Hematovision Blood Cell Classification Using Transfer Learning

Project Design Phase

Solution Architecture

Field Details

- **Date:** June 29, 2025
- **Team ID:** LTVIP2025TMID46346
- **Project Name:** Hematovision - Blood Cell Classification Using Transfer Learning
- **Maximum Marks:** 4 Marks

Solution Architecture:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications according to which the solution is defined, managed, and delivered.

Hematovision System Architecture Overview:

Business Problem:

Manual blood cell classification is time-consuming, subjective, and prone to human error. Laboratory technicians and pathologists need an automated, accurate, and efficient system to classify blood cells (Eosinophil, Lymphocyte, Monocyte, Neutrophil) to improve diagnostic accuracy and reduce processing time.

Technology Solution:

AI-powered blood cell classification system using transfer learning with deep neural networks, integrated with laboratory information systems and cloud-based infrastructure for scalable, real-time processing.

Architecture Components:

1. Data Layer

- **Image Storage:** Cloud-based storage for blood cell microscopy images
- **Metadata Database:** Patient information, test results, and classification history
- **Training Dataset:** Curated blood cell images with expert annotations

- **Model Repository:** Trained models, versions, and performance metrics

2. Processing Layer

- **Image Preprocessing:** Normalization, augmentation, and quality enhancement
- **Transfer Learning Model:** Pre-trained CNN (ResNet50/VGG16) fine-tuned for blood cell classification
- **Inference Engine:** Real-time classification with confidence scoring
- **Batch Processing:** High-throughput processing for multiple samples

3. Application Layer

- **Web Application:** User interface for lab technicians and pathologists
- **API Gateway:** RESTful APIs for system integration
- **Mobile Application:** Field collection and remote access
- **Dashboard:** Analytics, reporting, and performance monitoring

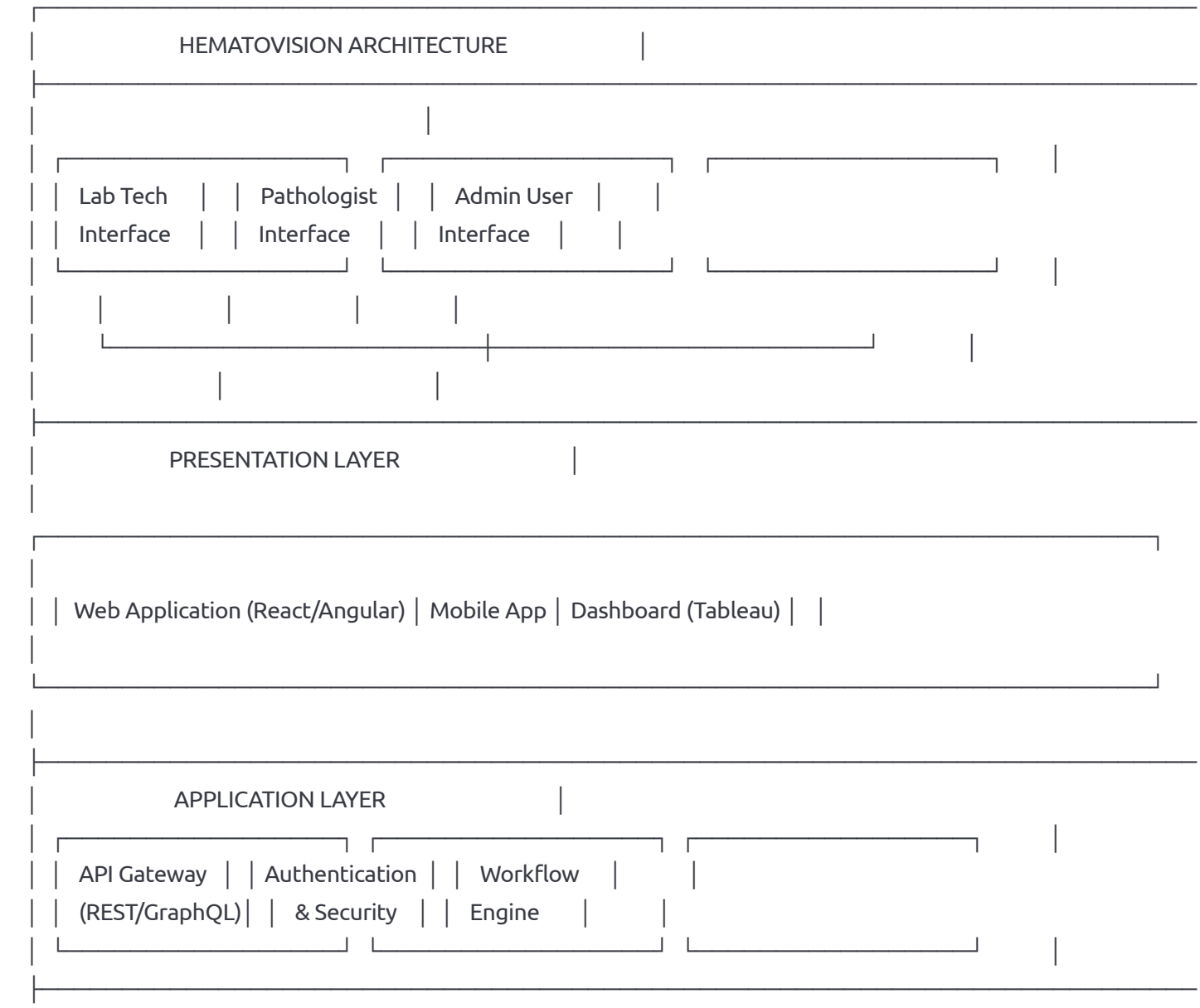
4. Integration Layer

- **Laboratory Information System (LIS) Integration**
- **Hospital Management System (HMS) Connectivity**
- **DICOM Compliance** for medical imaging standards
- **HL7 FHIR** for healthcare interoperability

5. Security & Compliance Layer

- **HIPAA Compliance:** Patient data protection and privacy
- **Role-Based Access Control (RBAC)**
- **Audit Logging:** Complete activity tracking
- **Data Encryption:** At-rest and in-transit protection

Solution Architecture Diagram:


HEMATOVISION ARCHITECTURE
Lab Tech Interface
Pathologist Interface
Admin User Interface
PRESENTATION LAYER
Web Application (React/Angular)
Mobile App
Dashboard (Tableau)
APPLICATION LAYER
API Gateway (REST/GraphQL)
Authentication & Security
Workflow Engine