stakeholders and based on various parameters such as risk assessment, product robustness, design modularity, budget and time constraints, the best design approach is selected for the product.

Stage 4: Structure or Mounting the Product:

In this stage of SDLC, the actual development starts and the products are built. The programming code is generated as per DDS during this stage. If the design is performed in a detailed and organized manner, code generation can be accomplished without much hassle.

Developers have to follow the coding guidelines defined by their organization and programming tools like compilers, interpreters, debuggers etc. are used to generate the code. Different high-level programming languages such as C, C++, Pascal, Java, and PHP are used for coding.

Stage 5: Testing the Product:

This stage is usually a subset of all the stages as in the modern SDLC models, the testing activities are mostly involved in all the stages of SDLC. However, this stage refers

to the testing-only stage of the product, where product defects are reported, tracked, fixed and retested until the product reaches the quality standards defined in the SRS.

Stage 6: Consumption in the Market and Safeguarding:

Once the product is tested and ready to be deployed it is released formally in the appropriate market. Sometimes product deployment happens in stages as per the organizations. Business strategy. The product may first be released in a limited segment and tested in the real business environment (UAT- User acceptance testing).

The product may be released as it is or with suggested enhancements in the targeted market segment. After the product is released in the market, its maintenance is done for the existing customer base.

TABLE:1-(2.4 HARDWARE AND SOFTWARE REQUIREMENTS)

| Developing Kit | | | | | | | |
|----------------|--|-------------------|---|--------|------------|-------|--|
| | Processor | | RAM | | Disk Space | | |
| Eclipse | Computer with a 2.6GHz processor or higher | | 2GB | | Minimum | 20 GB | |
| Database | | | | | | | |
| MySQL 5.0 | Intel processor or faster | Pentium at 2.6GHz | Minimum Physical Memory; 1 GB Recommended | 512 MB | Minimum | 20 GB | |
| HeidiSQL 8.3 | Intel processor or faster | Pentium at 2.6GHz | Minimum Physical Memory; 1 GB Recommended | 512 MB | Minimum | 20 GB | |

Software Requirements:

- **Front end** : core java, css, js, servlet
- **Web application** : J2ee Frameworks, Hibernate
- **Back end** : MySQL 5.1

OVERVIEW OF SOFTWARE ENGINEERING:

Software is more than just a program code. A program is an executable code, which serves some computational purpose. Software is considered to be a collection of executable programming code, associated libraries and documentation. Software, when made for a specific requirement is called a **software product**.

Engineering, on the other hand, is all about developing products, using well-defined, scientific principles and methods.



Figure.2

Software engineering is an engineering branch associated with the development of software products using well-defined scientific principles, methods and procedures. The outcome of software engineering is an efficient and reliable software product.

Definitions

IEEE defines software engineering as:

- (1) The application of a systematic, disciplined, quantifiable approach to the development, operation and maintenance of software; that is, the application of engineering to software.
- (2) The study of approaches as in the above statement.

Fritz Bauer, a German computer scientist, defines software engineering as:

Software engineering is the establishment and use of sound engineering principles to obtain economic software that is reliable and works efficiently on real machines.

Software Evolution

The process of developing a software product using software engineering principles and methods is referred to as **software evolution**. This includes the initial development of software and its maintenance and updates, till desired software product is developed, which satisfies the expected requirements.



Figure.3

Evolution starts from the requirement-gathering process. After this developers create a prototype of the intended software and show it to the users to get their feedback at the early stage of software product development. The users suggest changes, on which several consecutive updates and maintenance keep on changing. This process changes to the original software, till the desired software is accomplished.

Even after the user has the desired software in hand, the advancing technology and the changing requirements force the software product to change accordingly. Re-creating software from scratch and going one-on-one with requirements is not feasible. The only feasible and economical solution is to update the existing software so that it matches the latest requirements.

Software Evolution Laws

Lehman has given laws for software evolution. He divided the software into three different categories:

- **S-type (static-type)** - This is software, which works strictly according to defined specifications and solutions. The solution and the method to achieve it, both are immediately understood before coding. The s-type software is least subjected to changes hence this is the simplest of all. For example, a calculator program for mathematical computation.
- **P-type (practical-type)** - This is software with a collection of procedures. This is defined by exactly what procedures can do. In this software, the specifications can be described but the solution is not obvious instantly. For example, gaming software.
- **E-type (embedded-type)** - This software works closely with the requirements of the real-world environment. This software has a high degree of evolution as there are various changes in laws, taxes etc. in real-world situations. For example, Online trading software.

E-Type software evolution

Lehman has given eight laws for E-Type software evolution -

- **Continuing change** - An E-type software system must continue to adapt to real-world changes, or else it becomes progressively less useful.
- **Increasing complexity** - As an E-type software system evolves, its complexity tends to increase unless work is done to maintain or reduce it.

- **Conservation of familiarity** - The familiarity with the software or the knowledge about how it was developed, why was it developed in that particular manner etc. must be retained at any cost, to implement the changes in the system.
- **Continuing growth**- For an E-type system intended to resolve some business problem, its size of implementing the changes grows according to the lifestyle changes of the business.
- **Reducing quality** - An E-type software system declines in quality unless rigorously maintained and adapted to a changing operational environment.
- **Feedback systems**- The E-type software systems constitute multi-loop, multi-level feedback systems and must be treated as such to be successfully modified or improved.
- **Self-regulation** - E-type system evolution processes are self-regulating with the distribution of product and process measures close to normal.
- **Organizational stability** - The average effective global activity rate in an evolving E-type system is invariant over the lifetime of the product.

Software Paradigms

Software paradigms refer to the methods and steps, which are taken while designing the software. There are many methods proposed and are in work today, but we need to see where in software engineering these paradigms stand. These can be combined into various categories, though each of them is contained in one another:

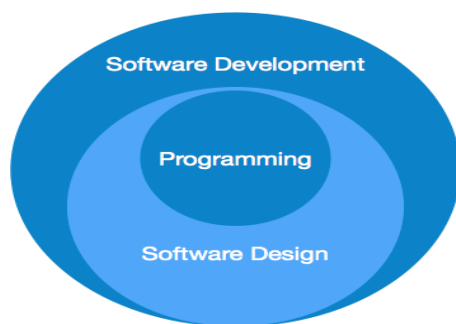


Figure.4

The programming paradigm is a subset of the Software design paradigm which is further a subset of the Software development paradigm.

Software Development Paradigm

This Paradigm is known as the software engineering paradigm where all the engineering concepts about the development of software are applied. It includes various research and requirement gathering which helps the software product to build. It consists of –

- Requirement gathering
- Software design
- Programming

Software Design Paradigm

This paradigm is a part of Software Development and includes –

- Design
- Maintenance
- Programming

Programming Paradigm

This paradigm is related closely to the programming aspect of software development. This includes –

- Coding
- Testing
- Integration

Need for Software Engineering

The need for software engineering arises because of a higher rate of change in user requirements and the environment in which the software is working.

- **Large software** - It is easier to build a wall than to a house or building, likewise, as the size of software becomes large engineering has to step in to give it a scientific process.
- **Scalability**- If the software process were not based on scientific and engineering concepts, it would be easier to re-create new software than to scale an existing one.

- **Cost-** As hardware industry has shown its skills and huge manufacturing has lowered the price of computer and electronic hardware. However, the cost of software remains high if the proper process is not adapted.
- **Dynamic Nature-** The always-growing and adapting nature of software hugely depends upon the environment in which the user works. If the nature of software is always changing, new enhancements need to be done in the existing one. This is where software engineering plays a good role.
- **Quality Management-** Better process of software development provides better and quality software products.

Characteristics of good software

A software product can be judged by what it offers and how well it can be used. This software must satisfy on the following grounds:

- Operational
- Transitional
- Maintenance

Well-engineered and crafted software is expected to have the following characteristics:

Operational

This tells us how well the software works in operations. It can be measured on:

- Budget
- Usability
- Efficiency
- Correctness
- Functionality
- Dependability
- Security
- Safety

Transitional

This aspect is important when the software is moved from one platform to another:

- Portability
- Interoperability
- Reusability
- Adaptability

Maintenance

This aspect briefs about how well software has the capabilities to maintain itself in the ever-changing environment:

- Modularity
- Maintainability
- Flexibility
- Scalability

In short, Software engineering is a branch of computer science, which uses well-defined engineering concepts required to produce efficient, durable, scalable, in-budget and on-time software products.

SOFTWARE DEVELOPMENT LIFE CYCLE

The Software Development Life Cycle is a process that ensures good software is built. Each phase in the life cycle has its process and deliverables that feed into the next phase. There are typically 5 phases starting with the analysis and requirements gathering and ending with the implementation. Let's look in greater detail at each phase:

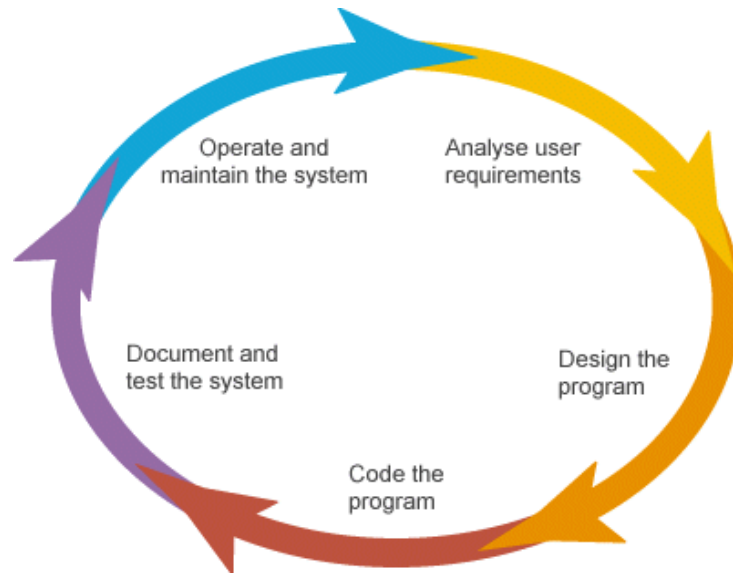


Figure.5

Stage 1: Scheduling and Requisite Analysis

During the discovery phase, our team conducts a detailed requirement analysis and creates a work breakdown structure.

Stage 2: Scheming the product design

We identify the design and architecture of the project. SRS is the reference for product architects to come out with the best architecture for the product to be developed.

Stage 3: Structure or Mounting of the Product

In this stage of SDLC, the actual development starts and the product is built. Different high-level programming languages such as C, C++, Pascal, Java, C# and PHP are used for coding.

Stage 4: Testing the Product

Testing is the last phase of the Software Development Life Cycle before the software is delivered to customers. During testing, experienced testers start to test the system against the requirements.

Stage 5: Consumption in the Market and Safeguarding

Once the product has been fully tested and no high-priority issues remain in the software, it is time to deploy to production where customers can use the system.

2.5 INPUT AND OUTPUT

The major inputs and outputs and major functions of the system are as follows:

Input:

- The entities such as authorities and users must register the account for login. All the user details have been stored the data in our database to identify the entities.
- The main and sub-authority upload the necessary details to be involved in the storing operation.

Output:

- Only authorized data users can able to access the data.
- Prediction of outflow will be calculated at the given time.

2.5 INPUT DESIGN

- Input design is a part of the overall system design. The main objective during the input design is given below.
- Input States: The user can maintain a database in MySQL server or SQL server for his/her business requirement.
- Input Media:
At this stage, the choice has to be made about the input media. To conclude about the input media consideration has to be given to:
 - In this section, the user can give the input for storage location and get the output from the admin side.

2.6 LIMITATIONS

- ✓ Reliance on post-production data analysis rather than real-time monitoring during manufacturing.
- ✓ Lack of proactive utilization of data hampers timely adjustments and improvements.
- ✓ Inefficient use of resources results in higher energy and material consumption.
- ✓ Increased production costs and environmental impact are consequences of resource inefficiency.
- ✓ The current system inadequately addresses sustainability concerns.
- ✓ Contributes to a larger environmental footprint, potentially facing regulatory challenges.
- ✓ Absence of predictive analytics leads to reactive issue resolution.
- ✓ Downtime and increased maintenance costs impact production efficiency and product quality

2.7 PROBLEMS IN EXISTING SYSTEM:

The existing system for biofuel cell manufacturing in the agricultural industry, while operational, faces notable limitations in fully utilizing data analytics, optimizing resource utilization, and meeting contemporary sustainability standards. The current approach falls short of harnessing the complete potential of available data to enhance efficiency and cost-effectiveness. Resource utilization is not optimized to its full potential, and the system lacks robust mechanisms to align with evolving sustainability requirements. In response to these constraints, our project proposes a transformational approach that integrates data-driven insights into the manufacturing process of biofuel cells. By addressing these limitations, our initiative aims to not only meet the increasing demand for efficient and cost-effective energy solutions in agriculture but also proactively promote environmental consciousness. The goal is to bridge existing gaps in the current system, foster innovation, and guide biofuel cell production toward a more sustainable and economically viable future within the agricultural industry.

2.8 PROPOSED SYSTEM

Our proposed system seeks to revolutionize fuel cell manufacturing by addressing existing limitations through a comprehensive suite of features. Data analytics plays a central role, enabling real-time monitoring and optimization of the entire production process. We prioritize efficiency, cost-effectiveness, and environmental sustainability, optimizing resource utilization and reducing energy and material consumption. Our commitment to sustainability is evident in the integration of predictive analytics, minimizing downtime and maintenance expenses. The introduction of a digital twin enhances innovation through simulations and testing. By leveraging data, our system aims to significantly reduce costs, improve efficiency, and make fuel cells more competitive, accelerating their commercialization while minimizing environmental impact.

Advantages of the Proposed System:

- ✓ The system leverages real-time data analytics to monitor and optimize the manufacturing process, providing immediate insights for enhanced decision-making and efficiency.
- ✓ Through efficient resource utilization, the system reduces energy and material consumption, resulting in lower production costs and a diminished environmental footprint.
- ✓ With a strong focus on sustainability, the proposed system aligns with environmental goals, making it more competitive in eco-conscious markets and addressing stringent environmental regulations.
- ✓ The system incorporates predictive analytics, allowing issues to be anticipated and resolved proactively, leading to reduced downtime and maintenance costs.

3. FEASIBILITY REPORT

- Research into new gel materials and manufacturing processes could further enhance performance, lifespan, and affordability, making gel batteries an even more attractive option for your project.
- The potential of lithium-ion gel batteries offers exciting possibilities for even greater performance gains in the future.

3.1 Technical Feasibility

- The project requires expertise in battery technology, including custom engineering to meet the unique energy requirements of agricultural machinery.
- Implementation of real-time monitoring systems and data analytics tools, including the integration of the Principal Component Analysis (PCA) algorithm, presents technical challenges that need to be addressed.
- Availability of necessary hardware and software infrastructure for data collection, analysis, and monitoring.

3.2 Operational Feasibility

- Initial investment in research and development, including battery design and testing, as well as the development of monitoring systems and analytics tools.
- Cost of manufacturing fuel paper cell batteries at scale, including materials, labour, and production overheads.
- Potential revenue streams from sales of batteries and subscription-based services for real-time monitoring and analysis.

3.3 Economic Feasibility

- The project addresses a critical need for reliable and sustainable energy sources in the agricultural sector, contributing to increased productivity and efficiency.

- Adoption of fuel paper cell batteries can lead to reduced reliance on fossil fuels, resulting in environmental benefits such as reduced greenhouse gas emissions and improved air quality.
- The project has the potential to create employment opportunities in research, development, manufacturing, and maintenance of fuel paper cell batteries and associated technologies.

4. SOFTWARE REQUIREMENT SPECIFICATION

INTRODUCTION

The purpose of this document is to present a detailed description of the Web application system. It will explain the purpose and features of the system, the interfaces of the system, what the system will do, the constraints under which it must operate and how the system will react to external stimuli. This document is intended for both the stakeholders and the developers of the system and will be proposed to the Regional Historical Society for its approval.

PURPOSE

The purpose of this Software Requirement Specification (SRS) is to help the project. It is provided with some requirements which are used in the Transaction Mercator System. All parts; design, coding and testing will be prepared with helping of SRS. The purpose of this document is to detail the requirements placed on the Transaction Mercator System and serve as a contract between the customer and the developers as to what is to be expected of the stock exchange, and how the components of the system are working with each other with external systems.

This document will be checked by the group member's supervisor and it will be corrected by members if the supervisor orders.

DEVELOPERS RESPONSIBILITIES OVERVIEW:

The developer is responsible for:

- Developing the system, which meets the SRS and solving all the requirements of the system?
- Demonstrating the system and installing the system at the client's location after the acceptance testing is successful.
- Submitting the required user manual describing the system interfaces to work on it and also the documents of the system.

- Conducting any user training that might be needed for using the system.
- Maintaining the system for one year after installation.

4.1 FUNCTIONAL REQUIREMENTS:

- Following is a list of functionalities of the browsing-enabled system.
- An Activity with a UI that allows you to browser settings. Provide a second Activity that allows users to access the share with permission from the administrator. Handle activity lifecycle appropriately. A precondition for any points in this part of the grade is code that compiles and runs.
- Your application should allow a user to browse the shares, and buy and sell the shares with specific metadata. The assignment requires you to create a UI for browsing and a UI for integrating the two.
- The Net Beans provide many useful layout components, views, and tools that you may want to use to create your location browser. As with the final project, you should design your application to only use the buttons on the Keyboard and mouse as input. Your application should use the Keyboard, Mouse and keywords.

4.2 NON-FUNCTIONAL REQUIREMENTS:

- The system should be supported by Net Beans. The member should use the System browser. Each member should have a separate system.
- The system should ask for the username and password to open the application. It doesn't permit unregistered users to access the System.
- The system should have Role-based System functions access. Approval Process has to be defined.
- The system should have Modular customization components so that they can be reused across the implementation.
- These are the main following:
- Secure access to confidential data. 24 X 7 availability
- Better component design to get better performance at peak time
- Flexible service-based architecture will be highly desirable for future extension

4.3 PERFORMANCE REQUIREMENTS:

Performance is measured in terms of the output provided by the application. Requirement specification plays an important part in the analysis of a system. Only when the requirement specifications are properly given, it is possible to design a system, that will fit into the required environment. It rests largely on the part of the users of the existing system to give the required specifications because they are the people who finally use the system. This is because the requirements have to be known during the initial stages so that the system can be designed according to those requirements. It is very difficult to change the system once it has been designed and on the other hand designing a system, which does not cater to the requirements of the user, is of no use.

The requirement specification for any system can be broadly stated as given below:

- The system should be able to interface with the existing system
- The system should be accurate
- The system should be better than the existing system

The existing system is completely dependent on the user to perform all the duties.

5. SYSTEM DEVELOPMENT ENVIRONMENT

5.1 INTRODUCTION TO JAVA

About Java:

Initially, the language was called as “oak” but it was renamed “Java” in 1995. The primary motivation for this language was the need for a platform-independent (i.e. Architecture architecture-neutral) language that could be used to create software to be embedded in various consumer electronic devices.

- Java is a programmer’s language
- Java is cohesive and consistent
- Except for those constraints imposed by the Internet environment. Java gives the programmer, full control

Finally, Java is for Internet Programming whereas c is for System Programming.

Importance of Java to the Internet

Java has had a profound effect on the Internet. This is because; Java expands the Universe of objects that can move about freely in Cyberspace. In a network, two categories of objects are transmitted between the server and the personal computer. They are passive information and Dynamic active programs. In the areas of Security and probability. But Java addresses these concerns and by doing so, has opened the door to an exciting new form of program called the Applet.

Applications and applets. An application is a program that runs on our Computer under the operating system on that computer. It is more or less like one creating, using C or C++. Java’s ability to create Applets makes it important. An Applet is an application, designed to be transmitted over the Internet and executed by a Java-compatible web browser. An applet is a tiny Java program, dynamically downloaded across the network, just like an image. But the difference is, that it is an intelligent program, not just a media file. It can react to the user input and dynamically change.

Java Architecture

Java architecture provides a portable, robust, high-performing environment for development. Java provides portability by compiling the byte codes for the Java Virtual Machine, which is then interpreted on each platform by the run-time environment. Java is a dynamic system, able to load code when needed for a machine in the same room or across the planet.

When you compile the code, the Java compiler creates machine code (called byte code) for a hypothetical machine called a Java Virtual Machine (JVM). The JVM is supposed to be executed the byte code. The JVM is created to overcome the issue of probability. The code is written and compiled for one machine and interpreted on all machines. This machine is called a Java Virtual Machine.

Compiling and interpreting Java source code.

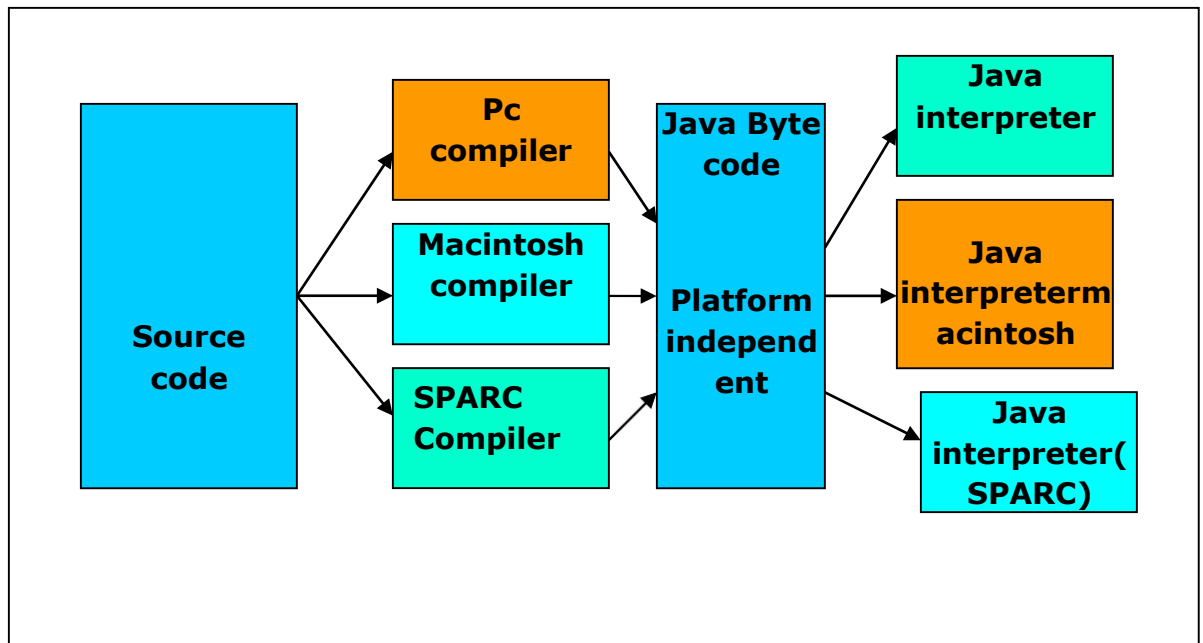


Figure.6

During run-time, the Java interpreter tricks the byte code file into thinking that it is running on a Java Virtual Machine. In reality, this could be an Intel Pentium Windows 95 or

Sun SPARCstation running Solaris or Apple Macintosh running system and all could receive code from any computer through the internet and run the Applets.

Simple:

Java was designed to be easy for the Professional programmer to learn and to use effectively. If you are an experienced C++ Programmer. Learning Java will orient features of C++. Most of the confusing concepts from C++ are either left out of Java or implemented in a cleaner, more approachable manner. In Java, there are a small number of clearly defined ways to accomplish a given task.

Object-oriented:

Java was not designed to be source-code compatible with any other language. This allowed the Java team the freedom to design with a blank slate. One outcome of this was a clean, usable, pragmatic approach to objects. The object model in Java is simple and easy to extend, while simple types, such as integers, are kept as high-performance non-objects.

Robust

The multi-platform environment of the web places extraordinary demands on a program because the program must execute reliably in a variety of systems. The ability to create robust programs. Was given a high priority in the design of Java. Java is a strictly typed language; it checks your code at compile time and runtime.

Java virtually eliminates the problems of memory management and deal location, which is completely automatic. In a well-written Java program, all run-time errors can and should be managed by your program.

5.2 SERVLETS/JSP

A Servlet is a generic server extension. Java classes that can be loaded dynamically to expand the functionality of a server. Servlets are commonly used with web servers. Where they can take the place of CGI scripts.

A Servlet is similar to a proprietary server extension, except that it runs inside a Java Virtual Machine (JVM) on the server, so it is safe and portable. Servlets operate solely within the domain of the server.

Unlike CGI and Fast CGI, which use multiple processes to handle separate programs or separate requests, separate threads within the web server process handle all servlets. This means that servlets are all efficient and scalable.

Servlets are portable; both across operating systems and also across web servers. Java Servlets offer the best possible platform for web application development.

Servlets are used as a replacement for CGI scripts on a web server; they can extend any sort of server, such as a mail server that allows servlets to extend its functionality, perhaps by performing a virus scan on all attached documents or handling mail filtering tasks.

Servlets provides a Java-based solution used to address the problems currently associated with doing server-side programming including inextensible scripting solutions platform-specific APIs and incomplete interfaces.

Servlets are objects that conform to a specific interface that can be plugged into a Java-based server. Servlets are to the server-side what applets are to the client-side. Applets are to the client-side what byte codes that can be dynamically loaded off the net. They differ from applets in that they are faceless objects (without graphics or a GUI component). They serve as platform-independent, dynamically loadable, pluggable helper byte code objects on the server side that can be used to dynamically extend server-side functionality.

For example, an HTTP servlet can be used to generate dynamic HTML content when you use servlets to do dynamic content you get the following advantages:

They're faster and cleaner than CGI scripts

They use a standard API (the servlet API)

They provide all the advantages of Java (run on a variety of servers without needing to be rewritten)

Attractiveness of servlets:

Many features of servlets make them easy and attractive to use these include:

- Easily configure using the GUI-based Admin tool]
- Can Be Loaded and Invoked from a local disk or remotely across the network.
- Can be linked together or chained, so that one servlet can call another servlet or several servlets in sequence.
- Can be called dynamically from within HTML, pages using server-side include-tags.
- Are secure when downloading across the network, the servlet security model and servlet and box protect your system from unfriendly behaviour.

Advantages of the Servlet API

One of the great advantages of the servlet API is protocol independence. It assumes nothing about:

- The protocol is used to transmit on the net
- How it is loaded
- The server environment it will be running in these quantities is important because it allows the Servlet API to be embedded in many different kinds of servers.

There are other advantages to the servlet API as well these include:

- It's extensible-you can inherit all your functionality from the base classes made available to you
- It's small, simple, and easy to use.

Features of Servlets:

- Servlets are persistent. The servlet is loaded only by the web server and can maintain services between requests.
- Servlets are fast. Since servlets only need to be loaded once, they offer much better performance than their CGI counterparts.
- Servlets are platform-independent.
- Servlets are extensible Java is a robust, object-oriented programming language, which easily can be extended to suit your needs.
- Servlets are secure
- Servlets are used with a variety of clients.

Every servlet must implement the `javax.servlet` interface. Most servlets implement it by extending one of two classes, `javax.servlet.GenericServlet` or `javax.servlet.http.HttpServlet`. A protocol-independent servlet should subclass `GenericServlet`. An HTTP servlet should subclass `HttpServlet`, which is itself a subclass of a generic servlet with added HTTP-specific functionality.

Unlike a Java program, a servlet does not have a `main ()` method. Instead, the server in the process of handling requests invokes certain methods of a servlet. Each time the server dispatches a request to a servlet, it invokes the servlet `Service ()` method.

A generic servlet should override its `service ()` method to handle requests as appropriate for the servlet. The `service()` accepts two parameters a request object and a response object. The request object tells the servlet about the request, while the response object is used to return a response.

In Contrast. an HTTP servlet usually does not override the service () method. Instead, it overrides do Get () to handle GET requests and do Post () to handle Post requests. An HTTP servlet can override either or both of these modules the service() method of HttpServlet handles the setup and dispatching to all the do XXX() methods. Which is why it usually should not be overridden

The remainder is in the java. servlet and Java. servlet. HTTP. The package is largely supported by classes. TheServletRequest and ServletResponse classes in Java. the servlet is provided access to generic server requests and responses while HttpServletRequest and HttpServletResponse classes in Javax. servlet provides access to generic server requests and responses while HttpServletRequest and HttpServletResponse in Java. servlet.http provide access a HTTP requests and responses. The javax. servlet.HTTP contains an HttpSession class that provides built-in session tracking functionality and a Cookie class that allows quick setup and processing of HTTP Cookies.

Loading Servlets:

Servlets can be loaded from their places. From a directory that is in the CLASSPATH. The CLASSPATH of the Java Webserver includes service root/classes/, which is where the system classes reside

From the <SERVICE_ROOT/servlets/directory. This is not in the server's classpath. A class loader is used to create a servlet from this directory. New servlets can be existing servlets can be recompiled and the server will notice these changes. From a remote location. For this, a code base like <http://nine.eng/classes/foo/> is required in addition to the servlet's class name. Refer to the admin GUI docs on the servlet section to see how to set this up.

Loading Remote Servlets

Remote servlets can be loaded from:

- Configuring the admin Tool to set up automatic loading of remote servlets.
- Selection up server-side includes tags in .html files

Invoking Servlets

A servlet invoker is a servlet that invokes the “server” method of a named servlet. If the servlet is not loaded into the server, then the invoker first loads the servlet (either from the local disk or from the network) and then invokes the “service” method. Also like applets, local servlets in the server can be identified by just the class name. In other words, if a servlet name is not absolute. It is treated as local.

A Client can Invoke Servlets in the Following Ways:

- The client can ask for a document that is served by the servlet.
- The client(browser) can invoke the servlet directly using a URL, once it has been mapped using the SERVLET ALIASES Section of the admin GUI
- The servlet can be invoked through the server side including tags.
- The servlet can be invoked by placing it in the servlet/directory
- The servlet can be invoked by using it in a filter chain

The Servlet Life Cycle:-

The Servlet life cycle is one of the most exciting features of Servlets. This life cycle is a powerful hybrid of the life cycles used in CGI programming and lower-level NSAPI and ISAPI programming.

The Servlet life cycle allows servlet engines to address both the performance and resource problems of CGI and the security concerns of low-level server API programming.

The servlet life cycle is highly flexible. Servers have significant leeway in how they choose to support servlets. The only hard and fast rule is that a servlet engine must conform to the following life cycle contract:

- Create and initialize the servlets
- Handle zero or more services for clients
- Destroy the servlet and then garbage collects it.

It's perfectly legal for a servlet to be loaded, created and initialized in its own JVM, only to be destroyed a garbage collected without handling any client request or after handling just one request

The most common and most sensible life cycle implementations for HTTP servlets are Single Java virtual machine and a static persistence.

Init and Destroy:-

Just like Applet servlets can define init () and destroy () methods, A servlets init (ServiceConfig) method is called by the server immediately after the server constructs the servlet instance. Depending on the server and its configuration, this can be at any of these times

- When the server starts
- When the servlet is first requested, just before the service() method is invoked
- At the request of the server administrator

The init () method is typically used to perform servlet initialization creating or loading objects that are used by the servlet in the handling of its request. To provide a new Servlet with any information about itself and its environment, a server has to call a servlet init () method and pass an object that implements the ServletConfig interface.

This ServletConfig object supplies a servlet with information about its initialization parameters. These parameters are given to the servlets and are not associated with any single request. They can specify initial values, such as where a counter should begin counting, or default values, perhaps a template to use when not specified by the request,

The server calls a servlet destroy () method when the servlet is about to be unloaded. In the destroy () method, a Servlet should free any resources it has acquired that will not be garbage collected. The destroy () method also gives a servlet a chance to write out its unsaved. Cached information or any persistent information that should be read during the next call to init ().

USER AUTHORIZATION:

One way to perform session tracking is to leverage the information that comes with User authorization. When a web server restricts access to some of its resources to only those clients that log in using a recognized username and password. After the client logs in, the username is available to a servlet through getRemoteUser ().

When using the username to track the session. Once a user has logged in, the browser remembers her username and resends the name and password as the user views new pages on the site. A servlet can identify the user through her username and they're by Track her session.

The biggest advantage of using user authorization to perform session tracking is that it's easy to implement. Simply tell the protect a set of pages, and use getRemoteUser() to identify each client. Another advantage is that the technique works even when the user accesses your site form or exits her browser before coming back.

The biggest disadvantage of user authorization is that it requires each user to register for an account and then log in each time they start visiting your site. Most users will tolerate registering and logging in as a necessary evil when they are accessing sensitive information, but it's all overkill for simple session tracking. Another problem with user authorization is that a user cannot simultaneously maintain more than one session at the same site.

Hidden Form Fields:

One way to support anonymous session tracking is to use hidden from the fields. As the name implies, these are fields added to an HTML, form that are not displayed in the client's browser, they are sent back to the server when the form that contains them is submitted.

In a sense, hidden form fields define constant variables for a form. For a servlet receiving a submitted form, there is no difference between a hidden field and a visible field.

As more information is associated with a client's session. It can become burdensome to pass it all using hidden form fields. In these situations, it's possible to pass on just a unique session ID that identifies as a particular client session.

That session ID can be associated with complete information about its session that is stored on the server.

The advantage of hidden form fields is their ubiquity and support for anonymity. Hidden fields are supported in all the popular browsers, they demand special server requirements, and they can be used with clients that haven't registered or logged in.

The major disadvantage of this technique, however, is that works only for a sequence of dynamically generated forms, the technique breaks down immediately with static documents, emailed documents bookmarked documents and browser shutdowns.

URL Rewriting:

URL rewriting is another way to support anonymous session tracking, With URL rewriting every local URL the user might click on is dynamically modified. Or rewritten, to include extra, information. The extra information can be in the form of extra path information, added parameters, or some custom, server-specific.URL change. Due to the limited space available in rewriting a URL, the extra information is usually limited to a unique session.

Each rewriting technique has its advantages and disadvantages

Using extra path information works on all servers, and it works as a target for forms that use both the Get and Post methods. It does not work well if the servlet has to use the extra path information as true path information.

The advantages and disadvantages of URL. Rewriting closely matches those of hidden form fields, The major difference is that URL rewriting works for all dynamically created documents, such as the Help servlet, not just forms. With the right server support, custom URL rewriting can even work for static documents.

Persistent Cookies:

A fourth technique to perform session tracking involves persistent cookies. A cookie is a bit of information. Sent by a web server to a browser that can later be read back from that browser. When a browser receives a cookie, it saves the cookie and thereafter sends the cookie back to the server each time, it accesses a page on that server, subject to certain rules. Because a cookie's value can uniquely identify a client, cookies are often used for session tracking.

Persistent cookies offer an elegant, efficient, and easy way to implement session tracking. Cookies provide as automatic an introduction for each request, as we could hope for. For each request, a cookie can automatically provide a client's session ID or perhaps a list of clients' performance. The ability to customize cookies gives them extra power and versatility.

The biggest problem with cookies is that browsers don't always accept cookies sometimes this is because the browser doesn't support cookies. More often it's because the browser doesn't support cookies. More often it's because the user has specifically configured the browser to refuse cookies.

The power of servlets:

The power of servlets is nothing but the advantages of servlets over other approaches, which include portability, power, efficiency, endurance, safety, elegance, integration, extensibility and flexibility.

Portability:

Servlets are written in Java and conform to a well-defined and widely accepted API. They are highly portable across operating systems and server implementation

We can develop a servlet on a Windows NT machine running the Java web server and later deploy it effortlessly on a high-end UNIX server running Apache. With servlets we can really "write once, serve everywhere"

Servlet portability is not the stumbling block it so often is with applets, for two reasons

First, Servlet portability is not mandatory, i.e. servlets have to work only on server machines that we are using for development and deployment

Second, servlets avoid the most error-prone and inconstancy-implemented portions of the Java languages.

Power:

Servlets can harness the full power of the core Java. APIs: such as Networking and URL access, multithreading, image manipulation, data compression, database connectivity, internationalization, remote method invocation (RMI) CORBA connectivity, and object serialization, among others.

Efficiency and Endurance:

Servlet invocation is highly efficient, Once a servlet is loaded it generally remains in the server's memory as a single object instance, Thereafter the server invokes the servlet to handle a request using a simple, lightweight method invocation. Unlike the CGI, there's no process to spawn or interpreter to invoke, so the servlet can begin handling the request almost immediately, Multiple, concurrent requests handle the request almost immediately. Multiple, concurrent requests are handled by separate threads, so servlets are highly scalable.

Servlets in general are enduring objects. Because a servlet stays in the server's memory as a single object instance. It automatically maintains its state and can hold onto external resources, such as database connections.

Safety:

Servlets support safe programming practices on several levels. As they are written in Java, servlets inherit stronger type safety of the Java language. In addition, the servlet API is implemented to be type-safe. Java's automatic garbage collection and lack of pointers mean that servlets are generally safe from memory management problems like dangling pointers invalid pointer references and memory leaks.

Servlets can handle errors safely, due to the Java exception–handling mechanism. If a servlet divides by zero or performs some illegal operations, it throws an exception that can be safely caught and handled by the server.

A server can further protect itself from servlets through the use of a Java security manager. A server can execute its servlets under the watch of a strict security manager.

Elegance:

The elegance of the servlet code is striking. Servlet code is clean, object-oriented modular and amazingly simple one reason for this simplicity is the served API itself. This includes methods and classes to handle many of the routine chores of servlet development. Even advanced operations like cookie handling and session tracking are abstracted into convenient classes.

Integration:

Servlets are tightly integrated with the server. This integration allows a servlet to cooperate with the server in two ways. E.g.: a servlet can use the server to translate file paths, perform logging, check authorization, perform MIME type mapping and in some cases even add users to the server's user database.

Extensibility and Flexibility:

The servlet API is designed to be easily extensible. As it stands today the API includes classes that are optimized for HTTP servlets. But later it can be extended and optimized for another type of servlets. It is also possible that its support for HTTP servlets could be further enhanced.

Servlets are also quite flexible; Sun also introduced Java server pages. Which offers a way to write snippets of servlet code directly within a static HTML page using syntax similar to Microsoft's Active Server Pages (ASP)

5.3 JDBC

What is JDBC?

Any relational database. One can write a single program using the JDBC API, and the JDBC is a Java API for executing SQL, Statements(As a point of interest JDBC are trademark name and is not an acronym; nevertheless, Jdbc is often thought of as standing for Java Database Connectivity. It consists of a set of classes and interfaces written in the Java Programming language.JDBC provides a standard API for tool/database developers and makes it possible to write database applications using a pure Java API

Using JDBC, it is easy to send SQL statements virtually program can send SQL Statements to the appropriate database. The combination of Java and JDBC lets a programmer write it once and run it anywhere.

What Does JDBC Do?

Simply put, JDBC makes it possible to do three things

- Establish a connection with a database
- Send SQL statements
- Process the results
- JDBC Driver Types
- The JDBC drivers that we are aware of at this time fit into one of four categories
- JDBC-ODBC Bridge plus ODBC driver
- Native-API party-Java driver
- JDBC-Net pure Java driver
- Native-protocol pure Java driver

An individual database system is accessed via a specific JDBC driver that implements the `java.sql.Driver` interface. Drivers exist for nearly all popular RDBMS systems, though few are available for free. Sun bundles a free JDBC-ODBC bridge driver with the JDK to allow access to standard ODBC, data sources, such as a Microsoft Access database, Sun advises against using the bridge driver for anything other than development and very limited development.

JDBC drivers are available for most database platforms, from several vendors and in several different flavors. There are four driver categories:

Type 01-JDBC-ODBC Bridge Driver

Type 01 drivers use a bridge technology to connect a Java client to an ODBC database service. Sun's JDBC-ODBC bridge is the most common type 01 driver. These drivers are implemented using native code.

Type 02-Native-API party-Java Driver

Type 02 drivers wrap a thin layer of Java around database-specific native code libraries for Oracle databases, the native code libraries might be based on the OCI(Oracle Call Interface) libraries, which were originally designed for c/c++ programmers, Because type-02 drivers are implemented using native code. In some cases, they have better performance than their all-Java counterparts. They add an element of risk, however, because a defect in a driver's native code section can crash the entire server

Type 03-Net-Protocol All-Java Driver

Type 03 drivers communicate via a generic network protocol to a piece of custom middleware. The middleware component might use any type of driver to provide the actual database access. These drivers are all Java, which makes them useful for applet deployment and safe for servlet deployment

Type-04-native-protocol All-Java Driver

Type 4 drivers are the most direct of the lot. Written entirely in Java, Type 04 drivers understand database-specific networking. Protocols and can access the database directly without any additional software

JDBC-ODBC Bridge

If possible use a Pure Java JDBC driver instead of the Bridge and an ODBC driver. This eliminates the client configuration required by ODBC. It also eliminates the potential that the Java VM could be corrupted by an error in the native code brought in by the Bridge (that is, the Bridge native library, the ODBC driver manager library, the library, the ODBC driver library, and the database client library).

WHAT IS The JDBC-ODBE Bridge?

The JDBC-ODBC Bridge is a JDBC driver, which implements JDBC operations by translating them into ODBC operations. To ODBC it appears as a normal application program. The Bridge is implemented as the sun.jdbc.odbc Java package and contains a native library used to access ODBC. The Bridge is a joint development of Intersolv and Java Soft.

5.4 HTML:

Hypertext Markup Language(HTML), the language of the World Wide Web (WWW), allows users to produce web pages that include text, graphics and pointers to other web pages (Hyperlinks).

HTML is not a programming language, but it is an application of ISO Standard 8879, SGML (Standard Generalized Markup Language), but Specialized to hypertext and adapted to the Web. The idea behind Hypertext is one point to another point. We can navigate through the information based on our interests and preferences. A markup language is simply a series of items enclosed within the elements that should be displayed. Hyperlinks are underlined or emphasized works that load to other documents or some portions of the same document.

HTML can be used to display any type of document on the host computer, which can be geographically at a different location. It is a versatile language and can be used on any platform or desktop

HTML provides tags (special codes) to make the document look attractive.

HTML provides are not case-sensitive. Using graphics, fonts, different sizes, colours, etc., can enhance the presentation of the document. Anything that is not a tag is part of the document itself.

Basic HTML Tags:

| | |
|---|---|
| <code><!-- --></code> | Specific Comments. |
| <code><A>.....</code> | Creates Hypertext links. |
| <code>.....</code> | Creates hypertext links. |
| <code><Big>.....</Big></code> | Formats text in large-font |
| <code><Body>..... </Body></code> | contains all tags and text in the Html-document |
| <code><Center>.....</Center></code> | Creates Text |
| <code><DD>.....</DD></code> | Definition of a term. |
| <code><TABLE>..... </TABLE></code> | creates a table |
| <code><Td>.....</Td></code> | indicates table data in a table. |
| <code><Tr>.....</Tr></code> | designates a table row |
| <code><Th>..... </Th></code> | creates a heading in a table. |

ADVANTAGE

- An HTML document is small and hence easy to send over the net. It is small because it does not include formatted information.
- HTML is platform-independent
- HTML tags are not case-sensitive.

5.5.JAVA SCRIPT:

The Java Script Language

JavaScript is a compact, object-based scripting language for developing client and server internet applications. Netscape Navigator 2.0 interprets JavaScript statements embedded directly in an HTML page. Livewire enables you to create server-based applications similar to common gateway interface (CGI) programs.

In a client application for Navigator, JavaScript statements embedded in an HTML Page can recognize and respond to user events such as mouse clicks from input, and page navigation.

For example, you can write a JavaScript function to verify that users enter valid information into a form requesting a telephone number or zip code. Without any network transmission, an HTML page with embedded Java Script can interpret the entered text and alert the user with a message dialogue if the input is invalid or you can use JavaScript to perform an action (such as play an audio file, execute an applet, or communicate with a plug-in) in response to the user opening or exiting a page.

6. SYSTEM DESIGN

6.1 INTRODUCTION

In our project, we aim to revolutionise the agricultural sector by introducing a versatile array of fuel paper cell batteries tailored for essential machinery, ranging from tractors to water pumps and larger vehicles like cars and buses. Our focus extends beyond mere development; we prioritise continuous monitoring and in-depth analysis of these batteries to ensure reliability and sustainability in modern agriculture. By incorporating real-time monitoring and leveraging data analytics, including the Principal Component Analysis (PCA) algorithm, we seek to provide comprehensive insights into battery performance metrics such as power consumption, water pump output, cycle times, and pressure levels. This transformative approach extends to fuel cell manufacturing, where we aim to enhance efficiency, cost-effectiveness, and environmental sustainability by unlocking hidden insights within manufacturing data. By addressing existing limitations, such as limited data utilization and resource inefficiency, our proposed system integrates predictive analytics to anticipate and address issues proactively, thereby minimizing downtime and enhancing overall reliability. Through these advancements, our project strives to make substantial contributions to clean and efficient energy solutions, particularly in vital sectors like agriculture, while aligning with global initiatives towards environmental sustainability.

6.2. SYSTEM ARCHITECTURE:

MODULES:

1. CLIENT
2. ADMIN
3. INDUSTRY
4. ANALYSER
5. TESTING

MODULE 1: CLIENT

Once the Client user logs in to the module after registering, they are then sent to the home page. Once the user logs in to the module after registering, they are then sent to the home page. There are menu options like client requirement, update pay, view status, and payment. To upload data for the client requirement fill out the Horsepower, Area, Battery Type. View the client product selection. Initial payment for the Manufacturing requested product. View the status of the product .

MODULE 2: ADMIN

You may log into the page with specified information including email and password. Once the user logs in they are sent to the home page. The menu options like client status, pay status, view reports, and send the status to the client. In client status, we can select the required client. Then we can send the client order requirements to the analyser for the payment process to the client and also view the manufacture reports sent the report to the client testing report.

MODULE 3: INDUSTRY

Register your information in this module, including your admin name, email, password, password confirmation, mobile number, organisation name, postal code, and address, so that you may log in to the page. Once the user logs in to the module after registering, they are then sent to the home page. view the requested details of the product for manufacturing upload the requirements for the manufactured product and send to the testing process view the testing reports and identify the validation over the product re-manufacture and send again to the testing process.

MODULE 4: ANALYSER

You may log in to the page with specified information including email and password once the user logs in they are sent to the home page. The menu options Like upload, upload crop analysis, view client, and view quantity analysis. Upload the product payment analysis view the quantity required and analyse the product for new final payment updating for the product

MODULE 5: TESTING

Register your information in this module, including email, and password, so that you may log in to the page. Once the user logs in to the module after registering, they are then sent to the home page. Once the user logs in to the module after registering, they are then sent to the home page The menu options Like upload, and view manufacturing report from here we upload the testing analysis for the product and then process the manufacturing reports and compare them with data testing data and analyse for the remanufacture or finalize product efficiency.

DATABASE SCREENSHOTS:-

Host: 127.0.0.1 Database: fuel-papercell Table: testing_report Data diagnosisSC.sql* database.sql X proj3.sql X finalcuservice.sql X

Basic Options Indexes (2) Foreign keys (1) Check constraints (0) Partitions CREATE code ALTER code

Name: testing_report

Comment:

Columns: Add Remove Up Down

| # | Name | Datatype | Length/Set | Unsign... | Allow N... | Zerofill | Default | Comment | Collation | Expression | Virtuality |
|----|------------------|----------|------------|--------------------------|-------------------------------------|--------------------------|-----------------|---------|-------------------|------------|------------|
| 1 | id | INT | 11 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | AUTO_INCREME... | | | | |
| 2 | fuelcell | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 3 | bat_recharge | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 4 | bat_working | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 5 | temp | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 6 | bat_size | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 7 | grade | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 8 | testing_result | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 9 | failure_reason | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 10 | mf_id | INT | 11 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | NULL | | | | |
| 11 | reqRange_bat... | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 12 | reqRange_batr... | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 13 | reqtemp | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |

Host: 127.0.0.1 Database: fuel-papercell Table: manuf_report Data diagnosisSC.sql* database.sql X proj3.sql X finalcuservice.sql X

Basic Options Indexes (1) Foreign keys (0) Check constraints (0) Partitions CREATE code ALTER code

Name: manuf_report

Comment:

Columns: Add Remove Up Down

| # | Name | Datatype | Length/Set | Unsign... | Allow N... | Zerofill | Default | Comment | Collation | Expression | Virtuality |
|----|------------------|----------|------------|--------------------------|-------------------------------------|--------------------------|-----------------|---------|-------------------|------------|------------|
| 1 | id | INT | 11 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | AUTO_INCREME... | | | | |
| 2 | fuelpapercell | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 3 | rawmaterial | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 4 | batt_recharg | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 5 | battery_worki... | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 6 | temperature | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 7 | Batterycodes | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 8 | grade | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 9 | hp | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 10 | Batterysize | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 11 | clord_id | INT | 11 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | | | |

Basic Options Indexes (0) Foreign keys (0) Check constraints (0) Partitions CREATE code ALTER code

Name: fuelcellanalysis

Comment:

Columns: Add Remove Up Down

| # | Name | Datatype | Length/Set | Unsign... | Allow N... | Zerofill | Default | Comment | Collation | Expression | Virtuality |
|----|-------------------|----------|------------|--------------------------|-------------------------------------|--------------------------|---------|---------|-------------------|------------|------------|
| 1 | id | INT | 11 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | | | |
| 2 | Battery_Type | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 3 | rawMaterial | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 4 | cost_of_ramat... | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 5 | manufacturin... | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 6 | Battery_fuel_cell | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 7 | temperature | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 8 | battery_size | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 9 | cost_pervolts | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 10 | grade | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |

Basic Options Indexes (1) Foreign keys (0) Check constraints (0) Partitions CREATE code ALTER code

Name: client

Comment:

Columns: Add Remove Up Down

| # | Name | Datatype | Length/Set | Unsign... | Allow N... | Zerofill | Default | Comment | Collation | Expression | Virtuality |
|---|-------|----------|------------|--------------------------|-------------------------------------|--------------------------|-----------------|---------|-------------------|------------|------------|
| 1 | id | INT | 11 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | AUTO_INCREME... | | | | |
| 2 | cname | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 3 | cmail | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 4 | cpass | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |

Basic Options Indexes (0) Foreign keys (0) Check constraints (0) Partitions CREATE code ALTER code

Name: analyse_bat

Comment:

Columns: Add Remove Up Down

| # | Name | Datatype | Length/Set | Unsign... | Allow N... | Zerofill | Default | Comment | Collation | Expression | Virtuality |
|---|----------------|----------|------------|--------------------------|-------------------------------------|--------------------------|---------|---------|-------------------|------------|------------|
| 1 | Load | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 2 | WaterPumpM... | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 3 | PowerConsu... | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 4 | Timetolrrigate | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 5 | appliance | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 6 | battery_type | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 7 | area_size | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |

Host: 127.0.0.1 Database: fuel-papercell Table: client Data Query*

Basic Options Indexes (1) Foreign keys (0) Check constraints (0) Partitions CREATE code ALTER code

Name: client

Comment:

Columns: Add Remove Up Down

| # | Name | Datatype | Length/Set | Unsign... | Allow N... | Zerofill | Default | Comment | Collation | Expression | Virtuality |
|---|-------|----------|------------|--------------------------|-------------------------------------|--------------------------|-----------------|---------|-------------------|------------|------------|
| 1 | id | INT | 11 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | AUTO_INCREME... | | | | |
| 2 | cname | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 3 | cmail | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 4 | cpass | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |

Help Discard Save

X Filter: Regular expression

Basic Options Indexes (1) Foreign keys (1) Check constraints (0) Partitions CREATE code ALTER code

Name: clientreq

Comment:

Columns: Add Remove Up Down

| # | Name | Datatype | Length/Set | Unsign... | Allow N... | Zerofill | Default | Comment | Collation | Expression | Virtuality |
|----|--------------|----------|------------|--------------------------|-------------------------------------|--------------------------|---------|---------|-------------------|------------|------------|
| 1 | id | INT | 11 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | | | |
| 2 | area | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 3 | hp | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 4 | battery_type | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 5 | battery_size | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 6 | appliance | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 7 | volts_amps | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 8 | cl_selection | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 9 | order_req | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 10 | payment | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 11 | pay_status | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 12 | area_size | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 13 | grade | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 14 | cl_id | INT | 11 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | | | |

Help Discard Save

Basic Options Indexes (0) Foreign keys (0) Check constraints (0) Partitions CREATE code ALTER code

Name: testing

Comment:

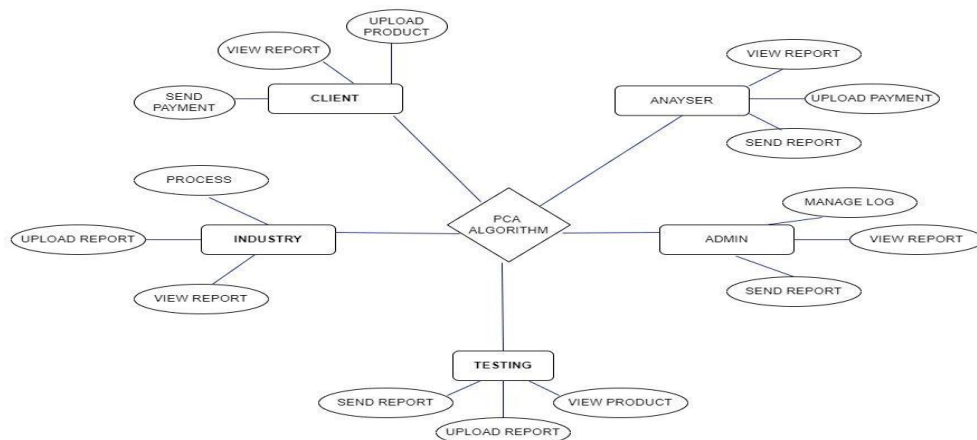
Columns: Add Remove Up Down

| # | Name | Datatype | Length/Set | Unsign... | Allow N... | Zerofill | Default | Comment | Collation | Expression | Virtuality |
|----|-------------------|----------|------------|--------------------------|-------------------------------------|--------------------------|---------|---------|-------------------|------------|------------|
| 1 | Temperature | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 2 | battery_rechar... | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 3 | battery_worki... | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 4 | Batterytype | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 5 | fuelpapercell | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 6 | rawmaterial | VARCHAR | 500 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 7 | Batterysize | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 8 | grade | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 9 | appliance | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |
| 10 | hp | VARCHAR | 50 | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | NULL | | latin1_swedish_ci | | |

6.3 E – R DIAGRAMS

- The relation upon the system is structured through a conceptual ER-Diagram, which not only specifies the existing entities, but also the standard relations through which the system exists and the cardinalities that are necessary for the system state to continue.
- The Entity Relationship Diagram (ERD) depicts the relationship between the data objects. The ERD is the notation that is used to conduct, the data modeling activity and the attributes of each data object noted, is the ERD can be described as a data object description.
- The set of primary components that are identified by the ERD are
 - Data object
 - Relationships
 - Attributes
 - Various types of indicators.

Figure.7:- The primary purpose of the ERD is to represent data objects and their relationships.



6.4 FLOW DIAGRAMS

A data flow diagram is a graphical tool used to describe and analyze the movement of data through a system. These are the central tools and the basis from which the other components are developed. The transformation of data from input to output through processing may be described logically and independently of physical components associated with the system. These are known as the logical data flow diagrams. The physical data flow diagrams show the actual implementation and movement of data between people, departments and workstations. A full description of a system consists of a set of data flow diagrams. Using two familiar notations Yourdon, Gane and Sarson notation develops the data flow diagrams. Each component in a DFD is labelled with a descriptive name. The process is further identified with a number that will be used for identification purposes. The development of DFD is done on several levels. Each process in lower-level diagrams can be broken down into a more detailed DFD in the next level. The top-level diagram is often called a context diagram. It consists of a single process bit, which plays a vital role in studying the current system. The process in the context level diagram is exploded into another process at the first level DFD.

The idea behind the explosion of a process into more processes is that understanding at one level of detail is exploded into greater detail at the next level. This is done until the further explosion is necessary and an adequate amount of detail is described for analysts to understand the process.

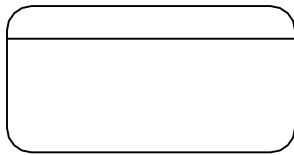
Larry Constantine first developed the DFD as a way of expressing system requirements in a graphical form, this led to the modular design.

A DFD also known as a “bubble Chart” has the purpose of clarifying system requirements and identifying major transformations that will become programmed in system design. So it is the starting point of the design to the lowest level of detail. A DFD consists of a series of bubbles joined by data flows in the system.

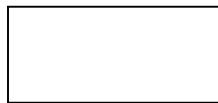
6.5 DFD SYMBOLS

In the DFD, there are four symbols

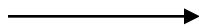
1. A square defines a source (originating) or destination of system data
2. An arrow identifies data flow. It is the pipeline through which the information flows
3. A circle or a bubble represents a process that transforms the incoming data flow into outgoing data flows.
4. An open rectangle is a data store, data at rest or a temporary repository of data



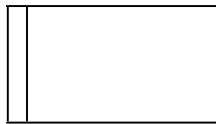
A process that transforms the data flow



Source or Destination of data



Data flow



Data Store

CONSTRUCTING A DFD:

Several rules of thumb are used in drawing DFD:

1. The process should be named and numbered for easy reference. Each name should be representative of the process.
2. The direction of flow is from top to bottom and from left to right. Data traditionally flow from the source to the destination although they may flow back to the source. One way to indicate this is to draw the long flow line back to a source. An alternative way is to repeat the source symbol as a destination. Since it is used more than once in the DFD it is marked with a short diagonal.

3. When a process is exploded into lower-level details, they are numbered.
4. The names of data stores and destinations are written in capital letters. Process and dataflow names have the first letter of each word capitalized

A DFD typically shows the minimum contents of the data store. Each data store should contain all the data elements that flow in and out.

Questionnaires should contain all the data elements that flow in and out. Missing interface redundancies and like are then accounted for often through interviews.

SALIENT FEATURES OF DFD'S

1. The DFD shows the flow of data, not of control loops and decisions are controlled considerations that do not appear on a DFD.
2. The DFD does not indicate the time factor involved in any process, whether the data takes place daily, weekly, monthly or yearly.
3. The sequence of events is not brought out on the DFD.

TYPES OF DATA FLOW DIAGRAMS

1. Current Physical
2. Current Logical
3. New Logical
4. New Physical

CURRENT PHYSICAL

In the Current Physical DFD process label includes the name of the people or their positions or the names of computer systems that might provide some of the overall system-processing label including an identification of the technology used to process the data. Similarly, data flows and data stores are often labelled with the names of the actual physical media on which data are stored such as file folders, computer files, business forms or computer tapes.

CURRENT LOGICAL:

The physical aspects in the system are removed as much as possible so that the current system is reduced to its essence to the data and the processes that transform them regardless of actual physical form.

NEW LOGICAL:

This is exactly like a current logical model if the user were completely happy with the functionality of the current system, but had problems with how it was implemented typically the new logical model will differ from the current logical model while having additional functions, absolute function removal and inefficient flows recognized.

NEW PHYSICAL:

The new physical represents only the physical implementation of the new system.

RULES GOVERNING THE DFD'S

PROCESS

- 1) No process can have only outputs.
- 2) No process can have only inputs. If an object has only inputs then it must be a sink.
- 3) A process has a verb phrase label.

DATASTORE

- 1) Data cannot move directly from one data store to another data store, a process must move data.
- 2) Data cannot move directly from an outside source to a data store, a process, that receives, must move data from the source and place the data into the data store
- 3) A data store has a noun phrase label.

SOURCE OR SINK

The origin and /or destination of data

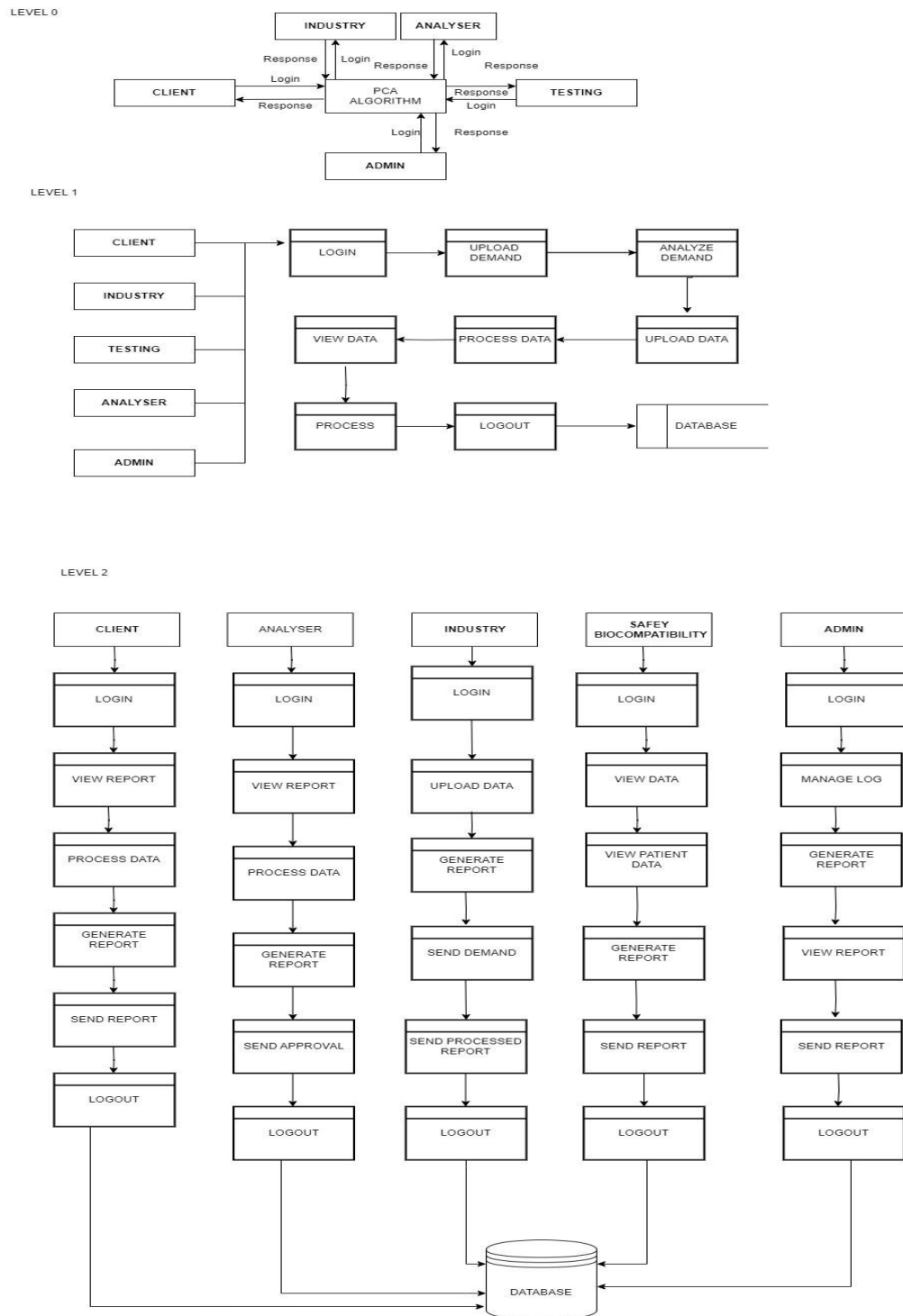
- 1) Data cannot move directly from a source to sink it must be moved from a process
- 2) A source and /or sink have a noun phrase label

DATA FLOW

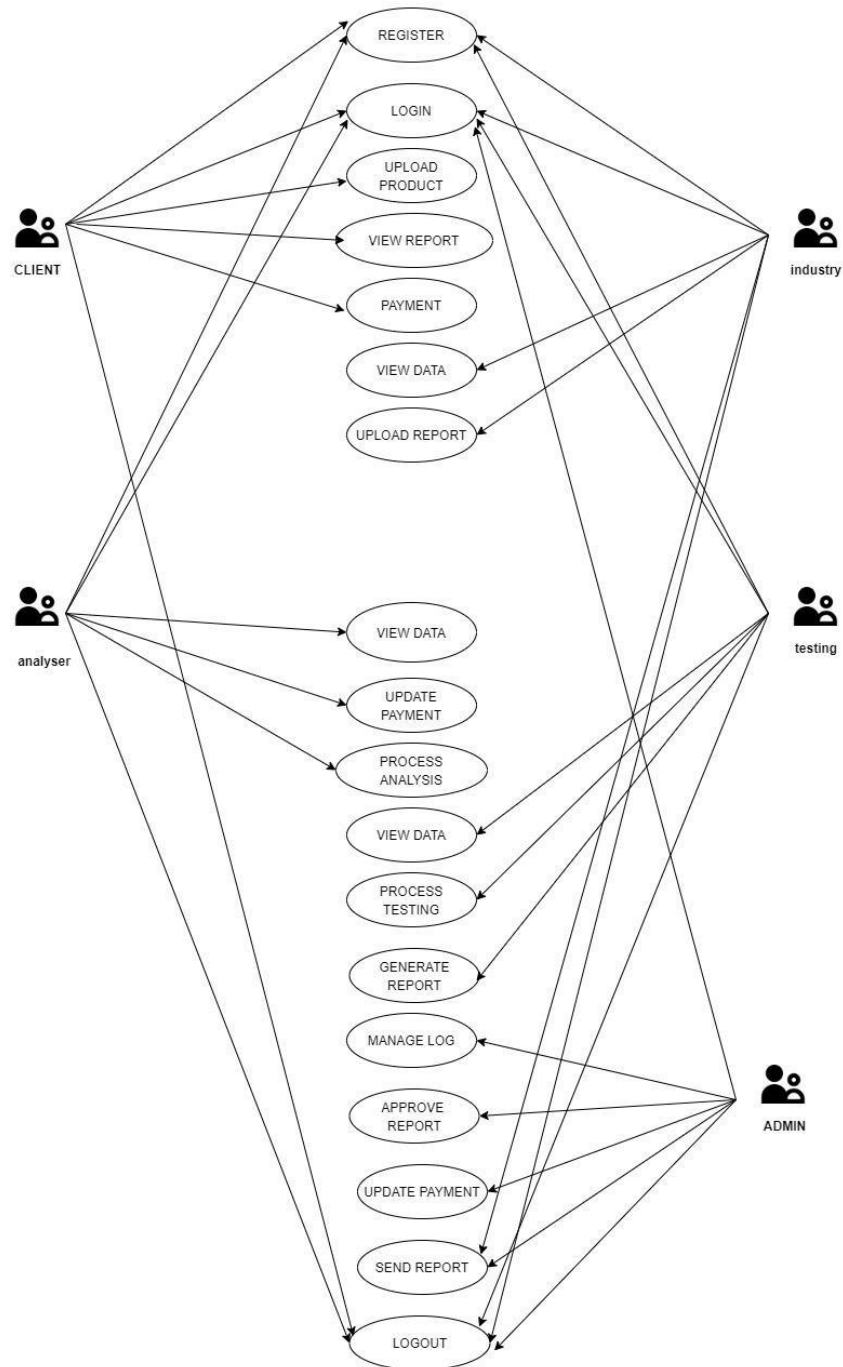
- 1) A Data Flow has only one direction of flow between symbols. It may flow in both directions between a process and a data store to show a read before an update. However, the latter is usually indicated by two separate arrows since these happen in different types.
- 2) A join in DFD means that the same data comes from any of two or more different processes data store or sink to a common location.
- 3) A data flow cannot go directly back to the same process it leads. At least one other process must handle the data flow and produce some other data flow that returns the original data in the beginning process.
- 4) A Data flow to a data store means update (delete or change).
- 5) A data Flow from a data store means retrieve or use.

A data flow has a noun phrase label more than one data flow noun phrase can appear on a single arrow as long as all of the flows on the same arrow move together as one package.

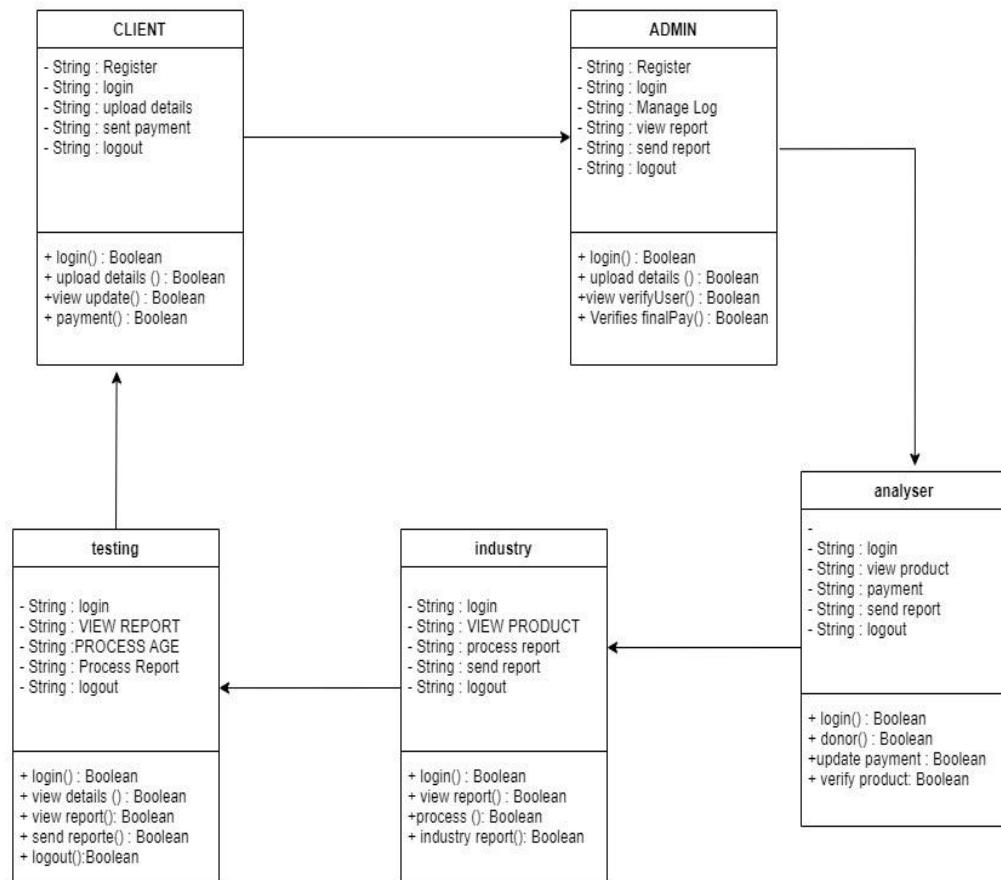
6.6) Figure 8:-DATA FLOW DIAGRAM



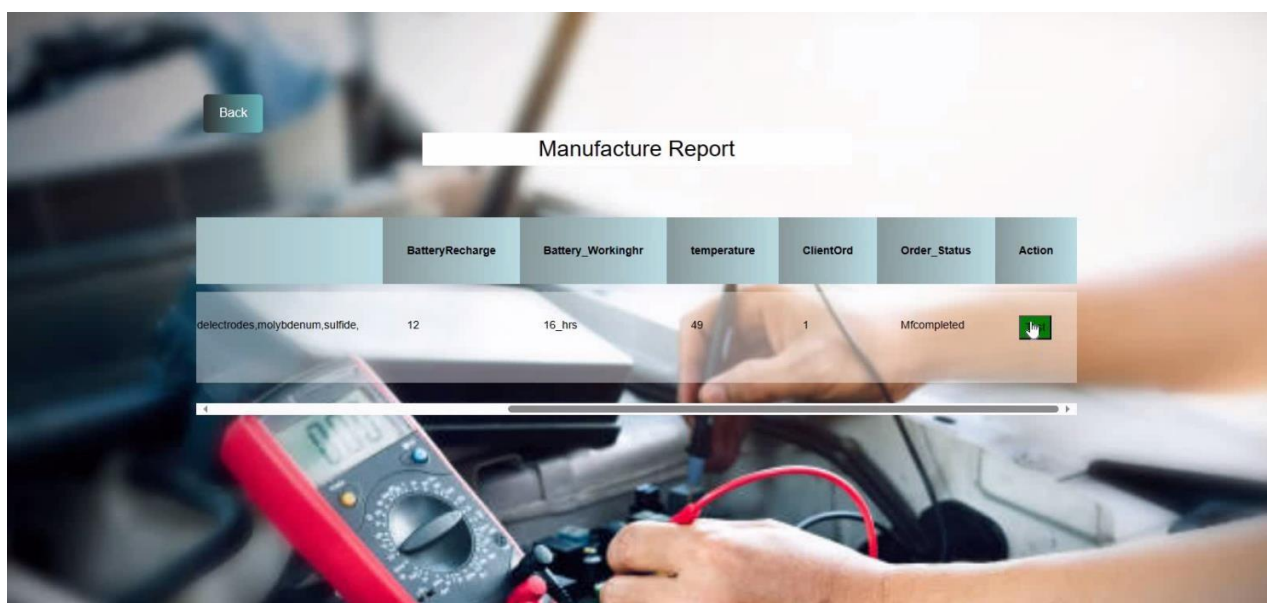
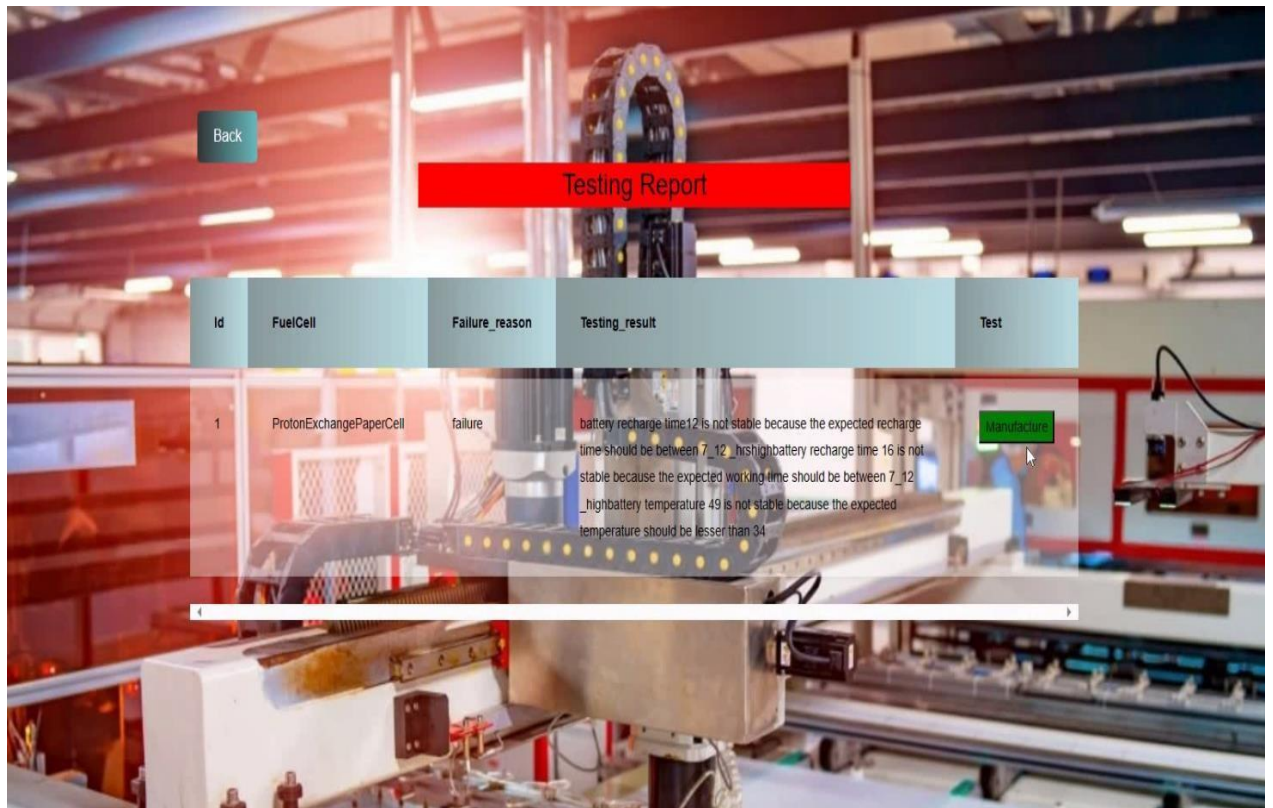
6.7) Figure-9 : USE CASE DIAGRAM

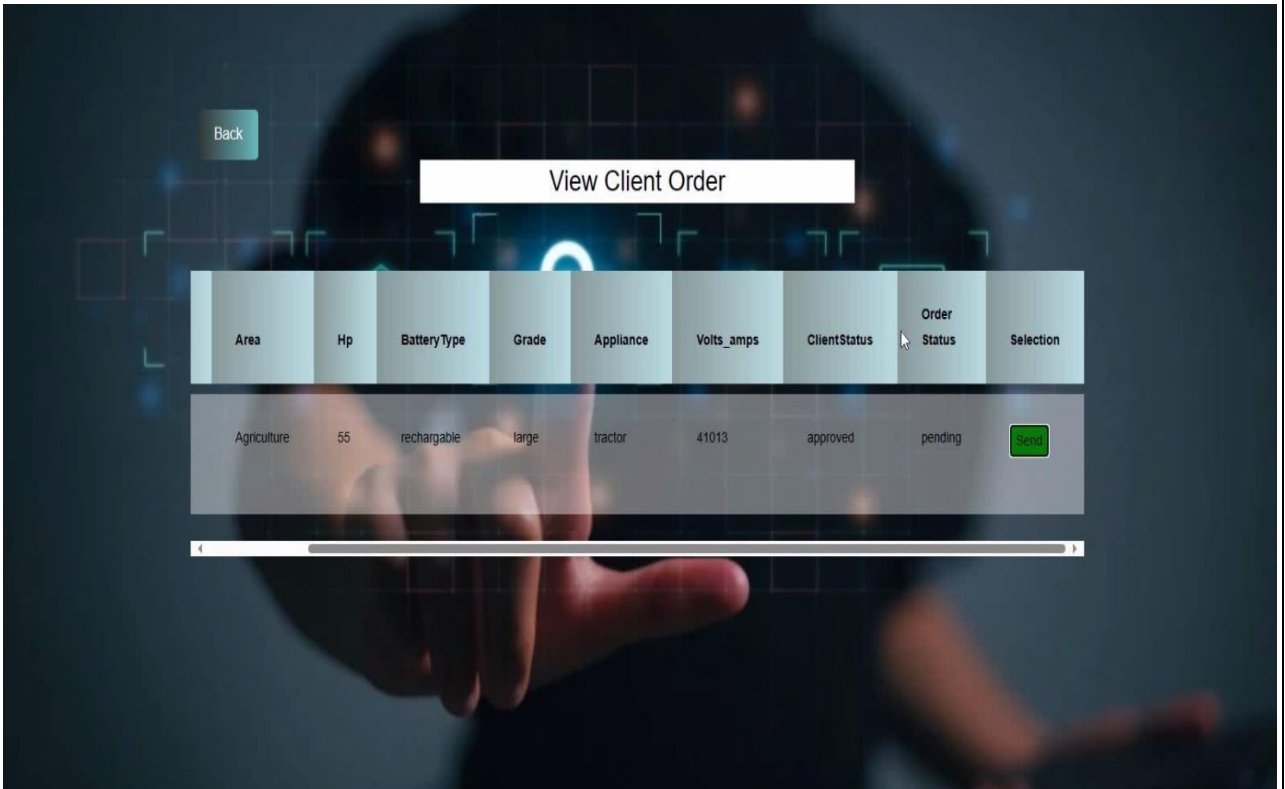


6.8) Figure-10: CLASS DIAGRAM



7. OUTPUT SCREENS





FUEL PAPER CELL

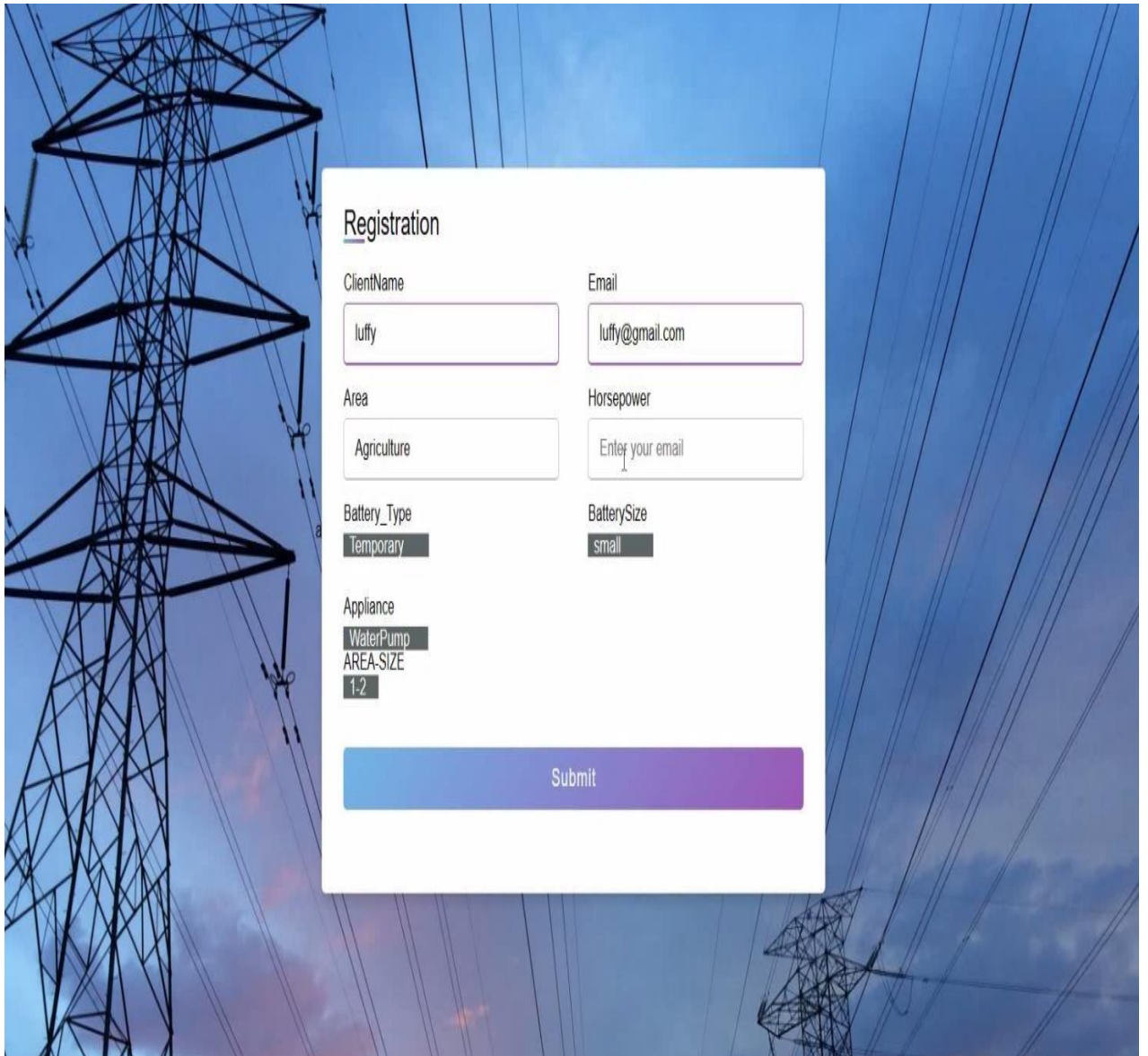
CLIENTADMINANALYSERTESTINGINDUSTRY

Providing High Quality Products

Our commitment to quality, innovation, and sustainability drives every step of the manufacturing process. Each battery is meticulously crafted using advanced techniques that leverage the electrochemical reactions of fuel cells and the versatility of paper-based structures

READ MORE

The background of the section is a dark, industrial-themed image. It features large, metallic gears and several small, stylized figures of workers in hard hats and safety gear, suggesting a manufacturing or industrial environment. The lighting is dramatic, with highlights on the gears and workers.



The background of the form is a photograph of high-voltage power lines stretching across a sky with soft sunset colors. The registration form is a white rectangular box with rounded corners, centered on the image.

Registration

| | |
|--|---|
| ClientName | Email |
| <input type="text" value="luffy"/> | <input type="text" value="luffy@gmail.com"/> |
| Area | Horsepower |
| <input type="text" value="Agriculture"/> | <input type="text" value="Enter your email"/> |
| Battery_Type | BatterySize |
| <input type="text" value="Temporary"/> | <input type="text" value="small"/> |
| Appliance | |
| <input type="text" value="WaterPump"/> | |
| AREA-SIZE | |
| <input type="text" value="1-2"/> | |

8. Coding

HOME PAGE: index.html

```
<!DOCTYPE html>

<html lang="zxx">

<head>

  <title>FUEL PAPER CELL BATTERRIES</title>

  <!-- Meta tag Keywords -->

  <meta name="viewport" content="width=device-width, initial-scale=1">

  <meta charset="UTF-8" />

  <meta name="keywords" content="Production Line Responsive web template,
Bootstrap Web Templates, Flat Web Templates, Android Compatible web template,
Smartphone Compatible web template, free web designs for Nokia, Samsung, LG,
SonyEricsson, Motorola web design" />

  <script>

    addEventListener("load", function() {

      setTimeout(hideURLbar, 0);

    }, false);

    function hideURLbar() {

      window.scrollTo(0, 1);

    }

  </script>

  <!-- //Meta tag Keywords -->

  <!-- Custom-Files -->
```

```

<link rel="stylesheet" href="index_css/css/bootstrap.css">

<!-- Bootstrap-Core-CSS -->

<link rel="stylesheet" href="index_css/css/style.css" type="text/css" media="all" />

<!-- Style-CSS -->

<!-- font-awesome-icons -->

<link href="index_css/css/font-awesome.css" rel="stylesheet">

<!-- //font-awesome-icons -->

<!-- /Fonts -->

<link
href="//fonts.googleapis.com/css?family=Poppins:100,100i,200,200i,300,300i,400,400i,5
00,500i,600,600i,700,700i,800,800i,900" rel="stylesheet">

<link
href="//fonts.googleapis.com/css?family=Source+Sans+Pro:200,200i,300,300i,400,400i,
600,600i,700,700i,900" rel="stylesheet">

<!-- //Fonts -->

</head>

<body>

<!--
<li><a href="cl_log.html">Client</a></li>

    <li><a href="ad_log.html">Admin</a></li>

    <li>

        <a href="analy_log.html">Analyser</a>

        <ul class="sub-menu">

            <li><a href="test_log.html">Testing</a></li>

            <li><a href="Industry_log.html">Industry</a></li>

        </ul>

```

```

</li>

<li><a href="test_log.html">Testing</a></li>

<li><a href="Industry_log.html">Industry</a></li> -->

```

```

<!-- mian-content -->

```

```

<div class="main-banner" id="home">

```

```

<!-- header -->

```

```

<header class="header">

```

```

<div class="container-fluid px-lg-5">

```

```

<!-- nav -->

```

```

<nav class="py-4">

```

```

<div id="logo">

```

```

<h1> <a href="index.html">FUEL PAPER CELL</a></h1>

```

```

</div>

```

```

<label for="drop" class="toggle">Menu</label>

```

```

<input type="checkbox" id="drop" />

```

```

<ul class="menu mt-2">

```

```

<li class="active"><a href="cl_log.html">CLIENT</a></li>

```

```

<li class="active"><a href="ad_log.html">ADMIN</a></li>

```

```

<li class="active"><a href="analy_log.html">ANALYSER</a></li>

```

```

<li><a href="test_log.html">TESTING</a></li>

```

```

<li><a href="Industry_log.html">INDUSTRY</a></li>

```

```

<!-- <li>

```

```

First Tier Drop Down

```

```

<label for="drop-2" class="toggle">Dropdown <span class="fa fa-
angle-down" aria-hidden="true"></span> </label>

```

```

        <a href="#">Dropdown <span class="fa fa-angle-down" aria-
hidden="true"></span></a>

        <input type="checkbox" id="drop-2" />

        <ul>

            <li><a href="gallery.html">Gallery</a></li>

            <li><a href="services.html">Services</a></li>

        </ul>

    </li> -->

    <!-- <li><a href="contact.html">Contact</a></li> -->

</ul>

</nav>

<!-- //nav -->

</div>

</header>

<!-- //header -->

<!--/banner-->

<div class="banner-info">

    <h3>Providing High Quality Products</h3>

    <p class="my-sm-4 my-3"> Our commitment to quality, innovation, and
sustainability drives every step of the manufacturing process. Each battery is meticulously
crafted using advanced techniques that leverage the electrochemical reactions of fuel cells
and the versatility of paper-based structures</p>

    <div class="ban-buttons">

        <a href="about.html" class="btn">Read More</a>

    </div>

</div>

<!--// banner-inner -->

```

```

</div>
<!-- /hand-crafted -->
<section class="hand-crafted bg-light py-5">
  <div class="container py-xl-5 py-lg-3">
    <div class="row banner-grids">
      <div class="col-lg-6 banner-image">
        <div class="effect-w3">
          

        </div>

      </div>

    </div>

    <div class="col-lg-6 last-img pl-lg-5 p-3">
      <h3 class="tittle mb-4">Looking An Adequate Solution For Your
Company?</h3>
      <p class="mb-4"> We understand the importance of providing customers with
reliable, high-performance energy solutions, which is why our fuel paper cell batteries
undergo rigorous testing to ensure optimal functionality and durability</p>
      <p class="mb-4"> From the selection of premium materials to the precision
assembly of components, we prioritize excellence in every aspect of production</p>
      <div class="ban-buttons">

    </div>

  </div>

</div>

</div>

</div>

</div>

</section>

```

```

<!-- //hand-crafted -->
<!--/ab -->
<section class="about py-lg-5 py-md-5 py-3">
  <div class="container">
    <div class="inner-sec-w3ls py-lg-5 py-3">
      <h3 class="tittle text-center mb-lg-5 pb-3"> Our Services</h3>
      <div class="feature-grids row mb-lg-5 my-3">
        <div class="col-md-4 p-0">
          <div class="bottom-gd p-lg-5 p-4">
            <span class="fa fa-fire" aria-hidden="true"></span>
            <h3 class="my-3">Commercial Fuel</h3>
            <p> We know that time is of the essence, which is why we strive to
            deliver your orders promptly and efficiently. With streamlined processes and reliable
            logistics partners, we ensure that your products reach you on time, every time.</p>
          </div>
        </div>
        <div class="col-md-4 p-0">
          <div class="bottom-gd p-lg-5 p-4">
            <span class="fa fa-industry" aria-hidden="true"></span>
            <h3 class="my-3"> Battery Work</h3>
            <p> Our satisfaction and peace of mind are our top priorities. </p>
          </div>
        </div>
        <div class="col-md-4 p-0">
          <div class="bottom-gd p-lg-5 p-4">
            <span class="fa fa-cogs" aria-hidden="true"></span>
            <h3 class="my-3"> Quality Materials</h3>

```

<p>Should you have any concerns or issues with your purchase, our dedicated customer support team is here to assist you.</p>

</div>

</div>

</div>

<!-- services -->

</div>

</div>

</section>

<!-- //ab -->

<!-- testimonials -->

<section class="testimonials py-5" id="testi">

<div class="container py-xl-5 py-lg-3">

<h3 class="title-w3 text-center text-wh mb-5 let font-weight-bold">What Our People Say</h3>

<div class="row pt-xl-4">

<div class="col-md-4 test-grid px-lg-5">

<div class="test-info text-center">

<p class="text-li">"With streamlined processes and reliable logistics partners, we ensure that your products reach you on time, every time.</p>

<div class="test-img text-center mt-4">

<!-- -->

</div>

<h3 class="mt-md-4 mt-3">Time Estimony</h3>


```

</div>
</div>
<div class="col-md-4 test-grid px-lg-5 my-MD-0 my-5">
    <div class="test-info text-center">
        <p class="text-li">"Your satisfaction is
guaranteed with our comprehensive warranty and returns policy. If you encounter any
issues with your product, we offer hassle-free returns and replacements within the warranty
period, ensuring that you're fully satisfied with your purchase.

```

Community Engagement: We believe in building a community around our products and services. </p>

```

    <div class="test-img text-center mt-4">
        <!--  -->

```

```

    </div>
    <h3 class="mt-md-4 mt-3">Warranty and
Returns</h3>

```

```

    </div>
</div>
<div class="col-md-4 test-grid px-lg-5">
    <div class="test-info text-center">
        <p class="text-li">Open and transparent
communication is key to building trust and fostering strong relationships with our
customers</p>

```

```

    <div class="test-img text-center mt-4">
        <!--  -->

```

```

    </div>
    <h3 class="mt-md-4 mt-3">Transparent
Communication</h3>

```

```

</div>

```

```

        </div>

    </div>

</div>

</section>

<!-- //testimonials -->

<!-- collection -->

<!-- <section class="collection py-lg-4 py-md-3 py-sm-3 py-3">

    <div class="container py-lg-5 py-md-4 py-sm-4 py-3">

        <h3 class="tittle text-center mb-lg-5 pb-3"> Our Features</h3>

        row

        <div class="row">

            <div class="col-lg-7 col-md-6 collection-w3layouts">

                <h4> Incididunt ut Lorem ipsum</h4>

                <p class="mt-2">sed do eiusmod tempor incididunt ut Lorem ipsum dolor sit amet
                Lorem ipsum dolor sit amet, eiusmod tempor incididunt ut labore et consectetur adipiscing
                sed do eiusmod</p>

                <div class="view-button mt-lg-4 mt-3">

                    <a href="services.html" class="">Read More</a>

                </div>

            </div>

            <div class="col-lg-5 col-md-6">

            </div>

        </div>

        // row

        row

        <div class="row my-lg-5 my-md-4 my-3">

            <div class="col-lg-5 col-md-6">

```

9. SYSTEM TESTING AND IMPLEMENTATION

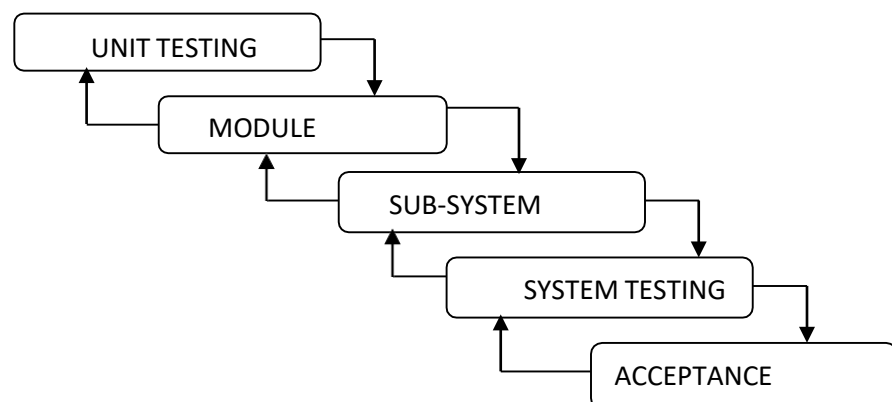
9.1. INTRODUCTION

Software testing is a critical element of software quality assurance and represents the ultimate review of specification, design and coding. In fact, testing is the one step in the software engineering process that could be viewed as destructive rather than constructive.

9.2. STRATEGIC APPROACH TO SOFTWARE TESTING

The software engineering process can be viewed as a spiral. Initially system engineering defines the role of software and leads to software requirement analysis where the information domain, functions, behavior, performance, constraints and validation criteria for software are established. Moving inward along the spiral, we come to design and finally to coding. To develop computer software we spiral in along streamlines that decrease the level of abstraction on each turn.

A strategy for software testing may also be viewed in the context of the spiral. Unit testing begins at the vertex of the spiral and concentrates on each unit of the software as implemented in source code. Testing progress is done by moving outward along the spiral to integration testing, where the focus is on the design and the construction of the software architecture. Talking another turn on outward on the spiral we encounter validation testing where requirements established as part of software requirements analysis are validated against the software that has been constructed. Finally, we arrive at system testing, where the software and other system elements are tested as a whole.



9.3. Unit Testing

Unit testing focuses verification effort on the smallest unit of software design, the module. The unit testing we have is white box oriented and some modules the steps are conducted in parallel.

1. WHITE BOX TESTING

This type of testing ensures that

- All independent paths have been exercised at least once
- All logical decisions have been exercised on their true and false sides
- All loops are executed at their boundaries and within their operational bounds
- All internal data structures have been exercised to assure their validity.

To follow the concept of white box testing we have tested each form .We have created independently to verify that Data flow is correct, All conditions are exercised to check their validity, All loops are executed on their boundaries.

2. BASIC PATH TESTING

The established technique of flow graph with Cyclamate complexity was used to derive test cases for all the functions. The main steps in deriving test cases were:

Use the design of the code and draw correspondent flow graphs.

Determine the Cyclamate complexity of the resultant flow graph, using formula:

$$V(G) = E - N + 2 \text{ or}$$

$$V(G) = P + 1 \text{ or}$$

$$V(G) = \text{Number of Regions}$$

Where $V(G)$ is Cyclomatic complexity,

E is the number of edges,

N is the number of flow graph nodes,

P is the number of predicate nodes.

Determine the basis of a set of linearly independent paths.

3. CONDITIONAL TESTING

In this part of the testing each of the conditions was tested to both true and false aspects. And all the resulting paths were tested. So that each path that may be generated on a particular condition is traced to uncover any possible errors.

4. DATA FLOW TESTING

This type of testing selects the path of the program, according to the location of the definition and use of variables. This kind of testing was used only when some local variables were declared. The definition-use chain method was used in this type of testing. These were particularly useful in nested statements.

5. LOOP TESTING

In this type of testing, all the loops are tested to all the limits possible. The following exercise was adopted for all loops:

- All the loops were tested at their limits, just above them and just below them.
- All the loops were skipped at least once.
- For nested loop test the innermost loop first and then work outwards.
- For concatenated loops, the values of dependent loops were set with the help of a connected loop.

TABLE.NO:- 2

| No | Test Scenario | Expected Result | Test Result |
|----|---|---------------------------------------|---------------------------------------|
| 1 | The username is correct. The password is incorrect. | Username and Password are incorrect. | Username and Password are incorrect. |
| 2 | The username is incorrect. The password is correct. | Username and Password are incorrect. | Username and Password are incorrect. |
| 3 | The username is empty. The password is correct. | A username is required. | A username is required. |
| 4 | The username is correct. The password is empty. | A password is required. | Password is required |
| 5 | Both Username and Password are incorrect. | Username and Password are incorrect. | Username and Password are incorrect. |
| 6 | Both Username and Password are empty. | A username and Password are required. | A username and Password are required. |
| 7 | Both Username and Password are correct. | Login Successful. | Login Successful. |

10. SYSTEM SECURITY

10.1 INTRODUCTION

Security systems can be divided into four related issues: The protection of computer-based resources that includes hardware, software, data, procedures and people against unauthorized use or natural

Disaster is known as System Security.

- Security
- Integrity
- Privacy
- Confidentiality

SYSTEM SECURITY refers to the technical innovations and procedures applied to the hardware and operation systems to protect against deliberate or accidental damage from a defined threat.

DATA SECURITY is the protection of data from loss, disclosure, modification and destruction.

SYSTEM INTEGRITY refers to the proper functioning of hardware and programs, appropriate physical security and safety against external threats such as eavesdropping and wiretapping.

PRIVACY defines the rights of the user or organizations to determine what information they are willing to share with or accept from others and how the organization can be protected against unwelcome, unfair or excessive dissemination of information about it.

CONFIDENTIALITY is a special status given to sensitive information in a database to minimize the possible invasion of privacy. It is an attribute of information that characterizes its need for protection.

10.2 SECURITY IN SOFTWARE

System security refers to various validations of data in the form of checks and controls to prevent the system from failing. It is always important to ensure that only valid data is entered and only valid operations are performed on the system. The system employs two types of checks and controls:

CLIENT-SIDE VALIDATION

Various client-side validations are used to ensure on the client side that only valid data is entered. Client-side validation saves server time and load to handle invalid data. Some checks are imposed:

- JavaScript is used to ensure those required fields are filled with suitable data only. Maximum lengths of the fields of the forms are appropriately defined.
- Forms cannot be submitted without filling up the mandatory data so that manual mistakes of submitting empty mandatory fields can be sorted out on the client side to save the server time and load.
- Tab indexes are set according to the need and take into account the ease of use while working with the system.

SERVER-SIDE VALIDATION

Some checks cannot be applied on the client side. Server-side checks are necessary to save the system from failing and inform the user that some invalid operation has been performed or the performed operation is restricted. Some of the server-side checks imposed are:

- A server-side constraint has been imposed to check for the validity of the primary key and foreign key. A primary key value cannot be duplicated. Any attempt to duplicate the primary value results in a message intimating the user about those values through the forms using the foreign key can be updated only with the existing foreign key values.
- The user is intimated through appropriate messages about the successful operations or exceptions occurring on the server side.

- Various Access Control Mechanisms have been built so that one user may not agitate upon another. Access permissions to various types of users are controlled according to the organizational structure. Only permitted users can log on to the system and can have access according to their category. User- names, passwords and permissions are controlled on the server side.
- Using server-side validation, constraints on several restricted operations are imposed.

11. CONCLUSION

Conclusion and Future Work:-

In conclusion, our proposed approach integrates advanced data analytics, real-time monitoring, and a digital twin for simulation into the existing biofuel cell manufacturing system. This enhancement not only optimises resource utilization and reduces energy and material consumption but also significantly improves efficiency and cost-effectiveness. By aligning with evolving sustainability standards, we address the current limitations of the system, which suffers from inefficiencies and a larger environmental footprint due to the lack of comprehensive features such as real-time monitoring and digital twin simulations.

Moving forward, our project aims to propel biofuel cell manufacturing in agriculture towards a more sustainable and economically viable future, fostering both innovation and environmental consciousness. To achieve these goals, several areas for future work have been identified:

1. **Integration of AI and Machine Learning:** Further enhance data analytics capabilities by incorporating AI and machine learning algorithms to predict system behaviors, optimize operations, and prevent potential issues before they arise.
2. **Scalability and Adaptability:** Develop scalable solutions that can be adapted to different sizes and types of biofuel cell manufacturing facilities, ensuring broader applicability and impact.
3. **IoT and Sensor Technology:** Expand the use of IoT devices and advanced sensor technology to improve the accuracy and breadth of real-time monitoring, leading to more precise control over the manufacturing process.
4. **User Training and System Usability:** Implement comprehensive training programs for users to maximize the benefits of the new system, and continuously improve the user interface for better usability and efficiency.

5. Environmental Impact Assessment: Conduct thorough assessments of the environmental impact of the enhanced system to quantify the benefits and identify areas for further improvement.
6. Collaboration and Partnerships: Foster collaborations with academic institutions, industry leaders, and government bodies to stay at the forefront of technological advancements and regulatory requirements.

By focusing on these future work areas, we can ensure that our transformative approach not only addresses current shortcomings but also continues to evolve, driving innovation and sustainability in biofuel cell manufacturing for agriculture.

13.REFERENCES

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