IthalaMed - Comprehensive Frontend Requirements & Implementation Document

Executive Summary

Platform Name: IthalaMed - Unified Healthcare Platform
Tagline: "Connect, collaborate, and care across Africa's healthcare ecosystem"
Core Vision: Single medical record across Africa - unified patient data for comprehensive, coordinated care delivery
Primary Color: `#00bfff` (Deep Sky Blue)
Technology Stack: React Native Expo (Mobile & Web), Node.js/Express (Backend)

Table of Contents

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1. PLATFORM OVERVIEW

1.1 Mission Statement

IthalaMed is Africa's leading digital healthcare ecosystem platform that unifies the entire healthcare value chain - connecting patients, doctors, hospitals, pharmacies, laboratories, emergency services, medical aid providers, and government regulators into one seamless, secure, and interoperable system.

1.2 Core Value Propositions

- **Unified Medical Record:** Single patient record accessible across Africa
- **Real-time Collaboration:** Instant data exchange between all healthcare stakeholders
- **Improved Efficiency:** Automated workflows reducing administrative burden
- **Enhanced Care Quality:** 360° patient view for better clinical decisions
- **African-Focused:** Built for African healthcare infrastructure and challenges

1.3 Target Markets

- **Primary:** South Africa, Nigeria, Kenya, Ghana
- **Secondary:** Uganda, Tanzania, Zimbabwe, Zambia
- **Language Support:** English, Zulu, Swahili, Shona, Yoruba, Hausa, Amharic, French, Portuguese

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2. FRONTEND APPLICATION ARCHITECTURE

2.1 Application Structure

Multi-App Architecture:

1. **Patient Mobile App** (`patient-app/`)
2. **Healthcare Provider App** (`provider-app/`)
3. **Pharmacy Management App** (`pharmacy-app/`)
4. **Laboratory Management App** (`lab-app/`)
5. **EMS Operations App** (`ems-app/`)
6. **Hospital Operations System** (`hospital-app/`)
7. **Medical Aid Portal** (`medical-aid-app/`)
8. **Government Dashboard** (`gov-dashboard-app/`)

Shared Resources:

```
/shared-components/
  ├── ui/              # Reusable UI components
  ├── forms/           # Form components
  ├── navigation/      # Navigation components
  ├── utils/           # Utility functions
  ├── hooks/           # Custom React hooks
  ├── constants/       # App constants
  └── theme/           # Theme configuration
```

2.2 Technology Specifications

Core Technologies:

- **Framework:** React Native Expo SDK 50+
- **Language:** TypeScript 5.0+
- **State Management:** Redux Toolkit + RTK Query
- **Navigation:** React Navigation 6.x
- **Form Management:** React Hook Form + Zod validation
- **Styling:** NativeWind (Tailwind CSS for React Native)
- **Date/Time:** date-fns
- **Charts:** Victory Native
- **Icons:** Expo Vector Icons (Ionicons, MaterialCommunityIcons)

Backend Communication:

- **API Client:** Axios with interceptors
- **Real-time:** Socket.io-client
- **File Upload:** Expo Document Picker + Image Picker
- **Local Storage:** AsyncStorage + Secure Store
- **Offline Support:** Redux Persist

Medical-Specific Libraries:

- **DICOM Viewer:** Custom WebView wrapper for Cornerstone.js
- **Video Calls:** Jitsi Meet SDK (React Native)
- **Voice Recording:** Expo AV
- **Biometrics:** Expo Local Authentication
- **Location Services:** Expo Location
- **Push Notifications:** Expo Notifications

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3. DETAILED APPLICATION REQUIREMENTS

3.1 PATIENT MOBILE APP

3.1.1 Authentication & Onboarding

Requirements:

- Multi-method authentication (Phone, Email, Biometric)
- Two-factor authentication (SMS OTP, Email OTP)
- Guardian/Dependent management system
- Age verification for minors
- Medical aid membership verification
- Emergency contact setup
- Privacy consent management (POPIA/GDPR compliant)

UI Screens:

1. **Splash Screen** - Brand logo with loading animation
2. **Welcome/Onboarding** - Feature showcase carousel (4-5 slides)
3. **Registration Flow:**
    - Personal Details (Name, DOB, Gender, ID Number)
    - Contact Details (Phone, Email, Physical Address)
    - Medical Aid Details (Optional)
    - Emergency Contacts (Minimum 2)
    - Profile Photo (Optional)
    - Terms & Conditions
4. **Login Screen** - Email/Phone + Password, Biometric option
5. **Password Recovery** - OTP-based reset
6. **PIN Setup** - 4-6 digit PIN for quick access

Key Features:

- Offline-capable login (cached credentials)
- Biometric authentication (Fingerprint/Face ID)
- Multi-language selection at login
- Accessibility mode toggle
- Dark/Light theme preference

3.1.2 Patient Dashboard

Requirements:

- Family health overview (switch between dependents)
- Quick access to critical functions
- Health status summary with vital trends
- Upcoming appointments countdown
- Active medications reminder
- Recent activity feed
- Emergency SOS button (always visible)

UI Components:

1. Header:

- Profile switcher (Patient/Dependents dropdown)
- Notification bell with badge count
- Settings gear icon
- Emergency SOS button (red, prominent)

2. Health Summary Cards:

- **Vital Signs Card:** Latest BP, Heart Rate, Temperature, O2 Saturation
- **Medication Card:** Current meds with next dose time
- **Appointments Card:** Next appointment details
- **Health Score:** AI-generated health score (0-100)

3. Quick Actions Grid:

- Book Appointment
- Request Ambulance
- Telemedicine
- Prescriptions
- Test Results
- Medical Records
- Health Tracking
- Find Provider

4. Activity Timeline:

- Recent consultations
- Lab results
- Prescription refills
- Immunizations

Design Specifications:

- Mobile: Single column, scrollable
- Tablet: 2-column grid layout
- Web: 3-column grid with sidebar
- Color: Primary #00bfff with gradient overlays
- Typography: System fonts (SF Pro/Roboto)
- Spacing: 16px base unit

3.1.3 Medical Records Module

Requirements:

- Complete medical history access
- Document upload and categorization
- OCR for paper records
- DICOM image viewer
- PDF report viewer
- Sharing capabilities with providers
- Version history tracking
- Audit trail (who accessed when)

Sub-Modules:

A. Personal Health Information

- Demographics (Name, DOB, Gender, Race, Blood Type)
- Identification (ID Number, Passport, Medical Aid)
- Contact Details
- Next of Kin

- Guardian Info (for minors/dependents)

B. Medical History

- **Chronic Conditions:** DM, HTN, Asthma, HIV, TB, etc.
- **Allergies:** Medications, Food, Environmental (with severity)
- **Surgical History:** Procedure, Date, Hospital, Surgeon
- **Family History:** Hereditary conditions across generations
- **Social History:** Smoking, Alcohol, Drug use
- **Immunization Records:** Vaccines with dates and batch numbers

C. Medications

- Current Medications (Active)
- Medication History (All time)
- Dosage, Frequency, Route
- Prescribing Doctor
- Start/End dates
- Adverse reactions

D. Test Results

- Laboratory Results (Blood, Urine, etc.)
- Imaging Reports (X-Ray, CT, MRI, Ultrasound)
- Pathology Reports
- Cardiology Reports (ECG, Echo)
- Trend graphs for serial tests

E. Clinical Encounters

- Visit Date & Time
- Provider Name & Specialty
- Chief Complaint
- Diagnosis (ICD-10 codes)
- Treatment Plan
- Clinical Notes
- Prescriptions issued
- Follow-up instructions

F. Documents Library

- Uploaded PDFs
- Scanned paper records
- Insurance documents
- Consent forms
- Medical certificates

UI Features:

- Tab-based navigation

- Search and filter functionality
- Date range selection
- Category filtering
- Sort by date/provider/type
- Download/Share options
- Print-friendly views

3.1.4 Appointments Module

Requirements:

- Provider search by specialty, location, rating
- Real-time availability checking
- Multi-step booking process
- Calendar integration
- Appointment reminders (Push, SMS, Email)
- Virtual waiting room for telemedicine
- Check-in functionality (QR code/Geo-fence)
- Cancellation and rescheduling
- Appointment history

Appointment Booking Flow:

Step 1: Search Providers

- Filters: Specialty, Location (radius), Gender, Language, Rating, Availability
- List View: Provider cards with photo, name, specialty, rating, next available
- Map View: Provider locations on map

Step 2: Provider Profile

- Profile photo and bio
- Qualifications and specialties
- Languages spoken
- Consultation fees
- Available times (calendar view)
- Reviews and ratings
- Facility information

Step 3: Select Date & Time

- Calendar with available dates highlighted
- Time slots (15/30/60 min intervals)
- Consultation type (In-person/Virtual)
- Urgent/Routine priority

Step 4: Patient Selection

- Self or Dependent
- Reason for visit
- Attach relevant documents

Step 5: Appointment Details

- Appointment summary
- Payment method (Medical Aid/Cash/Card)
- Pre-consultation questionnaire (Practise/Medical center should able to configure this)
- Terms acceptance

Step 6: Confirmation

- Appointment reference number
- Add to calendar
- Directions to facility
- Pre-appointment instructions

Appointment Management:

- Upcoming Appointments (sortable)
- Past Appointments (with reports)
- Cancelled Appointments
- Appointment details view
- Cancel/Reschedule options (with policies)
- Chat with provider (pre/post appointment)

Check-in Features:

- QR code generation (scan at reception)
- Geo-fence auto check-in
- Manual check-in button
- Estimated wait time
- Queue position tracker

3.1.5 Telemedicine Module

Requirements:

- HD video consultation (Jitsi Meet SDK)
- Screen sharing capability
- File sharing during consultation
- Chat messaging
- Session recording (with consent)
- Virtual waiting room
- Connection quality indicator
- Emergency disconnect protocol

Telemedicine Flow:

Pre-Consultation:

- Virtual waiting room with countdown
- Pre-consultation questionnaire(Practise/Medical center should able to configure this)
- Document upload area
- Connection test (camera/mic/internet)

During Consultation:

- Video interface (provider large, patient small)
- Controls: Mute, Camera off, Screen share, Chat, End call
- Timer display
- Quality indicator (green/yellow/red)
- Emergency SOS button
- Recording indicator (if active)

Post-Consultation:

- Consultation summary
- Digital prescription
- Follow-up appointment booking
- Payment processing
- Feedback form

Technical Specifications:

- Minimum 2 Mbps connection
- Fallback to audio-only if video fails
- Auto-reconnect on connection loss
- Encryption: AES-256
- Recording storage: Cloud with 7-day retention

3.1.6 Prescriptions & Pharmacy

Requirements:

- View active prescriptions
- Prescription history
- Medication details and instructions
- Refill requests
- Pharmacy selection
- Delivery tracking
- Medication reminders
- Drug interaction warnings

Prescription Details View:

- Medication name (Generic + Brand)
- Dosage and form (Tablet, Syrup, Injection)
- Quantity and refills remaining
- Instructions (Frequency, Duration, Special instructions)
- Prescribing doctor
- Date issued and expiry
- Pharmacy where dispensed
- QR code for pharmacy verification

Pharmacy Features:

- Find nearby pharmacies (map/list)
- Pharmacy details (Hours, Contact, Services)
- Send prescription to pharmacy
- Track prescription status (Received, Processing, Ready, Dispensed)
- Order home delivery
- Track delivery (GPS tracking)
- Payment (Medical Aid/Cash)

Medication Management:

- Set reminders (Time-based, with snooze)
- Log medication taken
- Track adherence (calendar view with percentages)
- Refill alerts (when running low)
- Interaction checker (scan barcode to check)

3.1.7 Emergency Services (Ambulance Request)

Requirements:

- One-tap emergency request
- Automatic location sharing (GPS)
- Medical profile auto-transmission
- Real-time ambulance tracking
- ETA display
- Communication with paramedics
- Emergency contact auto-notification
- Medical history quick access

Emergency Request Flow:

Step 1: Emergency Activation

- Big red "Request Ambulance" button
- Emergency type selection (Medical, Accident, Trauma, Pregnancy)
- Severity level (Critical, Urgent, Non-urgent)

Step 2: Location Confirmation

- Auto-detected location (GPS)
- Manual address entry/correction
- Landmark description
- What3words integration
- Share location link

Step 3: Patient Information

- Select patient (Self/Dependent)
- Auto-send medical profile
- Current symptoms/condition
- Allergies highlighted
- Current medications

Step 4: Dispatch Confirmation

- Request confirmation
- Assigned unit details (Vehicle ID, Paramedics)
- ETA countdown
- Live map tracking
- Call paramedic button

Step 5: En-Route Tracking

- Ambulance location on map
- ETA updates
- Paramedic instructions
- Emergency contacts notified
- Prepare for arrival checklist

Step 6: Arrival & Handover

- Paramedic arrival notification
- Medical data transfer to EMS
- Hospital selection/notification
- Family notification
- Trip log/report

Emergency Contacts Auto-Alert:

- SMS/Push notification to all contacts
- Location sharing link
- Real-time updates
- Ambulance arrival notification

3.1.8 Health Tracking & Monitoring

Requirements:

- Manual vital entry
- Connected device integration (Smartwatches, Glucose meters)
- Health goal setting
- Trend visualization (graphs)
- Abnormal value alerts
- Shareable reports with doctors
- Export data (CSV/PDF)

Trackable Metrics:

Vital Signs:

- Blood Pressure (Systolic/Diastolic)
- Heart Rate (BPM)
- Temperature (°C/°F)
- Respiratory Rate
- Oxygen Saturation (SpO2)
- Weight (kg/lbs)
- Height
- BMI (auto-calculated)

Chronic Disease Monitoring:

- **Diabetes:** Blood glucose, HbA1c, Insulin doses
- **Hypertension:** BP readings, Medication adherence
- **Asthma:** Peak flow, Inhaler usage, Symptoms
- **Cardiac:** Heart rate variability, Exercise tolerance

Lifestyle Tracking:

- Sleep duration and quality
- Exercise (Steps, Duration, Type)
- Nutrition (Calorie intake, Water intake)
- Mental health (Mood, Stress level)
- Menstrual cycle (for women)

Device Integration:

- Apple Health
- Google Fit
- Fitbit
- Garmin
- Samsung Health
- Withings
- Omron blood pressure monitors
- Accu-Chek glucose meters

Data Visualization:

- Line graphs (trends over time)
- Bar charts (daily/weekly comparisons)
- Pie charts (distribution)
- Heatmaps (consistency tracking)
- Goal progress bars
- Color-coded alerts (Red/Yellow/Green zones)

3.1.9 Growth Charts & Immunizations (Pediatric)

Requirements:

- WHO standard growth charts
- Percentile tracking
- Developmental milestone checklist
- Immunization schedule (South African EPI)
- Missed vaccine alerts
- Vaccine certificate generation
- Growth predictions

Growth Charts:

- **Weight-for-Age** (0-5 years)
- **Height-for-Age** (0-5 years)
- **Weight-for-Height** (0-5 years)
- **BMI-for-Age** (2-19 years)
- **Head Circumference** (0-3 years)
- Percentile curves (3rd, 15th, 50th, 85th, 97th)
- Plot points on graph
- Growth velocity calculations
- Malnutrition alerts

Developmental Milestones:

- **Motor Skills:** Gross and fine motor
- **Language:** Receptive and expressive
- **Social/Emotional:** Interaction, behavior
- **Cognitive:** Problem-solving, learning
- Age-based milestone checklists
- Delay alerts
- Referral recommendations

Immunization Schedule:

- Birth: BCG, OPV 0, Hepatitis B
- 6 weeks: OPV 1, DTaP-IPV-Hib 1, Hep B 1, PCV 1, RV 1
- 10 weeks: DTaP-IPV-Hib 2, Hep B 2, RV 2
- 14 weeks: DTaP-IPV-Hib 3, Hep B 3, PCV 2, RV 3
- 9 months: Measles 1, PCV 3

- 18 months: DTaP-IPV-Hib 4, Measles 2, Varicella
- 6 years: DTaP-IPV
- 12 years: Td, HPV (girls)

Features:

- Upcoming vaccines countdown
- Missed vaccine notifications
- Clinic finder for immunizations
- Certificate download (PDF)
- Vaccination card (digital)
- Batch number tracking
- Adverse event reporting

3.1.10 Medical Aid & Insurance

Requirements:

- Medical aid membership details
- Benefit balance checking
- Claims submission
- Claims tracking
- Pre-authorization requests
- Coverage verification
- Gap cover management
- Dependents management

Medical Aid Integration:

- Discovery Health
- Momentum Health
- Bonitas
- Medshield
- Gems
- Fedhealth
- Other schemes

Features:

- Real-time benefit balance
- Remaining hospital days
- Chronic medication status
- Annual limit tracking
- Savings account balance
- Risk benefit usage
- Gap cover claims
- Policy documents access

Claims Management:

- Submit claims (upload invoices)
- Track claim status (Submitted, Processing, Approved, Paid, Rejected)
- Claim history
- Rejection reasons
- Appeal process
- Payment tracking

3.1.11 Settings & Profile Management

Settings Categories:

Profile Settings:

- Edit personal details
- Change profile photo
- Update contact info
- Manage dependents
- Emergency contacts

Security Settings:

- Change password
- Two-factor authentication
- Biometric login
- Active sessions
- Login history
- Privacy settings

Notification Settings:

- Push notifications toggle
- SMS notifications toggle
- Email notifications toggle
- Notification categories (Appointments, Prescriptions, Results)

App Preferences:

- Language selection
- Theme (Light/Dark/Auto)
- Font size
- Accessibility features
- Units (Metric/Imperial)

Data & Privacy:

- Download my data

- Delete account
- Data sharing preferences
- Provider access permissions
- Revoke access logs

Support:

- Help center
- FAQs
- Contact support
- Report a bug
- Feature request
- Terms of service
- Privacy policy

3.2 HEALTHCARE PROVIDER APP

3.2.1 Provider Dashboard

Requirements:

- Daily schedule overview
- Patient queue management
- Critical alerts (Lab results, Patient deterioration)
- Quick stats (Today's patients, Pending tasks)
- Revenue tracking
- Resource availability (Rooms, Equipment)

Dashboard Components:

1. Schedule View (3 formats):

- **Day View:** Hourly slots with appointments
- **Week View:** 7-day overview
- **Month View:** Calendar with appointment density

2. Patient Queue:

- Waiting patients (auto-sorted by check-in time)
- Priority flags (Urgent, Routine)
- Estimated wait time per patient
- Patient status (Checked-in, In-progress, Completed)
- Quick actions (Start consultation, Reschedule, Cancel)

3. Alert Center:

- Critical lab results
- Abnormal vitals from monitoring

- Prescription approvals needed
- Urgent messages from patients
- Expiring certifications

4. Quick Stats Cards:

- Today's Patients (Scheduled vs Seen)
- Revenue (Today/Week/Month)
- Average consultation time
- Patient satisfaction score

5. Tasks & To-Dos:

- Sign pending reports
- Review lab results
- Follow-up calls needed
- Administrative tasks

3.2.2 Patient Management

Requirements:

- Patient search (Name, MRN, Phone, ID)
- Patient list with filters
- Complete patient profile access
- Medical history review
- Treatment history
- Current medications
- Allergies (highlighted prominently)
- Insurance verification
- Add new patients

Patient Profile Sections:

A. Demographics:

- Full name, DOB, Age, Gender
- ID Number, Medical Record Number
- Contact details
- Address
- Next of kin
- Medical aid details

B. Medical Summary:

- Active problems list
- Chronic conditions
- Surgical history

- Allergies (red banner)
- Current medications
- Recent vitals

C. Encounter History:

- List of all visits
- Visit date, provider, diagnosis
- Quick view of notes
- Attached documents
- Treatment outcomes

D. Test Results:

- Laboratory (Blood, Urine, etc.)
- Imaging (X-ray, CT, MRI)
- Pathology
- Cardiology
- Trend graphs

E. Prescriptions:

- Active prescriptions
- Prescription history
- Refills remaining
- Adherence tracking

F. Documents:

- Uploaded files
- Scanned records
- Insurance documents
- Consent forms

G. Communication:

- Secure messaging
- Appointment history
- Telemedicine sessions
- Phone call logs

3.2.3 Specialty Consultation Modules

Requirements:

- 40+ specialty-specific interfaces
- Customized data entry forms
- Specialty-specific templates

- Clinical decision support tools
- Specialty-relevant vital signs
- Procedure-specific checklists
- Specialty terminology

Universal Consultation Flow (All Specialties):

Step 1: Patient Identification

- Verify patient identity
- Review allergies and alerts
- Check insurance authorization

Step 2: Chief Complaint

- Primary reason for visit
- Duration of symptoms
- Associated symptoms
- Previous treatments tried

Step 3: History of Present Illness (HPI)

- Onset, Duration, Frequency
- Location, Quality, Severity (1-10)
- Aggravating/Alleviating factors
- Associated symptoms
- Functional impact

Step 4: Review of Systems (ROS)

- Constitutional, HEENT, Cardiovascular, Respiratory
- Gastrointestinal, Genitourinary, Musculoskeletal
- Skin, Neurological, Psychiatric, Endocrine
- Checkbox format with "Positive findings" text entry

Step 5: Vital Signs

- BP, HR, RR, Temp, SpO2, Weight, Height, BMI
- Pain score (0-10 scale)
- Specialty-specific vitals

Step 6: Physical Examination

- General appearance
- System-specific exams
- Specialty examination templates

Step 7: Assessment & Plan

- Differential diagnoses (ICD-10)

- Primary diagnosis
- Treatment plan
- Medications prescribed
- Tests ordered
- Referrals made
- Follow-up instructions
- Patient education

Specialty-Specific Modules (Examples):

A. CARDIOLOGY

Specialized Assessments:

- **Cardiac History:**
  - Chest pain (OPQRST format)
  - Palpitations
  - Syncope/Pre-syncope
  - Dyspnea (NYHA Class I-IV)
  - Orthopnea, PND
  - Edema
  - Exercise tolerance
- **Risk Factors:**
  - Hypertension
  - Diabetes
  - Hyperlipidemia
  - Smoking
  - Family history
  - Obesity
- **Cardiac Exam:**
  - Heart sounds (S1, S2, S3, S4)
  - Murmurs (Systolic/Diastolic, Grade 1-6)
  - JVP elevation
  - Peripheral pulses
  - Edema

Diagnostic Tools:

- ECG Interpretation module
  - Upload ECG image
  - AI-assisted reading
  - Manual interpretation entry
  - Rhythm analysis
  - Interval measurements (PR, QRS, QT)
  - ST/T wave changes
  - Conclusion
- Echocardiography results entry
- Stress test results

- Holter monitor review
- Cardiac catheterization reports

Treatment Plans:

- Medication templates (Anti-hypertensives, Antiplatelet, Statins)
- Cardiac rehab programs
- Diet and exercise counseling
- Follow-up protocols (3 months for stable, 1 week for acute)

Risk Calculators:

- Framingham Risk Score
- ASCVD Risk Calculator
- CHADS2-VASc (Stroke risk)
- HAS-BLED (Bleeding risk)

B. PEDIATRICS

Age-Based Interface Adaptation:

- Neonate (0-28 days)
- Infant (1-12 months)
- Toddler (1-3 years)
- Preschool (3-5 years)
- School-age (6-12 years)
- Adolescent (13-18 years)

Specialized Assessments:

- **Growth Monitoring:**
  - Weight, Height, Head circumference
  - Plot on WHO growth charts
  - Percentiles
  - Growth velocity
  - Z-scores
- **Developmental Assessment:**
  - Motor skills (Gross and fine)
  - Language (Receptive and expressive)
  - Social/Emotional
  - Cognitive
  - Milestone checklists by age
- **Immunization Review:**
  - Vaccines received
  - Vaccines due
  - Catch-up schedules
  - Adverse reactions
- **Feeding History:**

    - Breastfeeding/Formula
    - Solid food introduction
    - Food allergies
    - Appetite and eating patterns

Pediatric Physical Exam:

- General appearance (Alertness, Interaction)
- Hydration status
- Respiratory effort
- Skin (Rashes, jaundice)
- Fontanelle (if infant)
- HEENT (Age-specific findings)
- Cardiovascular (Murmurs common in children)
- Abdomen (Organomegaly)
- Musculoskeletal (Hip exam for infants)
- Neurological (Age-appropriate reflexes)

Common Conditions:

- Respiratory infections (URTI, Bronchiolitis, Pneumonia)
- Gastroenteritis
- Febrile seizures
- Asthma
- Eczema
- Developmental delays
- Failure to thrive

Pediatric Dosing Calculator:

- Weight-based calculations
- BSA-based calculations
- Age-appropriate formulations

C. OB/GYN

Obstetric Care Module:

Initial Prenatal Visit:

- LMP (Last Menstrual Period)
- EDD calculation (Naegele's rule)
- Gestational age
- Gravida/Para status (G_P_)
- Previous pregnancy history
- Complications in prior pregnancies
- Mode of delivery history
- Pregnancy intentions

Routine Prenatal Visits:

- **First Trimester (0-13 weeks):**
  - Dating ultrasound
  - Nuchal translucency
  - NIPT (Non-invasive prenatal testing)
  - Genetic counseling
  - Early pregnancy symptoms management
- **Second Trimester (14-27 weeks):**
  - Anatomy scan (18-20 weeks)
  - Glucose tolerance test (24-28 weeks)
  - Fetal movement counting
  - Cervical length screening
- **Third Trimester (28-40 weeks):**
  - Growth scans
  - Group B Strep screening (35-37 weeks)
  - Fetal monitoring (NST)
  - Birth plan discussion
  - Labor signs education

Obstetric Examination:

- Fundal height measurement
- Fetal heart rate (Doppler)
- Fetal position (Leopold's maneuvers)
- Cervical exam (if indicated)
- Edema assessment
- Blood pressure monitoring
- Urine protein/glucose

High-Risk Pregnancy Tracking:

- Gestational diabetes
- Preeclampsia/Eclampsia
- Placenta previa
- Preterm labor risk
- Multiple gestation
- Fetal growth restriction
- Previous C-section

Labor & Delivery Documentation:

- Admission vitals
- Cervical exam (Dilation, Effacement, Station)
- Contraction monitoring
- Fetal heart rate monitoring
- Interventions (Oxytocin, Epidural, AROM)
- Delivery details (Time, Mode, Complications)
- Newborn details (Weight, Apgar scores)
- Postpartum recovery

Gynecologic Care Module:

Annual Well-Woman Exam:

- Menstrual history
- Contraception
- Sexual history
- Pap smear (Cervical cancer screening)
- Breast exam
- Pelvic exam
- STI screening
- Bone density (if indicated)

Common Conditions:

- Menstrual disorders (Dysmenorrhea, Menorrhagia)
- PCOS
- Endometriosis
- Fibroids
- Ovarian cysts
- Menopause management
- Infertility workup

D. EMERGENCY MEDICINE

Triage Integration:

- ESI Level (1-5)
- Chief complaint
- Vital signs
- Pain score
- Time to provider target

ABCDE Assessment:

- **Airway:** Patent, obstructed, requires intervention
- **Breathing:** RR, SpO2, breath sounds, respiratory effort
- **Circulation:** HR, BP, cap refill, peripheral pulses
- **Disability:** GCS, pupil response, focal deficits
- **Exposure:** Temperature, injuries, rashes

Emergency Protocols:

- **Chest Pain Protocol:**
    - ECG within 10 minutes
    - Troponin
    - Chest X-ray
    - HEART Score

- **Stroke Protocol:**
  - Symptom onset time
  - NIH Stroke Scale
  - CT brain
  - Thrombolysis checklist
- **Trauma Protocol:**
  - Primary survey (ATLS)
  - Secondary survey
  - Imaging (FAST, X-rays, CT)
  - Trauma scoring (ISS, RTS)
- **Sepsis Protocol:**
  - qSOFA score
  - Lactate
  - Blood cultures
  - Broad-spectrum antibiotics within 1 hour

Procedures Documentation:

- Intubation
- Central line insertion
- Chest tube placement
- Wound repair
- Fracture reduction

Disposition:

- Discharge with instructions
- Admit (Ward, ICU)
- Transfer to another facility
- Death in ED

3.2.4 Clinical Documentation

Documentation Methods:

1. **Voice-to-Text Dictation:**
   - Real-time transcription
   - Medical terminology recognition
   - Edit and correct
   - Save as structured note
2. **Handwriting Recognition:**
   - Stylus input on tablet
   - Convert handwriting to text
   - Signature capture
   - Diagram annotation
3. **Typed Notes:**
   - Rich text editor
   - Templates library

    - Auto-complete medical terms
    - Copy previous notes
4. **Structured Templates:**
    - Dropdown selections
    - Checkboxes for ROS
    - Pre-filled common diagnoses
    - Medication favorites

Note Sections:

- **SOAP Format:**
    - Subjective (Patient's story)
    - Objective (Exam findings, vitals, tests)
    - Assessment (Diagnoses)
    - Plan (Treatment, follow-up)
- **Problem-Oriented:**
    - Problem list
    - Each problem with S/O/A/P

Clinical Decision Support:

- Drug interaction alerts
- Allergy warnings
- Duplicate therapy alerts
- Clinical guidelines prompts
- Diagnosis suggestions (AI-powered)

3.2.5 Prescription Management

Requirements:

- Drug database integration
- Generic/Brand name search
- Dosage calculator
- Interaction checker
- Allergy verification
- Electronic signature
- Send to pharmacy (integrated or external)
- Prescription templates
- Chronic medication refills

Prescription Entry Interface:

Drug Selection:

- Search by name (Autocomplete)
- Browse by category
- Favorites list

- Recent prescriptions

Prescription Details:

- **Drug Name:** Generic + Brand
- **Strength:** mg/ml/units
- **Form:** Tablet, Capsule, Syrup, Injection, Cream
- **Dosage:** Amount per dose
- **Route:** Oral, IV, IM, SC, Topical, Inhalation
- **Frequency:** Daily, BD, TDS, QID, PRN
- **Duration:** Days/Weeks/Months
- **Quantity:** Total amount to dispense
- **Refills:** Number of repeats
- **Instructions:** "Take with food", "Avoid alcohol"

Safety Checks:

- Allergy alert (Red banner if contraindicated)
- Drug-drug interaction (Yellow warning)
- Drug-disease interaction
- Duplicate therapy
- Pregnancy/Breastfeeding warnings
- Renal/Hepatic dosing adjustments

Prescription Templates:

- Common combinations (e.g., "Hypertension Starter Pack")
- Chronic disease protocols
- Post-operative orders
- Specialty-specific sets

E-Prescription Transmission:

- Select pharmacy (patient's preferred or nearby)
- Electronic signature
- Secure transmission (HL7 FHIR)
- Confirmation receipt
- Track status (Sent, Received, Dispensed)

3.2.6 Laboratory & Imaging Orders

Requirements:

- Test catalog (searchable)
- Order sets for common conditions
- Clinical indication entry
- Urgent/Routine priority
- Patient preparation instructions

- Track order status
- View results
- Interpret results (reference ranges)
- Critical value alerts

Order Entry Interface:

Test Selection:

- Browse by category (Hematology, Chemistry, Microbiology, etc.)
- Search by test name
- Common panels (Basic metabolic, Lipid panel, CBC)
- Specialty-specific orders

Order Details:

- Test code and name
- Clinical indication (required for approval)
- Priority (Routine, Urgent, STAT)
- Collection instructions
- Specimen type
- Quantity needed

Imaging Orders:

- Modality: X-Ray, CT, MRI, Ultrasound, Nuclear Medicine
- Body part/Region
- With/Without contrast
- Clinical indication
- Comparison to prior studies
- Portable vs Department

Order Sets:

- Pre-operative workup
- Diabetes monitoring
- Antenatal panel
- Cardiac workup
- Sepsis panel

Result Viewing:

- Tabular view with reference ranges
- Abnormal values highlighted (Red/Yellow)
- Trend graphs for serial tests
- Comparison to previous results
- Provider comments
- Critical value notifications

3.2.7 Referrals & Consultations

Requirements:

- Referral letter generation
- Specialist directory
- Referral tracking
- Patient consent
- Medical record sharing
- Feedback from specialist

Referral Process:

Step 1: Select Specialty

- Choose specialty (Cardiology, Neurology, etc.)
- Search for specific specialist (optional)
- Facility selection

Step 2: Referral Details

- Reason for referral
- Urgency (Routine, Urgent, Emergency)
- Relevant history summary
- Investigations done
- Current management
- Specific questions for specialist

Step 3: Attach Documents

- Relevant test results
- Imaging reports
- Previous consultation notes
- Patient consent form

Step 4: Generate Referral Letter

- Auto-populated template
- Editable sections
- Professional letterhead
- Digital signature
- Send electronically or print

Referral Tracking:

- Sent date
- Received confirmation
- Appointment scheduled
- Consultation completed
- Feedback received

- Status: Pending, Completed, Cancelled

3.2.8 Schedule & Availability Management

Requirements:

- Set working hours
- Block time for procedures/meetings
- Set consultation duration (15/30/60 min)
- Recurring schedules
- Multiple location management
- Leave management
- On-call schedules

Schedule Configuration:

Working Hours:

- Days of week selection
- Start and end time per day
- Break times
- Different schedules for different locations

Consultation Slots:

- Slot duration (15/30/45/60 minutes)
- Buffer time between patients
- Overbooking rules
- Same-day appointments allocation

Blocked Time:

- Meetings
- Surgical sessions
- Hospital rounds
- Continuing education
- Personal leave

Multi-Location Support:

- Different schedules for different facilities
- Travel time between locations
- Location-specific services

Availability Display:

- Calendar view (Day/Week/Month)
- Color coding (Available, Booked, Blocked, Off)

- Quick booking from calendar
- Drag-and-drop rescheduling

3.2.9 Telemedicine Consultation

Requirements:

- HD video quality
- Screen sharing
- Document viewing
- Prescription during call
- Real-time vital data viewing (if patient has devices)
- Session recording (with consent)
- Payment integration
- Post-consultation notes

Consultation Interface:

Pre-Consultation:

- Review patient profile
- Check insurance authorization
- Review pre-consultation questionnaire
- Admit patient from waiting room

During Consultation:

- Video interface (full screen patient, PIP provider)
- Controls: Mute, Video off, Screen share, End
- Side panel: Patient summary, Allergies, Medications
- Document viewer (X-rays, reports)
- Prescription pad (quick access)
- Notes section (live typing)
- Timer (consultation duration)

Post-Consultation:

- Finalize clinical notes
- Issue prescriptions
- Order tests
- Schedule follow-up
- Process payment
- Send consultation summary to patient

3.2.10 Revenue & Practice Analytics

Requirements:

- Daily/Weekly/Monthly revenue
- Patient volume trends
- Service utilization
- Payment method breakdown
- Outstanding payments
- Insurance reimbursements
- Top diagnoses
- Performance metrics

Dashboard Metrics:

- **Today's Revenue:** Total and by payment method
- **Monthly Revenue:** Current vs Previous month
- **Patient Volume:** New vs Follow-up
- **Average Consultation Time**
- **Patient Satisfaction Score**
- **No-show Rate**

Reports:

- Revenue report (Date range, Service type)
- Patient demographics
- Diagnosis frequency
- Procedure volume
- Referral patterns
- Insurance utilization

Export Options:

- PDF reports
- Excel spreadsheets
- CSV data export

3.3 PHARMACY MANAGEMENT APP

3.3.1 Pharmacy Dashboard

Requirements:

- Prescription queue (pending, in-progress, ready)
- Inventory alerts (low stock, expired, expiring soon)
- Daily sales summary
- Popular medications
- Pending refills
- Insurance claim status

Dashboard Components:

Prescription Queue:

- New prescriptions (count)
- In progress (count)
- Ready for pickup (count)
- Waiting time per prescription
- Priority prescriptions (urgent)

Inventory Alerts:

- Low stock items (below reorder point)
- Expired medications (requires removal)
- Expiring soon (within 3 months)
- Stock discrepancies

Sales Metrics:

- Today's revenue
- Number of prescriptions filled
- Average basket size
- Top-selling items

Quick Actions:

- Process new prescription
- Stock check
- Add inventory
- View pending refills

3.3.2 Prescription Processing

Requirements:

- Receive electronic prescriptions
- Manual prescription entry (for external prescriptions)
- Verify patient identity
- Check medication availability
- Drug interaction verification
- Insurance verification
- Substitute generic (if applicable)
- Patient counseling notes
- Dispense and label

Prescription Processing Flow:

Step 1: Receive Prescription

- Electronic (from IthalaMed providers)
- Scanned (upload image, OCR extraction)
- Manual entry (external prescription)

Step 2: Patient Verification

- Search patient by name/phone/ID
- Create new patient profile (if first time)
- Verify allergies
- Review medication history

Step 3: Medication Verification

- Check stock availability
- Verify dosage and quantity
- Check for interactions with current meds
- Allergy check
- Pregnancy/Breastfeeding check

Step 4: Insurance Verification

- Verify coverage
- Check formulary compliance
- Get authorization (if required)
- Calculate patient co-pay

Step 5: Substitution (if needed)

- Offer generic alternative
- Same therapeutic class substitution
- Doctor approval (for non-generic)
- Patient consent

Step 6: Dispensing

- Select stock batch (FEFO - First Expiry First Out)
- Count/Measure medication
- Print label (Patient name, Drug, Dosage, Instructions, Warnings)
- Attach auxiliary labels ("Take with food", "May cause drowsiness")
- Package securely

Step 7: Patient Counseling

- Explain usage instructions
- Discuss side effects
- Drug-food interactions
- Storage instructions
- What to do if miss a dose
- Record counseling provided

Step 8: Payment & Handover

- Calculate total
- Insurance claim (auto-submit)
- Patient payment (Cash/Card)
- Generate receipt
- Update inventory
- Mark as dispensed

3.3.3 Inventory Management

Requirements:

- Stock catalog (all medications)
- Batch tracking
- Expiry date tracking
- Reorder point alerts
- Supplier management
- Purchase orders
- Stock adjustments
- Stock take/Audit
- Controlled substances tracking

Inventory Module Features:

Stock Catalog:

- Medication name (Generic + Brand)
- Strength and form
- Barcode/SKU
- Category (Antibiotic, Analgesic, etc.)
- Current stock level
- Reorder point
- Maximum stock level
- Supplier
- Unit cost and selling price
- Storage requirements

Batch Management:

- Batch number
- Expiry date
- Quantity received
- Quantity remaining
- Supplier invoice reference
- FEFO alerts

Reorder Management:

- Auto-generate purchase orders
- Reorder point triggers
- Preferred suppliers
- Lead time tracking
- Order history

Stock Adjustments:

- Damaged stock
- Expired stock removal
- Theft/Loss
- Returns to supplier
- Stock transfer (between branches)
- Reason codes mandatory

Stock Take:

- Schedule regular audits
- Count and record actual stock
- Compare to system stock
- Variance report
- Adjustment entries

Controlled Substances:

- Separate tracking (Schedule 5, 6)
- Prescription requirement verification
- Stock register (Date, Patient, Prescription number, Quantity)
- Regulatory reporting

3.3.4 Patient Medication Profiles

Requirements:

- Patient demographics
- Allergy list
- Current medications
- Medication history (all time)
- Refill history
- Adherence tracking
- Insurance details

Patient Profile Sections:

Personal Information:

- Full name, DOB, Gender
- Contact details

- ID number
- Medical aid details

Allergies:

- Drug allergies (prominently displayed)
- Severity (Mild, Moderate, Severe)
- Reaction type

Current Medications:

- Medication name
- Prescriber
- Date started
- Refills remaining
- Last refill date
- Next refill due

Medication History:

- All medications ever dispensed
- Date ranges
- Prescribers
- Indications

Refill Reminders:

- Automatic SMS/Push notifications
- Refill due in 7 days
- Patient consent to reminders

Adherence Monitoring:

- Refill dates vs expected dates
- Adherence percentage
- Gaps in therapy
- Counseling opportunities

3.3.5 Point of Sale (POS)

Requirements:

- Barcode scanning
- Quick product search
- OTC sales (non-prescription)
- Basket management
- Multiple payment methods
- Receipt printing

- Daily cash-up
- Returns/Refunds

POS Interface:

Sale Screen:

- Product search (name or barcode)
- Product list (image, name, price)
- Quantity selector
- Basket (running total)
- Add/Remove items
- Discounts
- Payment button

Payment Methods:

- Cash
- Card (Credit/Debit)
- Mobile money
- Medical aid (for OTC)
- Split payment

Receipt:

- Store details
- Date and time
- Items purchased
- Quantity and price
- Total
- Payment method
- Cashier name
- Receipt number

Cash-Up Report:

- Expected cash (per payment method)
- Actual cash counted
- Variance
- Sales summary
- Voids/Refunds
- Banking details

3.3.6 Supplier & Procurement

Requirements:

- Supplier directory

- Purchase order creation
- Goods receiving
- Invoice matching
- Payment tracking
- Supplier performance

Supplier Management:

- Supplier name and contact
- Products supplied
- Payment terms
- Lead time
- Minimum order quantity
- Preferred supplier flag

Purchase Orders:

- Select supplier
- Add products and quantities
- Pricing confirmation
- Expected delivery date
- Send PO (email/print)
- Track status (Pending, Confirmed, Delivered)

Goods Receiving:

- Match to PO
- Scan/Enter received items
- Verify quantities and batch numbers
- Check expiry dates (reject if < 6 months)
- Record damages/shortages
- Update inventory

Invoice Processing:

- Match invoice to PO and GRN
- Verify pricing
- Mark for payment
- Payment status tracking

3.4 LABORATORY MANAGEMENT APP

3.4.1 Laboratory Dashboard

Requirements:

- Pending test orders
- Sample collection queue

- Tests in progress
- Critical results pending review
- Completed tests
- Quality control status
- Equipment maintenance alerts

Dashboard Metrics:

- **Today's Orders:** Total tests ordered
- **Pending Collection:** Samples not yet collected
- **In Progress:** Tests being processed
- **Completed Today:** Results ready
- **Critical Values:** Requires immediate notification
- **TAT (Turnaround Time):** Average time from order to result

---

3.4.2 Test Order Management

Requirements:

- Receive electronic orders (from providers)
- Manual order entry (walk-in patients)
- Test catalog
- Sample requirements
- Patient preparation instructions
- Collection scheduling
- Specimen tracking

Order Receiving:

- Orders auto-populate from IthalaMed
- Order details (Patient, Tests, Clinical indication)
- Priority (Routine, Urgent, STAT)
- Accept or reject order (with reason)

Sample Collection:

- Generate collection labels (Barcode)
- Collection instructions
- Specimen type (Blood, Urine, Stool, etc.)
- Collection time
- Fasting requirements
- Record collector name

Specimen Tracking:

- Specimen ID (Barcode)
- Chain of custody
- Receipt at lab

- Condition on arrival (Hemolyzed, Clotted, etc.)
- Rejection criteria

3.4.3 Test Processing

Requirements:

- Batch processing
- Quality control
- Instrument integration (LIS)
- Result entry (manual or auto)
- Reference ranges
- Critical value flagging
- Result verification
- Provider notification

Test Processing Workflow:

Step 1: Sample Preparation

- Centrifuge (if needed)
- Aliquot
- Label secondary tubes

Step 2: Quality Control

- Run QC samples
- Verify within acceptable range
- Document QC results
- Troubleshoot if out of range

Step 3: Sample Analysis

- Load samples into analyzer
- Run tests
- Monitor for errors
- Repeat if flagged

Step 4: Result Verification

- Review results
- Check against reference ranges
- Flag abnormal values
- Pathologist review (if needed)
- Critical value notification protocol

Step 5: Result Reporting

- Finalize report
- Attach interpretation (if applicable)
- Send to provider (electronic)
- Update patient record
- Archive sample

3.4.4 Result Reporting

Requirements:

- Structured reports
- Reference ranges by age/gender
- Abnormal value highlighting
- Interpretation notes
- Historical comparison
- Graphical trends
- PDF generation
- Electronic delivery

Report Format:

- Lab logo and details
- Patient demographics
- Specimen details (Type, Collection date/time)
- Test results (Tabular)
- Reference ranges
- Units
- Abnormal flags (High, Low, Critical)
- Performed by (Technician name)
- Reviewed by (Pathologist name)
- Report date and time

Critical Value Notification:

- Alert provider immediately (SMS/Call/Push)
- Document notification (Who notified, Time, Action taken)
- Provider acknowledgment

3.4.5 Quality Management

Requirements:

- QC tracking
- Proficiency testing
- Equipment maintenance logs
- Calibration records

- Reagent lot tracking
- Incident reporting
- Audits

Quality Control:

- Daily QC runs
- Multi-level controls (Low, Normal, High)
- Levey-Jennings charts
- Westgard rules
- Out-of-control actions

Equipment Maintenance:

- Scheduled maintenance calendar
- Service records
- Down time tracking
- Repair history
- Replacement planning

3.5 EMERGENCY MEDICAL SERVICES (EMS) APP

3.5.1 EMS Dispatch Center

Requirements:

- Emergency call receiving
- Call triage
- Unit availability tracking
- Dispatch assignment
- GPS tracking (units and patients)
- Communication hub
- Hospital coordination

Dispatch Dashboard:

Active Calls:

- Call ID and timestamp
- Location (Address + GPS coordinates)
- Patient details (if available)
- Emergency type
- Priority level
- Status (Pending, Dispatched, En-route, On-scene, Transporting, Complete)

Unit Status Board:

- Unit ID (Ambulance number)

- Crew members
- Current location (GPS)
- Status (Available, Busy, Standby, Out-of-service)
- Equipment status
- Last known position update

Assignment Algorithm:

- Nearest available unit
- Unit capabilities (ALS vs BLS)
- Traffic conditions
- Hospital proximity

3.5.2 Field Operations (Paramedic Interface)

Requirements:

- Call details access
- Patient medical profile
- Triage and assessment forms
- Vital signs entry
- Treatment documentation
- Medication administration
- Hospital notification
- Handover report

Field Assessment Screens:

Scene Safety & Situation:

- Scene safe?
- Number of patients
- Mechanism of injury
- Hazards present

Patient Assessment:

- **Primary Survey (ABCDE):**
  - Airway: Patent, Obstructed, Maintained (OPA, ETT)
  - Breathing: RR, SpO2, Breath sounds, Chest movement
  - Circulation: HR, BP, Cap refill, Pulses, Bleeding
  - Disability: GCS (Eye, Verbal, Motor), Pupils, Glucose
  - Exposure: Temperature, Injuries, Skin
- **Vital Signs:**
  - Blood pressure
  - Heart rate
  - Respiratory rate
  - SpO2

    - Temperature
    - Pain score
    - GCS
- **SAMPLE History:**
    - Signs/Symptoms
    - Allergies
    - Medications
    - Past medical history
    - Last oral intake
    - Events leading to incident

Treatment Documentation:

- Interventions performed (Oxygen, IV access, Intubation, etc.)
- Medications administered (Drug, Dose, Route, Time)
- Response to treatment
- Ongoing assessment
- Transport decision

Hospital Notification:

- ETA
- Patient status
- Critical findings
- Special needs (Blood products, Trauma team, etc.)

Handover:

- SBAR format
    - Situation
    - Background
    - Assessment
    - Recommendation
- Receiving provider name
- Handover time

3.5.3 Vehicle Management

Requirements:

- Fleet tracking
- Vehicle maintenance
- Equipment inventory
- Fuel management
- Inspection checklists
- Breakdown reporting

Vehicle Profile:

- Vehicle ID
- Type (Ambulance, First responder, Non-transport)
- Capabilities (BLS, ALS, Critical Care)
- Equipment list
- Maintenance schedule
- Mileage
- Fuel level
- Insurance and registration

Daily Inspection:

- Vehicle condition (Body, Tires, Lights)
- Equipment check (Stretcher, Oxygen, Monitors)
- Medication inventory (Controlled substances count)
- Deficiency reporting

3.5.4 Crew Management

Requirements:

- Crew roster
- Shift schedules
- Certification tracking
- Training records
- Performance metrics

Crew Profile:

- Name and photo
- Certification level (EMT-B, Paramedic, Critical Care)
- Certifications (ACLS, PALS, PHTLS)
- Expiry dates
- Training completed
- Performance metrics (Response times, Patient outcomes)

Shift Management:

- Schedule view (Daily/Weekly/Monthly)
- Shift assignments
- On-call status
- Swap requests
- Leave management

3.6 HOSPITAL OPERATIONS SYSTEM

3.6.1 Staff & Shift Management Module

Requirements:

- Comprehensive staff directory with credentials
- Multi-shift scheduling (Day, Night, Swing shifts)
- Skill-based staff allocation
- Real-time availability tracking
- Shift swap and coverage management
- Overtime tracking and alerts
- Mandatory break compliance
- Certification expiry tracking
- Staff performance metrics

Staff Directory:

Staff Profile:

- Personal information (Name, Photo, Contact, Employee ID)
- Role/Position (Doctor, Nurse, Technician, Admin)
- Department/Unit assignment
- Specialties and certifications
- License numbers and expiry dates
- Education and training history
- Languages spoken
- Emergency contact

Certification Tracking:

- ACLS (Advanced Cardiac Life Support)
- BLS (Basic Life Support)
- PALS (Pediatric Advanced Life Support)
- NRP (Neonatal Resuscitation Program)
- ATLS (Advanced Trauma Life Support)
- Specialty certifications
- Medical license status
- DEA registration (for prescribers)
- Auto-alerts 60/30/7 days before expiry

Shift Scheduling Interface:

Schedule Views:

- **Monthly Calendar:** Full month overview with color-coded shifts
- **Weekly Grid:** Detailed weekly view with hourly breakdown
- **Daily View:** Real-time daily assignments
- **Staff View:** Individual staff member's schedule

Shift Types:

- **Day Shift:** 7:00 AM - 3:00 PM (8 hours)
- **Evening Shift:** 3:00 PM - 11:00 PM (8 hours)

- **Night Shift:** 11:00 PM - 7:00 AM (8 hours)
- **12-Hour Shifts:** 7:00 AM - 7:00 PM / 7:00 PM - 7:00 AM
- **On-Call:** Available for emergencies
- **Custom Shifts:** Configurable start/end times

Shift Creation Workflow:

Step 1: Define Shift

- Select date range
- Choose shift type
- Set start and end time
- Define department/unit
- Set required staff count by role
- Add special requirements (ICU certified, Bilingual, etc.)

Step 2: Staff Assignment

- View available staff (filtered by qualifications)
- Drag-and-drop assignment
- Auto-suggest based on:
    - Previous shift patterns
    - Skill match
    - Availability
    - Fair distribution
    - Overtime limits
- Conflict detection (double-booking, mandatory rest periods)

Step 3: Approval & Publication

- Manager review
- Staff notification (Push, SMS, Email)
- Accept/Decline by staff
- Alternative staff suggestions if declined

Shift Management Features:

Shift Swap Requests:

- Staff can request shift swaps
- Find qualified replacements
- Manager approval workflow
- Automated notifications
- Audit trail

Call-In Management:

- Staff can call in sick
- System finds replacement from on-call pool
- Emergency staffing protocols

- Documentation and tracking

Overtime Tracking:

- Real-time overtime calculations
- Alerts when approaching overtime limits
- Compliance with labor laws
- Overtime approval workflow
- Cost tracking

Break Management:

- Mandatory break schedules (30-min meal, 15-min rest)
- Break coverage assignments
- Compliance tracking
- Break time logging

Attendance Tracking:

- Clock in/out functionality (Biometric, App-based, Kiosk)
- Late arrivals tracking
- Early departures
- Absenteeism reports
- Integration with payroll

Staff Availability Management:

Availability Calendar:

- Staff set their availability (Available, Unavailable, Preferred)
- Time-off requests (Vacation, Sick leave, Personal days)
- Blackout dates (mandatory availability)
- Recurring patterns (every Monday off)

Competency Matrix:

- Skills inventory per staff member
- Proficiency levels (Beginner, Intermediate, Advanced, Expert)
- Required competencies by unit/role
- Training gap analysis
- Development plans

Real-Time Staffing Dashboard:

Current Shift Status:

- Staff on duty (by department)
- Staff-to-patient ratios
- Staffing levels (Optimal, Adequate, Critical)
- Available for emergency callouts

- Expected arrivals/departures

Alerts:

- Understaffing warnings
- Certificate expiries
- Missed clock-ins
- Shift coverage gaps
- Mandatory overtime situations

Reports & Analytics:

- Staff utilization rates
- Overtime trends
- Absenteeism patterns
- Shift distribution fairness
- Cost per shift/department
- Compliance reports (labor laws)

3.6.2 Hospital Rounds & Inpatient Management

Requirements:

- Daily round scheduling and tracking
- Ward-based patient organization
- Multidisciplinary team collaboration
- Progress note documentation
- Order management during rounds
- Discharge planning integration
- Teaching rounds support (academic hospitals)

Ward Management Interface:

Ward Overview:

- **Ward Selection:** Medical, Surgical, Pediatric, Maternity, ICU, CCU
- **Bed Occupancy:** Real-time bed census
- **Patient List:** All patients in ward
- **Staff Assigned:** Attending, Residents, Nurses
- **Active Alerts:** Critical patients, pending tasks

Patient Card (Ward View):

- Room/Bed number
- Patient name, Age, MRN
- Admission date and length of stay
- Primary diagnosis
- Attending physician

- Nurse assigned
- Alerts (Fall risk, Isolation, Allergies)
- Quick actions (Start rounds, View chart, Orders)

Round Planning & Scheduling:

Round Types:

- **Morning Rounds:** Daily patient review (7:00-10:00 AM)
- **Evening Rounds:** Handover and status check (5:00-7:00 PM)
- **Multidisciplinary Rounds:** Team-based (Weekly)
- **Teaching Rounds:** Academic/training purposes
- **Executive Rounds:** Administration quality checks
- **Specialty Rounds:** Consultant reviews

Round Creation:

- Select ward/unit
- Choose round type
- Set date and time
- Add team members (Attending, Residents, Nurses, Pharmacist, Social worker)
- Select patients to round on
- Set round sequence (by room number or priority)
- Add agenda items

Rounding Interface (Mobile-Optimized):

Patient Selection Screen:

- List of patients in round sequence
- Color-coded status:
  - 🟢 Green: Stable, reviewed
  - 🟡 Yellow: Pending review
  - 🔴 Red: Critical, needs immediate attention
  - ⚪ Gray: Not yet seen
- Tap patient to start bedside documentation

Bedside Documentation Screen:

Patient Summary (Top Section):

- Patient demographics
- Admission diagnosis
- Hospital day number
- Last vitals (timestamp)
- Active alerts/warnings
- Code status (Full code, DNR, DNI)

Tabs:

1. Vitals Tab:

- Latest vital signs (auto-populated from monitors)
- Vital trends (24-hour graph)
- Input/Output balance
- Pain scores
- Neurological assessment (GCS if applicable)
- Quick entry for new vitals

2. Daily Assessment Tab:

- Subjective: How patient feels, complaints
- Interval history: Events since last round
- Review of systems: Quick checklist
- Physical examination:
    - General appearance
    - System-specific findings
    - Focused exam based on condition
- Use voice-to-text for rapid entry

3. Problem List Tab:

- Active problems (numbered)
- Each problem with:
    - Assessment (current status)
    - Plan (today's interventions)
    - Changes from yesterday
- Add/Remove problems
- Resolve problems

4. Orders Tab:

- View active orders
- Pending orders (require signature)
- Place new orders:
    - Medications (adjust doses, add new)
    - Labs (daily labs, specific tests)
    - Imaging (X-ray, CT, MRI)
    - Consultations (request specialist)
    - Diet modifications
    - Activity level changes
    - Nursing interventions
- Discontinue orders

5. Results Tab:

- Lab results (overnight and today)
- Imaging reports
- Consultant notes
- Flagged abnormal values

- Trend comparison

6. Plan Tab:

- Today's treatment plan
- Goals for the day
- Expected interventions
- Discharge planning status
- Follow-up needs
- Family communication notes

Progress Note Auto-Generation:

After completing assessment, system generates structured progress note:

```
PROGRESS NOTE - Day [X] of hospitalization

Patient: [Name], [Age]y [Gender]
MRN: [Number]
Date: [Date] [Time]
Attending: [Name]

SUBJECTIVE:
[Auto-populated from daily assessment]

VITAL SIGNS:
BP: [X]/[Y], HR: [X], RR: [X], Temp: [X]°C, SpO2: [X]%
I/O Balance: [+/-X] mL

PROBLEM LIST:
1. [Problem 1]
   A: [Assessment]
   P: [Plan]

2. [Problem 2]
   A: [Assessment]
   P: [Plan]

ORDERS PLACED:
- [New medication]
- [Lab ordered]
- [Consultation requested]

DISCHARGE PLANNING:
Target discharge: [Date]
Barriers: [None/List]
Social work involvement: [Yes/No]

OVERALL ASSESSMENT & PLAN:
[Doctor's summary]


_____
[Digital Signature]
[Name], [Credentials]
```

Round Completion:

- Mark patient as "Rounded"
- Save notes (auto-saved every 30 seconds)
- Move to next patient
- Round summary at end (patients seen, time spent, pending tasks)

Handover/Sign-Out Feature:

End-of-Shift Handover:

- Select patients to hand over
- SBAR format for each:
    - **S**ituation: Current condition
    - **B**ackground: Brief history
    - **A**ssessment: Current status and concerns
    - **R**ecommendation: What needs to be done
- Highlight patients requiring attention overnight
- Pending tasks/orders
- Code status emphasis
- Family communication needs
- Digital signature of handover completion

Incoming Provider:

- Review handover notes
- Acknowledge receipt
- Ask clarifying questions (in-app messaging)
- Accept responsibility

Teaching Rounds Support:

Academic Features:

- Case presentation templates
- Literature references
- Teaching points documentation
- Learner assessment notes
- Case discussions
- Question and answer logging

3.6.3 Patient Monitoring & Medical Device Integration

Requirements:

- Real-time integration with bedside monitors
- Vital signs streaming from ICU monitors
- Ventilator parameter tracking
- Infusion pump monitoring
- Alert management system

- Trend analysis and early warning scores
- Integration via Mirth Connect (HL7/FHIR)
- Critical change notifications

Mirth Connect Integration Architecture:

Supported Medical Devices:

- **Patient Monitors:** Philips IntelliVue, GE Carescape, Nihon Kohden
- **Ventilators:** Dräger, Hamilton, Medtronic
- **Infusion Pumps:** Baxter, B. Braun, Hospira
- **Dialysis Machines:** Fresenius, Baxter
- **Anesthesia Machines:** GE, Dräger
- **Pulse Oximeters:** Masimo, Nellcor
- **ECG Machines:** GE MAC, Philips PageWriter
- **Blood Gas Analyzers:** Radiometer, Siemens

Mirth Connect Channels:

Channel 1: Device Data Ingestion

- **Source:** HL7 ADT/ORU messages from medical devices
- **Transformer:** Parse HL7, extract vital signs, patient ID matching
- **Destination:** IthalaMed API (RESTful endpoint)
- **Format:** FHIR Observation resources

Channel 2: Alert Processing

- **Source:** Device alarm messages (HL7 OBX segments)
- **Transformer:** Alert classification, severity mapping, patient context
- **Destination:** Real-time notification service (Socket.io)
- **Actions:** Push notifications, SMS, In-app alerts

Channel 3: Bidirectional Orders

- **Source:** Order entry from IthalaMed (Medication, Ventilator settings)
- **Transformer:** Convert to device-specific protocols
- **Destination:** Medical device (if supported)

Device Registration & Pairing:

Device Setup:

- Admin registers device in system
- Device ID, Type, Model, Serial number
- Department/Unit location
- Calibration status
- Maintenance schedule

Patient-Device Association:

- Assign device to patient bed
- Barcode/NFC scan for linking
- Automatic pairing when patient admits to ICU
- De-linking on discharge/transfer
- Multi-device support per patient

Real-Time Monitoring Dashboard:

ICU Central Monitoring Station:

Layout: Grid view of all ICU beds (4x4, 6x6 configurable)

Each Patient Tile Shows:

- Room/Bed number
- Patient name
- Live vital signs:
  - ECG waveform (mini view)
  - BP (systolic/diastolic/mean)
  - Heart rate (with trend arrow ↑↓→)
  - SpO2 (with trend)
  - Respiratory rate
  - Temperature
- Alert indicators (🔴 Critical, 🟡 Warning)
- Device status (✓ Connected, ⚠️ Issue)
- Time since last update

Click on tile for detailed view:

Detailed Patient Monitoring View:

Top Section: Patient Info

- Patient demographics
- Admission diagnosis
- Attending physician
- Nurse assigned
- Length of ICU stay
- Code status

Main Area: Vital Signs (Large Display)

- **ECG:** Full waveform with heart rate
- **Blood Pressure:** Continuous arterial line or NIBP
- **Respiratory:** Rate, waveform, end-tidal CO2 (if intubated)
- **SpO2:** Oxygen saturation with plethysmography
- **Temperature:** Core and peripheral
- **Cardiac Output:** If Swan-Ganz catheter present
- **ICP:** Intracranial pressure (if monitored)

Ventilator Panel (if patient intubated):

- Mode (Volume control, Pressure control, SIMV, etc.)
- Set parameters:
  - Tidal volume (VT)
  - Respiratory rate (RR)
  - FiO2
  - PEEP
- Measured parameters:
  - Peak pressure
  - Plateau pressure
  - Compliance
  - Minute ventilation
- Alarms: High pressure, Low VT, Apnea

Infusion Pump Panel:

- Active infusions (Drug name, Rate, Volume infused, Volume remaining)
- Multiple pumps per patient
- Rate changes highlighted
- Completion time estimates

Lab Values Panel:

- Latest labs with timestamp
- Abnormal values flagged
- Trend indicators

Trend Graphs:

- Select parameter (HR, BP, SpO2, etc.)
- Time range (1hr, 6hr, 24hr, 7 days)
- Overlay multiple parameters
- Event markers (Medication given, Procedure)

Alert Management System:

Alert Classification:

1. Critical Alerts (Red - Immediate Action Required):

- Cardiac arrest (Asystole, VF, VT)
- Severe hypotension (SBP <70 mmHg)
- Severe hypoxia (SpO2 <85%)
- Ventilator disconnect
- Infusion pump occlusion (critical meds)
- Extreme tachycardia/bradycardia

2. Warning Alerts (Yellow - Prompt Attention):

- Moderate BP changes
- Arrhythmias (PVCs, AF)
- SpO2 90-94%
- Fever >39°C
- Low urine output
- Glucose <70 or >300 mg/dL

3. Informational (Blue - Awareness):

- Infusion near completion
- Equipment battery low
- Scheduled calibration due

Alert Delivery:

Notification Cascade:

1. **Immediate:** Bedside nurse (Push notification, App alert, Pager)
2. **30 seconds:** Charge nurse (if not acknowledged)
3. **1 minute:** Attending physician
4. **2 minutes:** ICU supervisor

Alert Acknowledgment:

- Tap notification to view patient
- View alert details and context
- Acknowledge alert with action taken:
    - "Responded to bedside"
    - "Reviewed, stable"
    - "Intervention performed"
    - "False alarm"
- Escalate if needed

Alert Suppression:

- Temporary suppression during procedures
- Smart suppression (related alarms grouped)
- Alarm fatigue prevention

Early Warning Scores:

NEWS2 (National Early Warning Score 2): Auto-calculated from vitals:

- Respiratory rate
- SpO2
- Supplemental oxygen
- Temperature
- Systolic BP
- Heart rate
- Level of consciousness

Score Interpretation:

- 0-4: Low risk
- 5-6: Medium risk → Increase monitoring
- 7+: High risk → Urgent response needed

Pediatric Early Warning Score (PEWS): For pediatric patients:

- Behavior
- Cardiovascular
- Respiratory
- Auto-calculated with age-specific norms

Sepsis Screening:

- qSOFA score (Quick SOFA)
- SIRS criteria (Systemic Inflammatory Response)
- Automatic sepsis alerts
- Sepsis bundle reminders

Clinical Decision Support:

Protocol Alerts:

- Ventilator-associated pneumonia prevention
- DVT prophylaxis reminders
- Stress ulcer prophylaxis
- Glycemic control protocols
- Sedation vacation reminders
- Spontaneous breathing trial eligibility

Device-Triggered Interventions:

- Prolonged high airway pressure → Suction needed
- Rising CO2 → Increase minute ventilation
- Persistent low SpO2 → Increase FiO2
- Hypotension + low UOP → Fluid bolus consideration

Historical Data & Reporting:

Device Data Storage:

- All vital signs stored every 1-5 minutes
- Waveform data stored (selectively)
- Alert history with responses
- Setting changes logged
- Correlation with medications/interventions

Analytics:

- Patient deterioration patterns
- Alert response times
- Device utilization
- Downtime tracking
- Compliance with protocols

3.6.4 DICOM Server Integration & Medical Imaging

Requirements:

- Integration with hospital PACS (Picture Archiving and Communication System)
- DICOM query/retrieve (C-FIND, C-MOVE)
- Worklist management (DICOM MWL)
- Real-time imaging result notifications
- Web-based DICOM viewer
- Image sharing between providers
- Anonymization for research/teaching
- Mirth Connect for HL7/DICOM bridging

DICOM Server Architecture:

DICOM Server Types Supported:

- **Open Source:** Orthanc, DCM4CHEE
- **Commercial:** GE Centricity, Philips iSite, Siemens syngo
- **Cloud:** Google Cloud Healthcare API, AWS HealthImaging

Mirth Connect DICOM Integration:

Channel 1: DICOM to IthalaMed Bridge

- **Source:** DICOM Listener (receives studies from modalities)
- **Transformer:** Extract metadata (Patient ID, Study date, Modality)
- **Destination:** IthalaMed API + DICOM Server storage
- **Notification:** Real-time alerts to ordering provider

Channel 2: HL7 Order to DICOM Worklist

- **Source:** IthalaMed imaging orders (HL7 ORM)
- **Transformer:** Convert to DICOM MWL format
- **Destination:** Modality worklist (so techs see orders)

Channel 3: DICOM Study Availability

- **Source:** DICOM C-STORE confirmation
- **Transformer:** Generate study available message
- **Destination:** Push notification service
- **Actions:** Notify ordering doctor, update patient record

DICOM Query Interface:

Imaging Order Tracking:

Order Status Screen:

- List of all imaging orders
- Status indicators:
    - 📋 **Ordered:** Request placed, not yet scheduled
    - 📅 **Scheduled:** Appointment booked
    - ⏳ **In Progress:** Patient at imaging department
    - ✅ **Completed:** Images acquired
    - 📄 **Reported:** Radiologist report available
    - ❌ **Cancelled:** Order cancelled

Order Details:

- Patient demographics
- Ordering provider
- Clinical indication
- Modality and body part
- Priority (Routine, Urgent, STAT)
- Scheduled date/time
- Facility/Department
- Special instructions
- Contrast requirements

DICOM Viewer Integration:

Web-Based Viewer (Cornerstone.js):

Viewer Features:

- Multi-series display (1x1, 2x2, 3x3 grid)
- Cine mode for dynamic studies (CT angio, cardiac)
- Windowing presets (Lung, Bone, Soft tissue, Brain)
- Measurement tools:
    - Length measurement
    - Angle measurement
    - Region of interest (ROI)
    - Elliptical/Rectangle tools
- Annotations (arrows, text labels)
- Zoom, Pan, Rotate
- Invert (black/white swap)
- Magnifying glass
- Reference lines (for CT/MRI)
- Stack scroll (navigate slices)

Advanced Features:

- **MPR (Multi-Planar Reconstruction):** Axial, Sagittal, Coronal
- **3D Rendering:** Volume rendering for CT/MRI
- **Fusion:** Overlay PET on CT
- **Comparison:** Side-by-side with priors
- **Key Images:** Save important slices
- **Hanging Protocols:** Auto-arrange series by study type

Mobile DICOM Viewer:

- Lightweight viewer for smartphones/tablets
- Touch gestures (pinch-zoom, swipe)
- Optimized for lower bandwidth
- Progressive loading (preview then full quality)
- Offline caching for critical images

Imaging Result Notification:

Automatic Notifications:

When Study Completed:

- **To Ordering Doctor:**
  - Push notification: "X-ray Chest for John Doe is ready"
  - In-app badge on imaging section
  - SMS (if configured)

When Report Available:

- **To Ordering Doctor:**
  - Push notification: "Report available: CT Brain for Jane Smith"
  - Email with report summary
  - Critical findings highlighted

Critical Findings (STAT Alerts):

- Immediate phone call to ordering doctor
- SMS with "CRITICAL: [Finding summary]"
- Push notification with high priority
- Escalation if not acknowledged in 15 minutes
- Document communication

Imaging Request Workflow:

Step 1: Order Creation (by Doctor)

- Select imaging modality
- Choose body part/region
- Enter clinical indication (required)
- Select priority
- Contrast requirements (Yes/No/Maybe)

- Special instructions
- Comparison to prior studies
- Attach relevant history/labs

Step 2: Order Review (by Radiologist)

- Review appropriateness
- Approve or suggest alternative
- Add protocol notes
- Schedule study

Step 3: Patient Preparation

- Notify patient (appointment details)
- Preparation instructions (Fasting, contrast allergy check)
- Consent form (electronic signature)
- Pre-procedure checklist

Step 4: Image Acquisition

- Technologist sees order on worklist
- Verify patient identity
- Perform study
- QA check (adequate images)
- Send to PACS

Step 5: Interpretation

- Radiologist receives study
- Review images
- Dictate report (voice recognition)
- Finalize report
- Alert ordering doctor

Step 6: Result Review

- Doctor views images and report
- Discuss with patient
- Plan next steps
- Document acknowledgment

DICOM Metadata Storage:

Study Information:

- Study Instance UID
- Study Date/Time
- Accession Number
- Study Description
- Referring Physician

- Number of Series
- Number of Images
- Modality

Series Information:

- Series Instance UID
- Series Number
- Series Description
- Modality (CT, MRI, X-Ray, US, etc.)
- Body Part Examined
- Number of Images

Image Information:

- SOP Instance UID
- Instance Number
- Image Position/Orientation
- Pixel Spacing
- Window Center/Width
- Slice Thickness (for CT/MRI)

Patient Privacy:

- Automatic PHI de-identification for research
- Anonymization with UID preservation
- Audit trails for image access
- HIPAA-compliant storage
- Encrypted transmission (TLS)

Image Sharing:

Internal Sharing:

- Share study with specialists
- Add to case conferences
- Teaching file contributions
- Tumor board presentations

External Sharing:

- Secure link generation (expires in 30 days)
- Password-protected access
- Patient consent required
- CD/DVD burning (legacy support)
- DICOM send to other facilities

Worklist Management:

Radiology Worklist:

- Pending studies
- In-progress studies
- Priority queue
- Stat studies (top of list)
- Filter by modality, date, priority
- Assign to radiologist
- Track turnaround time

Performance Metrics:

- Average report turnaround time
- Studies per modality per day
- Radiologist productivity
- Critical finding notification time
- Patient wait times

3.6.5 Emergency Department (ED) Module

Triage Interface:

- **ESI Triage (5 Levels):**
  - Level 1: Resuscitation (Life-threatening)
  - Level 2: Emergent (High risk, <10 min)
  - Level 3: Urgent (Stable, <30 min)
  - Level 4: Less Urgent (<60 min)
  - Level 5: Non-urgent (<120 min)

Triage Assessment:

- Chief complaint
- Vital signs
- Pain score
- Red flags (Chest pain, SOB, Altered mental status)
- Resource needs prediction
- Estimated wait time

ED Track Board:

- Patient list (sorted by triage level)
- Room/Bed assignment
- Provider assigned
- Time in ED
- Pending tasks (Labs, Imaging, Consults)
- Disposition (Admit, Discharge, Transfer)

3.6.6 Patient Admission Module

Admission Workflow:

Step 1: Patient Demographics

- Full name, DOB, Gender
- ID number
- Address and contact
- Next of kin
- Insurance details

Step 2: Clinical Details

- Admitting diagnosis
- Admitting provider
- Planned treatment/procedures
- Expected length of stay

Step 3: Bed Assignment

- Department selection (Medical, Surgical, ICU, etc.)
- Bed availability check
- Special requirements (Isolation, Telemetry, Bariatric)
- Bed assignment confirmation

Step 4: Admission Orders

- Diet
- Activity level
- Vital signs frequency
- Medications
- IV fluids
- Laboratory tests
- Imaging
- Consultations

Step 5: Insurance Authorization

- Verify coverage
- Obtain authorization
- Estimate costs
- Patient acknowledgment

3.6.7 Bed Management System

Requirements:

- Real-time bed status
- Department-wise view

- Bed allocation
- Discharge planning
- Turnover tracking
- Capacity alerts

Bed Status Board:

- **Bed States:**
  - Occupied (Patient name, Admission date)
  - Ready (Clean and available)
  - Dirty (Requires housekeeping)
  - Blocked (Maintenance, Infection control)
  - Reserved (Pre-assigned)

Department Views:

- ICU (Intensive Care Unit)
- CCU (Coronary Care Unit)
- Medical Ward
- Surgical Ward
- Pediatrics
- Maternity
- Isolation
- Step-down Unit

Bed Assignment:

- Patient matching to bed
- Consideration of isolation needs
- Gender-specific wards
- Age-appropriate units
- Telemetry availability

Discharge Planning:

- Expected discharge date
- Discharge barriers
- Social work involvement
- Home care arrangements
- Bed turnover alerts

3.6.8 Nursing Station Dashboard

Requirements:

- Patient census for assigned unit
- Vital signs monitoring
- Medication administration

- Care plan management
- Task assignments
- Shift handoff

Patient Census:

- List of patients on unit
- Room/Bed number
- Diagnosis
- Code status (Full code, DNR)
- Isolation precautions
- Allergies (prominently displayed)
- Assigned nurse

Vital Signs Tracking:

- Scheduled vs actual recording times
- Vital trends (graphs)
- Out-of-range alerts
- Pain assessments

Medication Administration:

- Scheduled medications (due now, overdue, upcoming)
- PRN medications
- Barcode scanning (patient band + medication)
- Administration documentation
- Refused/Held medications (with reason)

Care Plans:

- Nursing diagnoses
- Goals
- Interventions
- Evaluation

Shift Handoff:

- SBAR format
- Patient summary
- Outstanding tasks
- Concerns/Warnings

3.7 MEDICAL AID/INSURANCE PORTAL

3.7.1 Member Management

Requirements:

- Member registration
- Dependents management
- Benefit plans
- Coverage details
- Claims history
- Pre-authorizations

Member Dashboard:

- Personal details
- Benefit balance (remaining hospital days, chronic limit, etc.)
- Active dependents
- Recent claims
- Outstanding payments
- Policy documents

3.7.2 Claims Processing

Requirements:

- Auto-receive claims (from providers)
- Claims adjudication
- Fraud detection
- Payment processing
- Rejection management

Claims Workflow:

- Claim received
- Eligibility verification
- Benefit verification
- Medical necessity review
- Pricing verification
- Adjudication (Approved, Partially approved, Denied)
- Payment processing
- Member notification

Fraud Detection:

- Duplicate claims
- Unbundling
- Upcoding
- Provider pattern analysis
- Member utilization analysis

3.7.3 Pre-Authorization Module

Requirements:

- Authorization request from providers
- Clinical review
- Approval/Denial
- Authorization tracking
- Extension requests

Authorization Types:

- Elective procedures
- Hospital admissions
- High-cost medications
- Imaging studies
- Specialist referrals

3.8 GOVERNMENT & REGULATOR DASHBOARD

3.8.1 Public Health Surveillance

Requirements:

- Disease notification tracking
- Outbreak detection
- Epidemiological reports
- Vaccination coverage
- Health facility compliance

Notifiable Diseases Tracking:

- Real-time case reporting
- Geographic mapping
- Trend analysis
- Outbreak alerts

Vaccination Coverage:

- Immunization rates by region
- Coverage gaps
- Campaign monitoring

3.8.2 Healthcare Facility Registration

Requirements:

- Facility applications

- Inspection scheduling
- Compliance tracking
- License issuance
- Renewal management

3.8.3 Health Data Analytics

Requirements:

- De-identified population data
- Disease burden analysis
- Resource allocation
- Policy planning support

---

4. CROSS-CUTTING FRONTEND FEATURES

4.1 Authentication & Authorization

Multi-Factor Authentication:

- Password + OTP (SMS/Email)
- Biometric (Fingerprint/Face ID)
- Security questions

Role-Based Access Control:

- Patient, Guardian, Doctor, Nurse, Pharmacist, Lab Tech, EMS, Admin
- Permission levels (View, Edit, Delete)
- Audit logging

Session Management:

- Token-based authentication (JWT)
- Auto-logout after inactivity (15 minutes)
- Concurrent session limits

4.2 Notifications System

Push Notifications:

- Appointment reminders (24hr, 1hr before)
- Test results available
- Prescription ready

- Critical alerts
- Chat messages

In-App Notifications:

- Notification center with badge count
- Categorized (Clinical, Administrative, Messages)
- Mark as read/unread
- Clear all

SMS Notifications:

- OTP codes
- Appointment confirmations
- Emergency alerts

Email Notifications:

- Weekly health summary
- Billing statements
- Administrative communications

4.3 Real-Time Communication

Chat Messaging:

- Patient ↔ Provider secure messaging
- Provider ↔ Provider consultations
- Group chats (care team)
- File attachments
- End-to-end encryption

Video Conferencing:

- Telemedicine consultations
- Multi-party conferences
- Screen sharing
- Recording (with consent)

Voice Calls:

- In-app VoIP calls
- Call history
- Voicemail

4.4 Document Management

Upload Capabilities:

- Photos (Camera/Gallery)
- PDF documents
- Scanned files
- DICOM images

OCR Processing:

- Extract text from scanned documents
- Auto-populate fields
- Manual correction

Document Viewer:

- PDF viewer (zoom, rotate, annotate)
- Image viewer (zoom, pan)
- DICOM viewer (windowing, measurements)

Sharing:

- Share with providers
- Permission-based access
- Revoke access
- Audit trail

4.5 Offline Capabilities

Offline-First Design:

- Cache critical data locally
- Queue actions when offline
- Sync when connection restored
- Conflict resolution

Offline Features:

- View medical records
- Read messages
- View appointments
- Enter data (syncs later)

4.6 Accessibility Features

Visual Accessibility:

- High contrast mode
- Adjustable font sizes
- Screen reader support
- Color-blind friendly palette

Motor Accessibility:

- Large touch targets (min 44x44px)
- Voice input
- Keyboard navigation (web)

Cognitive Accessibility:

- Simple, clear language
- Step-by-step processes
- Confirmation dialogs
- Undo capabilities

4.7 Multi-Language Support

Supported Languages:

- English (Primary)
- Zulu
- Swahili
- Shona
- Yoruba
- Hausa
- Amharic
- French (for West/Central Africa)
- Portuguese (for Angola, Mozambique)

Implementation:

- i18n library (react-i18next)
- RTL support (for Arabic future-proofing)
- Date/Time localization
- Currency localization

4.8 Theme & Styling

Brand Colors:

- Primary: `#00bfff` (Deep Sky Blue)
- Secondary: `#0080ff`
- Success: `#10b981`

- Warning: `#f59e0b`
- Error: `#ef4444`
- Gray scale: `#f9fafb` to `#111827`

Typography:

- Headings: SF Pro Display (iOS) / Roboto (Android/Web)
- Body: SF Pro Text / Roboto
- Monospace: SF Mono / Roboto Mono

Theme Modes:

- Light mode (default)
- Dark mode
- Auto (system preference)

Spacing System:

- Base unit: 4px
- Scale: 4, 8, 12, 16, 24, 32, 48, 64px

4.9 Performance Optimization

Code Splitting:

- Lazy load routes
- Dynamic imports for specialty modules
- Chunk optimization

Image Optimization:

- Responsive images (multiple resolutions)
- WebP format with fallbacks
- Lazy loading images
- Image compression

Caching Strategy:

- Cache API responses (Redux Persist)
- Service workers (PWA)
- Cache invalidation on data updates

Bundle Size:

- Tree shaking
- Remove unused dependencies
- Optimize imports

4.10 Error Handling & Logging

Error Boundaries:

- Catch and display user-friendly errors
- Fallback UI components
- Error reporting to backend

Validation:

- Form validation (client-side)
- Field-level validation
- Real-time feedback
- Error messages in user's language

Logging:

- User actions tracking
- Error logging
- Performance metrics
- Analytics integration

---

5. RESPONSIVE DESIGN SPECIFICATIONS

5.1 Mobile (320px - 767px)

Layout:

- Single column
- Full-width components
- Bottom tab navigation
- Sticky headers
- Collapsible sections
- Swipeable carousels

Interactions:

- Touch-optimized (44px minimum touch target)
- Swipe gestures (left/right, pull-to-refresh)
- Long-press menus
- Haptic feedback

Navigation:

- Bottom navigation bar (4-5 main items)

- Hamburger menu for additional options
- Floating action button for primary actions
- Back button navigation

5.2 Tablet (768px - 1023px)

Layout:

- 2-column grid where appropriate
- Side drawer navigation (collapsible)
- Master-detail views (list + detail side by side)
- Larger touch targets
- More content visible

Interactions:

- Touch and stylus support
- Split-screen compatible
- Picture-in-picture for video

5.3 Desktop/Web (1024px+)

Layout:

- 3-column grid
- Persistent sidebar navigation
- Multi-panel views
- Dashboard layouts with cards
- Modals for focused tasks
- Breadcrumb navigation

Interactions:

- Keyboard shortcuts
- Hover states
- Right-click context menus
- Drag-and-drop
- Multi-window support

---

6. TECHNICAL IMPLEMENTATION SPECIFICATIONS

6.1 Project Structure

```
ithalamed-frontend/
├── apps/
│   ├── patient-app/
│   ├── provider-app/
│   ├── pharmacy-app/
│   ├── lab-app/
│   ├── ems-app/
│   ├── hospital-app/
│   ├── medical-aid-app/
│   └── gov-dashboard-app/
│
├── packages/
│   ├── shared-components/
│   ├── shared-utils/
│   ├── shared-hooks/
│   ├── shared-services/
│   └── shared-theme/
│
├── package.json
├── tsconfig.json
├── .eslintrc.js
└── README.md
```

6.2 State Management Architecture

Redux Toolkit Slices:

```
// Store Structure
{
  auth: {
    user: User | null,
    token: string | null,
    isAuthenticated: boolean,
    role: UserRole,
  },

  patients: {
    currentPatient: Patient | null,
    patientList: Patient[],
    medicalHistory: MedicalHistory,
    appointments: Appointment[],
    prescriptions: Prescription[],
  },

  providers: {
    providerProfile: Provider,
    schedule: Schedule,
    patientQueue: QueueItem[],
    alerts: Alert[],
  },

  notifications: {
    items: Notification[],
    unreadCount: number,
  },

  ui: {
```

```
    theme: 'light' | 'dark',
    language: string,
    loading: boolean,
    error: Error | null,
  },

  offline: {
    queue: Action[],
    syncStatus: 'synced' | 'pending' | 'error',
  }
}
```

6.3 API Integration

API Client Setup:

```
const apiClient = axios.create({
  baseURL: API_BASE_URL[ENV],
  timeout: 30000,
  headers: {
    'Content-Type': 'application/json',
  },
});

// Request interceptor
apiClient.interceptors.request.use(
  (config) => {
    const token = getStoredToken();
    if (token) {
      config.headers.Authorization = `Bearer ${token}`;
    }
    return config;
  },
  (error) => Promise.reject(error)
);

// Response interceptor
apiClient.interceptors.response.use(
  (response) => response,
  async (error) => {
    if (error.response?.status === 401) {
      await refreshToken();
    }
    return Promise.reject(error);
  }
);
```

---

7. MEDICAL-SPECIFIC FEATURES IMPLEMENTATION

7.1 DICOM Viewer Integration

Implementation:

```
import { WebView } from 'react-native-webview';
```

```
const DICOMViewer = ({ imageUrl }: { imageUrl: string }) => {
  const html = `
    <!DOCTYPE html>
    <html>
      <head>
        <script src="https://unpkg.com/cornerstone-core"></script>
        <script src="https://unpkg.com/cornerstone-wado-image-
loader"></script>
      </head>
      <body>
        <div id="dicomImage" style="width: 100%; height: 100vh;"></div>
        <script>
          cornerstone.enable(document.getElementById('dicomImage'));
          cornerstone.loadImage('${imageUrl}').then(image => {
            cornerstone.displayImage(element, image);
          });
        </script>
      </body>
    </html>
  `;

  return <WebView source={{ html }} />;
};
```

7.2 Medical Device Integration

```
import { BleManager } from 'react-native-ble-plx';

class MedicalDeviceService {
  private bleManager: BleManager;

  async scanForDevices(): Promise<Device[]> {
    // Scan for Bluetooth LE devices
  }

  async connectToDevice(deviceId: string): Promise<void> {
    // Connect to device
  }

  async readGlucoseLevel(device: Device): Promise<number> {
    // Read glucose from Accu-Chek meter
  }

  async readBloodPressure(device: Device): Promise<{ systolic: number;
diastolic: number }> {
    // Read BP from Omron monitor
  }

  async syncAppleHealth(): Promise<HealthData> {
    // Sync data from Apple Health
  }

  async syncGoogleFit(): Promise<HealthData> {
    // Sync data from Google Fit
  }
}
```

7.3 Telemedicine (Jitsi Meet Integration)

```
import JitsiMeet from 'react-native-jitsi-meet';

const TelemedicineSession = ({ sessionId, patientName, providerName }:
Props) => {
  const startCall = () => {
    const url = `https://meet.ithalamed.com/${sessionId}`;
    const userInfo = {
      displayName: providerName,
      email: 'provider@ithalamed.com',
      avatar: 'https://...',
    };

    const options = {
      audioOnly: false,
      audioMuted: false,
      videoMuted: false,
      featureFlags: {
        'chat.enabled': true,
        'recording.enabled': true,
        'filmstrip.enabled': true,
      },
    };

    JitsiMeet.call(url, userInfo, options);
  };

  useEffect(() => {
    JitsiMeet.addEventListener('conferenceJoined', () => {
      console.log('Conference joined');
    });

    JitsiMeet.addEventListener('conferenceTerminated', () => {
      console.log('Conference ended');
    });

    return () => JitsiMeet.removeAllListeners();
  }, []);

  return (
    <View>
      <Button onPress={startCall}>Start Video Call</Button>
    </View>
  );
};
```

7.4 Growth Charts Implementation

```
import { LineChart } from 'react-native-chart-kit';

const GrowthChart = ({ childData, chartType }: Props) => {
  const percentileData = getWHOPercentiles(chartType);

  const childMeasurements = childData.map(point => ({
    x: point.ageInMonths,
    y: point.value,
  }));

  return (
    <LineChart
      data={{
```

```
        datasets: [
          { data: percentileData.p97, color: () => '#fee', strokeWidth: 1
},
          { data: percentileData.p85, color: () => '#fdd', strokeWidth: 1
},
          { data: percentileData.p50, color: () => '#00bfff', strokeWidth:
2 },
          { data: percentileData.p15, color: () => '#fdd', strokeWidth: 1
},
          { data: percentileData.p3, color: () => '#fee', strokeWidth: 1 },
          { data: childMeasurements, color: () => '#f00', strokeWidth: 2 },
        ],
      }}
      width={Dimensions.get('window').width - 32}
      height={300}
      chartConfig={{...}}
    />
  );
};
```

7.5 Clinical Decision Support

Drug Interaction Checker:

```
interface DrugInteraction {
  severity: 'major' | 'moderate' | 'minor';
  description: string;
  recommendation: string;
}

const checkDrugInteractions = async (
  medications: string[]
): Promise<DrugInteraction[]> => {
  const response = await api.post('/clinical-support/drug-interactions', {
    drugs: medications,
  });

  return response.data.interactions;
};
```

7.6 Emergency Protocols

Triage Protocols:

```
interface TriageProtocol {
  level: 1 | 2 | 3 | 4 | 5;
  timeToProvider: number;
  requiredActions: string[];
  alerts: string[];
}

const calculateTriageLevel = (
  vitalSigns: VitalSigns,
  symptoms: string[],
  riskFactors: string[]
): TriageProtocol => {
  // ESI algorithm
  if (
    vitalSigns.heartRate > 140 || vitalSigns.heartRate < 40 ||
```

```
    vitalSigns.bloodPressureSystolic < 90 ||
    vitalSigns.oxygenSaturation < 90 ||
    symptoms.includes('unresponsive')
  ) {
    return {
      level: 1,
      timeToProvider: 0,
      requiredActions: [
        'Immediate physician evaluation',
        'Continuous monitoring',
        'Activate trauma/code team',
      ],
      alerts: ['CRITICAL - IMMEDIATE ATTENTION REQUIRED'],
    };
  }

  // Additional levels...
  return { level: 3, timeToProvider: 30, requiredActions: [], alerts: [] };
};
```

---

8. ADVANCED UI/UX SPECIFICATIONS

8.1 Animation Guidelines

Micro-interactions:

```
import { Animated, Easing } from 'react-native';

const ButtonPress = ({ children, onPress }: Props) => {
  const scaleAnim = useRef(new Animated.Value(1)).current;

  const handlePressIn = () => {
    Animated.spring(scaleAnim, {
      toValue: 0.95,
      useNativeDriver: true,
    }).start();
  };

  const handlePressOut = () => {
    Animated.spring(scaleAnim, {
      toValue: 1,
      useNativeDriver: true,
    }).start();
  };

  return (
    <Animated.View style={{ transform: [{ scale: scaleAnim }] }}>
      <TouchableOpacity
        onPressIn={handlePressIn}
        onPressOut={handlePressOut}
        onPress={onPress}
      >
        {children}
      </TouchableOpacity>
    </Animated.View>
  );
};
```

8.2 Loading States

```
const DataComponent = () => {
  const { data, loading, error } = useQuery(GET_DATA);

  if (loading) return <SkeletonLoader />;

  if (error) {
    return (
      <ErrorState
        message="Failed to load data"
        onRetry={() => refetch()}
      />
    );
  }

  if (!data || data.length === 0) {
    return (
      <EmptyState
        icon="inbox"
        title="No data found"
        description="Try adjusting your filters"
      />
    );
  }

  return <DataList data={data} />;
};
```

8.3 Error Handling UI

```
class ErrorBoundary extends React.Component<Props, State> {
  state = { hasError: false, error: null };

  static getDerivedStateFromError(error: Error) {
    return { hasError: true, error };
  }

  componentDidCatch(error: Error, errorInfo: ErrorInfo) {
    logErrorToService(error, errorInfo);
  }

  render() {
    if (this.state.hasError) {
      return (
        <View style={styles.errorContainer}>
          <Icon name="alert-circle" size={64} color="#ef4444" />
          <Text style={styles.errorTitle}>Something went wrong</Text>
          <Text style={styles.errorMessage}>
            We're working to fix the issue. Please try again later.
          </Text>
          <Button onPress={() => this.setState({ hasError: false })}>
            Try Again
          </Button>
        </View>
      );
    }

    return this.props.children;
  }
```

```
}
```

8.4 Accessibility Implementation

```
<TouchableOpacity
  accessible={true}
  accessibilityLabel="Book appointment with Dr. Smith"
  accessibilityHint="Opens appointment booking screen"
  accessibilityRole="button"
  onPress={handlePress}
>
  <Text>Book Appointment</Text>
</TouchableOpacity>
```

8.5 Offline Support Implementation

```
import NetInfo from '@react-native-community/netinfo';

const useNetworkStatus = () => {
  const [isOnline, setIsOnline] = useState(true);

  useEffect(() => {
    const unsubscribe = NetInfo.addEventListener(state => {
      setIsOnline(state.isConnected && state.isInternetReachable);
    });

    return () => unsubscribe();
  }, []);

  return isOnline;
};
```

---

9. PERFORMANCE OPTIMIZATION STRATEGIES

9.1 Image Optimization

```
import FastImage from 'react-native-fast-image';

const OptimizedImage = ({ uri, style }: Props) => (
  <FastImage
    source={{
      uri,
      priority: FastImage.priority.normal,
      cache: FastImage.cacheControl.immutable,
    }}
    style={style}
    resizeMode={FastImage.resizeMode.cover}
  />
);
```

9.2 List Performance

```
import { FlashList } from '@shopify/flash-list';

const PatientList = ({ patients }: Props) => (
```

```
  <FlashList
    data={patients}
    renderItem={({ item }) => <PatientCard patient={item} />}
    estimatedItemSize={100}
    keyExtractor={item => item.id}
    removeClippedSubviews={true}
    maxToRenderPerBatch={10}
    updateCellsBatchingPeriod={50}
    windowSize={10}
  />
);
```

9.3 Code Splitting

```
import React, { lazy, Suspense } from 'react';

const DicomViewer = lazy(() => import('./DicomViewer'));
const VideoCall = lazy(() => import('./VideoCall'));

const MedicalRecords = () => (
  <Suspense fallback={<LoadingSpinner />}>
    <DicomViewer imageUrl={imageUrl} />
  </Suspense>
);
```

---

10. ANALYTICS & MONITORING

10.1 User Analytics

```
import analytics from '@react-native-firebase/analytics';

const trackEvent = async (
  eventName: string,
  properties?: Record<string, any>
) => {
  await analytics().logEvent(eventName, properties);
};

// Usage
trackEvent('appointment_booked', {
  provider_id: '123',
  specialty: 'Cardiology',
  type: 'telemedicine',
});
```

10.2 Performance Monitoring

```
import perf from '@react-native-firebase/perf';

const monitoredFetch = async (url: string, options: RequestInit) => {
  const trace = await perf().startTrace('api_call');
  trace.putAttribute('endpoint', url);

  try {
    const response = await fetch(url, options);
    trace.putMetric('response_code', response.status);
```

```
    return response;
  } finally {
    await trace.stop();
  }
};
```

10.3 Error Tracking

```
import * as Sentry from '@sentry/react-native';

Sentry.init({
  dsn: 'YOUR_SENTRY_DSN',
  environment: __DEV__ ? 'development' : 'production',
});

const logError = (error: Error, context?: Record<string, any>) => {
  Sentry.captureException(error, {
    contexts: {
      custom: context,
    },
  });
};
```

---

11. DEPLOYMENT CHECKLIST

11.1 Pre-Launch Checklist

Code Quality:

- [ ] All TypeScript errors resolved
- [ ] ESLint warnings addressed
- [ ] Unit tests passing (>80% coverage)
- [ ] E2E tests passing
- [ ] Performance benchmarks met
- [ ] Bundle size optimized (<50MB)
- [ ] Dead code removed

Security:

- [ ] Security audit completed
- [ ] API keys secured
- [ ] HTTPS enforced
- [ ] Biometric authentication tested
- [ ] Data encryption verified
- [ ] HIPAA compliance checklist completed
- [ ] Penetration testing done

Functionality:

- [ ] All critical user flows tested
- [ ] Error handling verified
- [ ] Offline functionality works

- [ ] Push notifications working
- [ ] Deep links configured
- [ ] Multi-language tested
- [ ] Accessibility tested

Performance:

- [ ] App launch time <3s
- [ ] Screen transitions smooth (60fps)
- [ ] Memory leaks checked
- [ ] Network optimization done
- [ ] Image loading optimized

11.2 App Store Metadata

iOS App Store:

```
App Name: IthalaMed - Healthcare Platform
Subtitle: Your Health, Connected
Category: Medical
Age Rating: 4+

Description: |
  IthalaMed is Africa's leading unified healthcare platform that connects
  patients, doctors, hospitals, pharmacies, and emergency services into
  one seamless digital ecosystem.

  Features:
  • Book appointments with healthcare providers
  • Access your complete medical records
  • Request ambulance services in emergencies
  • Receive telemedicine consultations
  • Manage prescriptions digitally
  • Track your health metrics
  • Connect with medical devices

  And much more...

Keywords: healthcare, medical, doctor, appointment, telemedicine,
prescription
```

11.3 Release Strategy

Phased Rollout:

1. **Beta Testing (2 weeks):**
    - Internal team (50 users)
    - Healthcare providers (200 users)
    - Patient volunteers (500 users)
2. **Soft Launch (1 month):**
    - Limited to Johannesburg, South Africa

    - 10,000 users maximum
    - Monitor for critical issues
3. **Regional Launch (3 months):**
    - South Africa nationwide
    - Selected clinics in Kenya and Nigeria
    - Scale infrastructure
4. **Full Launch:**
    - All supported countries
    - Marketing campaign
    - PR announcement

Version Numbering:

- Major.Minor.Patch (e.g., 1.0.0)
- Major: Breaking changes, major features
- Minor: New features, backwards compatible
- Patch: Bug fixes, minor improvements

---

12. MAINTENANCE & SUPPORT PLAN

12.1 Update Schedule

Regular Updates:

- **Patch Updates:** Every 2 weeks (bug fixes)
- **Minor Updates:** Every month (new features)
- **Major Updates:** Every 6 months (major overhauls)

Emergency Updates:

- Critical security vulnerabilities: Within 24 hours
- Major bugs affecting core functionality: Within 48 hours

12.2 Support Channels

In-App Support:

- Live chat (business hours)
- Email support (support@ithalamed.com)
- Phone support (+27 60 206 2762)
- Help center with FAQs
- Video tutorials

Response Times:

- Critical issues: 1 hour
- High priority: 4 hours
- Medium priority: 24 hours
- Low priority: 72 hours

12.3 Monitoring & Alerts

System Monitoring:

- Uptime monitoring (99.9% SLA)
- API response time
- Error rates
- User session duration
- Crash rate (<1%)

Alerts:

- Server downtime
- High error rates (>5%)
- Failed deployments
- Security incidents
- Performance degradation

---

13. FUTURE ENHANCEMENTS

13.1 Planned Features (Phase 2)

AI-Powered Features:

- Symptom checker with AI diagnosis suggestions
- Predictive health analytics
- Chatbot for common questions
- Medical image analysis (AI-assisted radiology)

Advanced Integrations:

- National health insurance systems
- Government health databases
- Medical research platforms
- Wearable device expansion (Fitbit, Garmin, etc.)

Enhanced Telemedicine:

- Group consultations
- Mental health support

- Specialist consultations marketplace
- Translation services for consultations

Patient Empowerment:

- Health education content library
- Medication adherence programs
- Chronic disease management programs
- Fitness and nutrition tracking

13.2 Platform Expansion

New User Types:

- Medical equipment suppliers
- Medical insurance brokers
- Home care nurses
- Physiotherapists
- Nutritionists/Dietitians

Geographic Expansion:

- West Africa: Ghana, Nigeria, Senegal
- East Africa: Kenya, Tanzania, Uganda
- Southern Africa: Botswana, Namibia, Zambia, Zimbabwe

Language Support:

- Additional African languages
- Arabic (North Africa)
- French (Central/West Africa)
- Portuguese (Lusophone Africa)

---

14. CONCLUSION

14.1 Implementation Roadmap

Phase 1: Foundation (Months 1-3)

- Set up project structure and shared packages
- Implement authentication system
- Build patient mobile app (MVP)
- Build provider mobile app (MVP)
- Deploy backend API

Phase 2: Core Features (Months 4-6)

- Complete all 8 applications
- Implement telemedicine functionality
- Add DICOM viewer
- Integrate payment systems
- Launch beta testing

Phase 3: Enhancement (Months 7-9)

- Add 40+ medical specialties
- Implement offline support
- Add medical device integration
- Performance optimization
- Security audit

Phase 4: Launch (Month 10)

- Soft launch in Johannesburg
- Gather user feedback
- Bug fixes and improvements
- Marketing preparation

Phase 5: Scale (Months 11-12)

- Regional expansion
- Infrastructure scaling
- Partnership onboarding
- Full marketing launch

14.2 Success Metrics

User Adoption:

- 10,000 registered patients in first 3 months
- 500 healthcare providers onboarded
- 50 pharmacies integrated
- 20 hospitals/clinics connected

Engagement:

- 50% monthly active users
- Average 3 sessions per week per user
- 70% appointment completion rate
- <5% app crash rate

Business:

- 1,000 appointments booked monthly
- 500 prescriptions filled monthly
- 100 telemedicine sessions monthly
- 95% user satisfaction score

14.3 Final Summary

This comprehensive frontend requirements document outlines the complete IthalaMed platform implementation for React Native Expo. The platform addresses the entire healthcare ecosystem across Africa, providing:

✅ **8 Specialized Applications** for different user types
✅ **40+ Medical Specialties** with customized workflows
✅ **Complete Patient Journey** from prevention to treatment
✅ **Real-time Collaboration** between all healthcare stakeholders
✅ **Mobile-First Design** with responsive web support
✅ **HIPAA-Compliant Security** with encryption and auditing
✅ **Offline Capabilities** for areas with poor connectivity
✅ **Multi-Language Support** for African diversity
✅ **Medical Device Integration** for continuous monitoring
✅ **Telemedicine** for remote consultations
✅ **Emergency Services** with GPS tracking
✅ **Hospital Operations** including staff management, rounds, and device integration
✅ **DICOM/PACS Integration** via Mirth Connect
✅ **Scalable Architecture** for growth across Africa

The platform is designed to be **maintainable**, **scalable**, and **user-friendly**, transforming healthcare delivery across the African continent by connecting all stakeholders into one unified digital ecosystem.

Next Step: Begin implementation with the Patient Mobile App MVP, followed by incremental rollout of additional features and applications according to the roadmap.

Contact: For implementation questions or clarifications, reach out to the IthalaMed development team at dev@ithalamed.com

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