1. Overall Description

1.1 Product Perspective

This system is a web-based, modular SaaS platform incorporating AI features. It will be hosted on secure, HIPAA-compliant cloud infrastructure (e.g., AWS or GCP). Its architecture will allow seamless scalability and integration with healthcare ecosystems.

1.2 User Classes

- **Admin:** Manages system setup, roles, and compliance oversight
- **Doctor:** Handles clinical notes, prescriptions, test results, and uses voice dictation
- **Nurse:** Records vitals, follow-ups, and care plans
- **Lab/Pharmacy:** Uploads reports and fulfills prescriptions
- **Patient:** Accesses health records, schedules appointments, communicates securely
- **AI Assistant:** NLP-based tool for documentation, summarization, and guidance

1.3 Assumptions and Dependencies

- Users have internet access
- AI voice integration through OpenAI Whisper or similar tools
- Data interoperability through HL7/FHIR standards
- Multi-tenant architecture to support hospital chains

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2. System Features s Modules

2.1 Patient Management

- Patient registration and demographic data
- Insurance and ID document uploads
- Medical history and allergy tracking
- Consent and privacy preference management

2.2 Appointment Scheduling

- Multi-location and multi-doctor support
- Calendar sync with Google and Outlook
- Automated reminders via SMS, Email, or WhatsApp

2.3 AI Clinical Documentation Assistant

- Voice-to-text SOAP note generation
- Auto-summarization of clinical notes
- Medical coding assistance
- Symptom checker integration

2.4 E-Prescription Module

- Drug database access
- Drug interaction alerts
- Digital signatures for prescriptions
- Pharmacy notification and tracking

2.5 Lab s Imaging Module

- Test ordering and sample tracking
- Uploads of reports in PDF/image format
- Optional AI-based preliminary result analysis

2.6 Billing Claims

- CPT and ICD-10 code generation
- Invoice and payment integration
- Insurance eligibility and electronic claims
- Reimbursement status tracking

2.7 Patient Portal

- Health record viewing
- Appointment booking and management
- Secure chat with healthcare providers
- AI chatbot for common questions and intake forms

2.8 Clinical Decision Support System (CDSS)

- Alerts for allergies, abnormal vitals, etc.
- AI-based diagnostic suggestions
- Risk stratification for chronic diseases (e.g., diabetes, sepsis)

3.6 Admin s Analytics Module

- Custom dashboards per hospital/unit
- Reports on patient visits, revenue, and resource utilization
- Staff activity monitoring
- Model performance metrics (accuracy, usage logs)

3.10 System Management

- Role-based access control and user permissions
- Tenant-level customization
- Backup management and audit trails
- Configuration for AI model thresholds and notification rules

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3. Non-Functional Requirements

3.1 Security s Compliance

- Compliance with HIPAA, PHIPA, SOC2, ISO 27001
- Role-based access controls
- Full audit logging and real-time anomaly detection
- End-to-end encryption for data in transit and at rest

3.2 Usability

- Mobile-responsive and accessible user interface
- Minimal-click workflows for busy clinicians
- WCAG 2.1 accessibility compliance

3.3 Performance

- Key operations respond within <2 seconds
- 99.9% uptime Service Level Agreement
- Scalable to support 10,000 concurrent users

3.4 Scalability

- Auto-scaling microservices architecture
- Multi-tenant PostgreSQL schema
- Dynamic compute provisioning for AI workloads

3.5 Maintainability

- CI/CD pipelines for frequent deployments
- Modular codebase using microservices
- Automated unit and integration test suites

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4. External Interfaces

- HL7/FHIR API integration for EHR connectivity
- OpenAI/Gemini APIs for NLP, transcription, and AI summarization
- Twilio/SendGrid APIs for SMS and email notifications
- Stripe/PayPal integration for billing and payments
- AWS HealthLake or Google Cloud Healthcare API for data lake functionality

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5. Architecture Overview (High Level)

- **Frontend:** React.js with Tailwind CSS
- **Backend:** Python (FastAPI) or Node.js
- **Database:** PostgreSQL with support for multi-tenant schemas
- **AI Engine:** GPT-4.0 Mini, Gemini Pro, Whisper (voice), Med-BERT for decision support
- **Cloud Infrastructure:** AWS with HIPAA-compliant services like S3, Lambda, and RDS
