TRIBHUVAN UNIVERSITY
INSTITUTE OF SCIENCE AND TECHNOLOGY
CENTRAL CAMPUS OF TECHNOLOGY (CCT), HATTISAR, DHARAN

A Internship Report On

DEVOPS

Submitted To:
DEPARTMENT OF IT
CENTRAL CAMPUS OF TECHNOLOGY (CCT), HATTISAR, DHARAN, SUNSARI, KOSHI, NEPAL

In partial fulfilment of the requirements for the degree of Bachelor's of Science in Computer Science and Information Technology (B.Sc. CSIT)

Submitted By:
ROHAN KHANAL [29604/078]

TU Registration No : 5-2-8-148-2021

Under the Supervision of:
¡Supervisor's Name¿

Bhadra, 2082

INTERNSHIP CERTIFICATION

GENESE SOLUTION PVT. LTD.
Reg No: 212937/075/076

February 13, 2026

TO WHOM IT MAY CONCERN

This is to certify that Mr. Rohan Khanal has completed his internship as Intern | DevOps from November 10, 2025, to February 2, 2026 at Genese Solution Pvt. Ltd.

During the period of internship, Mr. Khanal was found to be very hardworking and committed towards projects and tasks assigned to him. He showed strong capability to complete tasks on time. He is very enthusiastic to learn new things and implement new ideas. He is strong on time management with good communication as well as technical skills. Moreover, he has achieved a lot during his internship period.

We wish him all the best for his future endeavors. If you have any further questions with regards to his background, please do not hesitate to contact us.

Bishrant Katwal
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SUPERVISOR RECOMMENDATION

This is to recommend that **ROHAN KHANAL [29604/078]** has carried out Internship on the position of "**DEVOPS**" in partial fulfilment of the requirements for the degree of Bachelor of Science (B.Sc.) degree in CSIT under my supervision in the Department of Information Technology, Central Campus of Technology, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal.

To my knowledge, this work has not been submitted for any other degree. The students have fulfilled all the requirements laid down by the Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal for the submission of the project work for the partial fulfillment of Bachelor of Science (B.Sc.) degree in CSIT

Mr. Prakash Neupane
Supervisor
Department of IT
Central Campus of Technology
Hattisar, Dharan, Sunsari, Koshi, Nepal

CERTIFICATE OF APPROVAL

This is to certify that the internship report entitled "**DEVOPS** ", submitted by **Mr. ROHAN KHANAL [29604/078]**, a student enrolled in the Bachelor of Science (B.Sc.) degree in CSIT at the Central Campus of Technology, Dharan, has been examined and approved by the undersigned.

The report has been evaluated based on its relevance to the internship experience, presentation of facts, adherence to prescribed guidelines, and overall quality. It has been found to meet the standards set by Tribhuvan University for the partial fulfillment of the requirements for the bachelor's degree.

Mr. Prakash Neupane
Supervisor
Department of IT
Central Campus of Technology
IOST, Tribhuvan University

Mr. Balabhadra Bhandari
Program Director
Department of IT
Central Campus of Technology
IOST, Tribhuvan University

Mr. Pradip Khatiwada
External Examiner
Mechi Multiple Campus
IOST, Tribhuvan University

DECLARATION

This internship report, entitled "**DEVOPS**", is being submitted to the Department of IT, Central Campus of Technology, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal, for the partial fulfillment of the requirements for the Bachelor of Science (B.Sc.) degree in CSIT. This project has been carried out by us under the supervision of Prakash Neupane, T.U., Department of IT, Central Campus of Technology, Institute of Science and Technology (IoST), Tribhuvan University (T.U.), Nepal.

We hereby declare that this work is original and has not been submitted earlier, in part or in full, to this or any other university or institution, here or elsewhere, for the award of any degree.

ROHAN KHANAL [29604/078]
Department of IT
Central Campus of Technology
Hattisar, Dharan, Sunsari, Koshi, Nepal

ACKNOWLEDGEMENT

First and foremost, I would like to express my sincere gratitude to **GENESE Solutions Pvt. Ltd.** for providing me with the opportunity to undertake my internship as a **Cloud and DevOps Engineer**. This internship provided valuable industry exposure and practical experience, allowing me to strengthen my technical knowledge and professional skills in a real-world working environment.

I am deeply grateful to my mentor, **Mr. Desh Deepak Dhobi**, for his continuous guidance, technical support, and encouragement throughout the internship period. His mentorship played a vital role in enhancing my understanding of cloud and DevOps practices.

I would also like to extend my sincere thanks to my supervisor, **Mr. Prakash Neupane**, for his support, constructive feedback, and supervision during the internship. His guidance greatly contributed to the successful completion of my assigned tasks and projects.

Furthermore, I would like to thank the faculty members of the **Department of Computer Science and Information Technology**, **Institute of Science and Technology (IoST)**, **Tribhuvan University**, for their academic guidance and support throughout my studies.

I am thankful to my colleagues, friends, and fellow students for their encouragement and support during this internship. I am also sincerely grateful to my family for their unwavering support and motivation throughout this journey.

Finally, I would like to thank everyone who directly or indirectly contributed to making this internship a valuable and enriching learning experience.

Thank you.

ROHAN KHANAL [29604/078]

ABSTRACT

This report presents the work carried out during the internship as a **Cloud and DevOps Engineer** at **GENESE Solutions Pvt. Ltd.**. The internship was conducted with the objective of gaining practical exposure to cloud computing, system administration, and DevOps practices in an industry environment.

During the internship period, various cloud technologies and tools were studied and implemented, primarily using Amazon Web Services (AWS). Major activities included system monitoring using CloudWatch, secure access management using IAM and RDS IAM authentication, and infrastructure maintenance through AWS Systems Manager Patch Manager. The internship also involved automation of deployment workflows by designing and implementing a CI/CD pipeline for a Lambda monorepo using AWS SAM.

In addition, tasks related to email systems, website testing, and operational support were performed. These included conducting a proof of concept for an SMTP server, resolving email rendering issues, and implementing features related to DKIM management. Research on web application security using AWS WAF was also carried out.

Overall, the internship provided practical knowledge of cloud infrastructure, DevOps automation, and operational best practices, helping to bridge the gap between academic learning and real-world application.

Keywords: Cloud Computing, DevOps, AWS, CI/CD, Monitoring, Security.

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CHAPTER 1
INTRODUCTION

1.1. Introduction

In recent years, the software development industry has undergone a major transformation with the emergence of DevOps practices and Cloud Computing technologies. Traditional software development methodologies often separated development and operations teams, resulting in slow delivery cycles, frequent deployment failures, infrastructure inconsistencies, and limited scalability. To address these challenges, DevOps has emerged as a cultural and technical movement that integrates development (Dev) and operations (Ops) into a unified workflow, promoting automation, collaboration, continuous integration, and continuous delivery. [1]

DevOps is not merely a toolset but a philosophy that emphasizes automation, monitoring, version control, infrastructure as code (IaC), containerization, and cloud-based deployment. Combined with cloud computing platforms such as Amazon Web Services (AWS), DevOps enables organizations to build scalable, resilient, and highly available systems with faster release cycles and improved reliability. [2]

During my internship at Genese Solution Pvt. Ltd., Lalitpur, Nepal, I worked as a Cloud and DevOps Engineering Intern, where I gained hands-on experience in implementing DevOps practices within real-world production environments. The organization specializes in cloud-based infrastructure solutions, automation, and scalable system design. Throughout the internship period, I was actively involved in designing and implementing CI/CD pipelines, managing AWS resources, automating deployment processes using AWS SAM (Serverless Application Model), configuring IAM roles and policies, and working with services such as AWS Lambda, CodeBuild, CodePipeline, S3, CloudFormation, EventBridge, and CloudWatch.

One of the major projects I contributed to involved a serverless architecture using AWS Lambda in a monorepo structure, where multiple independent Lambda functions shared common layers. The deployment was automated through CodePipeline and CodeBuild, enabling efficient version control and environment-based deployment (Development, Staging, Production). This experience provided deep practical exposure to infrastructure automation, cloud security, monitoring, and performance optimization.

This internship bridged the gap between academic learning and industry practices. It enhanced my understanding of distributed systems, cloud-native architectures, DevOps lifecycle, security best practices, and automation techniques required for modern software delivery.

1.2. Problem Statement

In traditional software development environments, several critical challenges exist:

- Manual deployment processes leading to human errors
- Lack of standardized infrastructure configuration
- Poor collaboration between development and operations teams
- Inconsistent environments (development vs. production mismatch)
- Slow release cycles
- Difficulty in scaling applications
- Limited monitoring and observability

Organizations aiming to build cloud-based applications often struggle with:

- Automating deployments efficiently
- Managing infrastructure securely
- Maintaining environment consistency
- Implementing continuous integration and continuous deployment (CI/CD)
- Managing multiple microservices or serverless functions efficiently
- Ensuring security and least-privilege access using IAM policies

Specifically, in serverless monorepo architectures, challenges arise in:

- Handling shared dependencies (common layers)
- Triggering selective deployments
- Avoiding unnecessary rebuilds
- Maintaining version control for multiple Lambda functions
- Ensuring proper role-based access control
- Managing S3 artifacts and CloudFormation packaging

Therefore, there was a need to design and implement a structured DevOps workflow that would:

- Automate build, package, and deployment processes
- Enable scalable serverless architecture
- Reduce manual intervention
- Improve deployment reliability
- Enforce security best practices
- Optimize cloud resource usage

1.3. Objectives

To understand and implement DevOps practices using cloud technologies in a production-level environment.

1.4. Scope and Limitation

Scope The scope of this internship primarily covered:

- Implementation of DevOps practices in cloud-based environments
- Serverless architecture design using AWS Lambda
- CI/CD pipeline development
- Infrastructure as Code using AWS SAM and CloudFormation
- Cloud security configuration using IAM
- S3 artifact management
- Monitoring and logging setup
- Automation of multi-environment deployments
- Version control integration with Git repositories

The internship provided exposure to real-time production systems and enterprise-level deployment strategies. The practical implementation helped understand how scalable and reliable cloud architectures are built in modern organizations.

Furthermore, the internship experience is highly relevant to academic subjects such as:

- Distributed Systems

- Cloud Computing
- Operating Systems
- Database Systems
- Software Engineering
- Computer Networks

Limitation Despite the extensive exposure, certain limitations were present:

- Limited access to confidential production data
- Restricted IAM permissions due to security policies
- Time-bound internship duration (12 weeks)
- Dependency on organizational infrastructure decisions
- Limited exposure to on-premises DevOps environments
- Focus primarily on AWS (not multi-cloud platforms)

Additionally, some enterprise-level configurations (e.g., advanced security compliance, cost governance strategies, and enterprise networking design) were outside the scope of the internship.

1.5. Report Organization

This internship report is organized into multiple chapters to systematically present the learning experience and technical contributions made during the internship.

- **Chapter 1: Introduction**
  Provides background, objectives, problem statement, scope, and structure of the report.
- **Chapter 2: Organization Overview**
  Describes Genese Solution Pvt. Ltd., its services, working environment, and organizational structure.
- **Chapter 3: Literature Review / Background Study**
  Covers theoretical concepts related to DevOps, CI/CD, Cloud Computing, AWS services, Infrastructure as Code, and Serverless Architecture.
- **Chapter 4: Methodology and Tools Used**
  Explains the technologies, tools, and workflow implemented during the internship.

- **Chapter 5: System Design and Implementation**
  Describes the architecture, CI/CD pipelines, serverless deployment structure, IAM configuration, and automation strategies.
- **Chapter 6: Results and Discussion**
  Analyzes implementation outcomes, performance improvements, challenges faced, and solutions applied.
- **Chapter 7: Conclusion and Future Recommendations**
  Summarizes key learning outcomes and suggests possible improvements and future enhancements.
- **Appendices**
  Includes screenshots, configuration files, code snippets, pipeline diagrams, and additional documentation.

CHAPTER 2
ORGANIZATION DETAILS AND LITERATURE REVIEW

2.1. Introduction to Organization

Genese Solution Pvt. Ltd. is a multinational technology consulting and cloud services company with a strong presence in Nepal and several other countries across Europe and Asia. It operates as part of the larger Genese Solution group headquartered in the United Kingdom, offering a wide range of digital transformation solutions including cloud computing consultation, software development, cybersecurity, infrastructure automation, and DevOps services. The company specializes in helping organizations optimize their IT operations by leveraging modern cloud technologies such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform to build scalable, secure, and cost-efficient systems. With a focus on innovation and customer-centric solutions, Genese Solution works with enterprises, startups, and public sector clients to design and deploy end-to-end digital solutions tailored to their unique business needs. [3]

In Nepal, Genese Solution has established itself as a key player in the IT and cloud consulting landscape, operating out of Jhamsikhel, Lalitpur and contributing significantly to the adoption of modern cloud and DevOps practices within the region. The company's team comprises highly skilled and internationally certified professionals who bring deep technical expertise to projects involving cloud migration, DevOps automation, continuous integration and delivery (CI/CD), and infrastructure optimization. Through its services, Genese Solution helps organizations enhance operational efficiency, reduce manual intervention, and accelerate software delivery cycles. Additionally, the company engages in initiatives aimed at bridging the skill gap between academia and industry by supporting cloud education and workforce development, further strengthening Nepal's technology ecosystem. [3]

2.2. Organizational Hierarchy

2.3. Working Domains of Organization

Genese Solution operates across multiple technology and consulting domains with a focus on enabling digital transformation and cloud adoption for businesses of all sizes. The primary working domains of the organization include:

- **Cloud Consulting & Cloud Services:** Providing strategy, planning, migration, managed

support, and optimization of cloud infrastructure, helping organizations transition to scalable and cost-efficient cloud platforms.

- **DevOps and Cloud Automation:** Implementing modern DevOps practices including continuous integration and continuous deployment (CI/CD), infrastructure as code (IaC), automated deployment pipelines, monitoring, and operational automation.
- **Software and Application Development:** Delivering web and mobile application solutions, backend systems, API development, and customized software to support business digitalization.
- **Cybersecurity & Compliance Solutions:** Offering security assessments, compliance audits, cyber risk mitigation strategies, and secure architecture services to protect critical systems.
- **Productivity & Collaboration Tools:** Deployment and support of communication and productivity systems for enterprises, such as unified collaboration suites and monitoring tools.
- **Digital Marketing & SEO Services:** Helping businesses improve online presence and engagement through search engine optimization and digital marketing strategies.
- **Cloud Education & Skill Development (Genese Cloud Academy):** Training programs and mentorship aimed at bridging the gap between academic knowledge and industry requirements by equipping students and professionals with cloud computing and DevOps skills.
- **Domain and Web Hosting Services:** Providing domain registration, hosting solutions, and managed server environments tailored to business needs.
- **Monitoring and Performance Optimization:** Tools and services dedicated to monitoring infrastructure performance, identifying anomalies, and optimizing cloud resource usage.

The organization's expertise spans a wide spectrum of digital technology domains, enabling it to support clients across different industries by delivering secure, scalable, and future-ready technology solutions.

2.4. Description of Intern Department

During my internship at Genese Solution Pvt. Ltd., Nepal, I was placed within the Cloud & DevOps Engineering Department, a core technical division responsible for implementing automation, cloud infrastructure solutions, and modern software delivery processes. This department plays a pivotal role in transforming how the company and its clients manage software deployment, infrastructure provisioning, and operational scalability. It focuses on designing, deploying, and maintaining cloud-native systems primarily on Amazon Web Services (AWS), as well as integrating continuous integration and continuous delivery (CI/CD) pipelines to streamline the development lifecycle. The team

works collaboratively with cross-functional stakeholders to ensure production-grade automation, robust security practices, and highly available cloud architectures, all of which contribute directly to modern digital transformation goals.

2.5. Literature Review

DevOps is a modern software engineering paradigm that emerged to address the inefficiencies and disconnects between traditional software development and IT operations. At its core, DevOps emphasizes collaboration, shared responsibility, and continuous processes that span from initial code development to production deployment and operational monitoring. Studies define DevOps as a cultural and technical approach that integrates development and operations teams to improve software delivery performance while reducing errors and lead time for changes. DevOps adoption involves organizational transformation as much as technical change, requiring clear practices, guidelines, and close alignment of cross-functional teams to realize its full potential. Research has shown that adopting DevOps practices can significantly streamline processes, improve communication, and enhance overall software delivery quality and velocity. [4]

A foundational element of DevOps is the implementation of continuous practices such as Continuous Integration (CI) and Continuous Delivery/Deployment (CD). CI involves the frequent integration of code changes into a shared repository, triggering automated builds and tests to detect issues early in the software lifecycle. CD extends CI by automating the release and deployment of validated changes to production environments with minimal manual intervention, improving delivery speed and system reliability. Research in this area highlights that CI/CD pipelines reduce human errors, accelerate feedback loops, and support faster feature deliveries, which are critical for competitive advantage in today's software-driven markets.[2]

The role of cloud computing has become particularly significant in enabling DevOps practices at scale. The elasticity, automation, and on-demand infrastructure of cloud platforms provide ideal underpinnings for DevOps workflows, allowing teams to dynamically provision resources, scale testing environments, and manage releases across multiple environments. Cloud-enabled DevOps has been linked with higher deployment frequency, improved scalability, and better resource utilization. Nevertheless, literature also notes that the integration of cloud infrastructure within DevOps introduces new challenges related to security, cost management, and the handling of legacy systems, indicating that organizations must adopt structured strategies to address these concerns.[1]

Another critical practice within DevOps is Infrastructure as Code (IaC), which describes the automation of infrastructure provisioning and configuration through code rather than manual processes. IaC improves consistency, repeatability, and traceability of infrastructure changes, helping teams manage complex environments reliably. Within DevOps research, IaC has been shown to reduce inconsistencies between environments and enforce version control practices across both infrastructure and application code. This aligns with modern DevOps objectives of automating as much of the software

delivery lifecycle as possible, further enabling rapid, scalable deployments. [5]

CHAPTER 3
INTERNSHIP ACTIVITIES

3.1. Roles and Responsibilities

During my internship at **Genese Solution Pvt. Ltd.**, I performed the following roles and responsibilities in the Cloud & DevOps Engineering Department:

- Assisted in designing and implementing **CI/CD pipelines** using AWS CodePipeline and AWS CodeBuild.
- Automated build, packaging, and deployment processes for serverless applications.
- Worked with **AWS SAM (Serverless Application Model)** for building and deploying Lambda-based applications.
- Developed and modified **AWS CloudFormation templates** to provision infrastructure using Infrastructure as Code (IaC).
- Managed deployment artifacts in **Amazon S3**, including packaging and version control of application builds.
- Configured and maintained **AWS IAM roles and policies** following the principle of least privilege.
- Assisted in creating and managing **serverless architectures using AWS Lambda** in a monorepo structure.
- Handled shared Lambda layers, versioning, and dependency management.
- Monitored application logs and system performance using **Amazon CloudWatch**.
- Identified and troubleshot build failures, deployment errors, and configuration issues.
- Supported multi-environment deployments (Development, Staging, Production).
- Participated in reviewing infrastructure changes and deployment workflows.
- Collaborated with development teams to improve automation and deployment efficiency.
- Maintained technical documentation related to CI/CD pipelines, IAM configuration, and deployment procedures.
- Followed Agile methodologies and participated in team meetings and progress discussions.
- Ensured adherence to cloud security best practices and operational standards.

3.2. Weekly log

Table 3.1: Weekly log of activities performed during the internship.

Week	Activity Performed
Week 1	Project onboarding and AWS architecture review of GUMP Now (Lambda, RDS, EC2, CloudWatch, CI/CD).
Week 2	Research on CloudWatch Synthetics canaries for availability, latency, and user-journey monitoring.
Week 3	Design of CloudWatch on-call support dashboards for staging and production environments.
Week 4	Implementation of CloudWatch dashboards and monitoring metrics for operational visibility.
Week 5	Implementation of IAM-based authentication for RDS in a staging environment.
Week 6	Research and execution of AWS SSM Patch Manager to patch all EC2 instances in staging.
Week 7	Research on AWS WAF capabilities including managed rules and web attack mitigation strategies.
Week 8	Design of automated CI/CD pipeline for Lambda monorepo using AWS SAM and custom trigger Lambda.
Week 9	Implementation of automated Lambda monorepo pipeline with CodeBuild, SAM build, package, and deploy.
Week 10	SMTP server proof of concept using Node.js `smtp-server` package for mail flow analysis.
Week 11	Functional and usability testing of the official GUMP Now website.
Week 12	Production improvements: Outlook invitation email fix and DKIM CSV download feature deployment to staging and production.

3.3. Description of the Project Involved During Internship

The **Genese Unified Mailing Platform (GUMP)** is an enterprise-grade cloud-based mailing solution developed by **Genese Solution Pvt. Ltd.** to streamline and centralize email communication processes for organizations. The platform is designed to handle high-volume email delivery requirements, including transactional emails, notification systems, marketing campaigns, and automated communication workflows. GUMP provides a unified interface for managing email templates, user segmentation, scheduling, tracking, and reporting, ensuring reliable and efficient communication between organizations and their customers. [6]

During my internship, I worked on multiple technical projects related to the **GUMP Now** platform, primarily focusing on cloud infrastructure, security enhancement, monitoring, automation,

and operational support. One of the key contributions involved designing and implementing cloud monitoring and observability solutions using **AWS CloudWatch**, including dashboards and synthetic monitoring for improved availability tracking and proactive issue detection in staging and production environments.

I also contributed to cloud security improvements by implementing **IAM-based authentication for Amazon RDS** and strengthening system security through patch management of EC2 instances using **AWS SSM Patch Manager**. In addition, I designed and implemented an automated **CI/CD pipeline** for a Lambda monorepo using **AWS SAM** and a custom trigger Lambda function, enabling efficient and selective serverless deployments.

Furthermore, I supported email infrastructure and application-level enhancements, including an SMTP server proof of concept, resolving Outlook email rendering issues, implementing a DKIM CSV download feature, conducting website testing, and supporting both staging and production environments. These activities collectively aimed to enhance the reliability, security, and operational efficiency of the GUMP platform.

3.4. Activities Performed

- **Cloud Monitoring and Observability:** Researched and configured AWS CloudWatch features, including custom dashboards and performance metrics for staging and production environments. Evaluated CloudWatch Synthetics canaries to monitor application availability, response time, and end-to-end user journeys, supporting proactive incident detection and on-call operations.
- **RDS IAM Authentication Implementation:** Implemented IAM-based authentication for Amazon RDS in the Gumpnow staging environment. Configured IAM roles and policies, updated database connection logic, and validated secure database access without static credentials.
- **On-Call Support Dashboards:** Designed and deployed CloudWatch dashboards aggregating key service metrics such as health status, error rates, and alarms. Validated dashboards in both staging and production environments.
- **Website and Application Testing:** Conducted functional and usability testing of the official GUMP Now website to ensure correct behavior, identify defects, and validate fixes before and after deployments.
- **SMTP Server Proof of Concept:** Developed a proof-of-concept SMTP server using the Node.js `smtp-server` package to analyze email handling, message flow, and integration mechanisms within the email infrastructure.
- **AWS WAF Research:** Researched AWS Web Application Firewall (WAF) capabilities, including managed rule groups and custom rules, to evaluate protection mechanisms against

SQL injection, cross-site scripting (XSS), and other web vulnerabilities.

- **Patch Management Using AWS SSM:** Patched all EC2 instances in the Gumpnow staging environment using AWS Systems Manager Patch Manager. Verified compliance, monitored execution, and ensured system stability after patching.
- **Email Rendering and Deliverability Fixes:** Investigated and resolved an issue where invitation email buttons were not displayed correctly in Microsoft Outlook. Improved HTML/CSS compatibility and validated rendering across email clients.
- **DKIM Feature Enhancement:** Implemented a feature in the `gumpnow-frontend-app` to enable downloading DKIM records in CSV format. Deployed and verified the feature in staging and production environments.
- **CI/CD Automation for Lambda Monorepo:** Designed and implemented an automated CI/CD pipeline for a Lambda monorepo using AWS SAM. Developed a custom trigger Lambda function to detect code changes and selectively trigger deployments, improving efficiency and reducing unnecessary builds.

CHAPTER 4
CONCLUSION AND LEARNING OUTCOMES

4.1. Conclusion

The internship at Genese Solution Pvt. Ltd. provided valuable practical exposure to real-world cloud infrastructure management, DevOps practices, and enterprise application support. Working on the Genese Unified Mailing Platform (GUMP Now) allowed me to understand how modern cloud-native systems are designed, deployed, secured, and maintained in production environments.

Throughout the internship period, I contributed to monitoring and observability improvements, cloud security enhancements, CI/CD automation, and operational support tasks. The implementation of CloudWatch dashboards, IAM-based RDS authentication, EC2 patch management using AWS Systems Manager, and Lambda monorepo automation significantly improved system reliability, security posture, and deployment efficiency. Additionally, involvement in email infrastructure improvements, DKIM feature enhancements, and frontend application support provided insight into how infrastructure and application layers interact in a production system.

This internship successfully bridged the gap between academic theory and industry practice. It strengthened my understanding of distributed systems, cloud computing concepts, security best practices, and automation workflows. The experience enhanced my ability to troubleshoot real-world problems, design scalable solutions, and contribute effectively within a collaborative engineering environment. Overall, the internship was instrumental in shaping my technical competence and professional readiness as a Cloud and DevOps Engineer.

4.2. Learning Outcome

During the internship, I achieved the following key learning outcomes:

- Developed practical understanding of DevOps lifecycle and CI/CD pipelines in real production environments.
- Gained hands-on experience with Amazon Web Services (AWS) including Lambda, EC2, RDS, S3, CloudWatch, IAM, WAF, and Systems Manager.
- Learned to implement Infrastructure as Code (IaC) using AWS SAM and CloudFormation.
- Understood the importance of monitoring and observability, including dashboard design, metrics tracking, and synthetic monitoring.

- Strengthened knowledge of cloud security best practices, including IAM role configuration, RDS IAM authentication, and web application firewall strategies.
- Acquired experience in automated patch management and maintaining system compliance.
- Improved skills in troubleshooting deployment failures and operational issues in staging and production environments.
- Learned to design and implement serverless architectures and Lambda-based monorepo pipelines.
- Enhanced understanding of email infrastructure, DKIM authentication, SMTP workflows, and email client compatibility.
- Developed professional skills such as team collaboration, technical documentation, agile work practices, and communication.
- Gained confidence in working with enterprise-level systems and production-grade cloud environments.

  Overall, the internship contributed significantly to both my technical expertise and professional development, preparing me for future roles in Cloud Engineering and DevOps domains.

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APPENDIX

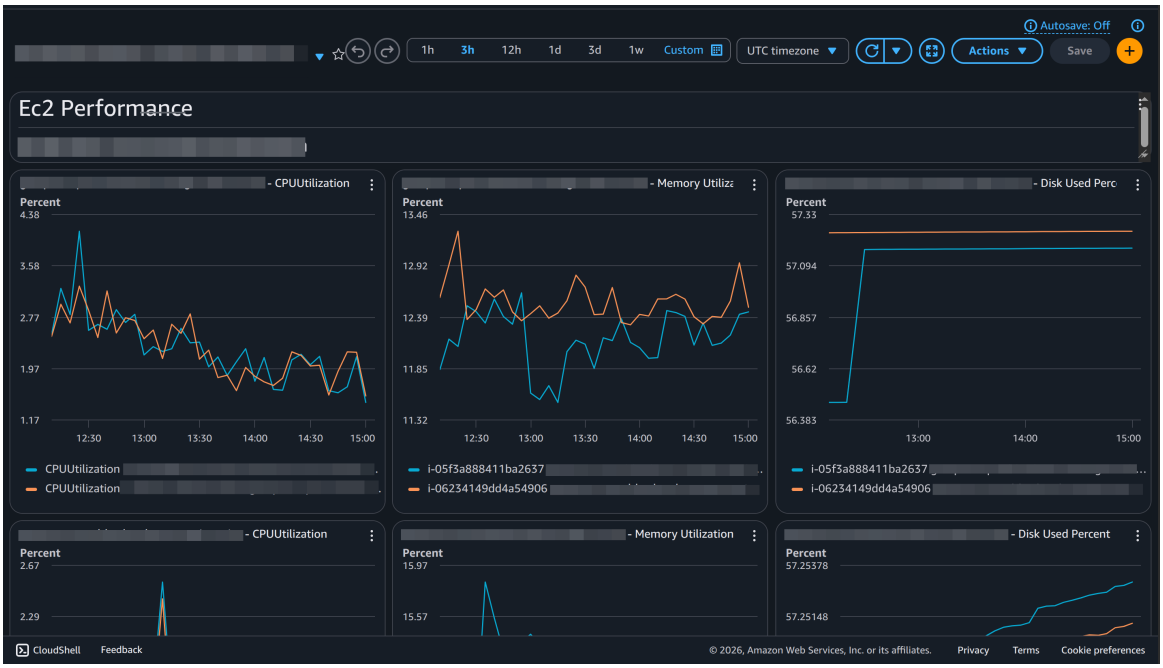

Figure 4.1: CloudWatch on-call support dashboards

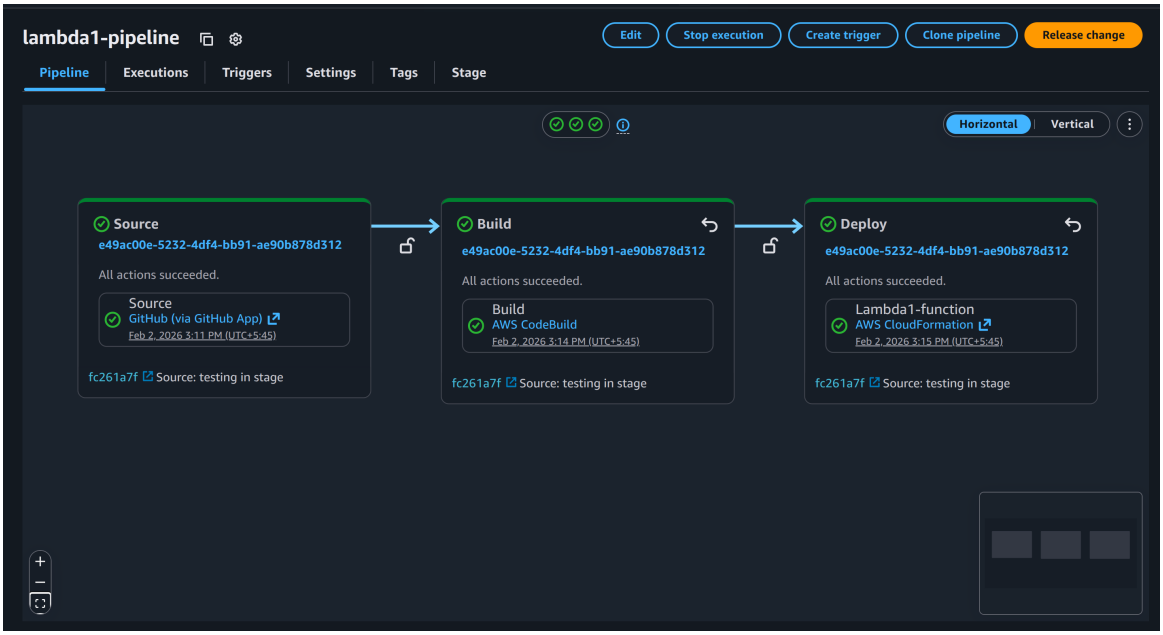

Figure 4.2: Automated CI/CD pipeline for Lambda monorepo

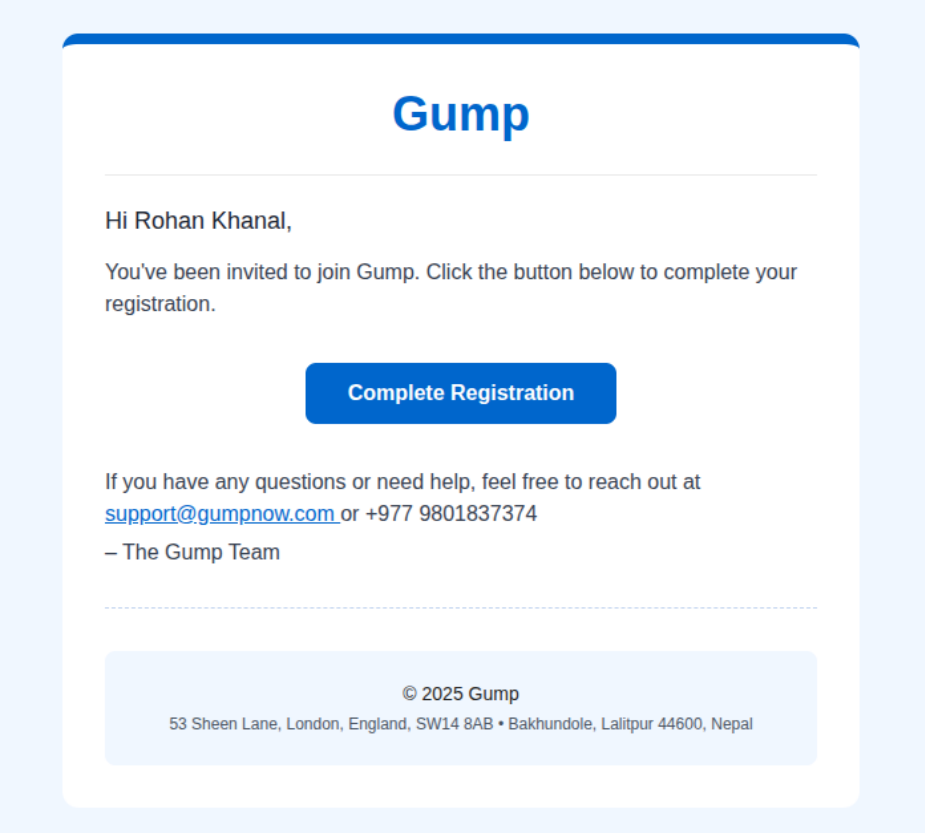

Figure 4.3: Outlook invitation email fix

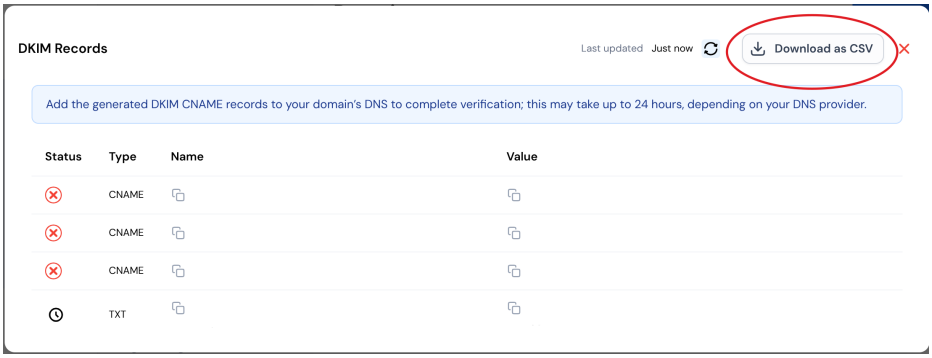

Figure 4.4: DKIM CSV download button

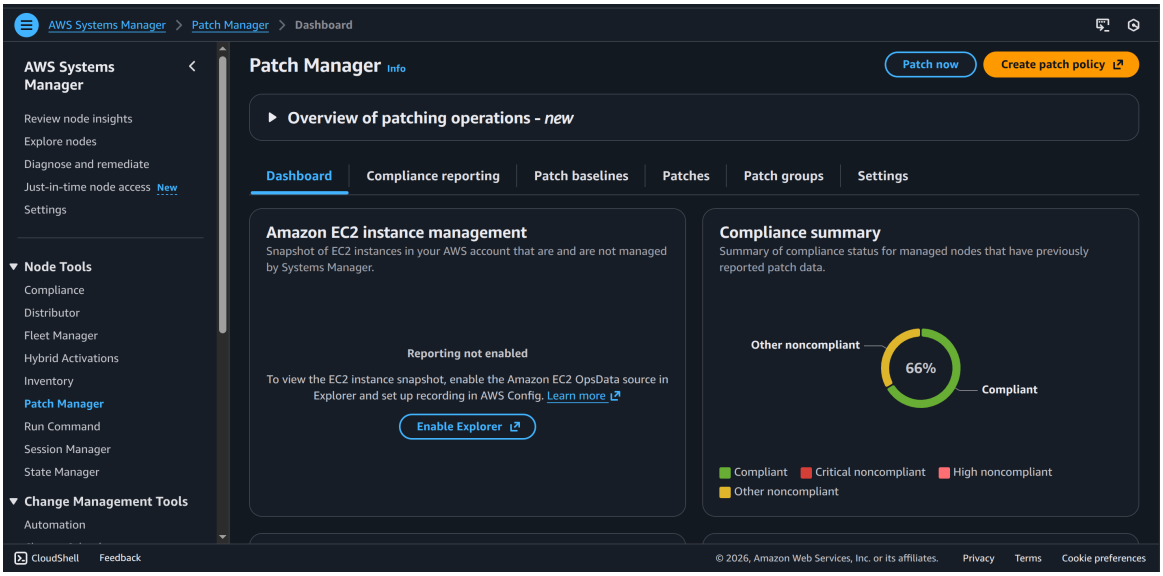

Figure 4.5: AWS SSM Patch Manager

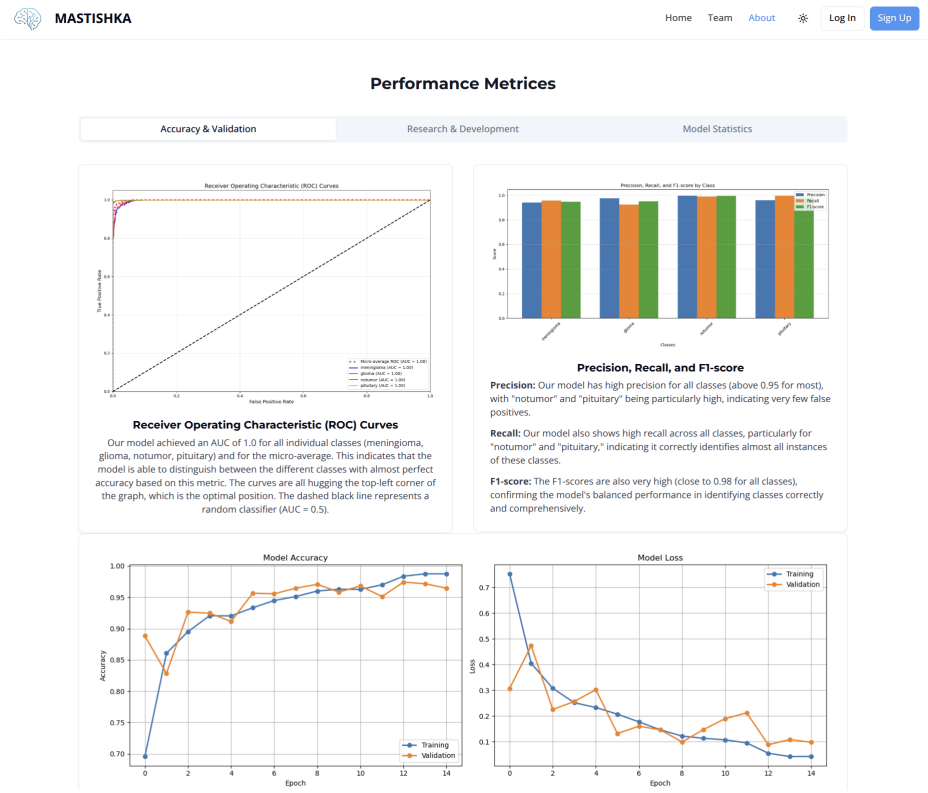

Figure 4.6: Statistics page of the web application

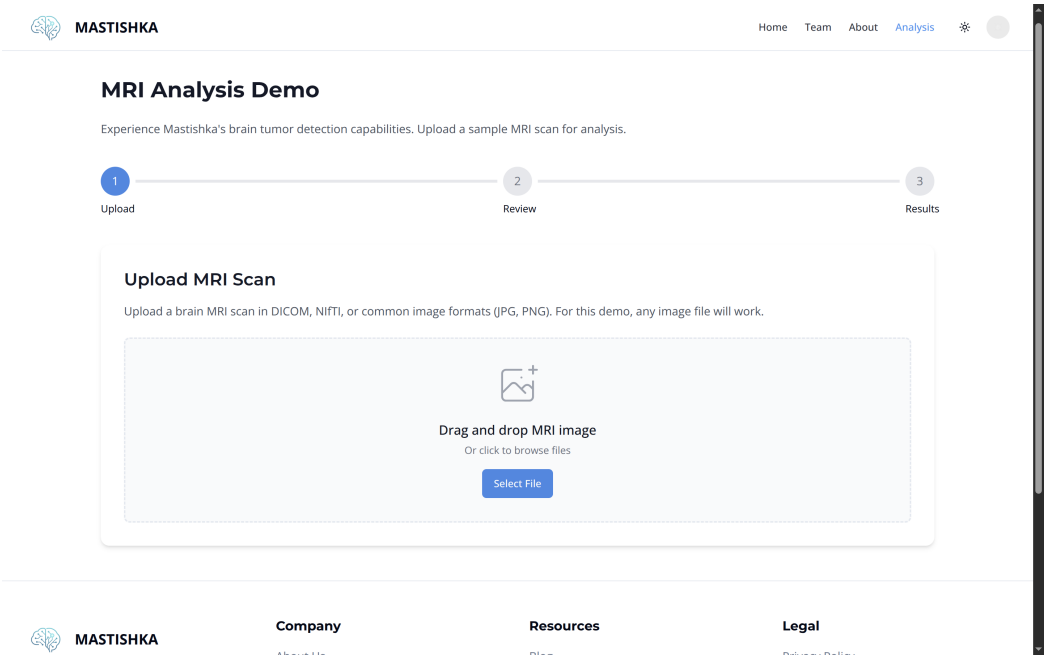

Figure 4.7: Analysis page of the web application

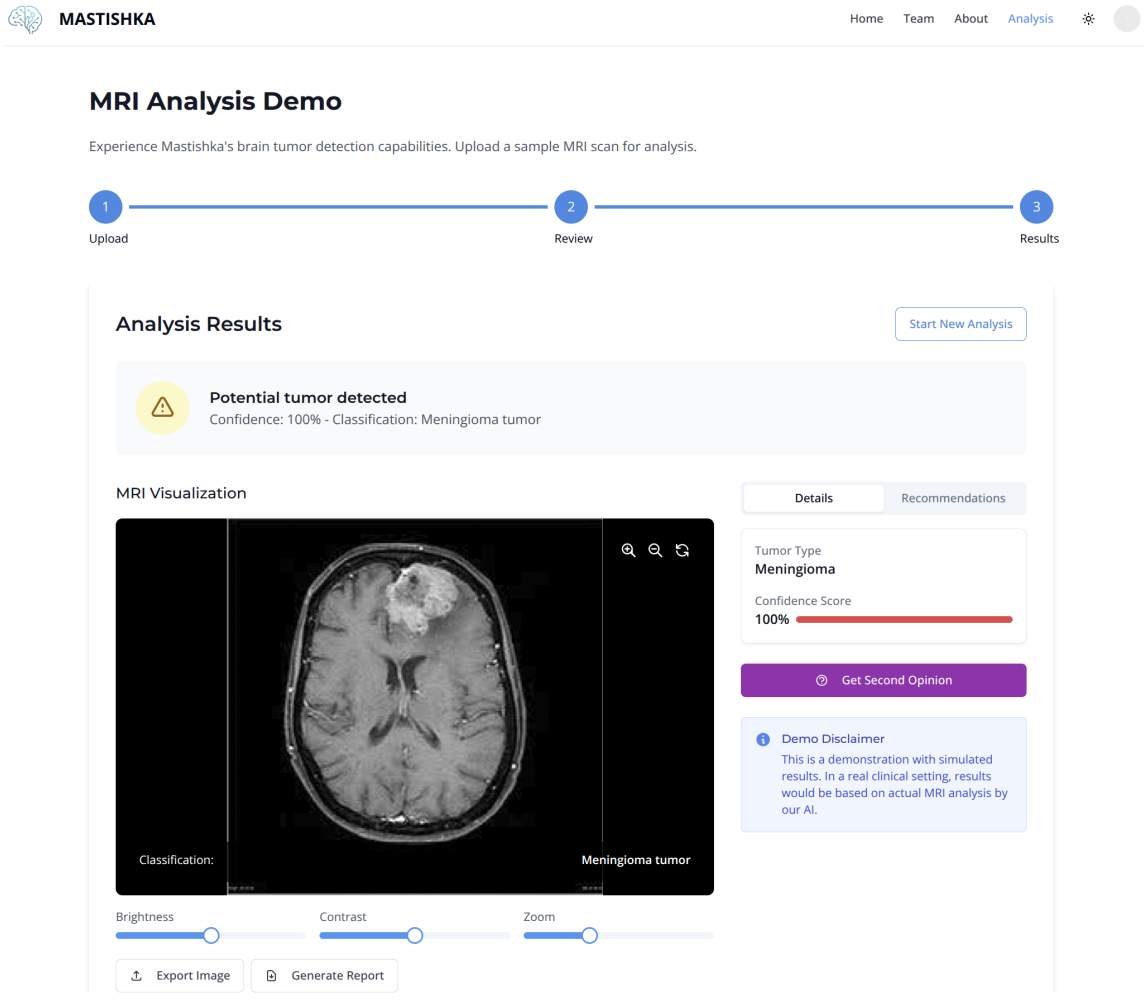

Figure 4.8: Analysis page of the web application

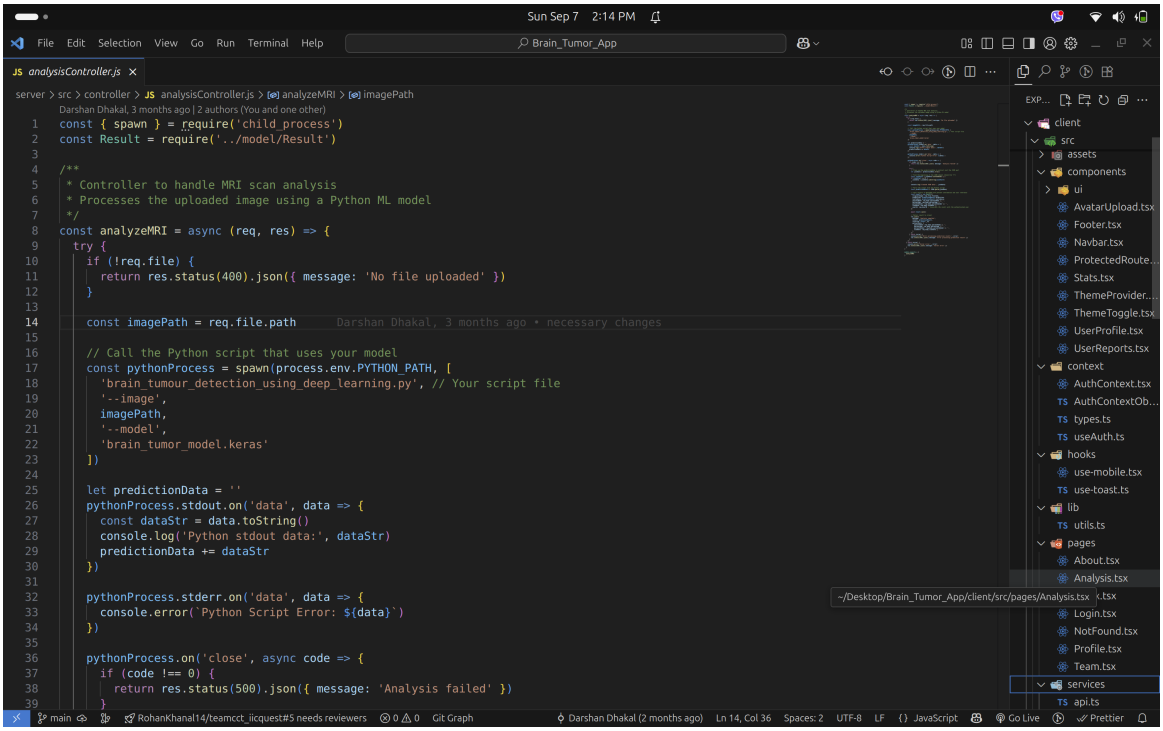

Figure 4.9: Frontend File Structure of the web application

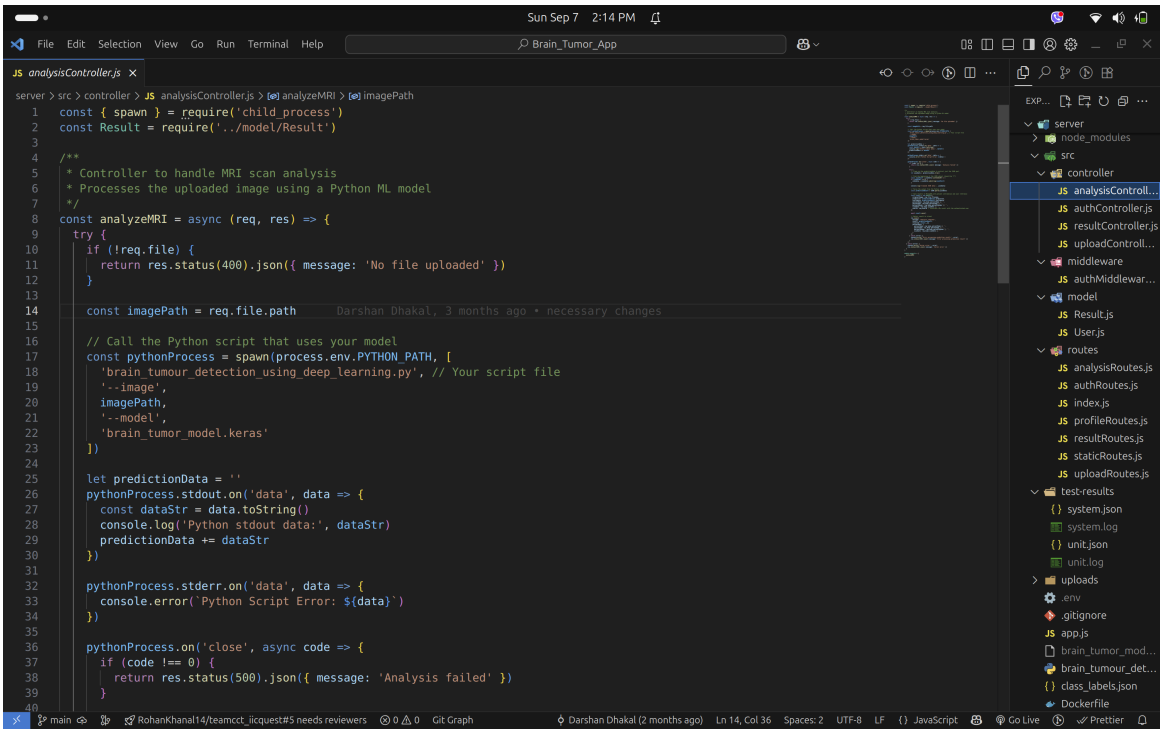

Figure 4.10: Backend File Structure of the web application

page of the web application

Central Campus of Technology

Dharan - 14

Weekly Internship Logbook

Week No: 1
Name of Student: Rohan Khanal
Internship Site/ Organization: Genese Solution Pvt. Ltd
Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-07-24	9	9	Internship orientation and introduction to GUMP Now project.
2	2082-07-25	9	18	Reviewed AWS architecture (Lambda, EC2, RDS, CloudWatch).
3	2082-07-26	9	27	Studied staging and production environments.
4	2082-07-27	9	36	Analyzed CI/CD pipelines and deployment flow.
5	2082-07-28	9	45	Documentation of system architecture and learning notes.
6	2082-07-29	Holiday	45	Weekend
7	2082-07-30	Holiday	45	Weekend

Current Week Summary: Completed onboarding and gained understanding of AWS-based architecture.

Next Week Plan: Research CloudWatch Synthetics.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

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Weekly Internship Logbook

Week No: 2

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-08-01	9	54	Research on CloudWatch Synthetics features.
2	2082-08-02	9	63	Studied availability monitoring using canaries.
3	2082-08-03	9	72	Tested latency monitoring setup.
4	2082-08-04	9	81	Created sample user-journey canary.
5	2082-08-05	9	90	Evaluated alarm integration and reporting.
6	2082-08-06	Holiday	90	Weekend
7	2082-08-07	Holiday	90	Weekend

Current Week Summary: Evaluated CloudWatch Synthetics suitability.

Next Week Plan: Design monitoring dashboards.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

Dharan - 14

Weekly Internship Logbook

Week No: 3

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-08-08	9	99	Identified key operational metrics for staging and production.
2	2082-08-09	9	108	Designed CloudWatch dashboard layout and widget structure.
3	2082-08-10	9	117	Planned Lambda/EC2/RDS metrics grouping and visualization.
4	2082-08-11	9	126	Reviewed alarm requirements and on-call visibility needs.
5	2082-08-12	9	135	Documented dashboard design and implementation plan.
6	2082-08-13	Holiday	135	Weekend
7	2082-08-14	Holiday	135	Weekend

Current Week Summary: Designed CloudWatch dashboards by structuring visualization for improved observability.

Next Week Plan: Implement dashboards and configure monitoring alarms.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

Dharan - 14

Weekly Internship Logbook

Week No: 4

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-08-15	9	144	Implemented CloudWatch dashboard for staging environment.
2	2082-08-16	9	153	Implemented CloudWatch dashboard for production environment.
3	2082-08-17	9	162	Configured CloudWatch alarms for key metrics.
4	2082-08-18	9	171	Tested alert notifications and verified alarm triggers.
5	2082-08-19	9	180	Fine-tuned dashboard widgets and documented monitoring setup.
6	2082-08-20	Holiday	180	Weekend
7	2082-08-21	Holiday	180	Weekend

Current Week Summary: Successfully implemented dashboards and alarms to enhance monitoring.

Next Week Plan: Strengthen database security using IAM authentication.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

Dharan - 14

Weekly Internship Logbook

Week No: 5

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-08-22	9	189	Researched RDS IAM authentication workflow and requirements.
2	2082-08-23	9	198	Configured IAM roles and policies for DB authentication.
3	2082-08-24	9	207	Enabled IAM database authentication in staging.
4	2082-08-25	9	216	Tested secure database connection using IAM tokens.
5	2082-08-26	9	225	Removed static DB credentials and documented security improvements.
6	2082-08-27	Holiday	225	Weekend
7	2082-08-28	Holiday	225	Weekend

Current Week Summary: Implemented IAM-based RDS authentication to enhance database security.

Next Week Plan: Research and implement patch management using AWS SSM.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

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Weekly Internship Logbook

Week No: 6

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-08-29	9	234	Studied AWS SSM Patch Manager concepts and workflow.
2	2082-09-01	9	243	Configured patch baseline and maintenance strategy.
3	2082-09-02	9	252	Performed EC2 patch scan and reviewed missing patches.
4	2082-09-03	9	261	Patched EC2 instances in staging environment.
5	2082-09-04	9	270	Verified compliance status and generated reports.
6	2082-09-05	Holiday	270	Weekend
7	2082-09-06	Holiday	270	Weekend

Current Week Summary: Successfully patched EC2 instances using AWS SSM Patch Manager.

Next Week Plan: Research AWS WAF for web application security.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

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Weekly Internship Logbook

Week No: 7

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-09-07	9	279	Researched AWS WAF capabilities and deployment options.
2	2082-09-08	9	288	Studied AWS Managed Rule Groups and best practices.
3	2082-09-09	9	297	Evaluated SQL injection protection approach.
4	2082-09-10	-	297	Christmas Leave - No work done.
5	2082-09-11	9	306	Reviewed rate limiting and documented recommendations.
6	2082-09-12	Holiday	306	Weekend
7	2082-09-13	Holiday	306	Weekend

Current Week Summary: Researched AWS WAF features for securing GUMP Now against web threats.

Next Week Plan: Design automated CI/CD pipeline for Lambda monorepo.

Total Hours Worked: 36

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

Dharan - 14

Weekly Internship Logbook

Week No: 8

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-09-14	9	315	Designed automated Lambda monorepo CI/CD architecture.
2	2082-09-15	9	324	Created custom trigger Lambda for selective deployment.
3	2082-09-16	9	333	Designed SAM build workflow and repository structure.
4	2082-09-17	-	333	New Year Leave - No work done.
5	2082-09-18	9	342	Planned environment-based deployment strategy.
6	2082-09-19	Holiday	342	Weekend
7	2082-09-20	Holiday	342	Weekend

Current Week Summary: Designed CI/CD pipeline architecture for Lambda monorepo automation.

Next Week Plan: Implement and test pipeline deployment workflow.

Total Hours Worked: 36

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

Dharan - 14

Weekly Internship Logbook

Week No: 9

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-09-21	9	351	Implemented CodeBuild pipeline stages.
2	2082-09-22	9	360	Integrated SAM build and packaging process.
3	2082-09-23	9	369	Integrated SAM deploy process.
4	2082-09-24	9	378	Debugged deployment configuration issues.
5	2082-09-25	9	387	Validated staging and production deployments.
6	2082-09-26	Holiday	387	Weekend
7	2082-09-27	Holiday	387	Weekend

Current Week Summary: Successfully implemented and tested automated CI/CD pipeline.

Next Week Plan: Explore SMTP server and email handling mechanisms.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

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Dharan - 14

Weekly Internship Logbook

Week No: 10

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-09-28	9	396	Researched SMTP protocol and email flow basics.
2	2082-09-29	9	405	Built SMTP server proof of concept using Node.js.
3	2082-09-30	9	414	Tested mail flow and analyzed server behavior.
4	2082-10-01	9	423	Analyzed email headers and logs.
5	2082-10-02	9	432	Documented findings and implementation insights.
6	2082-10-03	Holiday	432	Weekend
7	2082-10-04	Holiday	432	Weekend

Current Week Summary: Conducted SMTP proof of concept and analyzed email handling workflow.

Next Week Plan: Perform functional and usability testing of website.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

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Weekly Internship Logbook

Week No: 11

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-10-05	9	441	Performed functional testing of GUMP Now website.
2	2082-10-06	9	450	Conducted usability evaluation.
3	2082-10-07	9	459	Identified UI bugs and issues.
4	2082-10-08	9	468	Verified fixes and improvements.
5	2082-10-09	9	477	Prepared QA documentation.
6	2082-10-10	Holiday	477	Weekend
7	2082-10-11	Holiday	477	Weekend

Current Week Summary: Performed functional and usability testing, identified UI issues, and validated fixes.

Next Week Plan: Implement final production improvements and complete internship documentation.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____

Central Campus of Technology

Dharan - 14

Weekly Internship Logbook

Week No: 12

Name of Student: Rohan Khanal

Internship Site/ Organization: Genese Solution Pvt. Ltd

Address: Bakundol, Lalitpur, Nepal

S.N.	Date	Hours Worked	No. of Hours Worked to Date	Activity
1	2082-10-12	9	486	Fixed Outlook invitation email rendering issue.
2	2082-10-13	9	495	Implemented DKIM CSV download feature.
3	2082-10-14	9	504	Deployed updates to staging environment.
4	2082-10-15	9	513	Deployed updates to production environment.
5	2082-10-16	9	522	Final documentation and internship wrap-up.
6	2082-10-17	Holiday	522	Weekend
7	2082-10-18	Holiday	522	Weekend

Current Week Summary: Completed production improvements including Outlook email fix and DKIM CSV feature deployment. Finalized documentation and handover.

Next Week Plan: Internship completed.

Total Hours Worked: 45

Student's Signature:  **Date:** 2082-10-16

Mentor's Signature:  **Date:** 2082-10-16

Supervisor's Signature: _____ **Date:** _____