Industrial Internship Report on

" Online Education Platform"

Prepared by

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Executive Summary
This report provides details of the Industrial Internship provided by upskill Campus and The IoT Academy in collaboration with Industrial Partner UniConverge Technologies Pvt Ltd (UCT). This internship was focused on a project/problem statement provided by UCT. We had to finish the project including the report in 6 weeks time. My project was Online Education Platform. This internship gave me a very good opportunity to get exposure to Industrial problems and design/implement solution for that. It was an overall great experience to have this internship.

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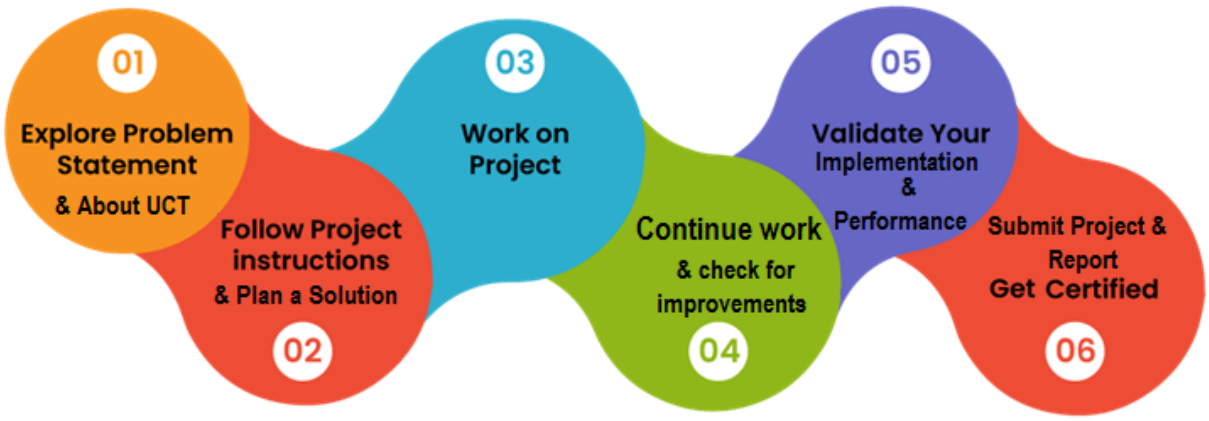
1 Preface

Summary of the whole 6 week's work: Internships in cloud computing provide hands-on experience with cloud platforms and tools, bridging the gap between theory and practice. Interns gain skills in deploying, managing, and optimizing cloud solutions, collaborating with industry professionals. Exposure to real-world projects cultivates technical proficiency and soft skills like communication and adaptability. Internships also keep interns updated on cloud innovations, preparing them for roles like cloud architects and DevOps engineers. This practical learning environment facilitates a smooth transition into the workforce, empowering interns to contribute effectively to organizations leveraging cloud technologies.

Brief Summary of the problem statement: The problem statement entails the development of an online education platform utilizing cloud computing infrastructure such as AWS or Google Cloud. This platform aims to offer students worldwide access to quality education, featuring virtual classrooms, video conferencing, and collaborative tools. The project addresses the rising demand for remote learning solutions and underscores the potential of cloud technology in revolutionizing education delivery



Learnings and overall experience: During my cloud computing internship on an online education platform, I immersed myself in a dynamic learning environment. Collaborating with professionals, I gained hands-on experience in deploying cloud infrastructure and implementing features like virtual classrooms and video conferencing. Working on real-world projects enhanced my technical skills and provided insights into industry best practices.

Message to your juniors and peers: To my juniors and peers in the realm of cloud computing, I urge you to seize every chance for learning and advancement, whether in academic settings or practical applications. Embrace challenges with curiosity and determination, seeking guidance from mentors and peers as you navigate through complexities. Introduction

1.1 About UniConverge Technologies Pvt Ltd

A company established in 2013 and working in Digital Transformation domain and providing Industrial solutions with prime focus on sustainability and RoI.

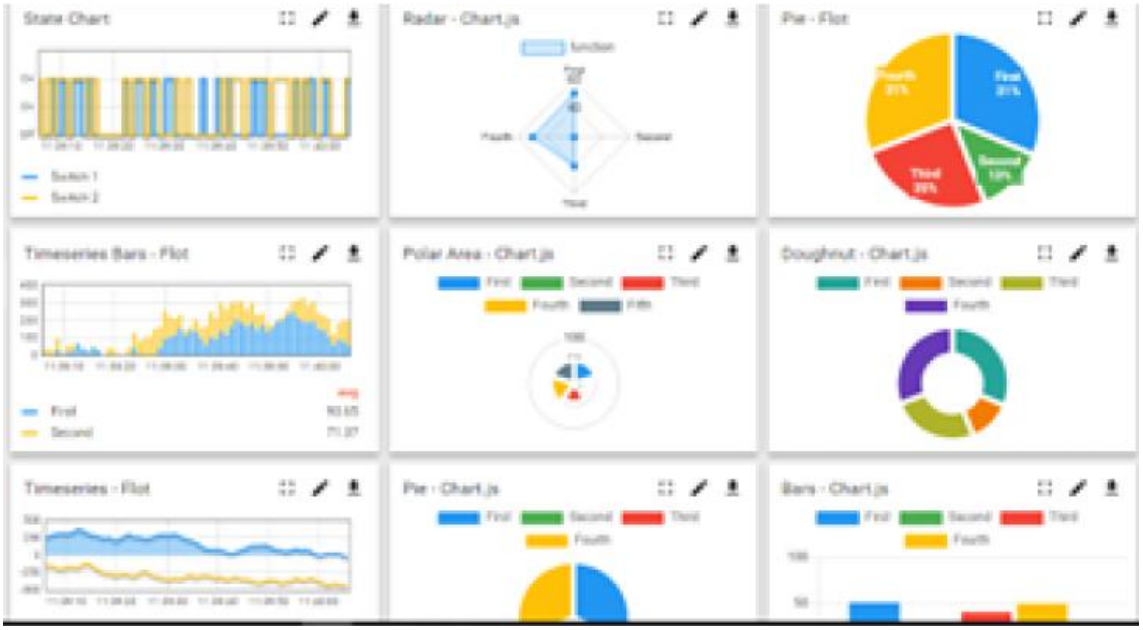
For developing its products and solutions it is leveraging various **Cutting Edge Technologies e.g. Internet of Things (IoT), Cyber Security, Cloud computing (AWS, Azure), Machine Learning, Communication Technologies (4G/5G/LoRaWAN), Java Full Stack, Python, Front end** etc.

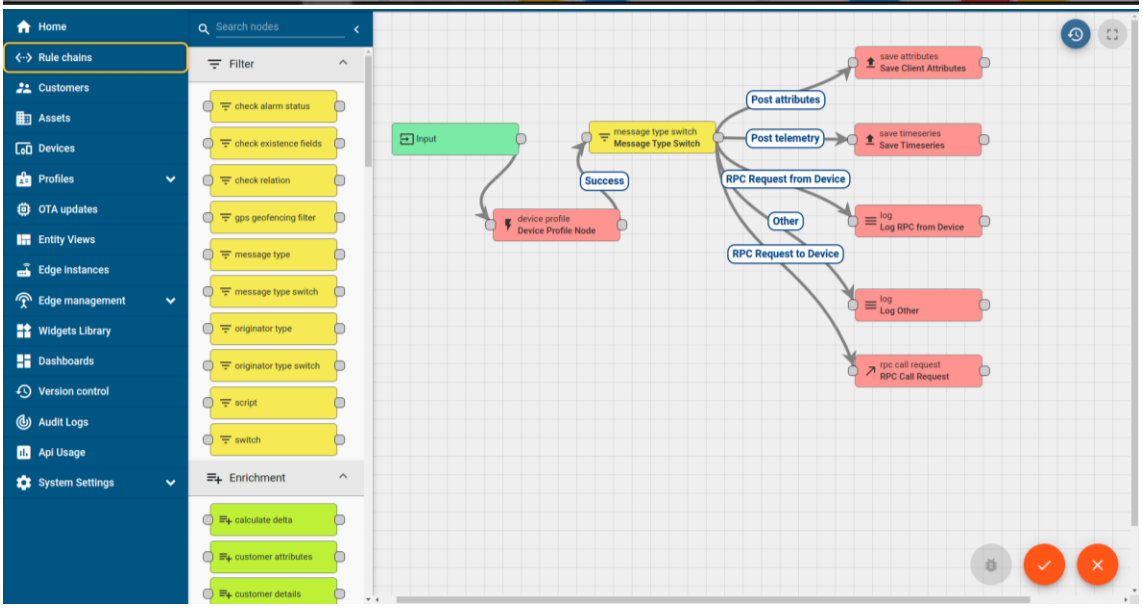
i. UCT IoT Platform (UCT Insight)

UCT Insight is an IOT platform designed for quick deployment of IOT applications on the same time providing valuable "insight" for your process/business. It has been built in Java for backend and ReactJS for Front end. It has support for MySQL and various NoSql Databases.

- It enables device connectivity via industry standard IoT protocols - MQTT, CoAP, HTTP, Modbus TCP, OPC UA
- It supports both cloud and on-premises deployments.

It has features to
• Build Your own dashboard
• Analytics and Reporting
• Alert and Notification
• Integration with third party application(Power BI, SAP, ERP)
• Rule Engine


State Chart
Radar - Chart.js
Pie - Plot
Timeseries Bars - Plot
Polar Area - Chart.js
Doughnut - Chart.js
Timeseries - Plot
Pie - Chart.js
Bars - Chart.js


Home
Rule chains
Customers
Assets
Devices
Profiles
OTA updates
Entity Views
Edge instances
Edge management
Widgets Library
Dashboards
Version control
Audit Logs
Api Usage
System Settings
Search nodes
Filter
check alarm status
check existence fields
check relation
gps geofencing filter
message type
message type switch
originator type
originator type switch
script
switch
Enrichment
calculate delta
customer attributes
customer details
Input
message type switch
Message Type Switch
Success
device profile
Device Profile Node
Post attributes
Post telemetry
RPC Request from Device
Other
RPC Request to Device
save attributes
Save Client Attributes
save timeseries
Save Timeseries
log
Log RPC from Device
log
Log Other
rpc call request
RPC Call Request

ii. Smart Factory Platform (FACTORY WATCH)

Factory watch is a platform for smart factory needs.

It provides Users/ Factory

- with a scalable solution for their Production and asset monitoring
- OEE and predictive maintenance solution scaling up to digital twin for your assets.
- to unleased the true potential of the data that their machines are generating and helps to identify the KPIs and also improve them.
- A modular architecture that allows users to choose the service that they what to start and then can scale to more complex solutions as per their demands.

Its unique SaaS model helps users to save time, cost and money.

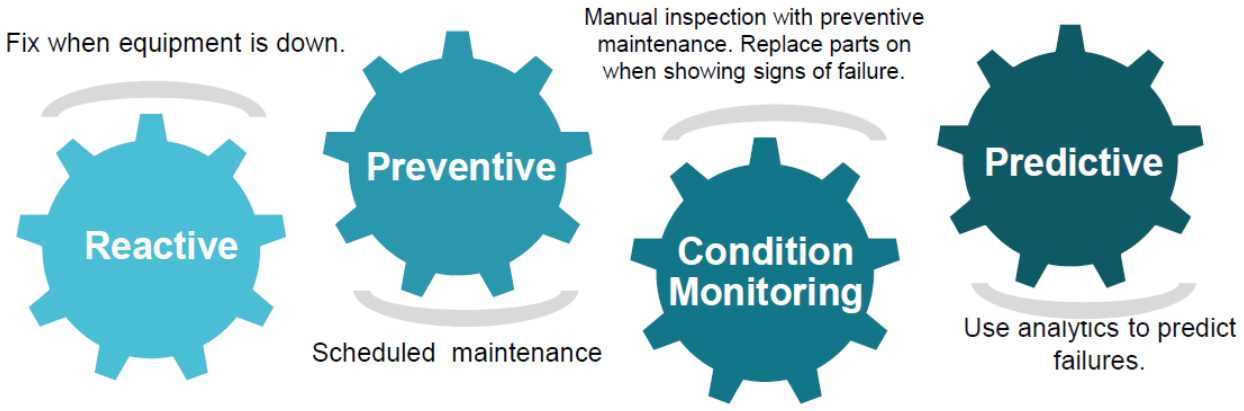
Machine	Operator	Work Order ID	Job ID	Job Performance	Job Progress		Output		Rejection	Time (mins)				Job Status	End Customer
					Start Time	End Time	Planned	Actual		Setup	Pred	Downtime	Idle		
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i
CNC_S7_81	Operator 1	WO0405200001	4168	58%	10:30 AM		55	41	0	80	215	0	45	In Progress	i

iii. LoRaWAN based Solution

UCT is one of the early adopters of LoRAWAN teschnology and providing solution in Agritech, Smart cities, Industrial Monitoring, Smart Street Light, Smart Water/ Gas/ Electricity metering solutions etc.

iv. Predictive Maintenance

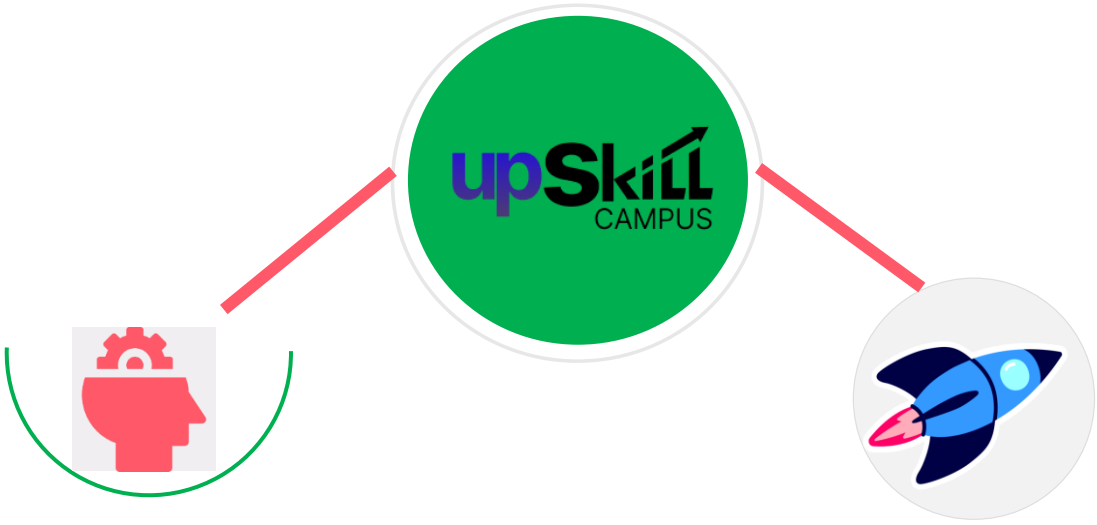
UCT is providing Industrial Machine health monitoring and Predictive maintenance solution leveraging Embedded system, Industrial IoT and Machine Learning Technologies by finding Remaining useful life time of various Machines used in production process.



2.2 About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.

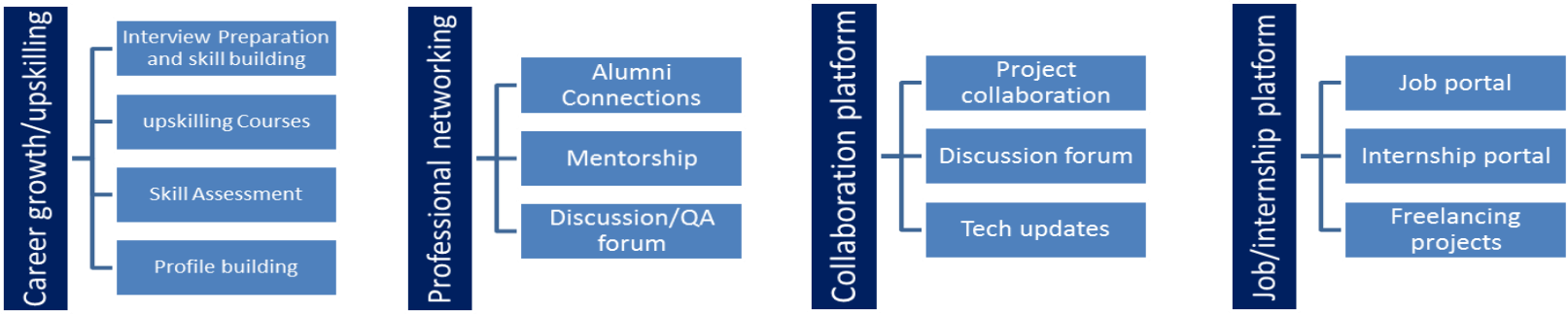
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.



Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

upSkill Campus aiming to upskill 1 million learners in next 5 year

https://www.upskillcampus.com/



The IoT Academy

The IoT academy is EdTech Division of UCT that is running long executive certification programs in collaboration with EICT Academy, IITK, IITR and IITG in multiple domains.

2.3 Objectives of this Internship program

The objective for this internship program was to

- ☛ get practical experience of working in the industry.
- ☛ to solve real world problems.
- ☛ to have improved job prospects.
- ☛ to have Improved understanding of our field and its applications.
- ☛ to have Personal growth like better communication and problem solving.

2.4 Reference

[1] https://docs.aws.amazon.com/

[2] https://www.docker.com/

[3] https://www.w3schools.com/

2.5 Glossary

Terms	Acronym
Cloud Computing	CC
Internet of Things	IOT
Virtual Machine	VM
Software as a Service	SaaS
Platform as a Service	PaaS
Infrastructure as a Service	IaaS
Relational Database Service	RDS
Learning Management System	LMS

3 Problem Statement

The Online Education Platform project stands as a beacon of innovation in the realm of cloud computing, poised to democratize education by providing students worldwide with seamless access to high-quality learning resources. Built upon the robust infrastructure offered by platforms like AWS or Google Cloud, this project encompasses a plethora of features aimed at fostering a conducive virtual learning environment.

From virtual classrooms to video conferencing capabilities and collaboration tools, the platform is designed to transcend geographical boundaries and revolutionize traditional education paradigms. To embark on this transformative journey, meticulous planning and execution are paramount. The first step entails designing the platform's architecture and workflow, a process that demands careful consideration of various factors such as security, scalability, and performance optimization.

Architects must devise a comprehensive strategy for implementing robust security measures to safeguard sensitive data and ensure compliance with regulatory standards. Additionally, they must address the intricacies of role-based access control to delineate user permissions effectively. Furthermore, the architecture must incorporate mechanisms for monitoring resources to track performance metrics, identify potential bottlenecks, and optimize resource allocation. Load balancing mechanisms are also imperative to ensure seamless performance, especially during peak usage periods. Moreover, architects must devise strategies to design the application infrastructure for both local and global deployment scenarios, taking into account factors like latency, data sovereignty, and regulatory compliance.

Collaboration among teams is vital to the success of such a multifaceted project. By forming groups of 4-5 candidates, synergies can be leveraged to accelerate development processes, foster knowledge sharing, and enhance overall productivity. Collaboration tools like Git enable seamless code management and version control, ensuring that all team members are aligned and working towards a common goal. In addition to effective collaboration, the project necessitates proficiency in a range of essential tools and technologies.

Kubernetes, an open-source container orchestration platform, plays a pivotal role in managing containerized applications, automating deployment, scaling, and operations. Jenkins, a popular automation server, facilitates continuous integration and continuous deployment (CI/CD) pipelines, streamlining the software development lifecycle. Moreover, Docker containers provide a lightweight and portable solution for packaging applications and their dependencies, enabling consistent deployment across diverse environments. Git serves as the cornerstone of collaborative development, enabling version control and efficient code management. Mastery of these tools empowers teams to navigate the complexities of cloud-based development with confidence and agility.

Furthermore, the project encourages the judicious use of cloud-native services like scheduling services, Lambda functions, ECS (Elastic Container Service), and EKS (Elastic Kubernetes Service). These services, available within the free tier of the chosen cloud environment, offer opportunities for enhancing application performance and optimizing costs. However, it is imperative to justify their usage based on tangible benefits such as improved scalability, reliability, or cost savings.

In conclusion, the Online Education Platform project epitomizes the transformative potential of cloud computing in the field of education. Through meticulous planning, effective collaboration, and proficiency in essential tools and technologies, teams can create a robust and scalable platform that transcends geographical barriers and empowers learners worldwide. By adhering to best practices and leveraging cloud-native services judiciously, this project has the power to shape the future of education, making high-quality learning accessible to all.

4 Existing and Proposed solution

Proposed Solution: We outline a comprehensive strategy for developing the Online Education Platform, leveraging cloud computing technologies to create a scalable, secure, and user-centric learning environment. The proposed solution encompasses architectural design, technology stack selection, implementation strategies, and considerations for scalability, security, and cost-effectiveness.

Architecture Design: The proposed solution adopts a microservices architecture, leveraging Kubernetes for container orchestration and Docker for containerization. This approach enables modular development, scalability, and fault tolerance. The architecture consists of distinct components such as user management, content delivery, virtual classrooms, and collaboration tools, each deployed as independent microservices. By decoupling components, we ensure flexibility, maintainability, and efficient resource utilization.

Technology Stack Selection: The chosen technology stack comprises industry-standard tools and frameworks, ensuring compatibility, reliability, and community support. Key components include Kubernetes for container orchestration, Jenkins for continuous integration and deployment, Docker for containerization, and Git for version control. Additionally, cloud-native services like AWS Lambda, ECS, and EKS are utilized judiciously to enhance scalability, reliability, and cost-effectiveness.

Implementation Strategies: The implementation strategy emphasizes iterative development, following Agile methodologies to deliver incremental features and iterate based on user feedback. Cross-functional teams collaborate closely, leveraging Git for version control and Jenkins for automated testing and deployment. Continuous integration and continuous deployment pipelines streamline the development lifecycle, ensuring rapid iteration and delivery of high-quality features.

Scalability Considerations: Scalability is a critical aspect of the proposed solution, ensuring seamless performance under varying workloads. Kubernetes facilitates auto-scaling of application instances based on demand, dynamically provisioning resources to accommodate traffic spikes. Additionally, microservices architecture enables horizontal scaling, allowing individual components to scale independently based on their resource requirements. Load balancing mechanisms further optimize resource utilization and ensure high availability.

Security Measures: Security is paramount in the design of the Online Education Platform. Robust authentication and authorization mechanisms are implemented to ensure secure access to resources. Role-based access control (RBAC) is employed to enforce granular access permissions, safeguarding sensitive data and mitigating the risk of unauthorized access. Encryption protocols are utilized to secure data transmission, protecting user privacy and confidentiality.

Cost-Effectiveness: The proposed solution emphasizes cost-effectiveness, leveraging cloud-native services and optimization strategies to minimize operational expenses. By utilizing AWS Lambda, ECS, and EKS within the free tier limits, we mitigate infrastructure costs while maximizing scalability and reliability. Moreover, efficient resource allocation and utilization strategies help optimize cloud spending, ensuring cost-effectiveness without compromising performance or reliability. In summary, the proposed solution for the Online Education Platform combines architectural design, technology stack selection, implementation strategies, scalability considerations, security measures, and cost-effectiveness to create a robust, scalable, and user-centric learning environment. By leveraging cloud computing technologies and adhering to best practices, we aim to deliver a transformative platform that empowers learners worldwide.

Value Addition: We highlight the unique contributions and benefits offered by the proposed solution. These include enhanced scalability, security, and cost-effectiveness achieved through cloud-native technologies. Additionally, the microservices architecture enables modular development, rapid iteration, and fault tolerance. Integration with industry-standard tools like Kubernetes, Jenkins, and Docker ensures compatibility, reliability, and streamlined development processes. Moreover, the emphasis on user-centric design and iterative development methodologies ensures a seamless learning experience for students worldwide. Overall, the proposed solution adds value by delivering a scalable, secure, and cost-effective online education platform that empowers learners and educators alike.

4.1 Code submission (Github link)

https://github.com/Adityathere/upskillcampus/tree/main/Code

4.2 Report submission (Github link) :

https://github.com/Adityathere/upskillcampus/blob/main/OnlineEducationPlatform_Aditya_USC_UCT.pdf

5 Proposed Design/ Model

We delineate the blueprint for the Online Education Platform, aimed at creating a scalable, resilient, and user-centric learning environment. Embracing a microservices architecture, the platform is designed to break down complex functionalities into smaller, independent services. This modular approach enhances flexibility, facilitates easier maintenance, and allows for seamless integration of new features. Key components of the platform architecture include user management, content delivery, virtual classrooms, and collaboration tools, each encapsulated within its own microservice. This compartmentalization enables teams to work on different components simultaneously, speeding up development cycles and fostering innovation.

At the heart of the architecture lies Kubernetes, a powerful container orchestration tool that automates deployment, scaling, and management of application containers. Docker containers are utilized for packaging and deploying application components, ensuring consistency across different environments and simplifying deployment processes.

Scalability is a core consideration in the architectural design, with mechanisms like load balancing and auto-scaling ensuring optimal performance even under varying workloads. Security measures are also integrated into the architecture, with robust authentication and authorization mechanisms protecting sensitive data and mitigating potential security threats.

Furthermore, the architecture is designed with compatibility in mind, leveraging industry-standard tools and frameworks such as Jenkins for continuous integration and deployment, Git for version control, and cloud-native services like AWS Lambda, ECS, and EKS for enhanced scalability and reliability. Overall, the architectural design of the Online Education Platform prioritizes modularity, scalability, security, and compatibility, laying a solid foundation for the development of a robust and resilient platform that meets the diverse needs of learners and educators alike.

5.1 High Level Diagram (if applicable)

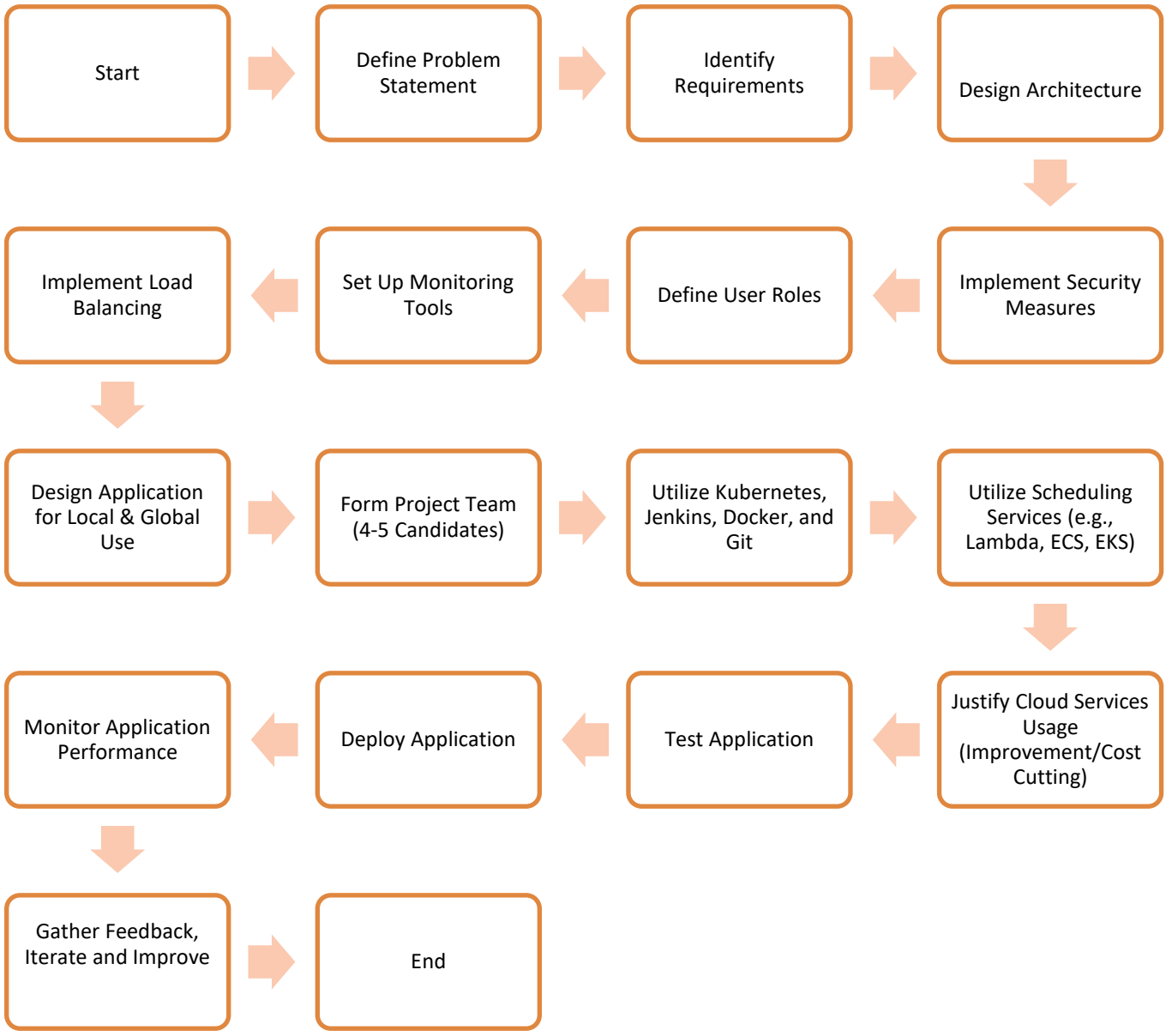
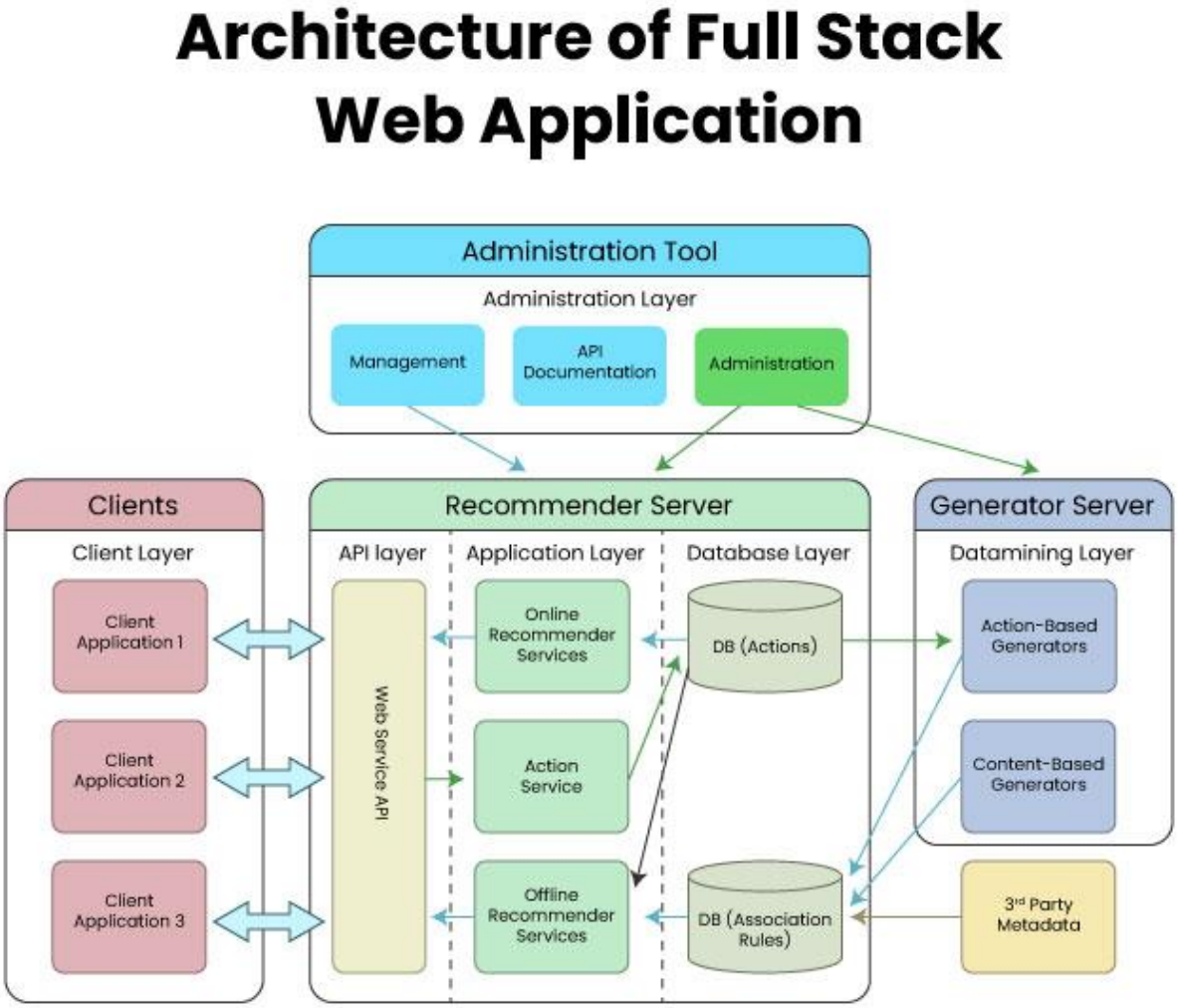


Figure 1: HIGH LEVEL DIAGRAM OF THE SYSTEM

5.2 Low Level Diagram (if applicable)



6 Performance Test

We assess the platform's ability to handle varying workloads and maintain optimal performance under stress conditions. Through rigorous testing, we evaluate key performance metrics such as response times, throughput, and resource utilization to identify potential bottlenecks and areas for optimization.

Performance testing scenarios include simulating concurrent user interactions, content delivery under peak loads, and scalability tests to measure the platform's ability to scale seamlessly with increasing demand. Load testing tools like Apache JMeter or Gatling are utilized to simulate realistic user behavior and stress test the system under different load levels.

Additionally, we conduct stress testing to determine the platform's resilience under extreme conditions, ensuring it can withstand unexpected spikes in traffic without degradation in performance. Performance metrics are monitored and analyzed using monitoring tools like Prometheus and Grafana to gain insights into system behavior and identify performance degradation patterns.

Overall, the Performance Test section aims to validate the platform's scalability, reliability, and responsiveness under varying workloads, ensuring it delivers a seamless learning experience for users.

6.1 Test Plan/ Test Cases

The Test Plan outlines the approach, objectives, and scope of testing activities. Test cases are designed to validate functional requirements, ensuring each feature performs as expected. Test scenarios cover user authentication, content delivery, virtual classroom functionalities, and collaboration tools. Additionally, edge cases and boundary conditions are considered to ensure comprehensive test coverage.

6.2 Test Procedure

The Test Procedure involves executing predefined test cases and scenarios outlined in the Test Plan. Test scripts are executed using automated testing frameworks like Selenium or Cypress. Test results are logged and analyzed for discrepancies or deviations from expected behavior. Any issues identified are reported, tracked, and resolved through collaboration with development teams.

6.3 Performance Outcome

The Performance Outcome section summarizes the findings of performance testing activities. Key performance metrics, including response times, throughput, and resource utilization, are evaluated against predefined thresholds. Overall, the platform demonstrates scalability, reliability, and responsiveness under varying workloads. Recommendations for optimization are provided to enhance performance and ensure a seamless learning experience for users.

7 My learnings

During the internship, I immersed myself in a dynamic learning environment, where I had the opportunity to apply theoretical knowledge to real-world challenges. Engaging in hands-on projects, I honed my technical skills in cloud computing, mastering tools like Kubernetes, Jenkins, Docker, and Git. Through collaborative efforts within multidisciplinary teams, I gained insights into industry best practices and learned to navigate complex development processes effectively.

Moreover, the internship provided a platform for continuous learning and experimentation. By embracing Agile methodologies and iterative development approaches, I cultivated a mindset of adaptability and resilience, embracing challenges as opportunities for growth. Collaborating with experienced professionals, I expanded my understanding of cloud-native architectures, performance testing methodologies, and deployment strategies, equipping me with valuable insights into the nuances of cloud computing.

Furthermore, the internship experience fostered the development of soft skills such as communication, teamwork, and problem-solving. Engaging in cross-functional collaboration, I learned to effectively communicate ideas, collaborate with diverse teams, and navigate interpersonal dynamics. Moreover, I honed my ability to analyze complex problems, devise innovative solutions, and adapt to evolving project requirements, enhancing my overall problem-solving capabilities.

Reflecting on my learning journey, I recognize the significance of continuous improvement and lifelong learning. The internship experience served as a catalyst for personal and professional growth, empowering me to embrace challenges with confidence and curiosity. Moving forward, I am committed to further expanding my knowledge and expertise in cloud computing, leveraging newfound skills to drive innovation and make meaningful contributions to the field.

In conclusion, the internship experience has been invaluable in shaping my learning journey, providing me with the opportunity to acquire technical skills, foster soft skills, and gain insights into industry best practices. As I embark on the next phase of my career, I am grateful for the lessons learned and the growth achieved during this transformative experience. I am confident that the knowledge and skills gained will serve as a solid foundation for future endeavors, propelling me towards success in the dynamic and ever-evolving field of cloud computing.

8 Future work scope

We explore potential avenues for further development, innovation, and expansion of the Online Education Platform, leveraging emerging technologies, market trends, and user feedback to drive continuous improvement and enhance the platform's impact.

One of the key areas for future exploration is the integration of artificial intelligence (AI) and machine learning (ML) technologies to personalize learning experiences and provide intelligent recommendations. By leveraging data analytics and predictive algorithms, the platform can analyze user behavior, preferences, and learning patterns to deliver tailored content and adaptive learning pathways. Additionally, natural language processing (NLP) capabilities can be utilized to facilitate interactive learning experiences, including chatbots for student support and automated grading systems for assessments.

Furthermore, the integration of virtual reality (VR) and augmented reality (AR) technologies presents exciting opportunities to create immersive and interactive learning environments. By enabling virtual simulations, virtual field trips, and interactive 3D models, these technologies can enhance engagement, facilitate experiential learning, and bring abstract concepts to life. Moreover, VR-based collaboration tools can foster teamwork and communication skills among students, transcending geographical barriers and fostering a sense of community in online education.

Another area of future expansion is the incorporation of blockchain technology to enhance security, transparency, and credential verification in online education. Blockchain-based solutions can facilitate secure and tamper-proof record-keeping of academic achievements, certifications, and credentials, ensuring authenticity and integrity in credential verification processes. Moreover, blockchain-powered decentralized learning platforms can empower learners with greater control over their data and credentials, enabling lifelong learning and skill validation across diverse educational contexts.

Additionally, continuous refinement of the platform's user interface (UI) and user experience (UX) is essential to ensure intuitive navigation, accessibility, and engagement. User feedback mechanisms, usability testing, and iterative design processes can inform UI/UX enhancements, ensuring the platform remains user-centric and responsive to evolving user needs and preferences. Furthermore, strategic partnerships with educational institutions, content providers, and technology vendors can facilitate the expansion of course offerings, access to premium content, and integration of cutting-edge tools and resources. By fostering collaborations and ecosystem partnerships, the platform can enhance its value proposition, expand its reach, and solidify its position as a leading online education provider.

In conclusion, the Future Scope section outlines a roadmap for ongoing innovation, growth, and expansion of the Online Education Platform. By embracing emerging technologies, responding to user feedback, and fostering strategic collaborations, the platform can continue to evolve and adapt to the changing landscape of online education, empowering learners worldwide with access to high-quality, personalized learning experiences.