



VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANA SANGAMA, BELAGAVI – 590 018

A Research/Industry Internship Report on

“CLOUD APPLICATION DEVELOPMENT”

Submitted in partial fulfillment of the requirements for the award of degree of

**BACHELOR OF ENGINEERING
IN
COMPUTER SCIENCE AND ENGINEERING**

Submitted by:

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Certificate

This is to certify that the internship work entitled “**CLOUD APPLICATION DEVELOPMENT**” is bonafide work carried out by **RAJASHEKHAR NADUVINAHALLI (2KA21CS037)**, in partial fulfillment of the requirements for the award of the degree of **Bachelor of Engineering in Computer Science and Engineering of Visvesvaraya Technological University, Belagavi**, during the year 2024-2025. It is certified that all the corrections/suggestions indicated for internal assessment have been incorporated in the report. The internship report has been approved as it satisfies the academic requirements in respect of internship work prescribed for the Bachelor of Engineering degree.

Signature of the Guide
Dr. Arunkumar Joshi

Signature of HOD
Dr. Arun Kumbi

Principal
Dr. Parashuram Baraki

Examiners: 1.

2.

DECLARATION

I, **RAJASHEKHAR NADUVINAHALLI** bearing the USN **2KA21CS037** studying in the eighth semester of Bachelor of Engineering in Information Science and Engineering at Smt. Kamala & Sri. Venkappa M. Agadi College of Engineering & Technology, Lakshmeshwar, hereby declare that this internship work entitled “**CLOUD APPLICATION DEVELOPMENT**” which is being submitted by me in the partial fulfillment for the award of the degree of Bachelor of Engineering in Computer Science and Engineering, from Visvesvaraya Technological University, Belagavi is an authentic record of me carried out during the academic year 2024-2025, under the guidance of **Dr. Arunkumar Joshi**, Asst. Prof, Department of Computer Science & Engineering, Smt. Kamala & Sri. Venkappa M. Agadi College of Engineering & Technology, Lakshmeshwar.

I further undertake that the matter embodied in the dissertation has not been submitted previously for the award of any degree by me to any other university or institution.

Place:

RAJASHEKHAR NADUVINAHALLI

Date:

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Place:

RAJASHEKHAR NADUVINAHALLI

Chapter 1

Company Profile

Rooman Technologies is a prominent provider of Information Technology (IT) and network services, strategically positioned to offer corporate training and educational solutions tailored to industry demands. Known for its focus on delivering high-impact training programs, Rooman plays a vital role in skilling the workforce for modern IT and cybersecurity challenges. As a venture capital-backed, privately held company, Rooman has leveraged its position to expand both in scale and capability, aligning with the growing needs of enterprise clients and aspiring IT professionals.

1. Core Offerings

Rooman specializes in delivering a wide spectrum of training programs under the umbrella of IT infrastructure, networking, and cybersecurity. The company's services are geared towards two primary segments:

1.1 Corporate (B2B) Training Solutions

Rooman partners with organizations to train their workforce in key IT areas, offering customized solutions that integrate with the client's internal systems and performance goals. These include:

- Network Management Systems (NMS)
- Data Storage and Backup Strategies
- Cybersecurity Protocols
- Security Audits and Risk Management
- Ethical Hacking and Penetration Testing

1.2 Educational and Consumer (B2C) Training Programs

For individual learners and students, Rooman provides classroom and online courses in:

- Hardware and Networking
- Firewall Configuration and Management
- Virtual Private Network (VPN) Setup and Maintenance
- Ethical Hacking Techniques
- Cyber Forensics and Investigation
- Security Auditing

Rooman's curriculum is frequently updated to reflect the latest technological trends and industry demands, ensuring learners gain practical, real-world skills.

Training Methodology:

Rooman's training model blends theoretical learning with hands-on practice. Students engage in simulated environments that replicate real-time IT challenges, enabling them to troubleshoot, deploy, and secure network infrastructures in practical scenarios. This pragmatic approach ensures that students are not just exam-ready but also job-ready, equipped with the technical and analytical skills needed in the workplace.

Industry Relevance and Vertical Integration:

Operating at the intersection of Technology, Media, and Telecommunications (TMT) and EdTech, Rooman integrates technology-enabled solutions to drive learning efficiency. It serves both enterprise and consumer markets, thus gaining a unique position to influence workforce development across sectors such as IT services, telecom, and digital infrastructure.

Rooman's programs are also aligned with various national and international certification bodies, adding credibility and value to its certifications. This alignment enhances job placement rates for students and increases the trust organizations place in Rooman-trained professionals.

Chapter 2

About Company

2.1 Our Journey and Foundation

Established in 1999 in Bangalore, India, Rooman Technologies was born from the collective vision of a group of passionate technology enthusiasts. Their goal was to create a center of excellence in IT training, dedicated to bridging the gap between education and employability. From the outset, the founders set a clear and impactful mission: to provide high-quality, industry-relevant training that not only imparts technical knowledge but also builds confidence and results in certifications that carry long-term value in the job market.

By bringing in some of the most skilled trainers of the time and continuously investing in innovation, Rooman quickly grew into a trusted name in IT education. The leadership team, comprised of visionary professionals, actively monitored global and national technological trends. Their proactive approach helped shape Rooman's training methodology to remain ahead of the curve, integrating fresh ideas and emerging technologies into the curriculum.

2.2 Empowering Through Government Partnerships

Rooman has always recognized the importance of inclusive growth and societal impact. Collaborating closely with government bodies, Rooman became a key partner in implementing large-scale skilling and reskilling initiatives. Through these efforts, the company has successfully delivered numerous vocational and employment-linked training programs, especially aimed at graduates, job seekers, and underserved populations.

With a pan-India presence, Rooman's training centres are strategically located to reach a wide demographic. These centres are instrumental in preparing individuals for various technical roles—ranging from IT technicians and network operators to customer support staff and systems assistants. The programs are tailored to ensure both theoretical understanding and practical competence, significantly improving employability across sectors.

2.3 Culture of Excellence in Teaching and Technology

At the heart of Rooman's operations lies an unwavering commitment to teaching excellence and technological advancement. Each trainer at Rooman is not only well-qualified but also undergoes continuous training to stay current with evolving tech landscapes. The company follows rigorous "train-the-trainer" programs, ensuring that the faculty is both motivated and well-equipped to deliver value-driven education.

Rooman has also made substantial investments in its physical and digital infrastructure. Learning environments are designed to facilitate collaboration, critical thinking, and real-world application. Facilities include modern study rooms, discussion lounges, fully equipped labs for hardware and networking, and access to comprehensive knowledge banks. These environments are crafted to simulate real industry scenarios, allowing students to gain hands-on experience in a controlled, supportive setting.

2.4 Industry-Aligned Training and Services

Rooman's training catalog has grown to encompass a wide variety of certifications and specialized courses. It offers globally recognized certifications from leading technology providers such as:

- Cisco – Networking and security solutions
- Microsoft – System administration, cloud, and office productivity
- Red Hat – Linux system administration and enterprise solutions

These services extend Rooman's impact beyond education and into active participation in the technology services industry, offering both students and clients access to the latest innovations and industry standards.

As the world of technology continues to evolve rapidly, Rooman Technologies remains committed to staying at the forefront of change. The company aims to empower the next generation of IT professionals.

Chapter 3

Tasks Performed

3.1 Key Learnings

1. Python Programming-1 & 2

Python is a powerful, beginner-friendly programming language widely used in fields ranging from web development to AI. In Python Programming-1, the basics are introduced: data types, variables, control structures (if-else, loops), functions, and error handling. Python Programming-2 advances into object-oriented programming (OOP), file handling, modules, and libraries such as NumPy and Pandas, which are essential for data manipulation and scientific computing. Mastery in Python lays a foundation for backend development, automation, and data science.

2. Prompt Engineering

Prompt engineering is the skill of designing effective input queries for AI models like ChatGPT. It involves understanding how to structure questions or instructions to get optimal responses from large language models. This skill is crucial in maximizing the performance of generative AI systems across fields such as content creation, programming, and customer support automation.

3. AI Coding Assistants

AI coding assistants, like GitHub Copilot and Amazon CodeWhisperer, leverage machine learning to help developers write code more efficiently. These tools provide real-time suggestions, complete code snippets, and even detect bugs, significantly improving productivity. Understanding their strengths and limitations is key for effective integration in the software development lifecycle.

4. Linux Basics

Linux is the backbone of most servers and cloud systems. Linux Basics covers command-line usage, file system navigation, permission management, shell scripting, and package installation. These fundamentals are crucial for system administration, cloud computing, and DevOps practices.

5. Networking Essentials

This introduces the basic concepts of computer networks including the OSI model, TCP/IP protocols, IP addressing, DNS, firewalls, and routing. Understanding networking is essential for diagnosing connectivity issues, configuring cloud resources, and managing secure data transfers.

6. Databases

Databases are central to application development. This includes understanding relational databases (SQL) and NoSQL systems, along with operations like CRUD (Create, Read, Update, Delete), normalization, indexing, and transactions. Tools like MySQL or MongoDB are explored, which are critical for dynamic and data-driven applications.

7. Web Development using Flask

Flask is a lightweight Python web framework used to develop web applications. It introduces routing, templates (Jinja2), form handling, and integrating databases. Flask is preferred for its simplicity and flexibility in creating REST APIs and microservices, often used in scalable cloud-based applications.

8. Introduction to Cloud Computing

Cloud computing delivers computing services over the internet. This section introduces cloud service models (IaaS, PaaS, SaaS), deployment models (public, private, hybrid), and benefits like scalability, reliability, and cost-efficiency. Major cloud providers like AWS, Azure, and GCP are also discussed.

9. Cloud Orchestration Platforms

Orchestration platforms like Kubernetes and AWS CloudFormation automate the deployment, scaling, and management of applications. These platforms improve operational efficiency by handling resource provisioning, monitoring, and infrastructure-as-code (IaC), ensuring reliable and reproducible cloud environments.

10. Introduction to AWS, Amazon S3

Amazon Web Services (AWS) is a leading cloud platform. This module introduces core AWS services, including Amazon EC2 (computing), RDS (database), and S3 (Simple Storage Service) for scalable object storage. It highlights S3's features like versioning, lifecycle policies, and secure data sharing.

11. AWS Command Line Interface (CLI) Basics

The AWS CLI provides a command-line interface to interact with AWS services. This includes managing S3 buckets, launching EC2 instances, and automating routine tasks. It is essential for scripting, DevOps, and managing infrastructure without using the web console.

12. DevOps on AWS

DevOps integrates development and operations to shorten the software development lifecycle. On AWS, DevOps involves using services like CodePipeline (CI/CD), CloudWatch (monitoring), and Elastic Beanstalk (deployment). The approach promotes automation, rapid deployment, and continuous delivery.

13. Code Quality with Amazon CodeGuru Reviewer and Secure Coding Techniques

Amazon CodeGuru Reviewer uses ML to identify code defects and provide recommendations. Coupled with secure coding practices—such as input validation, least privilege access, and avoiding hardcoded secrets—developers ensure that applications are robust, maintainable, and secure.

14. Assessment Readiness

This involves preparing for technical interviews, certification exams (e.g., AWS Certified Cloud Practitioner), and practical assessments. It includes problem-solving, mock tests, resume building, and hands-on project work to demonstrate applied knowledge and job readiness.

The journey through these interconnected domains—from foundational programming in Python to advanced cloud computing and DevOps practices—equips learners with a comprehensive, industry-relevant skill set. Beginning with core programming concepts and moving into specialized areas like AI coding assistants, prompt engineering, and Linux, students gain both theoretical knowledge and practical exposure to modern tools and workflows.

Networking essentials and database systems further enhance their ability to build and manage robust, data-driven applications. Web development using Flask introduces the full-stack mindset, while the modules on cloud computing and AWS services provide critical skills for deploying scalable, secure, and cost-effective solutions in real-world environments.

Cloud orchestration, DevOps practices, and the use of tools like AWS CLI and CodeGuru Reviewer underscore the importance of automation, code quality, and secure software development. Finally, assessment readiness ensures learners are well-prepared to take on industry roles and certifications with confidence.

Together, these topics form a strong foundation for a career in software development, cloud engineering, or DevOps—enabling learners to adapt to the fast-changing technology landscape with hands-on expertise and critical problem-solving abilities.

3.2 IBM Project

Project Title: Cloud-based Disaster Recovery System Using IBM Cloud Resiliency Orchestration

The Cloud-based Disaster Recovery System Using IBM Cloud Resiliency Orchestration project focuses on ensuring business continuity by automating and streamlining disaster recovery processes using cloud technologies. IBM Cloud Resiliency Orchestration offers a centralized, policy-based platform that allows organizations to manage, monitor, and test disaster recovery plans across hybrid IT environments. This system enables real-time replication, failover, and recovery of critical applications and data, minimizing downtime and data loss during unexpected disruptions. By leveraging the scalability and flexibility of the cloud, the project supports efficient recovery workflows, compliance reporting, and automated testing, making it an ideal solution for industries like banking, healthcare, and e-commerce that require high availability and resilience.

3.2.1 Introduction

In today's digital age, organizations heavily rely on uninterrupted access to their IT systems and data to maintain business operations and customer trust. However, disruptions such as cyberattacks, system failures, and natural disasters pose significant risks to data integrity and service availability. As enterprises increasingly adopt hybrid and cloud infrastructures, the need for robust, automated, and scalable disaster recovery solutions has become critical. This project aims to implement a Cloud-based Disaster Recovery System using IBM Cloud Resiliency Orchestration, which enables automated recovery planning, execution, and monitoring across complex IT environments. By leveraging cloud scalability and intelligent orchestration, the system ensures minimal downtime, regulatory compliance, and seamless business continuity.

Need for Cloud-based Disaster Recovery

Traditional disaster recovery approaches often rely on manual processes, physical infrastructure, and static plans, making them slow, costly, and difficult to scale. As IT environments grow more complex and distributed, organizations face increasing challenges that highlight the need for modern disaster recovery solutions, including:

- **Complexity:** Managing diverse IT infrastructures across on-premises and cloud environments.

- **Downtime Costs:** Even a few minutes of unplanned downtime can lead to significant financial and reputational losses.
- **Manual Processes:** Time-consuming recovery procedures increase the risk of human error and extended outages.
- **Compliance Requirements:** Industries must meet strict regulatory standards for data protection and recovery readiness.
- **Scalability and Flexibility:** Traditional methods lack the agility needed to support dynamic and growing digital ecosystems.

To address these challenges, this project implements a cloud-based disaster recovery solution using IBM Cloud Resiliency Orchestration. It provides automation, centralized control, and real-time visibility—enabling faster, more reliable recovery operations and ensuring business continuity in critical scenarios.

3.2.2 Objective:

The project aims to develop a scalable, resilient, and efficient web hosting solution using IBM Cloud's auto-scaling and load-balancing services. The focus is on providing seamless performance during traffic spikes, optimizing resource utilization, and ensuring high availability. By leveraging IBM Cloud's features, the solution will offer cost-effective, automated management and maintain service reliability. It will comply with industry standards for security and ensure rapid adaptability to changing workloads.

3.2.3 Problem, Target Users, and Goals

1. Identify Problem Parameters:

- **Problem Statement:** Traditional web hosting solutions struggle to handle fluctuating traffic volumes, leading to performance degradation, downtime, and customer dissatisfaction. A scalable and reliable cloud-based web hosting solution is essential.
- **Target Users:**
 - E-commerce businesses experiencing traffic surges during sales or events.
 - Enterprises with high-traffic websites or web applications.
 - Startups aiming for rapid scalability without infrastructure overhead.
- **Goals:**
 - Ensure seamless scalability to handle varying traffic loads.
 - Provide high availability and performance for hosted applications.

- Optimize hosting costs through automated resource allocation.

2. Key Challenges

- **Scalability:** Difficulty in adapting to rapid changes in traffic volume.
- **Performance:** Maintaining low latency and high throughput under heavy load.
- **Cost Efficiency:** Avoiding overprovisioning or underutilization of resources.
- **Security:** Protecting hosted applications from cyber threats.
- **Management:** Simplifying infrastructure monitoring and maintenance.

IBM Cloud Auto Scaling and Load Balancing

IBM Cloud's auto-scaling and load-balancing services provide dynamic scaling and efficient traffic distribution to ensure optimal web hosting performance. Key features include:

- **Auto Scaling:** Automatically adjusts resource allocation based on real-time traffic, ensuring resources are always available during peak times and scaled down during off-peak periods to save costs.
- **Load Balancing:** Distributes traffic across multiple servers to prevent overload, optimize response times, and maintain application performance during traffic surges.
- **Integration:** Seamlessly integrates with IBM Cloud Kubernetes Service, virtual servers, bare metal servers, and other IBM Cloud offerings, enabling businesses to create hybrid and multi-cloud architectures.
- **Monitoring and Analytics:** Provides real-time insights into resource usage and performance metrics, allowing proactive management and rapid troubleshooting of issues.
- **Customization:** Offers configurable scaling policies and advanced traffic routing options, empowering businesses to tailor their infrastructure to specific workload requirements.
- **High Availability:** Ensures minimal downtime by automatically redistributing workloads in case of server failures or maintenance events, thus maintaining uninterrupted service for end-users.

3.2.4 Benefits

- **Resilience:** Ensures high availability and reliability during traffic spikes.
- **Cost Savings:** Reduces costs by dynamically scaling resources based on demand.
- **Performance:** Enhances user experience with reduced latency and improved response times.
- **Security:** Incorporates robust security protocols for hosted applications and data.
- **Automation:** Simplifies infrastructure management through automated scaling and traffic distribution.
- **Flexibility:** Supports diverse applications and adapts seamlessly to changing workloads.
- **User Experience:** Provides uninterrupted service, maintaining customer trust and satisfaction.

Challenge	Solution Framework	IBM Cloud Service
Scalability: Handling rapid traffic fluctuations.	Implement auto-scaling to dynamically allocate resources based on traffic patterns.	IBM Cloud Auto Scaling: Adapts resource allocation to meet demand.
Performance: Ensuring low latency and quick response times.	Use load balancing to evenly distribute traffic across servers.	IBM Cloud Load Balancer: Optimizes traffic distribution for high availability.
Cost Efficiency: Avoiding overprovisioning or underutilization.	Employ pay-as-you-go models with dynamic resource scaling.	IBM Cloud Virtual Servers: Offers cost-effective, scalable compute resources.
Security: Safeguarding hosted applications from threats.	Apply multi-layered security protocols and encryption for data protection.	IBM Cloud Security: Provides advanced security tools for hosted environments.
Management: Monitoring infrastructure performance.	Use monitoring tools for real-time insights and automated alerts.	IBM Cloud Monitoring: Tracks performance with actionable analytics.
Disaster Recovery: Ensuring uptime during system failures.	Implement backup and recovery solutions for hosted applications.	IBM Resiliency Orchestration: Automates disaster recovery testing and execution.

3.2.5 Results and Discussions

1. Overview of Web Hosting Solution Implementation This project focuses on deploying a scalable and reliable web hosting solution using IBM Cloud's Auto-Scaling and Load Balancing features. The goal is to ensure high availability, performance optimization, and resource efficiency for hosting web applications. This implementation involves configuring virtual servers, setting up auto-scaling policies, integrating load balancers, and monitoring system performance.

2. Configuring IBM Cloud Virtual Servers 2.1 Steps to Set Up Virtual Servers

1. Create and Configure Virtual Server Instances:

- Step 1: Log in to the IBM Cloud Dashboard
 - Visit the IBM Cloud website and sign in with your credentials.
 - If you don't have an account, register by following the signup process.
- Step 2: Navigate to the "Compute" Section
 - Use the search bar to find the "Virtual Server" service.
 - If Virtual Servers are not yet provisioned in your account, click **Create Resource** and choose "Virtual Server for VPC."
- Step 3: Configure Virtual Server Instances
 - Select an appropriate region and resource group for the server.
 - Choose a server profile based on your application requirements (e.g., balanced, compute-intensive).
 - Specify the operating system image, storage, and network options.
 - Enable public or private networking based on your use case.

2. Set Up Security Groups and SSH Access:

- Define security group rules to allow only necessary traffic (e.g., HTTP, HTTPS, and SSH).
- Generate an SSH key pair for secure server access and upload the public key during instance creation.

3. Auto-Scaling Configuration 3.1 Setting Up Auto-Scaling Policies

1. Enable Auto-Scaling:

- Go to the IBM Cloud Console and locate the "Auto-Scaling" option under your Virtual Server for VPC settings.
- Configure the scaling group by specifying the minimum, maximum, and desired number of instances.

2. Define Scaling Policies:

- Policy Type: Choose between threshold-based or schedule-based scaling.
- Metrics: Set up scaling triggers based on CPU utilization, memory usage, or application response time.
- Thresholds: Define upper and lower limits for scaling actions (e.g., scale up if CPU usage exceeds 80%).

3. Test Auto-Scaling Behavior:

- Simulate high traffic scenarios to observe scaling behavior and ensure additional instances are provisioned as expected.

Python Script for Auto-Scaling

```
from ibm_platform_services import VpcV1
from ibm_cloud_sdk_core.authenticators import IAMAuthenticator

# IBM Cloud credentials
API_KEY = 'your-api-key'
authenticator = IAMAuthenticator(API_KEY)

# Initialize the VPC service
vpc_service = VpcV1(authenticator=authenticator)
vpc_service.set_service_url('https://us-south.iaas.cloud.ibm.com/v1')

# Define Auto-Scaling Policy
def create_auto_scaling_group(instance_group_id, min_instances, max_instances,
                              cooldown_period):
    try:
        scaling_policy = {
```

```
"name": "auto-scaling-policy",
"min_membership_count": min_instances,

"max_membership_count": max_instances,
"cooldown": cooldown_period,
"policies": [
    {
        "metric_type": "cpu",
        "operator": "greater_than",
        "value": 75,
        "scale_out": {
            "adjustment_type": "relative",
            "adjustment_value": 1
        }
    },
    {
        "metric_type": "cpu",
        "operator": "less_than",
        "value": 30,
        "scale_in": {
            "adjustment_type": "relative",
            "adjustment_value": 1
        }
    }
]
}

response = vpc_service.create_instance_group_membership(instance_group_id,
scaling_policy)
print("Auto-scaling group created:", response)
except Exception as e:
    print("Error creating auto-scaling group:", str(e))

# Example usage
INSTANCE_GROUP_ID = 'your-instance-group-id'
create_auto_scaling_group(INSTANCE_GROUP_ID, min_instances=2, max_instances=5,
cooldown_period=300)
```

4. Load Balancing Configuration 4.1 Deploying Load Balancers

1. Create a Load Balancer Instance:

- Navigate to the "Load Balancer" service in the IBM Cloud dashboard.
- Click **Create Load Balancer** and select the appropriate type (Public or Private).
- Choose the region and resource group where your servers are deployed.

2. Configure Listener and Pool Settings:

- Define listener protocols and ports (e.g., HTTP/80, HTTPS/443).
- Create a server pool by adding virtual server instances as members.
- Set health check parameters to monitor server availability and performance.

3. Test Load Balancer Functionality:

- Direct application traffic to the load balancer's IP or DNS.
- Validate even traffic distribution and failover mechanisms.

Python Script for Load Balancer

```
def create_load_balancer(vpc_id, subnet_ids, listener_port, pool_protocol, pool_port):
```

```
    try:
```

```
        load_balancer_config = {
```

```
            "name": "my-load-balancer",
```

```
            "is_public": True,
```

```
            "subnets": [{"id": subnet_id} for subnet_id in subnet_ids],
```

```
            "listeners": [
```

```
                {
```

```
                    "port": listener_port,
```

```
                    "protocol": "http",
```

```
                    "default_pool": {
```

```
                        "protocol": pool_protocol,
```

```
                        "port": pool_port,
```

```
                        "members": [
```

```
                            {"target": {"address": "192.168.1.10", "port": pool_port}},
```

```
                            {"target": {"address": "192.168.1.11", "port": pool_port}},
```

```
                        ]
```

```
                    }
```

```
        }
    ]
}

response = vpc_service.create_load_balancer(vpc_id, load_balancer_config)
print("Load Balancer created:", response)
except Exception as e:
    print("Error creating load balancer:", str(e))

# Example usage
VPC_ID = 'your-vpc-id'
SUBNET_IDS = ['subnet-id-1', 'subnet-id-2']
create_load_balancer(VPC_ID, SUBNET_IDS, listener_port=80, pool_protocol="http",
    pool_port=8080)
```

5. Monitoring and Optimization 5.1 Integrating IBM Cloud Monitoring

1. Set Up Monitoring Dashboards:

- Use IBM Cloud Monitoring with Sysdig to track key metrics like CPU usage, memory utilization, and response times.
- Create custom dashboards to visualize performance trends and identify bottlenecks.

2. Set Alerts and Notifications:

- Configure alert thresholds for critical metrics to receive real-time notifications.
- Integrate with tools like Slack or email for alert delivery.

Python Script for Sending Custom Metrics

```
import requests
import json

# Sysdig API Key
SYSDIG_API_KEY = 'your-sysdig-api-key'
SYSDIG_API_URL = 'https://app.sysdigcloud.com/api/v1/metrics'

# Push Custom Metric
def push_custom_metric(metric_name, value):
    headers = {
        "Authorization": f"Bearer {SYSDIG_API_KEY}",
```

```
"Content-Type": "application/json"
}
data = {
    "metrics": [
        {
            "name": metric_name,
            "type": "gauge",
            "value": value
        }
    ]
}
response = requests.post(SYSDIG_API_URL, headers=headers, data=json.dumps(data))
if response.status_code == 200:
    print("Metric sent successfully!")
else:
    print(f"Failed to send metric: {response.status_code}, {response.text}")
```

Example usage

```
push_custom_metric("app.cpu.usage", 70)
```

IBM Cloud CLI for Monitoring

Install IBM Cloud Monitoring CLI Plugin

```
ibmcloud plugin install monitoring
```

Configure Monitoring Service

```
ibmcloud monitoring target --instance-id <INSTANCE_ID>
```

View Metrics

```
ibmcloud monitoring metrics
```

7. Conclusion This project demonstrates the deployment of a scalable and reliable web hosting solution leveraging IBM Cloud's advanced features. The system ensures high availability through auto-scaling and load balancing while maintaining optimal performance and security. With proper monitoring and best practices in place, this solution is well-suited for production environments.

8. Further Enhancements

1. Advanced Auto-Scaling Strategies:

- Implement predictive scaling based on historical traffic data.

2. Global Traffic Management:

- Deploy IBM Cloud's DNS services for global load balancing and low-latency access.

3. Disaster Recovery Setup:

- Create a disaster recovery plan using IBM Cloud Backup and replication across regions.

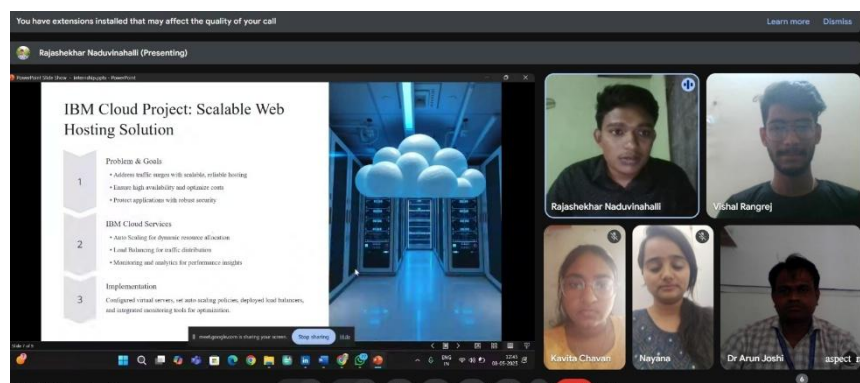
4. Cost Optimization:

- Regularly analyze billing and optimize resource allocation to reduce operational costs.

5. CI/CD Integration:

- Implement continuous integration and deployment pipelines for seamless application updates.

SNAPSHOTS



3.2.6 Conclusion

My academic project on "**Scalable Web Hosting Using Auto-Scaling and Load Balancing on IBM Cloud**" has been an immensely enriching experience that bridged the gap between theoretical learning and real-world application. Throughout this project, I gained practical exposure to cloud computing principles, infrastructure automation, load distribution mechanisms, and resource optimization using IBM Cloud services.

The implementation allowed me to explore IBM Cloud's offerings such as Virtual Servers, Load Balancers, Auto-Scaling, Monitoring with Sysdig, and infrastructure provisioning tools. Engaging in various stages of the project—ranging from requirement analysis, design, deployment, testing, to monitoring—sharpened my technical acumen and project management skills. I also learned to document, troubleshoot, and iteratively improve the deployed solution.

Working on this project helped me enhance not only my cloud skills but also critical thinking, analytical reasoning, and team collaboration abilities. It provided a hands-on understanding of how scalable architectures are planned and maintained in a cloud-native environment, which will be highly beneficial in my professional journey.

I am sincerely grateful for the guidance and support provided by my mentors, peers, and institution throughout this journey. This project has reinforced my interest in cloud technologies and has set a strong foundation for future learning and specialization in areas such as DevOps, SRE, and cloud security. The experience has been a key milestone in shaping my career path in the IT industry.

Chapter 4

Reflection

The project on **Cloud-Based Disaster Recovery System Using IBM Cloud Resiliency Orchestration** has been a transformative learning experience that significantly broadened my understanding of cloud computing, disaster recovery, and resiliency management in modern IT infrastructure. As a student venturing into the world of cloud solutions and enterprise-level disaster recovery, working with IBM Cloud Resiliency Orchestration allowed me to experience firsthand how to build, manage, and optimize disaster recovery systems for critical workloads in the cloud.

1. Learning Objectives and Outcomes:

The primary objective of this project was to explore and apply the concepts of cloud-based disaster recovery and resiliency using IBM Cloud Resiliency Orchestration. I began with a foundational understanding of cloud computing, disaster recovery, and the key principles of **RPO (Recovery Point Objective)** and **RTO (Recovery Time Objective)**. As the project progressed, I built expertise in using IBM Cloud Resiliency Orchestration to ensure data continuity, minimize downtime, and provide effective recovery mechanisms for various cloud-hosted applications.

A significant outcome of the project was my improved proficiency in cloud-based disaster recovery, particularly the ability to implement automated disaster recovery plans for applications and virtual machines across multi-cloud environments. IBM Cloud Resiliency Orchestration provided a seamless way to orchestrate failover and failback processes, ensuring that critical workloads are quickly restored after disruptions. I also gained insights into how to automate and streamline disaster recovery testing and compliance audits to meet organizational business continuity requirements.

2. Using IBM Cloud Resiliency Orchestration:

IBM Cloud Resiliency Orchestration served as the central platform for designing, implementing, and testing disaster recovery strategies. It allowed for seamless integration with IBM Cloud and other cloud environments, ensuring that disaster recovery was simplified and fully automated. The platform's intuitive interface made it easy to define and deploy recovery plans, while its powerful analytics provided valuable insights into system performance, recovery success rates, and potential vulnerabilities.

One of the major challenges I faced during this project was managing multi-cloud disaster recovery environments. Setting up a resilient infrastructure that spans across different cloud environments, such as **IBM Cloud** and **AWS**, required careful planning, testing,

and validation. I had to ensure that data was replicated effectively, failover processes were seamless, and recovery times were minimized.

Another challenge was the testing and validation of the disaster recovery plan. It was critical to perform rigorous testing to ensure that recovery processes worked as expected under various failure scenarios. This involved running periodic simulations, testing RPO and RTO goals, and ensuring compliance with industry standards. While initially time-consuming, this process gave me a comprehensive understanding of the importance of disaster recovery testing in maintaining business continuity.

3. Real-World Application and Impact:

One of the key highlights of this project was the opportunity to design a disaster recovery solution for a **real-world business use case**. For instance, by simulating the failure of key applications (e.g., customer-facing portals, databases, etc.), I was able to observe how IBM Cloud Resiliency Orchestration could quickly restore services without data loss. This is highly relevant in industries like **finance**, **healthcare**, and **e-commerce**, where application downtime can have significant financial and reputational impacts.

The practical exposure gained through this project is critical in the current industry landscape, where cloud adoption and business continuity planning are increasingly important. The ability to deploy disaster recovery systems in the cloud using tools like IBM Cloud Resiliency Orchestration will be highly beneficial as I pursue future roles in cloud solutions engineering, systems architecture, and IT infrastructure management.

Conclusion

My internship at Rooman Technologies has been a highly valuable and rewarding experience that significantly contributed to both my academic and professional development. Over the duration of the internship, I was exposed to a wide range of real-time projects and industrial practices that helped me gain a deeper understanding of the IT industry and its dynamic environment.

This internship allowed me to apply the theoretical knowledge I had acquired during my academic coursework to practical situations. I worked with various tools and technologies, and actively participated in project activities such as system configuration, troubleshooting, documentation, and testing. These tasks not only enhanced my technical capabilities but also developed my critical thinking, problem-solving, and analytical skills. One of the major highlights of the internship was the opportunity to learn from experienced professionals who provided constant guidance, feedback, and encouragement. Their mentorship played a crucial role in helping me understand industry expectations, improve my performance, and adapt to a professional work culture. Moreover, working at Rooman Technologies improved my soft skills such as communication, time management, and teamwork. I learned how to effectively interact with team members, manage deadlines, and contribute meaningfully to group discussions and project outcomes.

This internship has been a stepping stone toward my professional goals. It has given me a clearer perspective on my career path and inspired me to explore more advanced areas within the IT field. I am sincerely thankful to Rooman Technologies for providing me with this opportunity and to all the mentors and team members who supported me throughout the internship. The knowledge, skills, and experiences I gained here will undoubtedly serve as a strong foundation as I move forward in my career.

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On the Job Training Certificate

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D/o, S/o **Virupakshappa Naduvinahalli** has successfully completed the
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