A REPORT OF SEMESTER INDUSTRIAL TRAINING

at

[EDUCATION AND RESEARCH NETWOK OF INDIA]

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENT
FOR THE AWARD OF THE DEGREE OF

BACHELOR OF TECHNOLOGY

(Computer Science and Engineering)

MARCH 2025 – SEPTEMBER 2025

SUBMITTED BY:

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DEPARTMENT OF COMPUTER SCIENCE and ENGINEERING

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY

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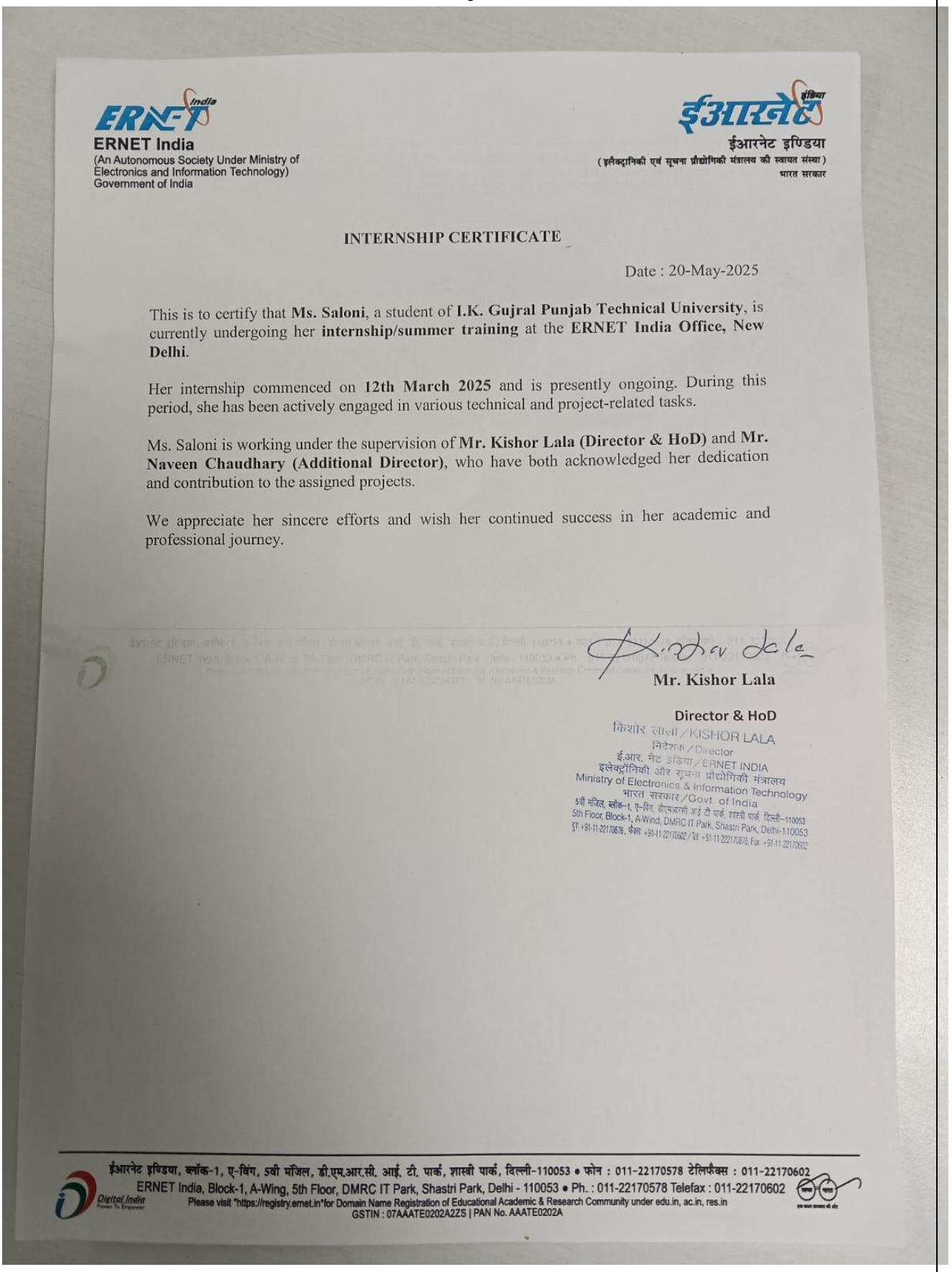
Certificate by ERNET



ERNET India
(An Autonomous Society Under Ministry of Electronics and Information Technology)
Government of India

ईआरनेट इण्डिया
(इलैक्ट्रानिकी एवं सूचना प्रौद्योगिकी मंत्रालय की स्वायत संस्था)
भारत सरकार

INTERNSHIP CERTIFICATE

Date : 20-May-2025

This is to certify that **Ms. Saloni**, a student of **I.K. Gujral Punjab Technical University**, is currently undergoing her **internship/summer training** at the **ERNET India Office, New Delhi**.

Her internship commenced on **12th March 2025** and is presently ongoing. During this period, she has been actively engaged in various technical and project-related tasks.

Ms. Saloni is working under the supervision of **Mr. Kishor Lala (Director & HoD)** and **Mr. Naveen Chaudhary (Additional Director)**, who have both acknowledged her dedication and contribution to the assigned projects.

We appreciate her sincere efforts and wish her continued success in her academic and professional journey.

Mr. Kishor Lala

Director & HoD

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निदेशक/Director
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इलेक्ट्रॉनिकी और सूचना प्रौद्योगिकी मंत्रालय
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Please visit "https://registry.ernet.in" for Domain Name Registration of Educational Academic & Research Community under edu.in, ac.in, res.in
GSTIN : 07AAATE0202A2ZS | PAN No. AAATE0202A

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY, KAPURTHALA

CANDIDATE'S DECLARATION

I SALONI hereby declare that I am undertaking six months industrial training at "EDUCATION AND RESEARCH NETWORK OF INDIA" during a period from March to September in partial fulfilment of requirements for the award of degree of B.Tech (Department of computer Science Engineering) at I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY, KAPURTHALA. The work which is being presentedin the training report submitted to Department of Computer Science and Engineering at I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY, KAPURTHALA is an authentic record of training work.

Signature of the Student

The six months software training Viva–Voce Examination of_____has been held on_____and accepted.

Signature of Internal Examiner

Signature of External Examiner

ABSTRACT

ERNET (Education and Research Network) India is a premier organization that provides internet, IT services to educational and research institutions across the country.

During my ongoing internship at ERNET, I am working as a Software Intern, focusing on variety of things. Currently I have assigned to design a visitor management system.

The core objective is to develop a system that streamlines visitor management portal, reducing the time and effort involved in manual interventions.

Throughout this internship, I am gaining hands-on experience in automating workflows using various software tools and technologies. I am developing solutions that replace manual entries management tasks with automated processes.

This involves analysing the existing manual system, understanding its workflow, and creating scripts and software solutions that efficiently handle the automating tasks. The project also includes integration with existing systems, ensuring that automated processes adhere to compliance and security standards.

The internship is providing me with invaluable exposure to software automation techniques, enhancing my problem-solving skills, and allowing me to contribute to improving the efficiency of visitor management system at ERNET.

I am also collaborating with cross-functional teams, gaining insights into integration of automated systems within organizational workflows.

I work closely with senior developers to design and implement the automation pipeline, ensuring seamless communication between the various stages of the management process.

Additionally, I am enhancing my understanding of the software development lifecycle, from requirement gathering and system design to deployment and maintenance.

This internship is not only deepening my technical knowledge but is also improving my ability to work in a collaborative, deadline-driven environment, providing a well-rounded perspective on real-world software development practices.

ACKNOWLEDGEMENT

It is my pleasure to express, with a deep sense of gratitude, my sincere thanks to **Mr. Kishor Lala**, Director (Head of Division), ERNET India, for his constant guidance, continual encouragement, and understanding. More than anything, he teaches me patience in my endeavours. My association with him is not confined to academics alone—it is a great opportunity and privilege to work with such an intellectual and expert.

I would also like to express my heartfelt gratitude to **Mr. Naveen Choudhary** for providing a supportive environment to work in and for his consistent inspiration during the tenure of my internship.

In a jubilant mood, I express my whole-hearted thanks to the Head of Department (Computer Science and Engineering), along with all teaching staff and university members, for their enthusiastic support and timely encouragement. Their guidance continues to motivate me in acquiring the knowledge required to progress successfully in my academic and professional journey.

I would like to extend a special thank you to my teammates, Anchal Sharma & Ajay Chand, for their constant support and valuable contributions throughout my journey at ERNET India.

I am especially thankful to my parents for their continuous support and belief in me.
It is also a pleasure to thank my friends, who encourage and motivate me to take on & complete this project with confidence.

Last but not least, I express my sincere gratitude and appreciation to all those who are helping me directly or indirectly toward the successful completion of this project.

ABOUT THE COMPANY

COMPANY BRIEF INTRODUCTION

Education and Research Network of India (ERNET India) is an autonomous society registered under the Societies Registration Act, 1860 under the administrative control of the Ministry of Electronics and Information Technology (MeitY), Government of India and is functioning under the overall control and guidance of its Governing Council. The Hon'ble Minister for Electronics & Information Technology is the Chairperson of the Council and the members have been chosen from premier Academic & Research institutions, Government organizations and Professional bodies.

Figure 0.1: ERNET LOGO

Figure 0.2: ERNET OFFICE

ABOUT THE COMPANY

ERNET India is a not-for-profit organization with the objective of facilitating Education and Research Institutions in the establishment of cutting-edge ICT infrastructure. It brought the Internet to India way back in the year 1986.
ERNET India is serving in the areas of ICT Project consultations, Terrestrial and VSAT networks, Domain registration for education & research institutions, Web-hosting services, setting up of smart virtual classrooms/ digital classrooms including high-resolution e-classrooms for medical colleges/

hospitals, Edu roam services for educational institutions, setting up of Wi-Fi campus in universities and also work in other contemporary and emerging technologies.

Education and Research Network of India

ERNET India is an autonomous scientific society under the administrative control of Ministry of Electronics and Information Technology, Government of India having one of the largest nation-wide terrestrial and satellite network. Focus of ERNET India is not limited to just providing connectivity, but to meet the entire needs of the academic and research institutions by providing consultancy, project management, training and other value-added services such as web hosting, e-mail services, video conferencing, domain registration, CUG services.

ERNET India is serving more than 1300 institutions in various sectors, namely, health, agriculture, higher education, schools and science & technology. ERNET was also identified by Govt. of India as the nodal network for India and was connected through high-speed link to the pan-European Education and Research Network (GEANT) during 2006 to 2010.

ERNET – NETWORK

The ERNET network is a judicious mix of terrestrial and satellite based wide area network. The satellite Wide Area Network (WAN) uses Very Small Aperture Terminal (VSAT) technology which is easily deployable and facilitates reliable and quick access to remote areas. ERNET network supports IPv4 and IPv6 Internet Protocol in native mode with dual stack, unicast and multicast.

ERNET – DOMAIN REGISTRATION

ERNET India is an exclusive domain registrar for education and research domains; registering the domains under ac.in, edu.in & res.in from 2005.The domain registration, renewal & modification process is fully automated with online payment facility for registering and renewing domain names on just a click. The automated website is GIGW compliant. In automated system, customer can modify online their DNS entries and other permissible information related to their institution. ERNET registers domain names under विद्या.भारत under internationalized domain names (IDN).

Figure 0.3: ERNET DOMAIN SEARCH

Since the users had challenges to manage their domains registered with ERNET, DNS Authoritative Name server Service for Educational & Research institutions were started on a commercial basis by ERNET. During the financial year April 20 - March 2021, ERNET had registered/ renewed approx. 5700 academic/educational/research domains and Total 15000 domains have been registered.

ERNET – RESEARCH & DEVELOPMENT

ERNET India has been carrying out research experiments on Visible Light Communications jointly with IIT Madras and IIIT Delhi. Further, it is proposed to set up an Indoor Hybrid LiFi-WiFi multi user testbed under the MeitY funded joint project with IIITD to demonstrate various mobility scenarios and perform link aggregation experiments.

ERNET India is executing a joint project with IISc Bangalore on "Designing Reliable and Low-latency Networks for Tactile Cyber-Physical Systems" funded by MeitY. The objective of this project is to design and implement Tactile Cyber-Physical System that addresses the challenges of achieving real-time interaction between physical and virtual worlds in prominent applications like remote surgery and virtual reality that require ultra-reliable low latency communications (URLLC).

ERNET - PROJECTS

ERNET has conceptualized, developed and implemented large number of projects on turn-key basis for various Educational Institutes and Research Organization. Several National and International Projects have been done by ERNET India.

National(Running Projects)

- FSOC Technology
- Optical Wireless Access Network for Rural and Urban Communication
- Setting up of e-classroom Infrastructure in 50 Medical colleges
- Information Security Education & Awareness (ISEA)-Phase II
- Centre of Excellence for IoT-MeitY, NASSCOM, ERNET initiative to help the IoT start up ecosystem
- IT infrastructure and LANs for e-learning centers at schools
- Smart Virtual Classroom Project

National (Completed Projects)

- LiFi Experimental Testbed
- Repository of Digital Library
- E-Linkage of Jawahar Navodaya Vidyalayas
- E-Linkage of Kendriya Vidyalayas
- E-Linkage of Krishi Vigyan Kendras under ICAR
- Data Centre
- Campus Network
- Video Conferencing

MISSION and VISION – ERNET

Our Vision

To advance Indian Research and Education by operating and developing world class Networks, Applications and Services.

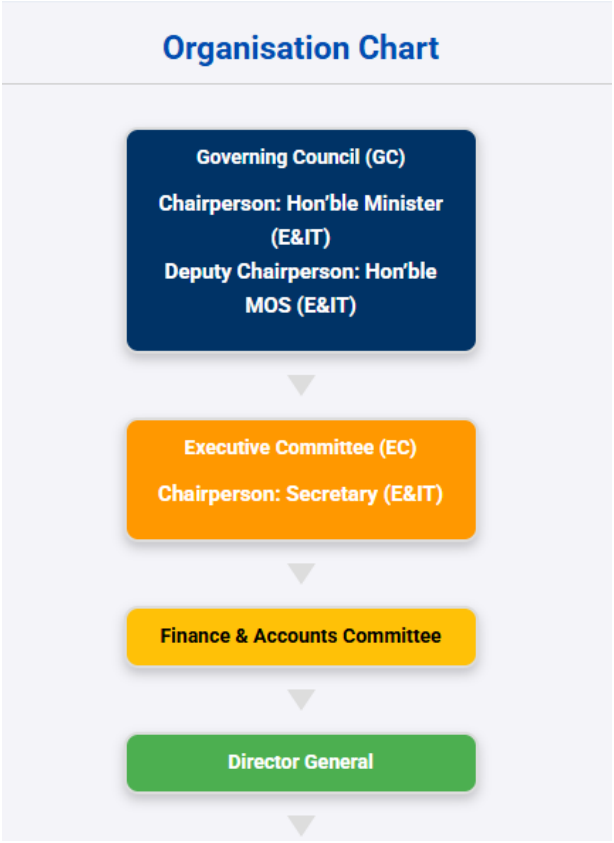
Our Mission

Provide Network Infrastructure Services and Connectivity addressing the requirements of India's Research and Education sector facilitating them to become increasingly efficient and effective in their chosen field. Undertaking cutting edge Research and Development in Networking and its Applications and also development of Human Resources in Networking.

Objectives

- Operations of National Academic and Research Network: Providing a world class reliable, robust and state-of-the-art Network Services to Academic and Research institutions of the country.
- Research and Development in the area of Data Communications and its applications.
- Human Resource Development in the area of Networking.
- Consultancy and implementation of ICT Projects for target Users.

ORGNISATION CHART



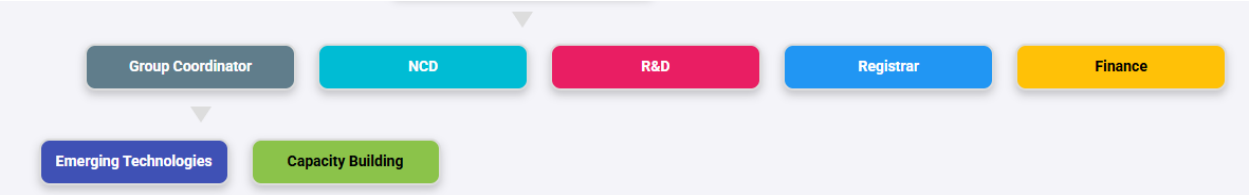
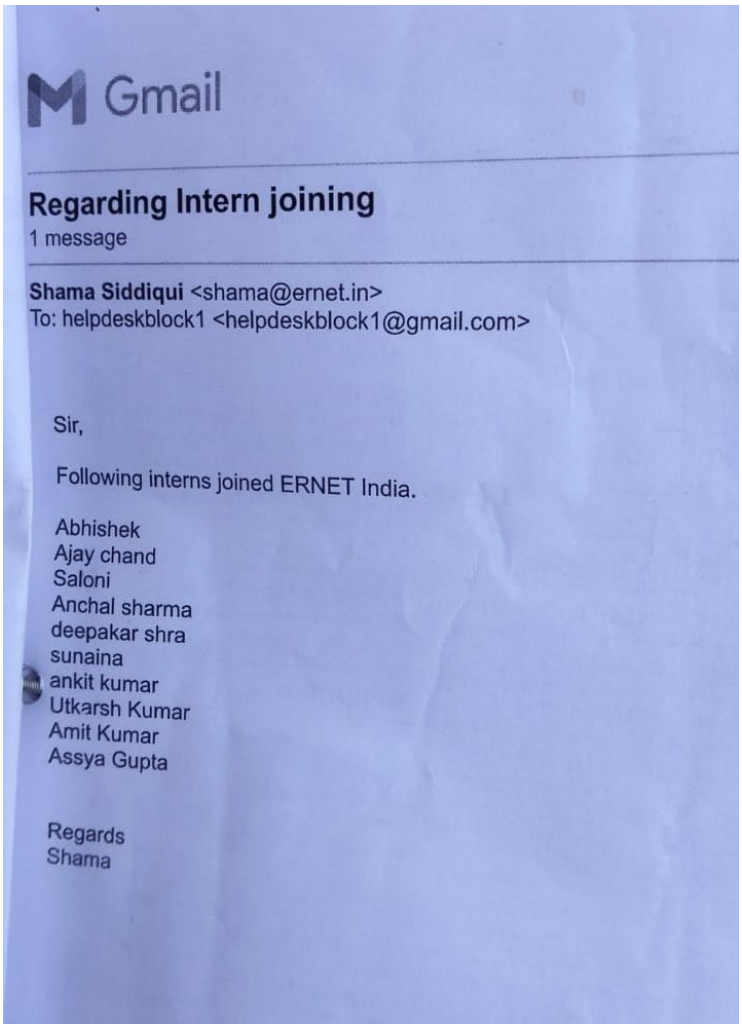


Figure 0.4: ERNET Organization Chart

ERNET (Educational and Research Network) India operates under the Ministry of Electronics and Information Technology (MeitY), Government of India. Its organizational structure comprises various levels, with a governing body overseeing its strategic direction, consisting of representatives from government departments, academic institutions, and research organizations

MY TEAM HIERACHY



Gmail

Regarding Intern joining

1 message

Shama Siddiqui <shama@ernet.in>
To: helpdeskblock1 <helpdeskblock1@gmail.com>

Sir,

Following interns joined ERNET India.

Abhishek
Ajay chand
Saloni
Anchal sharma
deepakar shra
sunaina
ankit kumar
Utkarsh Kumar
Amit Kumar
Assya Gupta

Regards
Shama

Figure 0.5: Intern at ERNET

Chapter-1: INTRODUCTION

THE OPPORTUNITY:

During my internship at ERNET, I have gained invaluable insights into the world of networking and internet technologies. ERNET (Education and Research Network) is dedicated to enhancing the digital landscape for academic and research institutions across the country. I have had the opportunity to work on various projects that involve managing and maintaining high-speed networks, as well as ensuring the efficient transfer of data across educational and research networks.

One of the keys take aways has been learning about how ERNET designs and implements reliable network infrastructures for large-scale operations. I have been exposed to the protocols and systems that handle connectivity between various research institutions, offering me a first-hand understanding of how robust networks are built to withstand heavy data loads while maintaining security and speed.

METHODOLOGY:

At the start of my internship at ERNET, I was introduced to various foundational courses that provided a strong understanding of the technology stack and systems ERNET utilizes. These courses covered key concepts, including block chain technology for secure login credentials, the basics of Excel, and the fundamentals of automation, AI, and ML. After completing the training sessions, I was assigned a knowledge provider who conducted in-depth knowledge transfer (KT) sessions, focusing on specific areas related to my project.

Once the KT sessions were completed, I was assigned to work on real-world tasks, including understanding how tender processes work manually and the steps involved in transforming them into automated systems. I was also tasked with studying the integration of block chain for enhancing security and managing credentials effectively.

As part of my project, I collaborated with the development team to explore how AI and ML can improve automation processes. This involved understanding existing systems, proposing solutions, and participating in the development of the automation framework.

KEY FINDINGS:

- **Understanding the Tender Process Workflow:** I gained insight into the traditional, manual workflow involved in processing tenders, and learned how the automation of this process can significantly increase efficiency and reduce errors.
- **Block chain for Secure Login Credentials:** Through research and practical application, I realized how block chain can provide a secure and tamper-proof method for managing login credentials, which is critical for enhancing the security of sensitive data in automation systems.
- **Excel and Its Role in Automation:** By studying Excel's role in managing and transforming data, I learned how a tool commonly used in manual data processing could serve as a bridge during the automation process. I also understood the importance of structuring data in a way

that would be easy to integrate into an automated workflow.

- **Hands-on Exposure to Development and AI/ML:** Working alongside the development team, I was able to apply my understanding of AI/ML to identify areas where machine learning algorithms could improve decision-making processes within the automation framework.
- **Adapting to Corporate Practices:** The internship helped me understand how the corporate sector operates, from project initiation to execution. I was able to grasp the company's work protocols & align my contributions with the team's goals.

BENEFITS TO THE COMPANY:

Implementing an internship program at ERNET offers significant advantages. It provides access to fresh ideas and perspectives from students who are up-to-date with the latest trends and technologies. Additionally, mentoring interns helps current employees develop valuable leadership and management skills, as they coach and guide interns through real-world projects. By, managing interns, employees enhance their ability to lead and communicate effectively, which strengthens the overall leadership within the company. Interns also contribute to ongoing projects, bringing enthusiasm and technical expertise that supports ERNET's goals, particularly in areas like automation and emerging technologies.

In summary, the internship program benefits ERNET by nurturing leadership within the team, injecting new ideas into projects, and potentially cultivating future employees familiar with the organization's culture and processes.

1.1 BACKGROUND OF THE TOPIC

The goal of my internship at **ERNET (Education and Research Network)** is to gain practical experience in networking and internet technologies, with a particular focus on understanding the design, management, and maintenance of large-scale network infrastructures. During my 6-month internship, I have the opportunity to work on various projects related to enhancing the connectivity and security of educational and research networks across the country.

ERNET is an organization dedicated to advancing the digital landscape for academic and research institutions, offering services such as high-speed internet connectivity, network management, and the facilitation of seamless data transfer. A significant part of my experience involves working with key technologies and protocols that form the foundation of ERNET's operations. I am gaining insights into how ERNET builds and maintains resilient and secure network infrastructures capable of handling high data loads, ensuring uninterrupted service for research and educational purposes.

Additionally, my work allows me to explore how ERNET integrates emerging technologies, such as blockchain for secure credential management and the application of AI/ML in automation. I am also involved in exploring and understanding various operational workflows within the organization, such as the visitor management process, and how automation can streamline these tasks for greater efficiency, accuracy. This provides me with hands-on experience in both networking and the application of cutting-edge technologies in real-world scenarios.

ABSTRACT:

This report offers a detailed examination of my ongoing 6-month internship at **ERNET (Education and Research Network)**, where I am gaining hands-on experience in networking and internet technologies, with a focus on network infrastructure management, data transfer, and emerging technologies. The internship allows me to explore the principles & practices behind building scalable and secure networks for educational and research institutions. I have the opportunity to work with advanced protocols, automation, blockchain, and AI/ML, providing me with a comprehensive understanding of how these technologies integrate into ERNET's operations.

The report covers key aspects of my internship, including the methodologies I am using in real-world projects, the findings from my involvement in automation processes, and how these efforts contribute to the organization's goals. Additionally, the report highlights the benefits ERNET gains from mentoring interns and integrating fresh perspectives into its ongoing projects. By discussing the challenges and opportunities within this sector, the report concludes with insights into the future of networking technologies and ERNET's role in shaping the digital landscape for academic institutions.

Introduction:

• Overview of networking and its importance in modern infrastructure
• Introduction to ERNET's role in enhancing the digital landscape for academic and research institutions
• Brief history of ERNET and its adoption of cutting-edge technologies to support large-scale networks

Understanding Networking Infrastructure:

• Definition and characteristics of robust networking systems
• The role of protocols, data transfer, and connectivity in a reliable network
• Advantages of a well-structured network infrastructure in educational and research environments

Introducing ERNET:

• Overview of ERNET and its key services
• Comparison with other national and international networking organizations
• ERNET's network architecture and how it supports data transfer across institutions

ERNET's Key Technologies:

• High-speed internet connectivity and network management
• Security protocols to ensure safe data transfer
• Integration of block chain for secure login credentials
• Role of automation, AI, and ML in streamlining networking operations

Working with ERNET:

• Overview of the internship setup and on boarding process
• Understanding the tender process and its transformation into an automated workflow
• Collaborating with teams to explore automation and AI/ML applications in network management
• Hands-on exposure to real-world networking scenarios and protocols

ERNET Tools and Ecosystem:

• Tools used for network monitoring and management
• Integration of emerging technologies like block chain and automation
• Documentation practices and knowledge-sharing within the ERNET community
• Resources for continuous learning and development in networking

Benefits of ERNET's Network Solutions:

• Improved efficiency and performance in data transfer
• Scalability and reliability of the network for research and educational use
• Security and data integrity through innovative solutions like block chain
• Developer productivity through automation and AI/ML integration

Real-world Applications:

• Collaboration with institutions to improve network connectivity and performance
• Case studies of ERNET's success in providing high-speed internet to academic institutions
• Implementation of new technologies in real-world network environments

Challenges and Limitations:

• Challenges in adopting new technologies across a diverse set of institutions
• Dealing with issues like inconsistent browser compatibility for emerging technologies
• Overcoming resistance to automation and new workflows in legacy systems

Conclusion:

• Recap of key learnings and insights gained during the internship
• Future prospects for ERNET and the expansion of its services
• The importance of ERNET's contributions to the future of digital education and research infrastructure

WEB COMPONENTS IN ERNET:

At ERNET, I am introduced to the importance of data validation and verification in maintaining the accuracy and integrity of information being transferred across educational and research networks. Much like web components that encapsulate functionality, ERNET's systems leverage modularity in their network operations to ensure smooth and reliable communication between institutions.

DATA VALIDATION AND VERIFICATION:

In the context of ERNET, data validation and verification are essential for ensuring that the information passing through the network is correct and conforms to predefined standards. During my internship, I am working on implementing data validation techniques to verify incoming data, ensuring it met specific criteria, such as format, accuracy, and completeness. This process is crucial for ERNET, as it guarantees that research and educational institutions have reliable and error-free data to work with.

EXCEL AUTOMATION AND TASK MANAGEMENT:

I am also involved in automating data-related tasks using Excel to streamline workflows within ERNET. One of the primary tasks I am working on is automating the process of data verification and validation in Excel spreadsheets. By utilizing Excel's built-in functions and incorporating simple automation scripts, I was able to create systems that significantly reduced manual work and improved efficiency.

Through my work, I am developing Excel tools to automate data cleansing tasks, including checking for inconsistencies, duplicates, and format errors. These tools simplified the process of ensuring data integrity and allowed for faster, more accurate processing of large datasets. By, integrating Excel-based automation into existing workflows, I am helping ERNET move towards a more automated and error-free environment, in line with the organization's goals of improving operational efficiency and reducing manual intervention.

KEY FEATURES & METHOLOGIES AT ERNET:

• **Data Validation and Automation Capabilities:**

At ERNET, I have the opportunity to implement data validation processes and automate repetitive tasks using Excel. This allowed for highly efficient and accurate verification of large datasets, which is crucial for managing data across multiple institutions. By automating these tasks, ERNET ensured consistent and error-free data management.

• **Efficient Workflow Automation:**

ERNET's workflow automation techniques improved efficiency by minimizing manual intervention. Automation of tasks, such as data verification and report generation, led to faster decision-making and streamlined operations.

• **Integration of Automation Tools and Excel:**

ERNET integrated various automation tools with Excel for data verification. The combination of Excel's built-in functions and custom macros made it easier to handle complex data validation processes, ensuring data integrity across different datasets and reducing the need for manual corrections.

• **Custom Scripts and Automation Features:**

I utilized custom scripts and functions to streamline data validation process. These scripts allowed me to automate tasks such as: error checking, data formatting, and consistency verification, making it easier for ERNET to manage data on a large scale.

Building and Automating the Tender Process Workflow at ERNET:

At ERNET, I am working on streamlining and automating the tender process, which involves multiple steps. The tender process can be broken down into several phases, each of which requires careful handling and verification.

TENDOR WORKFLOW PROCESS:

• Preparation of Documentation:

The first step in the tender process involves preparing the necessary documentation that outlines the project's requirements, specifications, and terms. This documentation needs to be detailed, as it serves as the foundation for vendor selection. I am working on ensuring that all the required fields in this documentation were accurate and aligned with the project's needs.

• Vendor Verification and Specification Compliance:

Once the documentation is ready, the next step is to receive bids from various vendors. These bids need to be carefully verified to ensure they meet the specified requirements, much like the validation process in development where data must conform to defined standards. I will assist in automating verification of vendor proposals using Excel and custom scripts to cross-check the specifications against the documentation, ensuring that the submissions met all the project's criteria.

• Tender Finalization and Negotiation:

After the vendor verification, the next stage involves finalizing the best-suited vendor & negotiating the terms. This process requires careful coordination and decision-making. I will help develop automated workflows to track the progress of negotiations and finalize the vendor selection efficiently.

• Budget Preparation and Government Approval:

Once the vendor is selected, the budgeting process begins. This includes preparing financial documents and sending them to the government for approval. I will work on automating the budgeting process and ensuring that all financial details were compiled correctly before submission.

• Finalizing the Tender and Workflow:

The final step involves sending the tender documents to the appropriate authorities for approval and completing the workflow. To streamline this process, I will work on developing Excel-based automation tools that ensured all necessary steps were followed and completed without errors.

AUTOMATION AND EFFICIENCY:

I will help to automate the various stages of the tender process to enhance efficiency. The automation eliminated the need for repetitive manual checks and allowed for quicker decision-making, making the process smoother and more reliable.

By using Excel and automating various tasks, I will be able to assist ERNET in reducing errors, saving time, and ensuring that the tender workflow was completed efficiently and in compliance with regulatory standards.

BENEFITS OF AUTOMATION IN TENDOR PROCESS:

• **Improved Efficiency and Accuracy:** The automation of documentation verification and vendor selection ensured faster, more accurate processing of tenders.

• **Reusability and Modularization:** The automated tasks within the tender process can be reused in future projects, streamlining future tenders and reducing the overhead of manual processes.

• **Cross-Department Compatibility:** The automated workflow integrated seamlessly across multiple teams at ERNET, ensuring that all departments involved in the tendering process had up-to-date information.

• **Increased Productivity and Time-Saving:** Automation reduced the time spent on manual tasks, improving overall productivity and allowing team members to focus on more strategic aspects of the project.

REAL WORLD APPLICATION OF TENDOR PROCESS:

The automation of the tender process at ERNET directly improved operational efficiency, especially when dealing with large-scale projects that require precise coordination. This approach is similar to the benefits seen in software development with tools, reusable and efficient components are crucial for successful large-scale applications.

CHALLENGES AND LIMITATIONS:

• **Learning Curve and Process Adaptation:** Adapting to a fully automated tender process required time and training for the team. Ensuring everyone understood the new system and its benefits was key to successful implementation.

• **Limited Tooling for Tender Management:** While ERNET had automated some processes, there were still gaps in the tooling available for tender management. Similar to how automation is still growing its ecosystem, there were areas where additional automation could have enhanced the workflow further.

1.2 THEORETICAL EXPLANATION

The core concepts I am working with my internship revolved around automation, data integrity, the application of block chain for security, and the handling of large datasets across educational and research networks. These areas are crucial for ERNET, as the organization's primary goal is to

enhance the digital landscape for academic institutions by providing a seamless flow of information while maintaining high security and efficiency.

1. **DATA VALIDATION AND VERIFICATION:**

   Theoretical concepts of data validation involve ensuring that the data conforms to the required format, range, or standards before being processed. Data verification ensures that the data is accurate and consistent with the source. For instance, when handling tender processes, it is essential to validate the submitted vendor proposals and verify them against pre-defined specifications.

   - **Validation Process:** This step ensures that the data entered (for example, vendor documents or specifications) meets certain conditions, such as proper format, range of values, or integrity checks.
   - **Verification Process:** After validation, verification checks are performed to cross-check the data against source data or predefined rules. This is necessary for preventing errors or inconsistencies in sensitive data.

2. **AUTOMATION:**

   Automation refers to using technology to perform tasks that were previously done manually. The automation process streamlines workflows, saves time, and reduces human errors. At ERNET, I worked on automating the process using Excel macros and scripts, which included automating the validation of vendor proposals, budget preparation, and approvals.

   - Excel Automation: Using formulas and scripting tools, I developed automated systems that allowed for automatic validation of entered data and the generation of reports and financial documents, improving efficiency and reducing manual errors.

3. **BLOCKCHAIN FOR SECURE LOGIN & DATA INTEGRITY:**

   Block chain technology, while primarily associated with cryptocurrencies, has broad applications in ensuring data security and integrity. During my internship, I am researching and discussing the potential application of blockchain for secure login credentials and data management within the organization.

   Block chain Basics: At the theoretical level, block chain is a distributed ledger technology (DLT) that securely records transactions across a decentralized network. It uses encryption and consensus mechanisms to ensure data integrity and prevent tampering.

   - **Block chain for Authentication:** I explore how block chain could enhance security for user login processes by utilizing it as a tamper-proof method for verifying credentials. This would address issues such as data breaches and identity theft in sensitive environments like ERNET, where secure data handling is paramount.
   - **Block chain for Transparency and Auditability:** The transparency and immutability of block chain were also studied for use in managing vendor transactions and tendering processes, ensuring that all transactions and changes in the process were securely logged and auditable.

4. **VISITOR MANAGEMENT SYSTEM:**

I am specifically focusing on the development of a secure Visitor Management System (VMS). The goal is to design a system that could automate the check-in/check-out process while ensuring data integrity and tamper-proof authentication using blockchain. I am exploring the integration of machine learning algorithms to analyze visitor patterns and flag anomalies, such as unauthorized access attempts or frequent visits from unknown sources. Each visitor's credentials and visit metadata will be hashed and securely logged on a private blockchain, enabling real-time tracking and immutable recordkeeping. This not only improved physical security and transparency within the organization but also demonstrated how blockchain and AI/ML can be jointly leveraged to automate identity verification and access control in sensitive digital infrastructures. The system aligned with our broader research objective of creating AI-augmented, blockchain-based frameworks for secure and efficient process automation in government and institutional settings.

5. **TENDOR WORKFLOW:**

The tender process consists of several stages, such as document preparation, vendor verification, and finalization. The main theoretical concept here was to ensure that all steps in these processes were completed accurately and efficiently, from preparing documents for government approval to finalizing the vendor selection.

- Process Flow**:** Understanding the flow of activities involved in tendering helped identify points where automation could be implemented to optimize the process. This included automating the process of verifying which vendors met the project requirements and managing the workflow from start to finish.

1.3 SOFTWARE/HARDWARE TOOLS LEARNT

During my internship at ERNET, I have the opportunity to work with a variety of software and hardware tools that enhanced my technical skills in data management, network automation, and process optimization, while also exploring the application of block chain technology.

TOOLS:

1. **MICROSOFT EXCEL**

Excel was a key tool for automating data validation, verification, and report generation. I used the following Excel features to improve efficiency in tasks related to data management:

- **Formulas and Functions**:
  I utilized Excel's powerful functions such as VLOOKUP**,** IF statements**,** and INDEX/MATCH to validate and compare data.
- **Pivot Tables and Data Analysis**:
  I used pivot tables for summarizing large datasets, which allowed me to efficiently analyze and visualize tender-related data.
- **PDF Verification**:
  In addition to using Excel, I verified data from PDF documents submitted by vendors. Using tools I extracted and cross-checked data from PDFs against Excel sheets to ensure consistency in tender proposal documents.

2. **PYTHON (SCRIPTING FOR AUTOMATION)**

Python played a key role in automating several aspects of the data processing and tendering workflow:

- **Python Scripting**:
  I wrote Python scripts to automate repetitive tasks in the excel process. I created workflows that automatically processed pdf data, validated data entries, integrating seamlessly with existing ERNET systems.
- **Libraries**:
  - **Pandas**: I used the Pandas library for data manipulation, such as cleaning and validating large datasets preparing data for analysis.
  - **Open PyXL**: I utilized Open PyXL to read and write Excel files**,** automating tasks like filling out financial sheets or updating vendor verification statuses.

3. **BLOCK CHAIN**

During my internship, I am exploring the potential application of block chain technology for improving ERNET's data security and workflow automation:

- **Block chain Research**:
  I engaged in research on block chain frameworks that could be used to improve ERNET's security infrastructure. Specifically, I focused on how block chain could be used for secure authentication and transparent data management in the tendering process.
- **Block chain Platforms**:
  I am exploring platforms like Ethereum and Hyperledger for building smart contracts and permissioned block chain solutions that would enhance security, transparency, and auditability in ERNET's workflow.

4. **VISITOR MANAGEMENT SYSTEM TOOLS**

1. Frontend (UI/UX Design & Development)
React.js: For building dynamic, component-based web applications.
Tailwind CSS: For responsive and modern UI styling.
Figma / Adobe XD / Sketch: For UI/UX prototyping, wireframing, and collaborative design workflows.
Chart.js / Recharts: For integrating visual visitor analytics in the dashboard.
React QR Reader / react-webcam: For QR scanning and capturing images directly via browser.

2. ID/Card Scanning & OCR
Tesseract.js / OpenCV.js: For extracting text from scanned ID cards using OCR in-browser or backend.
QR/Barcode Scanning: Libraries like react-qr-reader, ZBar, or Scanbot SDK for reading pre-issued badges.
Webcam Integration: Capture visitor photo via React Webcam API for records.

3. Backend & Automation
Python (Flask/FastAPI) and dyjango: RESTful API backend for managing data and logic.
MongoDB / PostgreSQL / Firebase Firestore: For storing visitor details, images, scan records, and

access logs.
JWT / OAuth2: For implementing secure, token-based login with Role-Based Access Control (RBAC).
Role Logic Middleware: Restrict routes and access by user roles (Admin, Security, Receptionist).

4. Real-Time Reporting & Analytics
Pandas: To generate automated daily, weekly, monthly visitor reports.
Plotly / Dash / Power BI / Tableau: For interactive and visual analytics dashboards.
CSV/PDF Export: For exporting logs in multiple formats.

5. AI/ML + Blockchain Security (Advanced Layer)
scikit-learn / TensorFlow: To detect unusual visitor patterns or access anomalies.
Face Recognition (OpenCV): For validating frequent visitors through facial data.
Blockchain Integration (Ethereum / Hyperledger): Store hashes of visit logs for tamper-proof records.
Use smart contracts for verifiable access logs.

5. DevOps, Hosting & Deployment
Firebase / AWS / Heroku / Netlify / Vercel: For hosting frontend and backend services.
Docker: Containerization of the entire application for easy deployment.
GitHub / GitLab: Version control and collaboration.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING TOOLS

AI and ML tools were essential in automating the vendor verification process**,** improving data analysis, and optimizing decision-making during the tender workflow. Here's how they were integrated:

- **AI-Based Document Analysis and Verification**:
  I will explore the use of Natural Language Processing (NLP) techniques to automate the analysis of vendor proposals. Using AI-based tools, I will develop models that could read and interpret the content of vendor proposals, automatically identifying compliance with project requirements.
- **AI for Vendor Compliance Detection**:
  I will also use machine learning models to classify vendor proposals based on their compliance with project specifications. By training models on past data, the system could automatically categorize proposals into compliant and non-compliant groups, making the verification process faster and more efficient.
- **AI/ML-Based Decision Support**:
  Machine learning models will be applied to help optimize the final vendor selection**.** These models analyzed historical tender data to predict which vendors were likely to provide the best fit for the project based on factors like past performance, proposal accuracy, and financial stability.
- **AI for Workflow Automation**:
  AI will also be utilized to streamline the overall tender workflow. By analyzing past tender processes, AI models suggested optimizations, such as identifying bottlenecks in vendor verification or automating the negotiation stages by flagging issues that required human intervention.

CHAPTER 2: FIELD OF TRAINING

PROJECT SCOPE

The primary objective of this project is to develop a system that automates the manual process, minimizing the time and effort required for manual interventions. This system aims to stream line the management workflow by replacing traditional manual tasks with automated processes, ensuring efficiency, accuracy, and adherence to compliance and security standards.

METHODOLOGY

Software Development Life Cycle:

SDLC stands for Software Development Life Cycle. It is a structured approach or framework that describes the stages and activities involved in the development of software- applications. The SDLC provides a systematic and standardized way to plan, design, develop, test, deploy, and maintain software systems. It serves as a guide to ensure that software projects are completed efficiently, effectively, and with high quality.

The SDLC typically consists of several phases, which may vary in naming and order depending on the specific methodology or approach being followed. However, the common phases of the SDLC include:

- ✓ **Requirements Gathering:** In this phase, the project team works with stakeholders to understand and document the functional and non-functional requirements of the software. This involves gathering user needs, analyzing business processes, and definingsystem requirements.
- ✓ **System Design:** During this phase, the high-level architecture and system design are created based on the gathered requirements. The design may include the overall systemstructure, user interface design, database schema, and integration of external components.
- ✓ **Development:** The development phase involves writing the code according to the design-specifications. Programmers or developers implement the software based on the requirements and design, following coding standards and best practices.
- ✓ **Testing:** The testing phase is dedicated to ensuring the quality and reliability of the software. Various testing activities, such as unit testing, integration-testing, system testing, and user acceptance testing, are performed to identify and fix any defects orissues.
- ✓ **Deployment:** In this phase, the software is deployed to the production environment or made available to end-users. It involves activities such as installation, configuration, data migration, & user training.
- ✓ **Maintenance:** Once the software is deployed, it enters the maintenance phase. This involves ongoing support, bug fixes, updates, and enhancements based on user feedbackand changing requirements.

Throughout the SDLC, documentation, version control, and project management practices, are maintained to ensure proper tracking and control of the software development process. Additionally, collaboration, communication, and coordination among team members and stakeholders are vital for successful software development.

Different methodologies and approaches, such as Waterfall, Agile, and DevOps, have their variations & adaptations of the SDLC. Each methodology has its strengths and weaknesses and is suited for different types of projects and organizational contexts. The SDLC provides a structured

approach to software development, helping teams deliver high-quality software that meets user requirements and is delivered on time and within budget.

Agile methodology is an iterative and collaborative approach to project management and software development. It emphasizes flexibility, adaptability, and continuous improvement-throughout the project lifecycle. Agile methodologies, such as Scrum and Kanban, promote collaboration, transparency, and frequent feedback to deliver high-quality products efficiently. Here's a brief overview of Agile methodology:

Principles of Agile: Agile methodologies are guided by the Agile Manifesto, which outlines four key values:

- ✓ Individuals and interactions over processes and tools
- ✓ Working software over comprehensive documentation
- ✓ Customer collaboration over contract negotiation
- ✓ Responding to change over following a plan

These principles prioritize human interactions, product functionality, customer involvement, and adaptability, fostering a flexible and customer-centric approach.

Iterative and Incremental Development: Agile projects are divided into small iterations or time-bound cycles, often called sprints. Each sprint focuses on delivering a functionalincrement of the product. Iterative development allows for regular feedback, reduces risk, and enables continuous improvement throughout the project.

Roles and Responsibilities: Agile projects typically have specific roles, including:

- ✓ *Product Owner:* Represents the customer or stakeholder and defines the product vision, priorities, and requirements.
- ✓ *Scrum Master:* Facilitates the Scrum process, removes obstacles, and ensures the team adheres to Agile principles.
- ✓ *Development Team:* Cross-functional group responsible for developing and delivering increments of the product.

Scrum Framework: Scrum is a popular Agile framework that emphasizes teamwork,collaboration, and iterative development. It consists of specific events, artifacts, androles:

- ✓ *Sprint Planning:* The team plans the work to be done in the upcoming sprint, breaking it down into actionable tasks.
- ✓ *Daily Stand-up:* A short daily meeting where team members discuss progress,challenges, and plans for the day.
- ✓ *Sprint Review:* The team demonstrates the completed work to stakeholders and gathers feedback for future iterations.
- ✓ *Sprint Retrospective:* The team reflects on the sprint, identifies improvement areas, and plans changes for the next iteration.

Kanban Methodology: Kanban is another Agile approach that focuses on visualizing the workflow and optimizing the flow of work. It uses a Kanban board to visualize tasks andtheir status, limiting work in progress, and ensuring a smooth and continuous flow of tasks.

Continuous Integration and Testing: Agile methodologies encourage continuous integration, where code changes are frequently integrated into a shared repository. Continuous integration and testing help identify and address issues early, reducing risks and improving the overall product quality.

Adaptability and Collaboration: Agile promotes collaboration, transparency, and flexibility. The team frequently engages with stakeholders to gather feedback, incorporate changes, and ensure the project aligns with customer needs. Agile methodologies embrace change, enabling teams to adapt to evolving requirements andmarket conditions.
Agile Artifacts: Agile projects often utilize artifacts such as user stories, product backlogs, sprint backlogs, and burndown charts to track progress, prioritize work, andensure visibility and transparency.
Agile methodologies offer numerous benefits, including faster time-to-market, improved customer satisfaction, increased team collaboration, and the ability to respond to changingrequirements effectively.

However, successful Agile implementation requires active participation, effective communication, and a commitment to continuous improvement from all project stakeholders.

WHY WEB COMPONENTS

Web Components are required for several reasons:

- ✓ **Reusability:** With Web Components, developers can create custom, reusable HTML elements that can be used across multiple web pages and web applications.
- ✓ **Modularity:** Web Components allow developers to encapsulate functionality and styles within custom elements, making it easier to manage and maintain complex web applications.
- ✓ **Standardization:** Web Components are based on standardized web technologies, like Custom Elements, Shadow DOM, and HTML Templates.
- ✓ **Scalability:** Web Components can help improve the scalability of web applications by allowing developers to create independent, reusable UI components.
- ✓ **Interoperability:** Web Components can be used with other web technologies, such as JavaScript frameworks and libraries, to create powerful and flexible web applications.

Overall, Web Components can help improve the efficiency, maintainability, and scalability-of web applications, making them an important technology for modern web development.

The Project Requirements:

Develop a set of web components that can be used across various platforms. Ensure that the components can be easily integrated into existing projects.
The components should be published using NPM, allowing anyone to use them by running a single command in the terminal.
The components should be customizable, allowing users to modify them based on their requirements.

SYSTEM REQUIREMENTS:

Hardware Requirements:

- ✓ Processor: Intel core or above
- ✓ RAM: Minimum 2GB
- ✓ Hard Disk: Minimum 160GB

Software requirements:

- ✓ Operating System: Windows 7 or above

- ✓ Browser: Google Chrome and Mozilla Firefox
- ✓ Frontend Framework: HTML/CSS/Tailwind CSS
- ✓ Language: Java script
- ✓ Text Editor (IDE): Visual Studio Code

Technologies Used:

To develop the web components, we used a range of web development technologies, including:

- ✓ **React:** React is a popular front-end framework for building web applications. We used React to develop some of the components that required dynamic user interactions and data manipulation.
- ✓ **Angular:** Angular is another popular front-end framework that we used to develop some of the more complex components. We found that Angular provided a more structured approach to web development and was particularly useful for building large-scale applications.
- ✓ **Vanilla JS:** We used Vanilla JS to develop some of the simpler components that did not require any external libraries or frameworks.

We also used a range of other tools and technologies, including NPM, Git, and GitHub, to manage the project and collaborate with the team.

PROJECT IMPLEMENTATION

The project was implemented in several stages, including scoping the requirements, designing the components, developing the components, testing and debugging, and publishing the components.

SCOPING THE REQUIREMENTS

The first stage of the project involved scoping the requirements and identifying the key components that needed to be developed. We worked closely with the project manager to ensure that the requirements were clearly defined and aligned with the project's overall goals.

DESIGNING THE COMPONENTS

Once we had identified the key components, we started designing the components, including defining user interfaces, data models, and component architecture. We used tools such as Sketch and Figma to create wireframes and mockups of the components to get a better understanding of how they would look and function.There are many tools available for building and working with Web Components. Here, are a few popular tools:

- ✓ **Lit-Element**: Lit-Element is a lightweight library for building Web Components that is based on the Lit HTML templating engine. It provides a simple way to create custom elements, manage component state, and handle events.
- ✓ **Polymer:** Polymer is a JavaScript library that provides a set of tools for building Web Components. It includes a number of pre-built UI components, as well as a set of tools for managing data, handling events, and creating custom elements.
- ✓ **Web Components Dev-Tools:** The Web Components Dev-Tools is a browser extension for Google Chrome that provides a set of tools for debugging and profiling Web Components. It includes a component tree view, a property inspector, and a JavaScript console, among other features.

OTHER TOOLS

1. MICROSOFT EXCEL

Excel was a key tool for automating data validation, verification, and report generation. I used the following Excel features to improve efficiency in tasks related to data management:

- ✓ Excel Automation and Macros
- ✓ Formulas and Functions
- ✓ Pivot Tables and Data Analysis
- ✓ PDF Verification

2. PYTHON (SCRIPTING FOR AUTOMATION)

Python played a key role in automating several aspects of the data processing and excel workflow:

- ✓ Python Scripting:
  I wrote Python scripts to automate repetitive tasks in the process. I created workflows that automatically processed and validated data entries, also generated customized reports, integrating seamlessly with existing ERNET systems.
- ✓ Libraries:
- **Pandas**: I used the Pandas library for data manipulation, such as cleaning and validating large datasets and preparing data for analysis.
- **Open PyXL**: I utilized Open PyXL to read and write Excel files, automating tasks like filling out financial sheets or updating vendor verification statuses.

3. BLOCK CHAIN

During my internship, I explored the potential application of block chain technology for improving ERNET's data security and workflow automation:

- ✓ **Block chain Research**:
  I engaged in research on block chain frameworks that could be used to improve ERNET's security infrastructure. Specifically, I focused on how block chain could be used for secure authentication and transparent data management in the tendering process.
- ✓ **Block chain Platforms**:
  I am exploring platforms like Ethereum and Hyperledger for building smart contracts and permissioned block chain solutions that would enhance security, transparency, and auditability in ERNET's workflow.

4. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING TOOLS

AI and ML tools will be essential in automating the vendor verification process, improving data analysis, and optimizing decision-making during the tender workflow. Here's how they were integrated:

- ✓ **AI-Based Document Analysis and Verification**:
  I will explore the use of Natural Language Processing (NLP) techniques to automate the analysis of vendor proposals. Using AI-based tools, I will develop models that could read and interpret the content of vendor proposals, automatically identifying compliance with project requirements.
- ✓ **AI for Workflow Automation**:
  AI will also be utilized to streamline the overall tender workflow. By analyzing past tender processes, AI models suggested optimizations, such as identifying bottlenecks in vendor verification or automating the negotiation stages by flagging issues that required human intervention.

CHALLENGES FACED

During my internship with ERNET India, I am encountering several challenges that helped me grow both technically and professionally. Some of the key challenges included:

- ✓ **Block chain for Secure Login Credentials:**
  Major challenge is researching and applying block chain technology for secure login credentials. While block chain offers significant security benefits, integrating it into the existing systems posed a technical challenge. I have to ensure the system was compatible with block chain's decentralized approach while also maintaining a user-friendly experience and security for sensitive data.
- ✓ **Integrating Excel with Automation:**
  Using Excel as a bridge between manual and automated processes posed its own set of challenges. Excel, being widely used for data handling, had to be properly structured for efficient integration into the automation workflow. Ensuring data consistency, error-free imports, and automating Excel-based tasks required a careful balance of traditional tools and new automation techniques.
- ✓ **Understanding the Tender Process Workflow:**
  One of the challenges I am facing is understanding the traditional, manual workflow involved in processing tenders. The complexity of the existing processes, combined with the need for automation, made it clear how automation could streamline these workflows. Identifying specific bottlenecks required deep understanding and careful mapping of the manual processes before proposing improvements.
- ✓ **Adapting to Corporate Practices:**
  Adapting to the corporate environment is another challenge. From understanding project initiation to execution, I have to quickly align my work with the company's goals and timelines. Learning how to effectively communicate with teams, manage expectations, and meet deadlines was a key learning curve.

FUTURE SCOPE

While the internship provided valuable experience, there are several areas where further development & exploration can be done:

1. **Further Automation of the Tender Process:**
   Expanding the automation of the tender process to include additional stages, such as automatic document verification or smart contract integration, could increase efficiency even further. Integrating intelligent decision-making mechanisms could also reduce human error and speed up processing.
2. **Block chain for Broader Security Applications:**
   The implementation of block chain for secure login credentials is just the beginning. Exploring its application for other security-sensitive areas, such as contract management, data integrity, and auditing, could further strengthen the system's overall security.
3. **Expanding AI/ML Capabilities:**
   The role of AI/ML in improving decision-making could be expanded by training models on more diverse datasets, refining predictive capabilities, and using AI to optimize workflows in real-time. Additionally, enhancing explainability in AI models can ensure greater trust in automated decisions.
4. **Integration with Other Tools and Platforms:**
   As automation continues to evolve, exploring the integration of additional platforms, tools,

or technologies (such as cloud computing, big data analytics, or IoT) can further enhance the efficiency and scalability of ERNET India's systems.

5. **Continuous Improvement in Data Structuring and Processing:**
   Further efforts in optimizing data structures for automation workflows could lead to more efficient handling and processing, reducing errors and increasing system reliability. Additionally, exploring advanced data analytics techniques could enhance decision-making within automation systems.

CONCLUSION

My internship at ERNET India is providing a comprehensive learning experience where I am exposed to various aspects of automation, security, and AI/ML applications. I am gaining practical knowledge in transforming traditional processes into automated systems, particularly in the context of tender management, secure login systems, and data processing with Excel. Working closely with the development team is giving me valuable hands-on exposure to AI/ML tools and how they can be applied to real-world problems.

The challenges I encounter are helping me grow technically and adapt to the corporate work culture, while also enhancing my problem-solving skills. The knowledge I am acquiring about blockchain, automation, and AI/ML is something I look forward to carrying forward in my career. Looking ahead, I see immense potential for further development in automating workflows, improving security, and harnessing the power of AI/ML for decision-making—all of which can significantly benefit ERNET India and similar organizations in the future.

CHAPTER 3: TRAINING WORK UNDERTAKEN

Task-1: Automating Data Validation and Verification

As part of my internship at ERNET, In the First week, I worked on automating data extraction and verification tasks to streamline processes involving multiple PDFs and Excel files. Initially, we had to manually verify large amounts of data such as Customer ID**,** Invoice Number**,** Invoice Date**,** Capacity**,** Billing From**,** and Billing To across 512 PDFs. This task was tedious, so I automated it using Python scripts to extract data from PDFs and compare the extracted data with reference Excel sheets.

The goal was to create scripts that would not only extract the required data but also ensure its integrity by comparing it with the data in an Excel file. This way, we could ensure consistency across files and reduce human error in future processes.

1. **Code for Extracting Data from PDFs**:
    - The first code script is designed to extract Customer ID**,** Invoice Number**,** Invoice Date**,** Capacity**,** Billing From**,** and Billing To from multiple PDF documents.
    - The data is extracted from the PDFs which allows us to access tables and text within the document.
    - After extracting the relevant information, it is formatted into a structured CSV file with rows and columns for easier review and verification.
2. **Code for Verifying Data Between Two Excel Sheets**:
    - The second code automates the process of comparing two Excel sheets.
    - It checks whether the two sheets are identical row-by-row and column-by-column. If they are not the same, it highlights the differences and generates a new file containing a detailed report of the discrepancies.
    - This verification step ensures that the extracted data matches the reference data stored in the Excel file.

Additional Details

- Handling Missing Data**:** In both scripts, if any data is missing or structured inconsistently, the code may need additional error handling to manage those cases, such as using try-except blocks.
- Column Order in Excel**:** When comparing Excel sheets, it's important to ensure that the columns are in the same order in both sheets.
- Scalability**:** The scripts are designed to handle a large number of PDFs or Excel rows and can be extended to more complex data structures by modifying the extraction and comparison logic accordingly.

index.py

C: > Users > Administrator > Desktop > verify > index.py > extract_details

```python
import os
import re
import pandas as pd
from PyPDF2 import PdfReader

def extract_text_from_pdf(pdf_path):
    """Extract text from a given PDF file."""
    text = ""
    try:
        with open(pdf_path, "rb") as file:
            reader = PdfReader(file)
            for page in reader.pages:
                page_text = page.extract_text()
                if page_text:
                    text += page_text + "\n"
        print(f"Successfully extracted text from {pdf_path}")
    except Exception as e:
        print(f"Error reading {pdf_path}: {e}")
    return text

def extract_serial_no(text):
    """Extract Serial No using multiple patterns to ensure capture."""
    # Try several patterns that might match the Serial No format
    patterns = [
        r"Serial No\s*:\s*:\s*(\d+)",        # Matches "Serial No: : 0972023244"
        r"Serial No\s*:\s*(\d+)",            # Matches "Serial No: 0972023244"
        r"Serial No[^0-9]*(\d{10})",         # Matches any 10-digit number after "Serial No"
        r"Serial[^0-9]No[^0-9](\d+)"       # More flexible pattern
    ]

    for pattern in patterns:
        match = re.search(pattern, text, re.IGNORECASE)
        if match and match.group(1):
            serial_no = match.group(1).strip()
            print(f"Found Serial No: {serial_no} using pattern: {pattern}")
            return serial_no

    # If we get here, we couldn't find the Serial No
    print("WARNING: Could not find Serial No in the document text")
    print("Text sample for debugging (first 500 chars):", text[:500])
    return "Not Found"

def extract_details(text):
    """Extract required details using regex with improved handling."""
    # Extract Serial No first
    serial_no = extract_serial_no(text)

    # Extract other details
    patterns = {
        "CP number": r"PTSL CP\s*:?\s*(\d+)",
        "GST Invoice No.": r"Invoice No\s*:?\s*(\S+)",
        "Capacity": r"Capacity\s*:?\s*([\d.]+\s*(MBPS|GBPS))?",
        "Period From": r"Billing From\s*:?\s*(\d{2}\.\d{2}\.\d{4})",
        "Period To": r"Billing To\s*:?\s*(\d{2}\.\d{2}\.\d{4})"
    }

    extracted_data = {"Serial No": serial_no}
```

```
    for key, pattern in patterns.items():
        match = re.search(pattern, text, re.IGNORECASE)
        if match and match.group(1):
            extracted_data[key] = match.group(1).strip()
        else:
            extracted_data[key] = "Not Found"
            print(f"WARNING: Could not find {key} in the document")

    return extracted_data
def extract_links_number(folder_name):
    """Extract the number of links from a folder name like '327 invoices of 171 Links'."""
    # Pattern to match "X invoices of Y Links" and extract Y
    pattern = r"\d+\s+[Ii]nvoices\s+of\s+(\d+)\s+[Ll]inks"
    match = re.search(pattern, folder_name)

    if match and match.group(1):
        return match.group(1)
    else:
        # Return the original folder name if no match
        return folder_name
def find_all_pdfs(root_directory):
    """Find all PDF files in a directory tree recursively."""
    # Dictionary to store PDF paths and their parent folder info
    pdf_info = {}
    # Get the main folders directly under the root
    main_folders = []
    for item in os.listdir(root_directory):
        item_path = os.path.join(root_directory, item)
        if os.path.isdir(item_path):
            main_folders.append(item)
    # Walk through all directories
    for dirpath, dirnames, filenames in os.walk(root_directory):
        # Find which main folder this is under
        relative_path = os.path.relpath(dirpath, root_directory)
        parent_folder = relative_path.split(os.sep)[0] if relative_path != "." else ""
        # Only process if we're in one of the main folders
        if parent_folder in main_folders:
            for filename in filenames:
                if filename.lower().endswith('.pdf'):
                    pdf_path = os.path.join(dirpath, filename)
                    # Store the PDF path and which main folder it belongs to
                    pdf_info[pdf_path] = parent_folder
    return pdf_info
def process_pdfs_in_folder(root_folder, output_excel):
    """Process all PDFs in the given root folder (including all nested subfolders) and save extracted data in an Excel file."""
    data = []
    # Find all PDFs and their parent folder info
    pdf_info = find_all_pdfs(root_folder)
    print(f"Found {len(pdf_info)} PDF files to process")
    for pdf_path, parent_folder in pdf_info.items():
        try:
            print(f"\nProcessing: {pdf_path}")
            # Extract text from the PDF
            text = extract_text_from_pdf(pdf_path)
            # Extract details using regex
            details = extract_details(text)

              # Extract the links number from the parent folder name
              part_of = extract_links_number(parent_folder)
              # Create a new row with only the required columns in the correct order
              row_data = {
                  "Part of": part_of,
                  "Bill.Doc.": details["Serial No"],  # Use the extracted Serial No as Bill.Doc.
                  "CP number": details["CP number"],
                  "GST Invoice No.": details["GST Invoice No."],
                  "Capacity": details["Capacity"],
                  "Period From": details["Period From"],
                  "Period To": details["Period To"]
              }
```

```
            # Print the results for debugging
            print("Extraction results:")
            for key, value in row_data.items():
                print(f"  {key}: {value}")
            # Add to results regardless of Serial No extraction success to see all data
            data.append(row_data)
        except Exception as e:
            print(f"Error processing {pdf_path}: {e}")
    # Create a DataFrame from the extracted data
    df = pd.DataFrame(data, columns=["Part of", "Bill.Doc.", "CP number", "GST Invoice No.", "Capacity", "Period From", "Period To"])
    df["Bill.Doc."] = df["Bill.Doc."].astype(str)

    # Save to Excel with xlsxwriter for better formatting
    df.to_excel(output_excel, index=False, engine="xlsxwriter")
    print(f"\nExtraction complete. Data saved to {output_excel}")

    # Print summary
    success_count = len(df[df["Bill.Doc."] != "Not Found"])
    print(f"Successfully extracted Serial No for {success_count} out of {len(df)} PDF files")

# Example usage
root_folder = r"C:\Users\Administrator\Desktop\verify"  # Change this to your actual root folder path
output_excel = r"C:\Users\Administrator\Desktop\verify\F_extracted_data.xlsx"  # Change this to your desired save location
process_pdfs_in_folder(root_folder, output_excel)
```

Figure 3.1: Automating script code

Conclusion

The automation of data extraction and verification not only makes the process more efficient but also significantly reduces the potential for human errors. The Python scripts provided allow for quick extraction of data from PDFs and reliable verification of data between two Excel files, streamlining workflows for future use.

These scripts will be especially useful when the same process needs to be repeated with different datasets, ensuring consistency and accuracy each time.

Task-2: Block-Chain discussion and implementation

During my 2nd week, I explored and implemented the use of block chain technology to enhance security in managing login credentials and ensuring data integrity. I began by studying block chain fundamentals—its decentralized structure, immutability, and transparency—and applied these principles to real-world scenarios within the organization.

Practically, I designed a prototype system where user credentials were hashed using SHA-256 and stored on a private Ethereum-based block chain. During the login process, the system would hash the entered credentials and compare them with the stored hash to verify authenticity—eliminating traditional database vulnerabilities. I also implemented a sample smart contract in Solidity to handle credential verification on-chain. Here are some of my key findings:

What is Block chain?

Block chain is a decentralized, distributed digital ledger that records transactions across a peer-to-peer network. Key features include:

- Decentralization – No single entity controls the system.
- Immutability – Once data is written, it cannot be altered.
- Transparency – All participants can verify records.
- Security – Uses cryptographic techniques to prevent tampering and unauthorized access.

Block chain for Secure Login Credentials

- Problem**:** Traditional systems store user credentials in centralized databases. These are prone to data breaches, hacks, and manipulation.
- Block chain Approach**:**
    - Passwords are hashed (e.g., using SHA-256) and stored on a permissioned block chain (like Hyper ledger or private Ethereum).
    - During login, the input password is hashed and compared with the on-chain hash via smart contracts.
    - Since block chain is tamper-proof, it ensures integrity and prevents credential forgery or leaks.

This approach eliminates the need for centralized credential storage and reduces attack vectors.

Block chain for Certificate Issuance and Verification

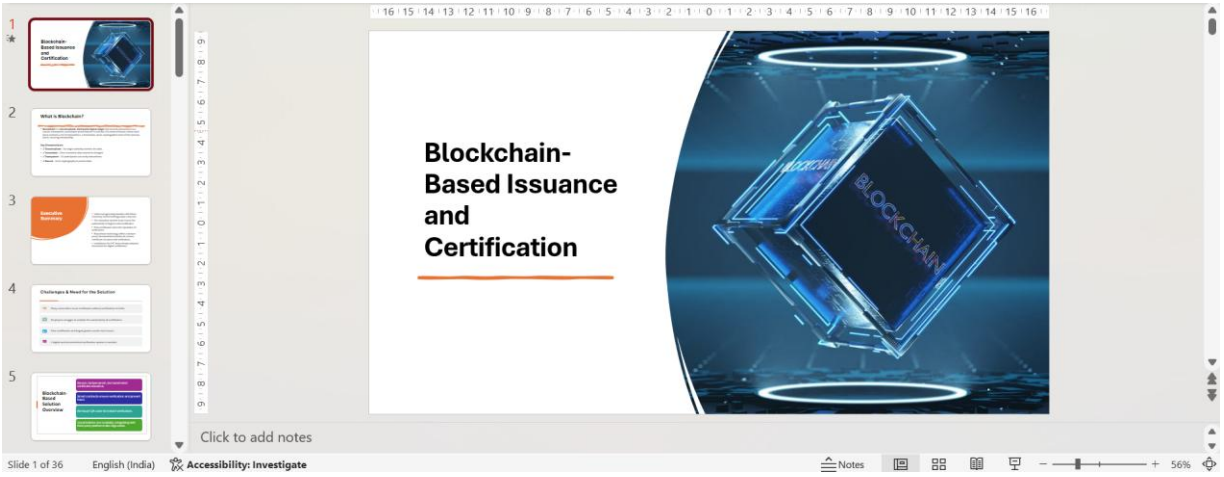
- Problem**:** Fake certificates and manual verification processes.
- Block chain Solution**:**
    - Institutions issue certificates → hashed (using SHA-256) → hash stored on block chain.
    - Actual certificate (PDF) is stored off-chain (IPFS, AWS S3).
    - A QR Code containing transaction details or certificate hash is printed on the certificate.
    - Verifiers scan the QR to retrieve the stored hash and compare it with a fresh hash of the certificate file.
    - If hashes match → certificate is authentic.

Key Components:

- Smart Contracts**:** Used to store and retrieve certificate hashes or verify login credentials.
- SHA (Secure Hash Algorithm)**:** Irreversible function used to generate a fixed-length unique string (hash) from inputs like passwords or certificates.
- Off-Chain Storage**:** Due to block chain storage limitations, documents are stored externally (like IPFS), and only hashes are stored on-chain.
- Consent-Based Data Access**:** Candidates can control who verifies their certificate (important for privacy and GDPR compliance).

Architecture Highlights:

- Frontend**:** React.js or mobile app for user access.
- Backend**:** Node.js or Python backend.
- Block chain Gateway**:** Interfaces between smart contracts and your app.
- API Gateway**:** Secures communication between users and backend.
- Identity Provider: Handles role-based access (issuer, student, verifier).



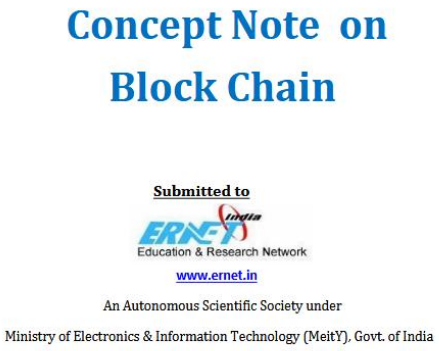


Figure 3.2: Prepared ppt and studied about blockchain presented by ERNET

Task-3: Worked on preparing a detailed Project Report for office at ERNET India

OVERVIEW:

During the 3rd week of my internship at ERNET India**,** I was assigned the task of understanding and analysing the Detailed Project Report (DPR) for the upcoming Data Centre Infrastructure Development at KIADB Hi-Tech Defence and Aerospace Park**,** Devanahalli, Bengaluru. This initiative forms a crucial part of ERNET's mission to establish a highly secured, scalable, and energy-efficient data centre that can serve various national digital initiatives, including Digital India, India-AI, and the National Digital Health Mission.

My role involved in-depth review of the technical, architectural, and infrastructural plans as outlined in the DPR. I collaborated with senior engineers and planning officials to understand the vision and functional requirements of the facility and to break down each proposed building's utility, floor planning, energy provisioning, and zoning criteria.

OBJECTIVE:

The objective of the project is to design and construct a Tier-3 level data centre with support facilities that can host:

- ERNET National Operations Centre (NOC)
- CERT-In's Regional Security Operations
- Managed Cloud Services for Government & Academic Institutions
- Security Solutions (EDUSOC, Incident Response, Disaster Recovery)

The project is designed to be developed in phases, beginning with land allocation and tower-level planning.

SITE LOCATION AND KEY ATTRIBUTES:

- **Total Site Area**: 5 acres (Located in KIADB Aerospace SEZ)
- **Geography**: Flat terrain with 2m slope (West to East)
- **Connectivity**: 12 km from Kempegowda International Airport via road
- **Elevation**: Approximately 920m above sea level

TOWER-WISE PLANNING OVERVIEW:

Tower	Function	Structure Type	Facilities
T1	ERNET + CERT-In Offices	S+G+4	Management offices, meeting rooms, admin support spaces
T2	Data Center + NOC	S+G+4	Server rooms, control rooms, auditorium, BMS, IT hubs, cafeteria, gym
T3	Electrical Substation	G+1	Diesel generators, UPS, transformers, power panels
T4	CSF Security Office & Misc. Utility Block	G+1	Guard rooms, visitor lounge, control office
T5	Residential Quarters for Staff	G+4	20+ Staff living units with dining, laundry, and recreation

FLOOR-WISE FUNCTIONAL ZONING (TOWER 2):

- **Basement**: Parking, HVAC & electrical access areas
- **Ground Floor**: Health centre, 100+ seater auditorium, BMS Room, cafeteria
- **1st & 2nd Floors**: Data halls, Network Operations Centre, server rooms, lab space
- **3rd Floor**: Cafeteria, gymnasium, meeting rooms, rest areas
- **4th Floor**: IT hub, training rooms, lab support units

TECHNICAL SYSTEMS AND INFRASTRUCTURE FEATURES:

Power & Electrical:

- 37,500 kVA DG capacity (with synchronization panels)
- 25,000 kVA UPS backup (N+1 Redundancy)

HVAC & Cooling:

- Total cooling load of 6000 TR with standby 1800 TR
- Precision AC systems in data halls
- Environmental monitoring and energy-efficient zoning

Smart Automation:

- Building Management System (BMS) integrated
- VESDA smoke detection system
- Access control via RFID and biometrics

Sustainability Initiatives:

- Use of high-performance glass, low VOC paints, and green certified materials
- Rainwater harvesting and wastewater recycling

MY KEY CONTRIBUTIONS & LEARNINGS:

- Reviewed and interpreted the DPR blueprints, architectural layouts, and service tower specifications
- Gained practical exposure to data centre compliance standards (Tier-3, green norms)
- Understood zoning strategy, functional segmentation, and integration of critical systems
- Participated in internal briefings where I prepared summarized technical notes on:
    - Power Distribution Topology
    - Floor-wise usage plans
    - Recommendations for scaling in Phases II & III

SUMMARY:

Week 3 provided a unique opportunity to explore the intersection of IT infrastructure and architectural planning**.** I developed a stronger understanding of the groundwork that goes into creating high-availability, mission-critical facilities such as data centres. This experience expanded my appreciation of how software, hardware, and physical infrastructure align to support India’s digital goals.

Detailed Project Report

for

"Development of Data Center at ERNET India's Land at Bengaluru"

Contents

4.7.1 Elevation-1

4.7.2 Elevation-1

5.0 Tentative Cost

5.1 Tentative Construction Cost:

Abstract of Preliminary Estimate:

Sl. No.	Description	Amount in Crore		Total in (Cr)	Remarks
		DSR	MR		
1	Tower-1 Office Building	139.97	4.72	144.69	
2	Tower-2 Data Center	381.08	118.59	499.67	
3	Tower-3 Electrical Sub Station (Structure)	4.05	0.03	4.08	
4	Tower-4 CSF Building	4.07	0.24	4.31	
5	Tower-5 Staff Quarters	9.42	0.16	9.58	
7	**Sub Total (A)**	**538.59**	**123.74**	**662.34**	
8	Add Cost index on DSR 2023 is 116 (116-107/107) = 8.41%	45.30		45.30	
9	**Sub Total**	**583.89**	**123.74**	**707.64**	

Figure 3.3: Overview of the project report

Task-4: Visitor Management Portal

Objective:
To design and develop a secure and automated Visitor Management System (VMS) for ERNET India that:

- Automates visitor check-in/check-out processes
- Ensures data integrity using blockchain
- Enhances security via ML-driven anomaly detection
- Simplifies user experience with OCR-based ID scanning

Work Completed So Far:

- ✅ Conducted requirement analysis and workflow mapping of existing manual process.
- ✅ Designed wireframes and UI layout for the web-based VMS portal.
- ✅ Prepared a detailed Software Requirements Specification (SRS) document outlining:
  - Functional and non-functional requirements
  - System architecture
  - User roles and permissions
  - Data flow diagrams
- ✅ Finalized security and compliance parameters for integration with existing ERNET systems.

Current Task: OCR-Based Visitor Data Capture

- Developing an OCR (Optical Character Recognition) module to automate form filling from scanned ID documents such as Aadhar cards, driving licenses, or employee badges.
- Using Python libraries such as Tesseract, OpenCV to detect, extract, and parse key fields like:
  - Name, ID number
  - Date of Birth
  - Address
  - Photo (for profile verification)
- Ensuring proper **data formatting and validation** before submitting the data to backend.
- Planning integration of scanned data with frontend forms using **React/JavaScript**.

Future Tasks:

- **Frontend Development:**
  - Implement responsive UI using React.js and Tailwind CSS
  - Integrate OCR results into user-facing check-in form
- **Backend Development:**
  - Develop RESTful APIs using Python Flask
  - Integrate blockchain-based logging for tamper-proof visit data storage
  - Use Firebase/Firestore or MongoD**B** for storing visitor metadata
- **Reporting & Analytics Module:**
  - Build real-time dashboards for admin view
  - Use charts.js, Power BI, or Python (Matplotlib) for visual analytics
  - Implement ML algorithms to detect unusual visitor behaviour patterns

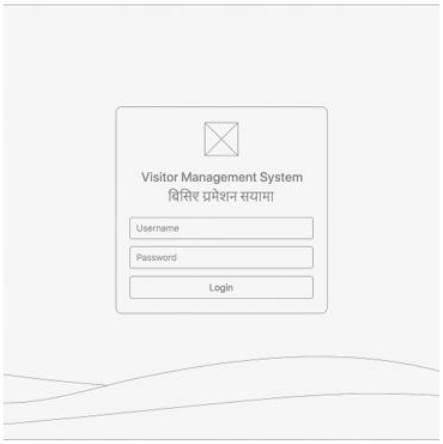
Collaboration & Learning:

- Working closely with senior software engineers to understand secure software design practices.

- Gaining exposure to AI-augmented access control, blockchain frameworks, and OCR automation pipelines.
- Improving practical knowledge of SDLC, requirement analysis, API development, and deployment practices.

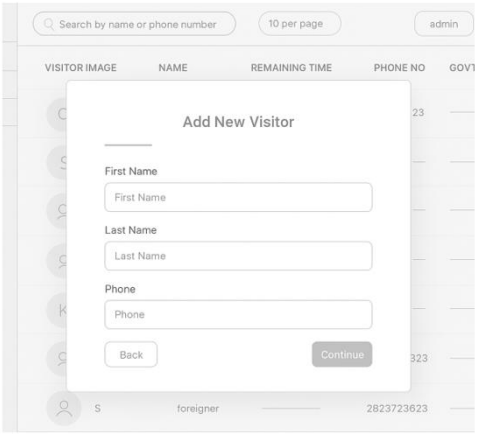
VMS Wireframe

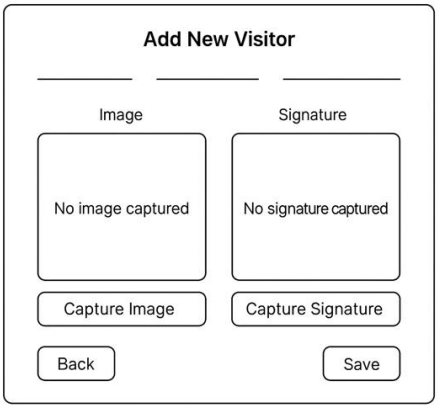
1. Login Page



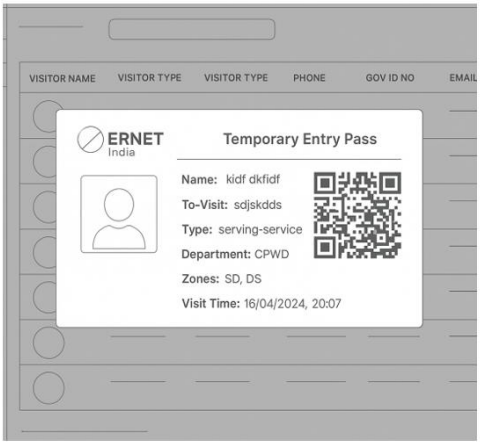
2. Dashboard

3. Manual Visitor Entry

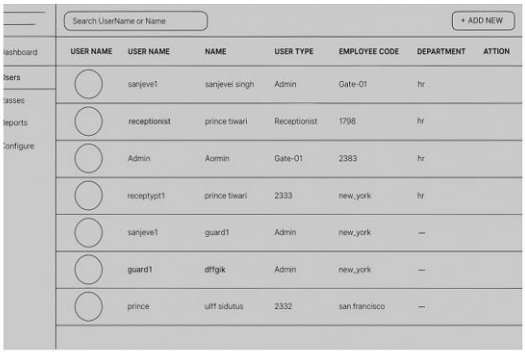




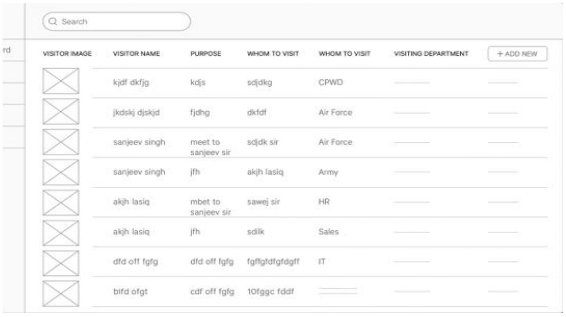
5. Generated Pass



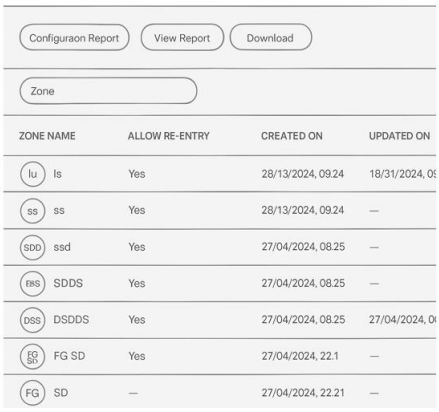
Users Section on Dashboard



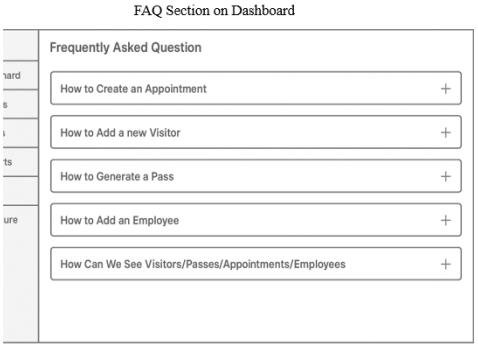
Passes Section on Dashboard



Reports Section on Dashboard



FAQ Section on Dashboard



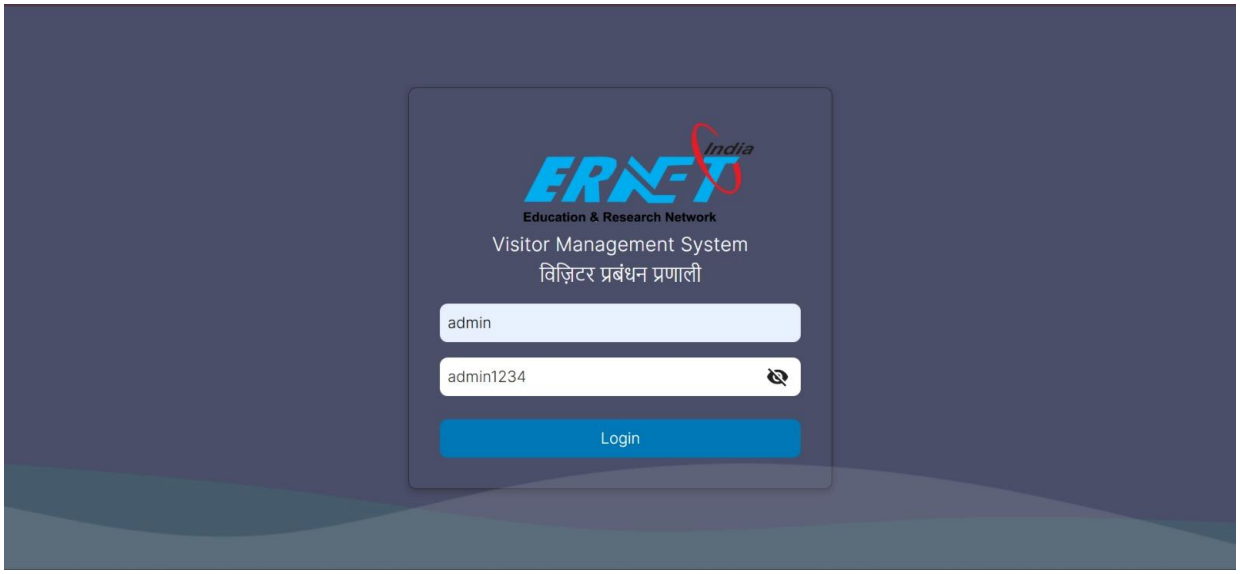


Figure 3.4: Visitor Management System

CHAPTER 4: RESULTS AND DISCUSSION

4.1 RESULTS

During my internship at ERNET India, I was able to achieve the following outcomes:

- **Automation of Data Handling**: Successfully automated the data validation and verification processes for Excel-based workflows using scripting and logical checks. This reduced manual errors and increased data processing efficiency.
- **Enhanced Understanding of Blockchain Integration**: Gained deep insights into blockchain principles and applied them to design a tamper-proof visitor management mechanism. Each visitor's credentials and metadata were proposed to be securely hashed and stored on a private blockchain for enhanced security.
- **Client-Ready Documentation**: Contributed to the preparation of a Detailed Project Report (DPR) that outlined the vision, system architecture, and technical specifications of the Visitor Management System. This document served as a foundation for internal review and future development.
- **Development of a Secure Visitor Management System (VMS)**: Designed initial wireframes and drafted the Software Requirements Specification (SRS) for the VMS. Initiated work on integrating OCR functionality to scan visitor ID cards and auto-fill the form, ensuring faster check-in and minimal manual entry.

4.2 DISCUSSIONS

The internship offered practical exposure to modern development workflows and enhanced my technical and collaborative capabilities:

- **Real-World Implementation**: Applying classroom knowledge to real-world scenarios taught me how to work with real data, identify inefficiencies, and design automated systems to overcome them.
- **Tech Stack Application**: I applied technologies like React, Tailwind CSS, Redux, and JavaScript to design intuitive user interfaces. Backend research helped in understanding how different layers of a system communicate and the importance of secure API design.
- **Team Collaboration**: Working with mentors and cross-functional teams enabled me to better understand organizational goals, manage deadlines, and improve team-based problem-solving skills.
- **Client Feedback Integration**: Regular feedback from mentors and stakeholders taught me the value of iterative development, version control, and adapting to real-time inputs for better output.
- **Security and Innovation Focus**: The integration of blockchain and machine learning into

VMS not only demonstrated innovation but also emphasized the importance of secure and intelligent systems in institutional automation.

CHAPTER 5: CONCLUSION AND FUTURE SCOPE

5.1 CONCLUSION

The internship at **ERNET India** has been a highly enriching experience that enabled me to apply theoretical knowledge to practical challenges. My key contributions involved automating manual workflows, implementing secure data handling techniques, and actively working on the design and development of a **Visitor Management System (VMS)**. I gained substantial exposure to cutting-edge technologies such as **blockchain** for data integrity and **machine learning** for anomaly detection in visitor behaviour. Additionally, I improved my software development lifecycle understanding, from documentation and wireframing to OCR integration and frontend/backend planning. This hands-on experience not only enhanced my technical skills but also improved my ability to collaborate, communicate, and contribute meaningfully in a professional setup.

5.2 FUTURE SCOPE

Looking ahead, the project has significant potential for scalability and advancement:

- **Full-stack Development**: The next phase involves implementing the OCR-enabled visitor form and building the complete frontend and backend architecture for the VMS using modern frameworks and database systems.
- **Blockchain Deployment**: Expanding the blockchain module for real-time check-in/check-out data storage on a private chain to ensure immutability and transparency.
- **Machine Learning Integration**: Integrating ML algorithms for analyzing visitor patterns and flagging anomalies like unauthorized access or repeated suspicious visits.
- **Mobile Compatibility**: Extending the system to mobile platforms to enable on-the-go visitor check-ins and admin control.
- **Government/Institutional Adoption**: With further refinements, the system could serve as a robust model for secure, automated visitor management in government offices, educational institutions, and corporate environments.

CHAPTER-6: REFERENCES

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