Industrial Internship Report on

Healthcare Data Management

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 of developing a healthcare management system that enables efficient patient data handling and secure authentication. It provides a comprehensive solution for managing patient records, scheduling, and billing. 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.

[Your College Logo]

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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 all (with names), who have helped you directly or indirectly.

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
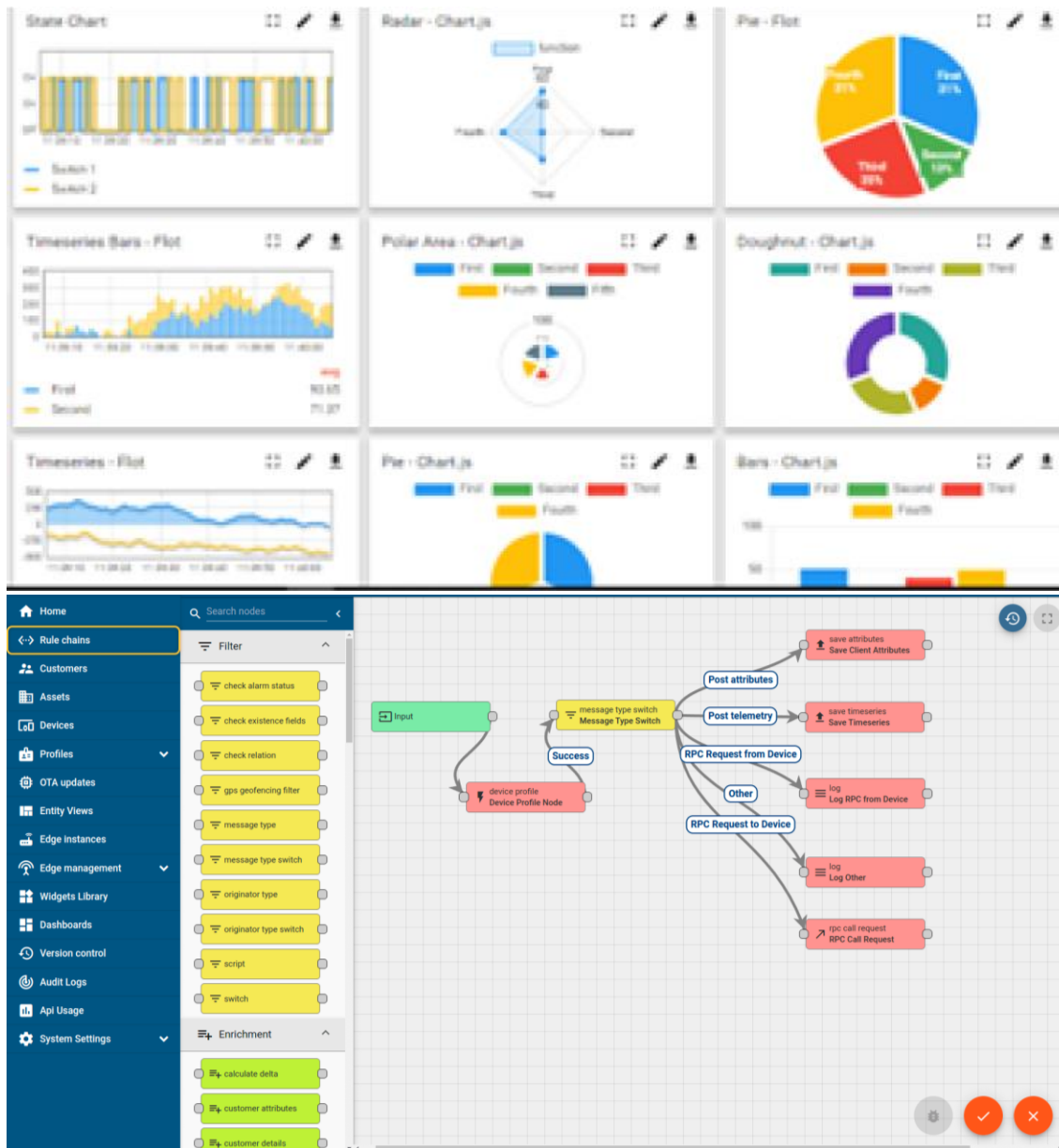
ii.   **Smart Factory Platform (** FACTORY WATCH **)**

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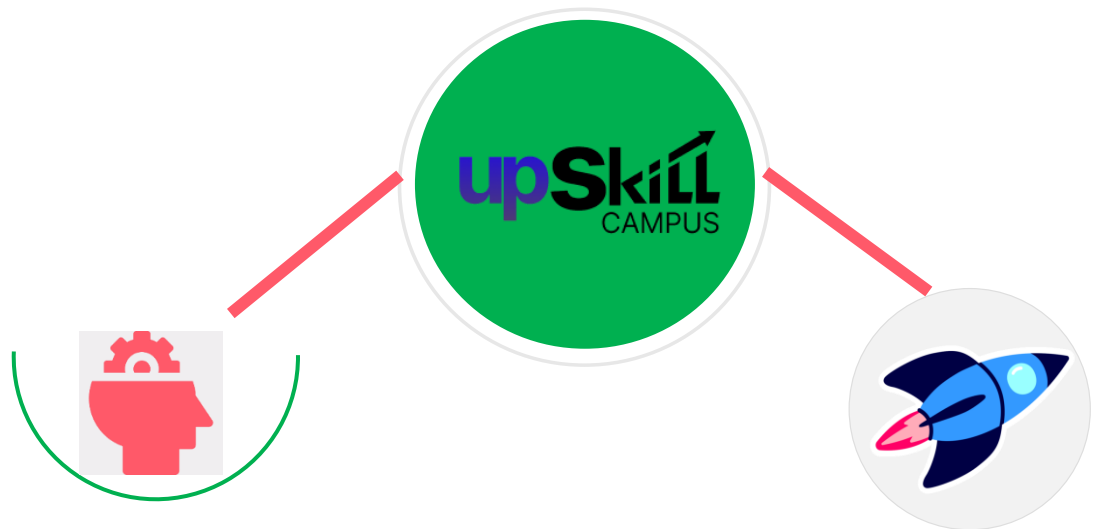
Seeing need of upskilling in self paced manner along-with additional support services e.g. Internship, projects, interaction with Industry experts, Career growth Services

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

https://www.upskillcampus.com/

Career growth/upskilling
- Interview Preparation and skill building
- upskilling Courses
- Skill Assessment
- Profile building

Professional networking
- Alumni Connections
- Mentorship
- Discussion/QA forum

Collaboration platform
- Project collaboration
- Discussion forum
- Tech updates

Job/internship platform
- Job portal
- Internship portal
- Freelancing projects

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]

[2]

[3]

2.6 Glossary

Terms	Acronym

3 Problem Statement

In the assigned problem statement

The assigned project aimed to develop a comprehensive healthcare management system to address key challenges in handling patient data, medical records, and imaging. The primary issues included:

1. **Data Integration**: Consolidating fragmented patient data from various sources into a unified system.
2. **Data Security**: Ensuring robust protection of sensitive patient information against unauthorized access and breaches.
3. **Accessibility**: Providing quick and reliable access to patient records for healthcare providers, both on-site and remotely.
4. **Data Sharing**: Facilitating secure sharing of patient data and medical imaging among authorized healthcare professionals.
5. **Scalability**: Creating a system that can grow with increasing data volumes and user demands.
6. **Compliance**: Meeting regulatory requirements like HIPAA to ensure legal and secure data handling practices.

The solution aimed to create a secure, efficient, and scalable cloud-based platform to streamline the management of critical healthcare information.

4 Existing and Proposed solution

Several healthcare management systems are currently available, offering various features for managing patient data and medical records. Some notable examples include Epic Systems, Cerner, and Allscripts. While these solutions have their strengths, they also have significant limitations:

1. **Epic Systems**:
   - **Strengths**: Comprehensive suite of tools, strong market presence, robust support.
   - **Limitations**: High cost, complex implementation, limited customization options, and often requires extensive training.
2. **Cerner**:
   - **Strengths**: Extensive data analytics capabilities, strong focus on interoperability, wide adoption in large healthcare organizations.
   - **Limitations**: Expensive, can be difficult to integrate with legacy systems, user interface can be cumbersome.
3. **Allscripts**:
   - **Strengths**: Flexible deployment options, good support for outpatient settings, relatively user-friendly.
   - **Limitations**: Inconsistent performance, frequent updates can cause disruptions, limited scalability for larger organizations.

Limitations of Existing Solutions:

- **Cost**: High implementation and maintenance costs, making them less accessible for smaller healthcare providers.
- **Complexity**: Difficult and time-consuming to implement and customize.
- **Integration**: Challenges in integrating with existing legacy systems and other third-party applications.
- **User Experience**: Often have complex and unintuitive user interfaces, leading to longer training times and reduced efficiency.
- **Scalability**: Some solutions struggle to scale efficiently with growing data volumes and user bases.

Proposed Solution

Our proposed solution is a cloud-based healthcare management system designed to address the limitations of existing solutions. Key features include:

1. **Cost-Effectiveness**: Leveraging cloud infrastructure to reduce implementation and maintenance costs, making it accessible to both large and small healthcare providers.
2. **Ease of Implementation**: Simplified deployment process with comprehensive documentation and support, minimizing downtime and resource requirements.
3. **Integration**: Seamless integration with existing legacy systems and third-party applications through standardized APIs and data exchange protocols.
4. **User-Friendly Interface**: Intuitive and easy-to-use interface designed to enhance user experience and reduce training time.
5. **Scalability**: Built on a scalable cloud platform, allowing the system to grow with the needs of the organization.

6. **Security and Compliance**: Robust security measures and compliance with healthcare regulations such as HIPAA to ensure data protection and privacy.

Value Addition

Our solution offers several value additions over existing systems:

1. **Enhanced Accessibility**: Cloud-based architecture allows secure access to patient data from anywhere, at any time, facilitating remote consultations and telemedicine.
2. **Advanced Analytics**: Integrated analytics tools provide valuable insights into patient care and operational efficiency, helping healthcare providers make informed decisions.
3. **Interoperability**: Strong focus on interoperability ensures smooth data exchange between different healthcare systems and providers.
4. **Customizability**: Flexible and customizable to meet the unique needs of different healthcare organizations, with options for tailored workflows and features.

By addressing the limitations of existing solutions and adding these unique values, our healthcare management system aims to provide a comprehensive, efficient, and secure solution for healthcare organizations of all sizes.

4.1 Code submission (Github link)

4.2 Report submission (Github link) :

5 Proposed Design/ Model
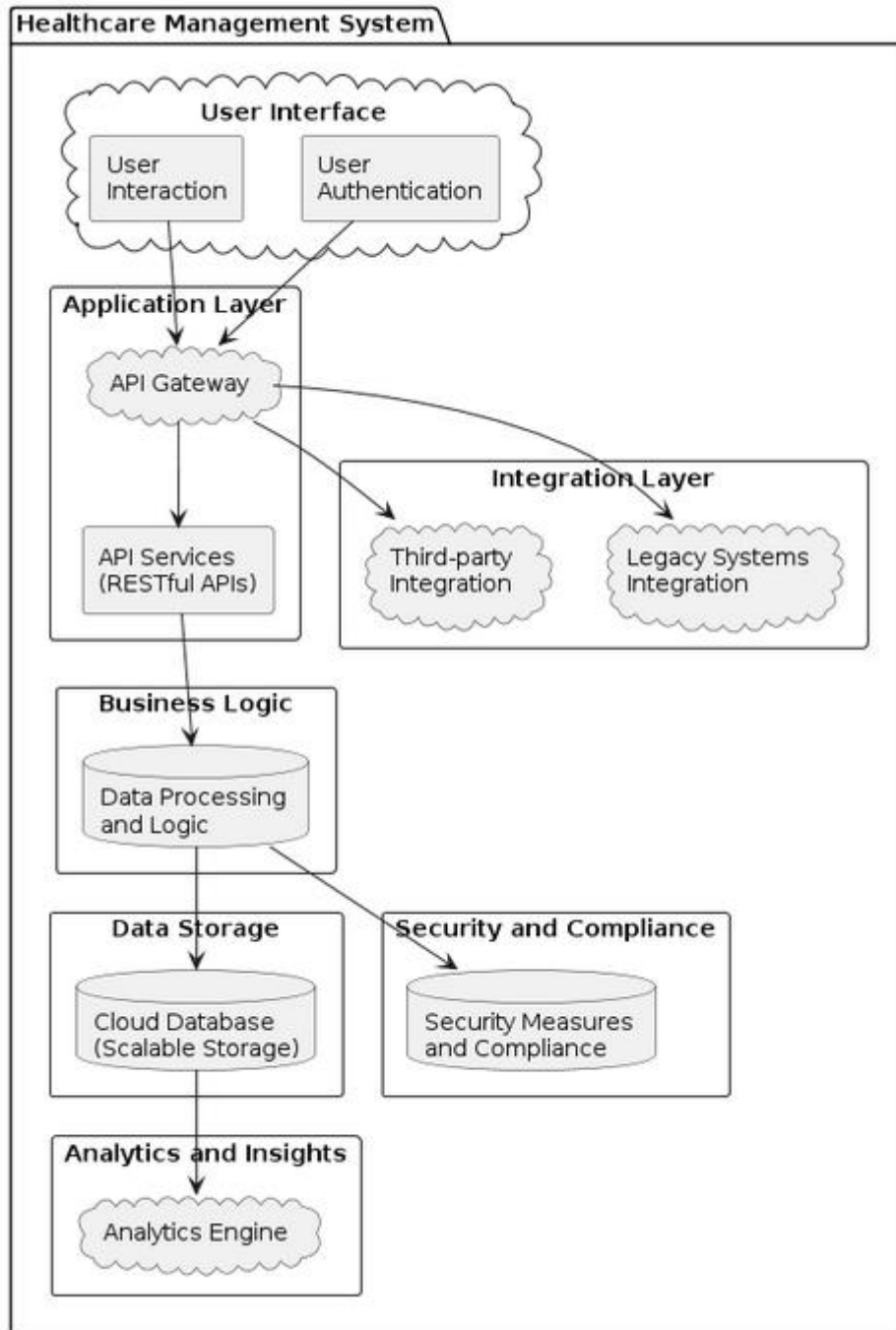
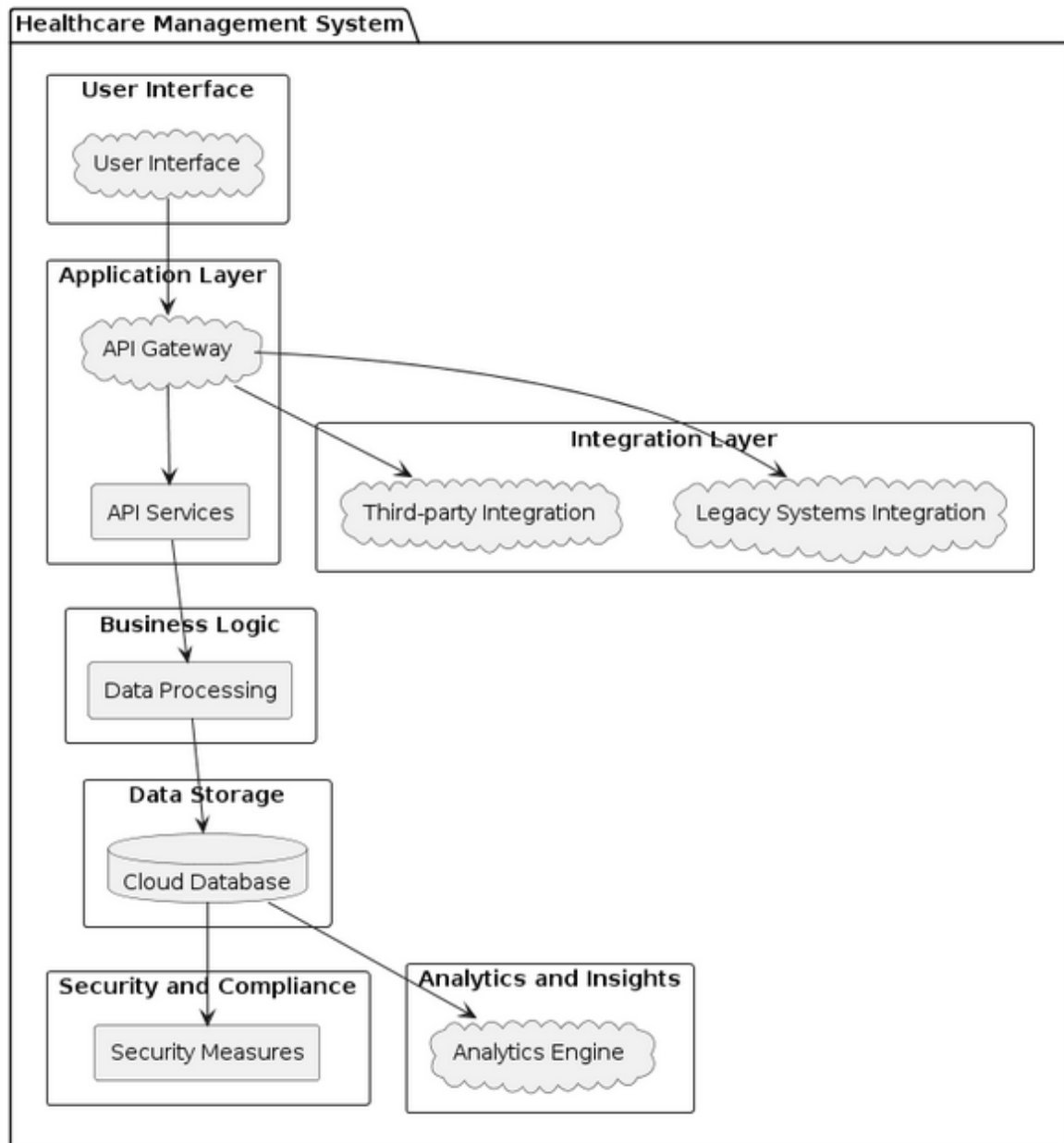## 5.1 High Level Diagram (if applicable)
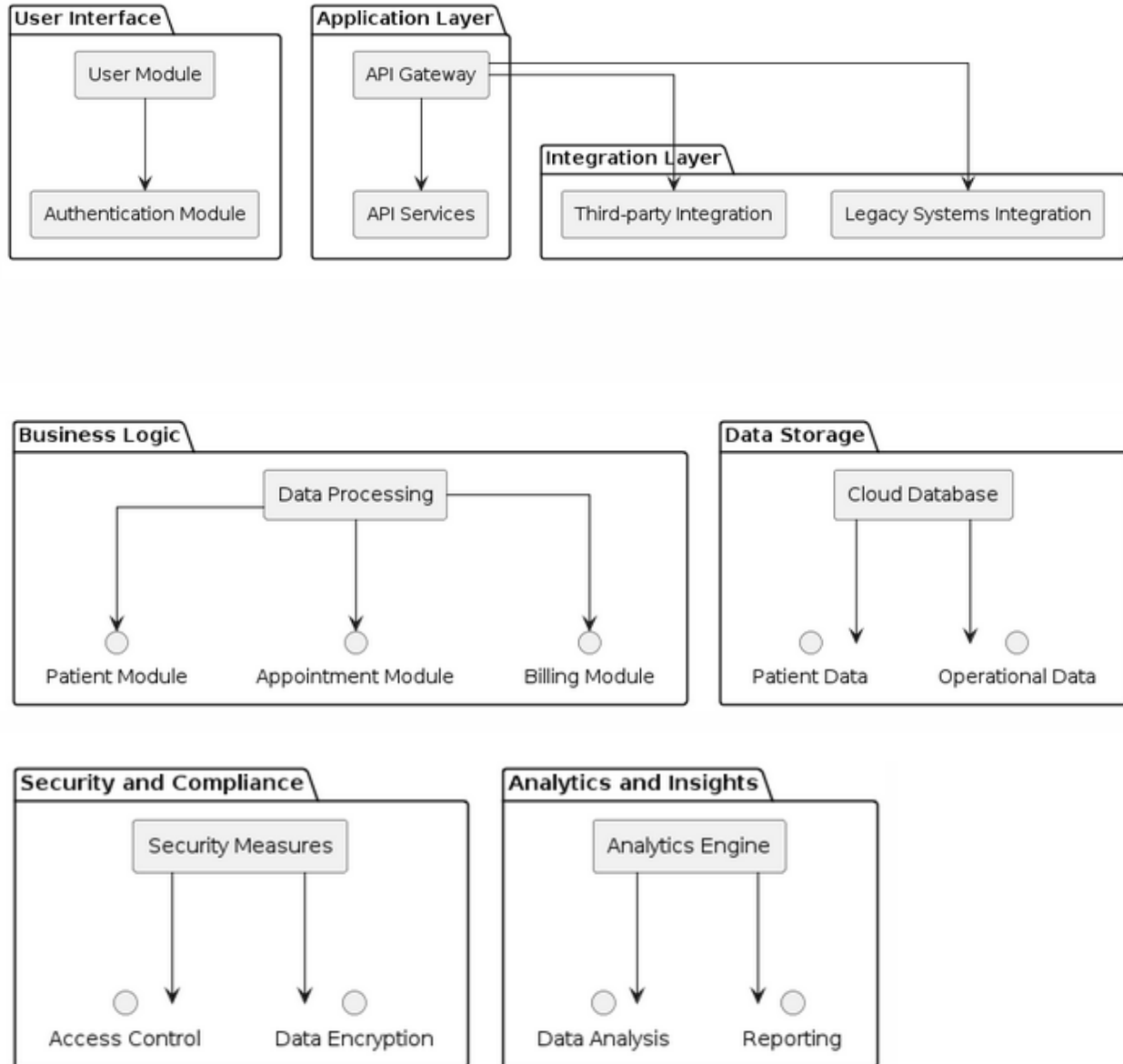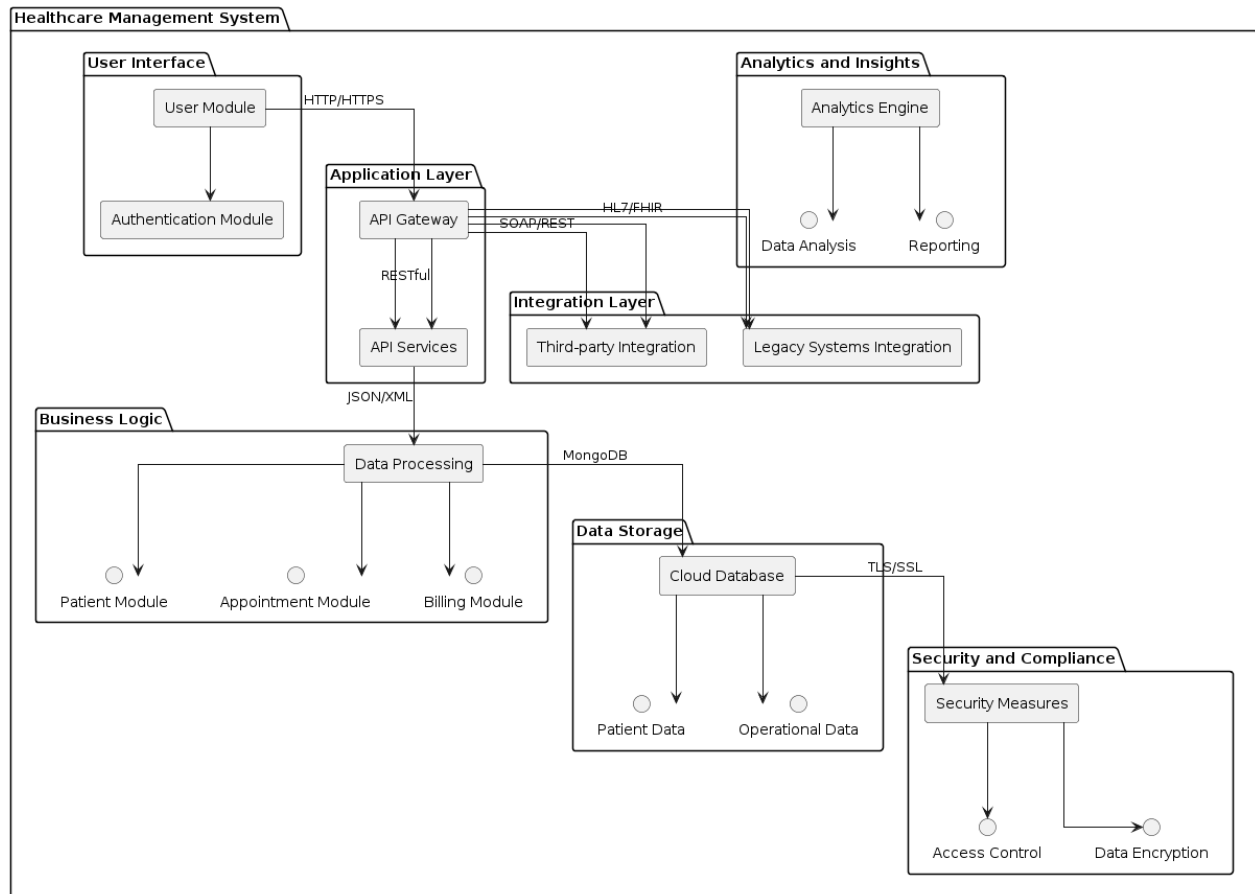

Figure 1: HIGH LEVEL DIAGRAM OF THE SYSTEM

5.2 Low Level Diagram (if applicable)

5.3   Interfaces (if applicable)

Update with Block Diagrams, Data flow, protocols, FLOW Charts, State Machines, Memory Buffer Management.

6 Performance Test

To address constraints and their handling in your healthcare management system design, especially in a real industry context, you should document the following aspects in your report:

6.1.1 1. Identified Constraints:

- **Memory**: Limitations on memory usage, especially in cloud environments.
- **Performance (MIPS)**: Requirements for speed and operations per second (throughput).
- **Accuracy**: Precision and correctness of data processing and analytics.
- **Durability**: Reliability and robustness of data storage and processing.
- **Power Consumption**: Efficiency in resource usage, particularly in cloud or server environments.

6.1.2 2. Handling Constraints in Design:

- **Memory Management**: Utilizing efficient data structures and algorithms to optimize memory usage. For example, using appropriate caching strategies or optimizing database queries.
- **Performance Optimization**: Implementing asynchronous processing, parallelism, or optimizing critical paths in algorithms to meet performance requirements.
- **Accuracy Assurance**: Validating data inputs, implementing error handling mechanisms, and ensuring data integrity through validations and checks.
- **Durability and Reliability**: Implementing redundant storage, failover mechanisms, and backup strategies to ensure data availability and durability.
- **Power Efficiency**: Optimizing code for reduced computational overhead and minimizing resource usage in cloud deployments.

6.1.3 3. Test Results and Validation:

- **Container Testing in Java**: Documenting test scenarios and results for containerized components, ensuring compatibility, scalability, and performance within Docker or Kubernetes environments.
- **Impact Assessment**: If specific constraints were not directly tested, discuss potential impacts on system performance or reliability. For example, increased memory usage affecting scalability or inadequate performance under peak loads.
- **Recommendations**: Providing recommendations to mitigate potential issues, such as scaling horizontally with microservices architecture, implementing auto-scaling policies, or optimizing resource allocation based on workload patterns.

6.2   Test Plan/ Test Cases

Objective: The objective of testing is to ensure the functionality, performance, and reliability of the healthcare management system.

Types of Testing:

- **Unit Testing:** Validate individual components.
- **Integration Testing:** Verify interactions between modules.
- **System Testing:** Evaluate overall system functionality.
- **Performance Testing:** Measure responsiveness and scalability.
- **Security Testing:** Assess vulnerabilities and data protection measures.
- **User Acceptance Testing (UAT):** Validate against user requirements.

Test Cases:

- **User Interface:** Validate usability and responsiveness.
- **API:** Verify endpoints and data integrity.
- **Data Processing:** Validate accuracy and logic.
- **Integration:** Ensure compatibility with third-party systems.
- **Performance:** Measure response times and throughput.
- **Security:** Assess authentication and encryption.
- **UAT:** Validate system usability and alignment with user needs.
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6.3   Test Procedure

Execution Steps:

1. **Setup:** Prepare test environment and data.
2. **Testing:** Execute test cases according to defined scenarios.
3. **Monitoring:** Capture and analyze test results.
4. **Reporting:** Document findings, issues, and resolutions.

Tools Used: Testing tools and methodologies such as JUnit for unit testing, Postman for API testing, and JMeter for performance testing were employed to ensure comprehensive coverage.

6.4 Performance Outcome

Metrics Evaluated:

- **Response Time:** Average and peak response times measured under varying loads.
- **Throughput:** System capacity assessed with increasing user interactions and data.
- **Scalability:** Performance evaluated as system load and user base scaled.

Results:

- Quantitative data on performance metrics including response times and throughput.
- Findings discussed, highlighting successful outcomes and areas for improvement.

Conclusion:

- Summary of performance outcomes and implications for system reliability.
- Recommendations for optimizations and enhancements based on test results.

7   My learnings

Working on the healthcare management system project enhanced my:

- **Technical Skills:** Architecting scalable systems, leveraging cloud infrastructure, and optimizing database management.
- **Project Management:** Applying Agile methodologies and fostering team collaboration.
- **Problem-Solving:** Addressing technical challenges and making data-driven decisions.
- **Domain Knowledge:** Understanding healthcare regulations and industry best practices.

This experience prepares me for career growth by:

- Strengthening technical proficiency and problem-solving abilities.
- Deepening domain expertise in healthcare IT.
- Developing leadership potential through project management and team collaboration.

8 Future work scope

Some ideas and potential future directions for the healthcare management system project that were not pursued due to time limitations:

1. **Enhanced Data Analytics**: Implementing advanced analytics algorithms to derive deeper insights from patient data, such as predictive analytics for disease management or operational efficiency improvements.
2. **Telemedicine Integration**: Developing robust features for telemedicine, including real-time video consultations, remote monitoring of patient vitals, and integration with wearable devices for continuous health monitoring.
3. **Natural Language Processing (NLP)**: Incorporating NLP capabilities to automate data entry from clinical notes, improve search functionalities within medical records, and enhance decision support systems.
4. **Machine Learning for Personalized Medicine**: Utilizing machine learning models to personalize treatment plans based on patient data, genetic profiles, and historical outcomes, enhancing precision medicine initiatives.
5. **Blockchain for Data Security**: Exploring blockchain technology to enhance data security, ensure immutability of medical records, and facilitate secure sharing of patient information across healthcare providers.
6. **Mobile App Development**: Creating a mobile application for patients to access their medical records, schedule appointments, receive medication reminders, and interact with healthcare providers seamlessly.
7. **IoT Integration**: Integrating Internet of Things (IoT) devices for remote patient monitoring, capturing real-time health data, and providing proactive healthcare interventions based on continuous monitoring.
8. **Comprehensive Patient Engagement Tools**: Developing tools for patient education, health tracking, and wellness management to promote active patient engagement and improve health outcomes.