Industrial Internship Report on

"HealthCare Data Management System"

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 Healthcare Data management system using AWS cloud services |
| 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. |

TABLE OF CONTENTS

1 Preface

Summary of the whole 6 weeks' work.

About need of relevant Internship in career development.

Brief about Your project/problem statement.

Opportunity given by USC/UCT.

How Program was planned
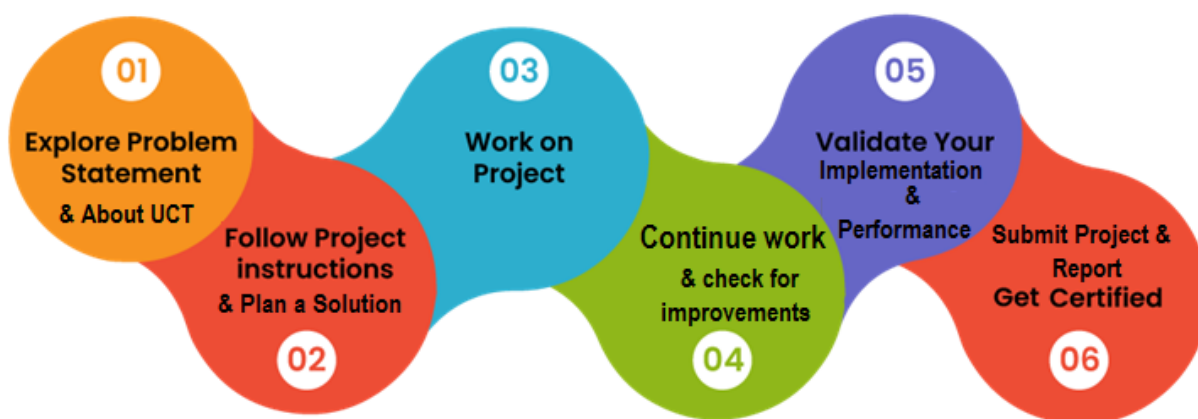
Your Learnings and overall experience.

Thank to Ankit Sir,

Your message to your juniors and peers.

2   Introduction

2.1   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
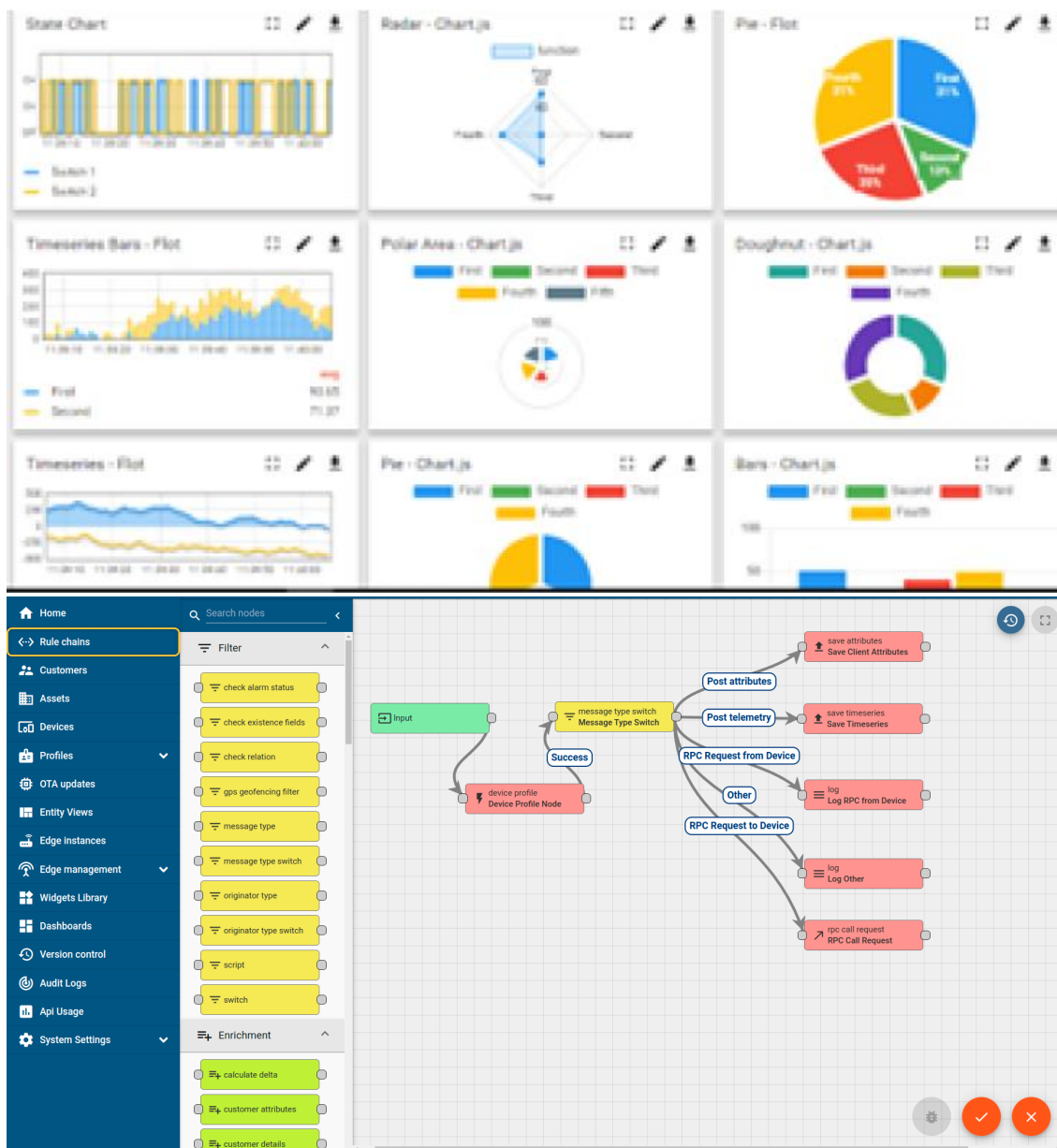
ii. **Smart Factory Platform (** **)**

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.
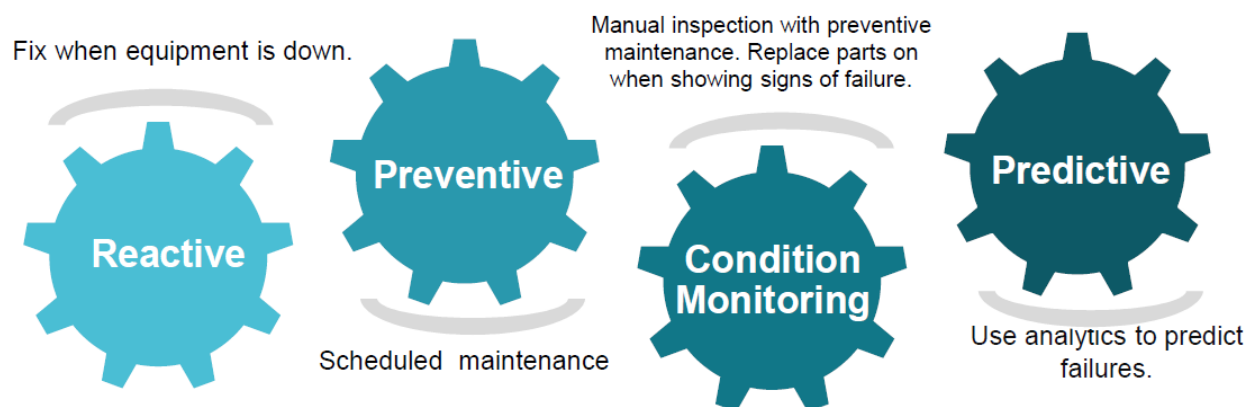
2.2   About upskill Campus (USC)

upskill Campus along with The IoT Academy and in association with Uniconverge technologies has facilitated the smooth execution of the complete internship process.
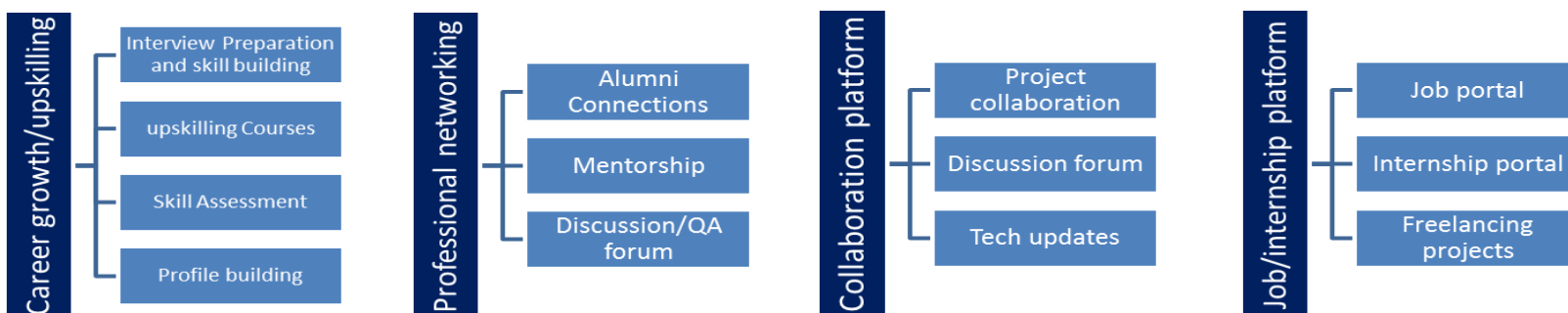
USC is a career development platform that delivers **personalized executive coaching** in a more affordable, scalable and measurable way.
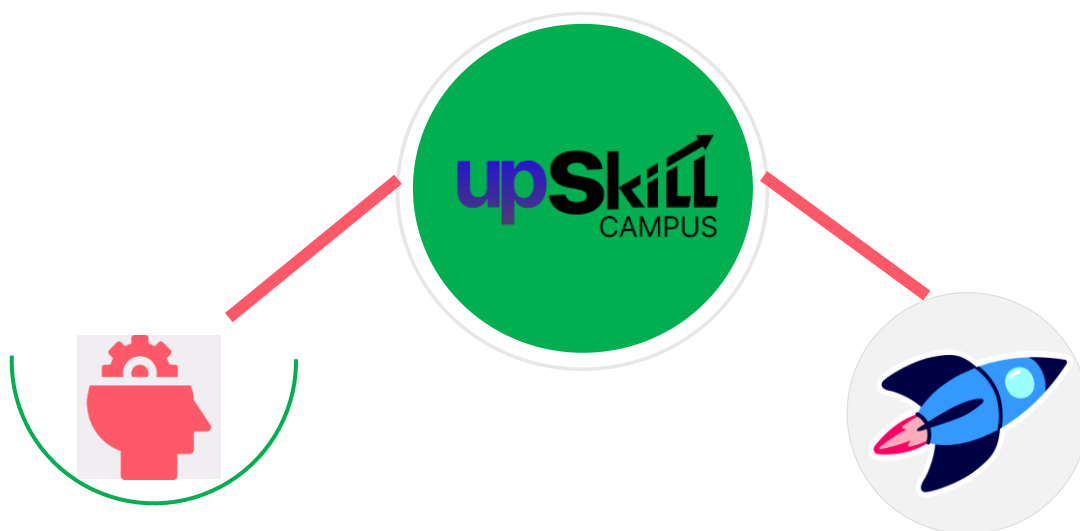
Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

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

https://www.upskillcampus.com/

Career growth/upskilling		Professional networking		Collaboration platform		Job/internship platform	
	Interview Preparation and skill building		Alumni Connections		Project collaboration		Job portal
	upskilling Courses		Mentorship		Discussion forum		Internship portal
	Skill Assessment		Discussion/QA forum		Tech updates		Freelancing projects
	Profile building						

2.3   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.

2.4   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.

2.5   Reference

[1] Binstock, Andrew (May 20,2015)." Java's 20 Years of innovation". Forbes, Archived from the originally
on March 14,2016. Retrieved March 18, 2016

[2] Herbert Scheldt, Java Complete Reference, Fifth Edition, Tata McGraw Hill Edition

[3] "The Java Language Specification, 2nd Edition "Archived from original on August 5, 2011.

Retrieved February 8,2009

2.6 Glossary

Terms	Acronyms
Healthcare Data Management System	AWS: Amazon Web Services
Cloud Computing	HIPAA: Health Insurance Portability and Accountability Act
Data Security	API: Application Programming Interface
Scalability	EMR: Elastic MapReduce
Compliance	RDS: Relational Database Service
Interoperability	S3: Simple Storage Service
Data Integration	Lambda: AWS Lambda (Serverless Compute Service)
Analytics	EHR: Electronic Health Record
Machine Learning	ML: Machine Learning
Electronic Health Records (EHRs)	GDPR: General Data Protection Regulation
Predictive Analytics	AI: Artificial Intelligence
Anomaly Detection	

3 Problem Statement

In the assigned problem statement

In the healthcare sector, effective management and analysis of patient data are critical for improving healthcare delivery, enhancing patient outcomes, and optimizing resource utilization. However, healthcare organizations often face challenges in efficiently storing, processing, and securing vast amounts of patient data while adhering to strict regulatory requirements. Additionally, the need for seamless access to healthcare data across various stakeholders further complicates data management processes.

Key Challenges:

1. **Data Security and Compliance:** Healthcare data is highly sensitive and subject to stringent regulatory standards such as HIPAA (Health Insurance Portability and Accountability Act). Ensuring data security and compliance with regulatory requirements while storing and processing patient data in the cloud is a significant challenge.

2. **Scalability and Performance:** Healthcare organizations must accommodate the exponential growth of patient data while maintaining high-performance standards. Scalability becomes crucial to handle increasing data volumes, especially during peak periods, without compromising system performance.

3. **Interoperability and Data Integration:** Integrating disparate healthcare systems and data sources to enable seamless data exchange and interoperability is essential for providing comprehensive patient care. However, achieving interoperability between legacy systems and modern cloud-based solutions poses integration challenges.

4. **Data Analytics and Insights:** Leveraging healthcare data for actionable insights and predictive analytics can enhance clinical decision-making and patient outcomes. However, organizations often lack the necessary infrastructure and expertise to implement advanced analytics solutions effectively.

4   Existing and Proposed solution

1. **Summary of Existing Solutions Provided by Others and Their Limitations**:
   - Existing solutions provided by others include approaches for conducting performance testing effectively. They emphasize establishing measurable criteria, evaluating system responses under various conditions, and focusing on specific areas such as AWS cloud platform performance, IoT data collection and analysis, security, compliance, load testing, and optimization.
   - Limitations of existing solutions may include lack of specificity regarding tools and techniques for performance testing, insufficient consideration of scalability and security aspects, and absence of comprehensive analysis and optimization strategies.

2. **Proposed Solution**:
   - Our proposed solution builds upon the foundations laid by existing approaches but aims to address their limitations by providing a more detailed and structured framework for conducting performance testing.
   - We will outline specific tools and techniques for performance testing in each area, such as using AWS CloudWatch for monitoring AWS resource utilization and JMeter for load testing IoT data ingestion.
   - Our solution will emphasize scalability, security, and compliance by incorporating best practices for resource allocation, encryption, and regulatory compliance checks.
   - We will focus on comprehensive analysis and optimization strategies, including identifying performance bottlenecks, implementing caching mechanisms, and establishing continuous monitoring for proactive issue detection.

4.1   Code submission (Github link):

https://github.com/Ambati-Sai/upskillcampus/tree/main/HealthCare_Data_Management_System-pythoncode

4.2   Report submission (Github link):

https://github.com/Ambati-Sai/upskillcampus
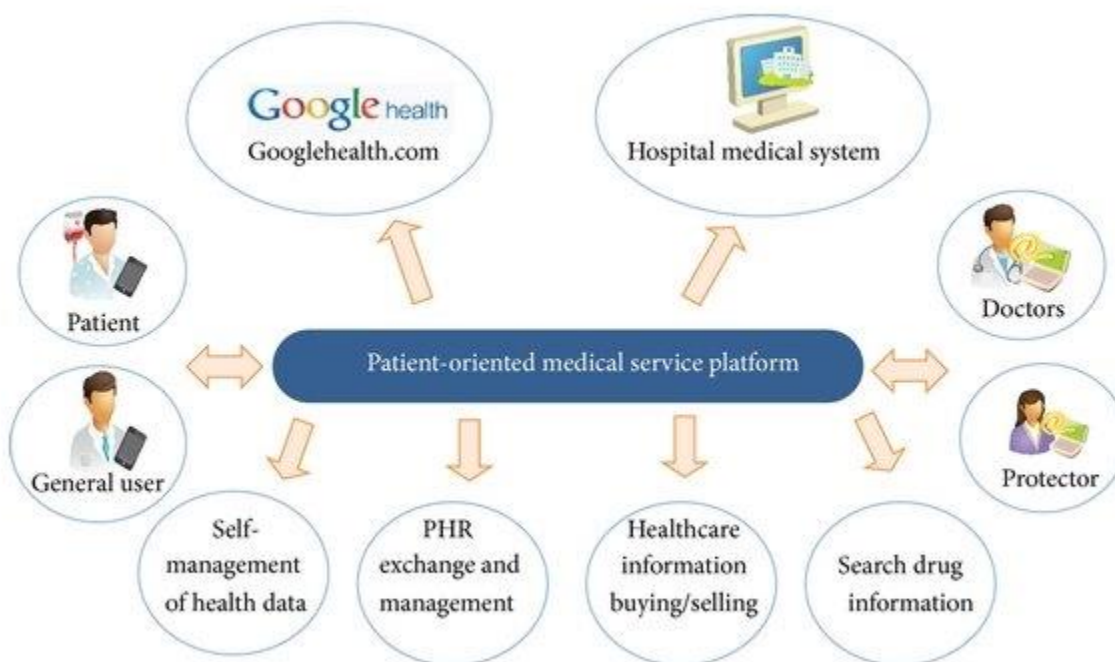
4.3   Proposed Design/ Model

Given more details about design flow of your solution. This is applicable for all domains. DS/ML Students can cover it after they have their algorithm implementation. There is always a start, intermediate stages and then final outcome.
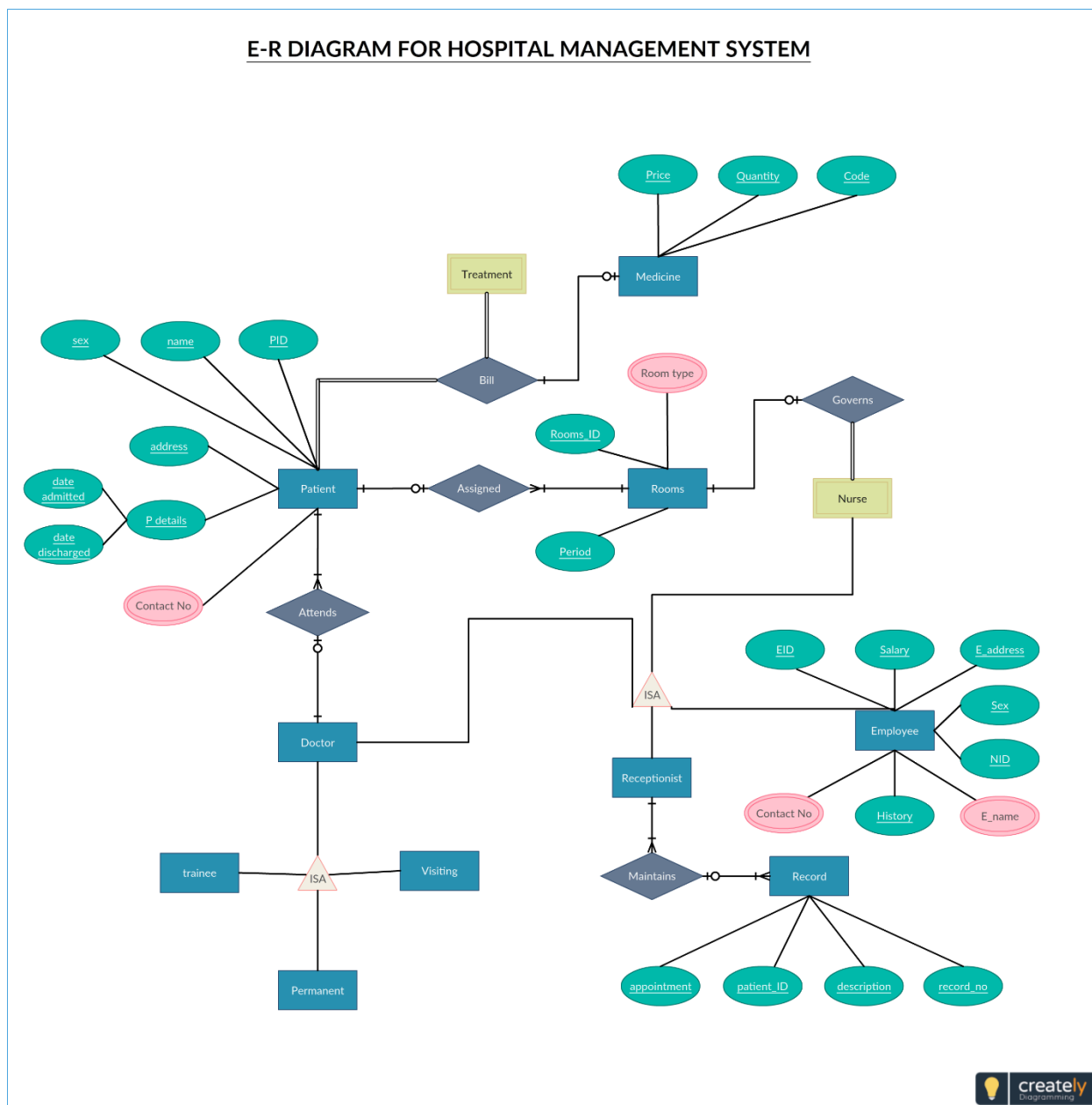
4.4   High Level Diagram

Figure 1: HIGH LEVEL DIAGRAM OF THE HealthCare Date Management System

Zero Level DFD - Health Center Management System

4.6 Interfaces

E-R DIAGRAM FOR HOSPITAL MANAGEMENT SYSTEM
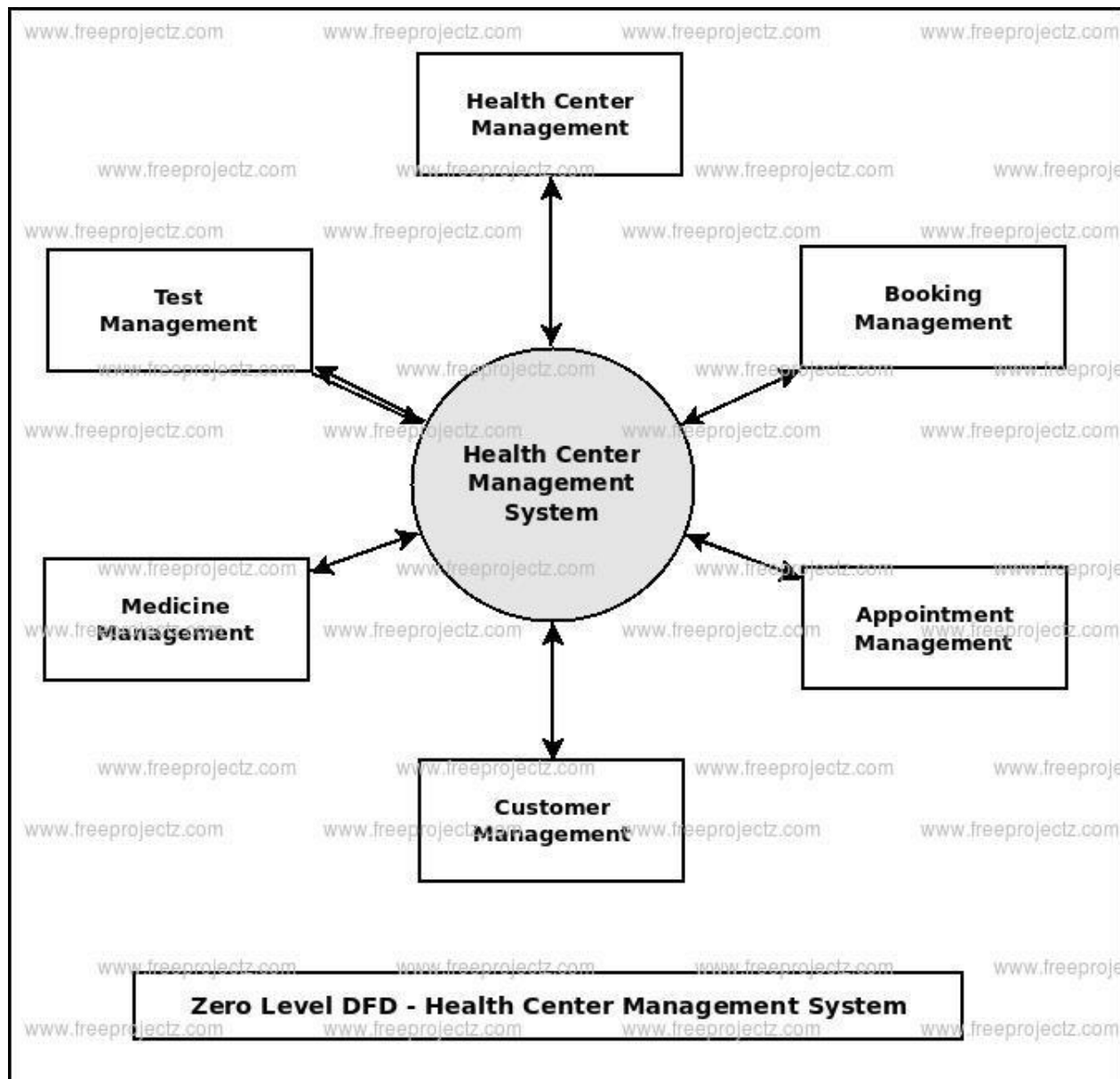
Effective performance testing involves establishing measurable criteria and evaluating system response under varied conditions. Here's an approach tailored for the project:

AWS Cloud Platform Performance:

- Measure response time for operations like AWS service access and SQL server setup.
- Assess scalability during resource provisioning and data processing.
- Monitor CPU, memory, and storage utilization to identify bottlenecks.

IoT Data Collection and Analysis:

- Evaluate data ingestion rate from IoT devices.
- Assess data processing time and visualization performance.
- Ensure timely presentation of insights to users.

Security and Compliance:

- Evaluate encryption impact on data transmission speed.
- Measure authentication and authorization checks' impact on system performance.
- Assess compliance with regulations like GDPR or HIPAA.

Load Testing:

- Simulate realistic scenarios with varying user loads and transaction rates.
- Stress test to identify performance thresholds and failure points.
- Conduct endurance testing to verify system stability under sustained usage.

Analysis and Optimization:

- Identify bottlenecks like slow queries or network latency.
- Implement optimization strategies such as caching or query optimization.
- Establish continuous monitoring to proactively identify performance issues.

Comprehensive performance testing ensures that the project's cloud infrastructure, IoT integration, and data processing meet requirements, delivering a responsive and reliable user experience.

4.7   Test Plan/ Test Cases

4.8   Test Procedure

4.9   Performance Outcome

My learnings

Project Summary:

The project involves a structured learning journey encompassing SQL revision, cloud computing exploration, and integration of IoT platforms. The participant utilized various resources and engaged in hands-on activities to acquire knowledge and skills relevant to the project objectives.

4.9.1 SQL Revision and Cloud Computing Exploration:

- **Days 01-06**: Engaged in SQL revision covering database fundamentals, advanced commands, and cloud computing concepts.
- **Utilized Learning Resources**: Leveraged USC_TIA documentation, attended webinars, and participated in cloud computing challenges to deepen understanding.
- **Project Research and Decision-Making**: Conducted thorough research on project requirements, including hardware, software, and cloud platforms. Opted for AWS after evaluating different options.
- **Hands-on Practice**: Created AWS Cloud Platform Account, installed necessary libraries, and explored cloud platform basics.

4.9.2 Integration of IoT Platforms:

- **Learning about IoT Platforms**: Explored ThingSpeak and AWS IoT Core platforms for IoT data collection, analysis, and visualization.
- **Key Features**: Learned about ThingSpeak's data collection and analysis capabilities and AWS IoT Core's managed cloud platform for secure device connectivity.

- **Integration with IBM Bluemix**: Investigated data upload capabilities to IBM Bluemix for storage, processing, and analysis in the cloud platform.

4.9.3 Learning Resources Utilized:

- **USC_TIA Documentation**: Utilized official documentation for reference and troubleshooting, supplemented by webinars and online tutorials.
- **Cloud Computing Resources**: Engaged with AWS Fundamentals and completed a short-term course on MSSQL DBMS to strengthen cloud computing skills.
- **IoT Platform Exploration**: Learned about ThingSpeak and AWS IoT Core features and functionality to enable IoT integration.

4.9.4 Conclusion:

This project demonstrates a proactive approach to learning and project implementation, combining SQL revision, cloud computing exploration, and IoT integration. By leveraging a diverse range of resources and platforms, the participant has acquired valuable knowledge and skills, laying a solid foundation for future projects and career development in relevant domains.
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5   Future work scope

Certainly! Here are some additional ideas that could not be implemented due to time limitations but could be considered for future exploration:

1. **Advanced SQL Topics**: Delve deeper into advanced SQL topics such as stored procedures, triggers, and views for more comprehensive database management skills.
2. **Cloud Services Comparison**: Conduct a detailed comparison between different cloud service providers (e.g., AWS, Azure, Google Cloud) to understand their strengths, weaknesses, and suitability for various project requirements.
3. **IoT Platform Integration**: Explore additional IoT platforms beyond ThingSpeak and AWS IoT Core, such as Google Cloud IoT or Microsoft Azure IoT Hub, to broaden understanding and skillset in IoT integration.
4. **Machine Learning Integration**: Investigate the integration of machine learning models with IoT data for predictive analytics and anomaly detection, enhancing the project's data analysis capabilities.
5. **Advanced AWS Services**: Dive deeper into advanced AWS services such as AWS Lambda, AWS S3, or AWS DynamoDB to expand knowledge and skillset in cloud computing.
6. **DevOps Practices**: Learn and implement DevOps practices for automated deployment, monitoring, and management of cloud-based applications, enhancing project scalability and reliability.
7. **Data Visualization Techniques**: Explore advanced data visualization techniques and tools beyond MATLAB for more insightful analysis and presentation of IoT data.
8. **Security and Compliance**: Gain a deeper understanding of cloud security best practices and compliance requirements, ensuring robust security measures are in place for the project's cloud infrastructure.
9. **Continuous Learning**: Continue to engage with online courses, webinars, and forums to stay updated with the latest developments in SQL, cloud computing, and IoT technologies, fostering continuous learning and skill enhancement.

By considering these ideas for future exploration, you can further enrich your learning journey and broaden your expertise in relevant domains.