**SmartSheba - High-Level Use Case Diagram**

**Enterprise-Grade System Analysis & Actor Interaction Model**

**SYSTEM BOUNDARY DEFINITION**

**System Name:** SmartSheba Local Service Marketplace Platform **System Scope:** Complete ecosystem including mobile apps, backend services, AI/ML components, admin portals, and external integrations **System Purpose:** Connect customers with local service providers through an AI-powered, secure, and scalable platform

**1. PRIMARY ACTORS**

**1.1 Customer (End User)**

* **Description:** Individual seeking local services
* **Characteristics:**
  + Mobile app user (Android/iOS)
  + Age range: 18-65
  + Urban/semi-urban Bangladesh residents
  + Various technical proficiency levels
* **Authentication:** Phone-based OTP authentication
* **Access Level:** Customer role permissions

**1.2 Service Provider**

* **Description:** Professional/business offering local services
* **Characteristics:**
  + Individual professionals or small businesses
  + Multiple service categories capability
  + Location-based service delivery
  + Verified identity and skills
* **Authentication:** Enhanced verification with document upload
* **Access Level:** Provider role permissions

**1.3 System Administrator**

* **Description:** SmartSheba platform management team
* **Characteristics:**
  + Platform oversight responsibility
  + Technical and business decision authority
  + User dispute resolution capability
  + System configuration management
* **Authentication:** Multi-factor authentication
* **Access Level:** Admin role permissions

**1.4 Super Administrator**

* **Description:** Highest level system authority
* **Characteristics:**
  + Complete system access and control
  + Security and compliance oversight
  + System-wide configuration authority
  + Emergency response capability
* **Authentication:** Hardware token + biometric
* **Access Level:** Super admin permissions

**2. SECONDARY ACTORS (External Systems)**

**2.1 Payment Gateway Systems**

* **bKash Payment Gateway**
* **Nagad Payment Gateway**
* **SSLCommerz Payment Gateway**
* **International Card Payment Systems**

**2.2 Communication Services**

* **SMS Service Providers** (SSL Wireless, Robi Axiata)
* **Email Service Providers** (SendGrid, Amazon SES)
* **Push Notification Services** (Firebase, APNS)

**2.3 Location & Mapping Services**

* **Google Maps Platform**
* **Location Services Provider**
* **Geofencing Services**

**2.4 Emergency Services**

* **Local Police (999)**
* **Ambulance Services**
* **Fire Department**
* **Hospital Systems**

**2.5 AI/ML Services**

* **Natural Language Processing Engine**
* **Computer Vision Service**
* **Recommendation Engine**
* **Fraud Detection System**

**2.6 Regulatory & Compliance Systems**

* **Bangladesh Bank (for payments)**
* **BTRC (for telecommunications)**
* **Government Identity Verification**
* **Tax Authority Systems**

**3. DETAILED USE CASES BY ACTOR**

**3.1 CUSTOMER USE CASES**

**Authentication & Profile Management**

UC-C001: Register Account

- Actor: Customer

- Precondition: User has valid Bangladesh phone number

- Main Flow: Enter phone → Receive OTP → Verify → Create profile

- Postcondition: Account created, authenticated

- Includes: UC-C002 (Verify Phone Number)

- Extends: UC-C003 (Complete Profile Setup)

UC-C002: Verify Phone Number

- Actor: Customer, SMS Service Provider

- Main Flow: Request OTP → SMS Service sends OTP → User enters OTP

- Alternative Flow: Resend OTP after timeout

UC-C003: Complete Profile Setup

- Actor: Customer

- Main Flow: Enter personal details → Upload profile picture → Set preferences

- Extensions: Skip optional field s

UC-C004: Login to Account

- Actor: Customer

- Main Flow: Enter phone → Enter OTP → Access dashboard

- Alternative Flow: Biometric login (if configured)

UC-C005: Manage Profile

- Actor: Customer

- Main Flow: View profile → Edit information → Save changes

- Includes: Change password, Update location, Manage preferences

**Service Discovery & Search**

UC-C006: Browse Service Categories

- Actor: Customer

- Main Flow: View home screen → Select category → View subcategories

- Extensions: View featured services, Popular services

UC-C007: Search for Services

- Actor: Customer

- Main Flow: Enter search query → View results → Apply filters

- Includes: UC-C008 (Apply Search Filters)

- Extensions: Voice search, Image-based search

UC-C008: Apply Search Filters

- Actor: Customer

- Main Flow: Select filters (price, rating, distance) → Apply → View filtered results

UC-C009: View Service Details

- Actor: Customer

- Main Flow: Select service → View provider profile → See pricing → Read reviews

UC-C010: Get AI-Powered Service Recommendations

- Actor: Customer, AI Recommendation Engine

- Main Flow: System analyzes user behavior → Generates recommendations → Display suggestions

**Provider Discovery & Selection**

UC-C011: Browse Service Providers

- Actor: Customer

- Main Flow: Select service category → View provider list → Sort/filter providers

UC-C012: View Provider Profile

- Actor: Customer

- Main Flow: Select provider → View profile details → See ratings/reviews → Check availability

UC-C013: Compare Providers

- Actor: Customer

- Main Flow: Select multiple providers → View comparison → Make selection

**Booking Management**

UC-C014: Create Service Booking

- Actor: Customer

- Precondition: User authenticated, provider available

- Main Flow: Select provider → Choose date/time → Enter details → Confirm booking

- Includes: UC-C015 (Select Schedule), UC-C016 (Enter Service Details)

- Postcondition: Booking created, provider notified

UC-C015: Select Schedule

- Actor: Customer

- Main Flow: View available slots → Select preferred time → Confirm selection

UC-C016: Enter Service Details

- Actor: Customer

- Main Flow: Describe service requirements → Add location → Specify preferences

UC-C017: View My Bookings

- Actor: Customer

- Main Flow: Access booking history → Filter by status → View booking details

UC-C018: Modify Booking

- Actor: Customer

- Precondition: Booking exists, modification allowed

- Main Flow: Select booking → Edit details → Confirm changes

- Extensions: Reschedule, Cancel booking

UC-C019: Cancel Booking

- Actor: Customer

- Main Flow: Select booking → Choose cancel reason → Confirm cancellation

- Includes: Check cancellation policy, Process refund if applicable

UC-C020: Track Service Provider

- Actor: Customer, Location Services

- Main Flow: View active booking → See provider location → Track in real-time

- Includes: View ETA, Get arrival notifications

**Communication**

UC-C021: Chat with Provider

- Actor: Customer, Service Provider

- Main Flow: Open booking → Access chat → Send messages → Receive responses

- Extensions: Send images, Voice messages, Share location

UC-C022: Call Provider

- Actor: Customer, Service Provider

- Main Flow: Select booking → Initiate call → Conduct conversation

UC-C023: Receive Notifications

- Actor: Customer, Notification Services

- Main Flow: System sends notification → User receives → User responds if needed

- Types: Booking updates, Messages, Promotional, Emergency

**Payment & Financial**

UC-C024: Make Payment

- Actor: Customer, Payment Gateway

- Main Flow: Select payment method → Enter details → Confirm payment → Receive confirmation

- Includes: UC-C025 (Select Payment Method)

- Extensions: Failed payment retry, Alternative payment method

UC-C025: Select Payment Method

- Actor: Customer

- Main Flow: View available methods → Choose preferred → Validate selection

- Options: bKash, Nagad, Card, Cash on delivery

UC-C026: View Payment History

- Actor: Customer

- Main Flow: Access wallet → View transactions → Filter by date/type

UC-C027: Request Refund

- Actor: Customer

- Main Flow: Select transaction → Request refund → Provide reason → Submit request

**Review & Rating**

UC-C028: Rate and Review Service

- Actor: Customer

- Precondition: Service completed

- Main Flow: Select completed booking → Rate provider → Write review → Submit

- Extensions: Add photos, Report issues

UC-C029: View Reviews and Ratings

- Actor: Customer

- Main Flow: Select provider → View all reviews → Filter by rating/date

**Emergency & Safety**

UC-C030: Activate SOS Emergency

- Actor: Customer, Emergency Services

- Main Flow: Press SOS button → Confirm emergency → Send alerts → Share location

- Includes: Notify emergency contacts, Contact authorities, Log incident

UC-C031: Report Safety Concern

- Actor: Customer, System Administrator

- Main Flow: Select booking/provider → Report issue → Provide details → Submit report

UC-C032: Manage Emergency Contacts

- Actor: Customer

- Main Flow: Access settings → Add/edit contacts → Set contact types → Save changes

**AI-Powered Features**

UC-C033: Use AI Chatbot

- Actor: Customer, AI Chatbot Service

- Main Flow: Ask question → AI processes query → Receive response → Continue conversation

- Extensions: Service recommendations, Problem diagnosis, Booking assistance

UC-C034: Upload Problem Image for Diagnosis

- Actor: Customer, Computer Vision Service

- Main Flow: Take/select photo → Upload image → AI analyzes → Receive service suggestions

UC-C035: Get Personalized Recommendations

- Actor: Customer, Recommendation Engine

- Main Flow: System analyzes preferences → Generates suggestions → Display recommendations

**3.2 SERVICE PROVIDER USE CASES**

**Provider Authentication & Profile**

UC-P001: Register as Service Provider

- Actor: Service Provider

- Main Flow: Submit application → Upload documents → Await verification → Complete profile

- Includes: UC-P002 (Upload Verification Documents)

- Extensions: Resubmit if rejected, Add additional services

UC-P002: Upload Verification Documents

- Actor: Service Provider

- Main Flow: Select document type → Upload file → Add description → Submit for review

- Document Types: ID, Certificates, Portfolio, References

UC-P003: Complete Provider Verification

- Actor: Service Provider, System Administrator

- Main Flow: Admin reviews documents → Verification status updated → Provider notified

UC-P004: Manage Provider Profile

- Actor: Service Provider

- Main Flow: Edit business info → Update services → Modify pricing → Save changes

UC-P005: Set Service Availability

- Actor: Service Provider

- Main Flow: Access calendar → Set available hours → Block unavailable times → Save schedule

**Service & Pricing Management**

UC-P006: Add Service Offerings

- Actor: Service Provider

- Main Flow: Select service category → Define service details → Set pricing → Publish service

UC-P007: Update Service Pricing

- Actor: Service Provider

- Main Flow: Select service → Modify pricing → Set special offers → Update listing

UC-P008: Manage Service Portfolio

- Actor: Service Provider

- Main Flow: Upload work samples → Add descriptions → Organize gallery → Publish portfolio

**Booking Management**

UC-P009: View Incoming Booking Requests

- Actor: Service Provider

- Main Flow: Access dashboard → View pending requests → Review details → Take action

UC-P010: Accept Booking Request

- Actor: Service Provider, Customer

- Main Flow: Review request → Accept booking → Confirm details → Notify customer

- Postcondition: Booking confirmed, schedule updated

UC-P011: Decline Booking Request

- Actor: Service Provider, Customer

- Main Flow: Select request → Choose decline reason → Provide alternative → Submit response

UC-P012: Manage Booking Schedule

- Actor: Service Provider

- Main Flow: View calendar → Reschedule bookings → Update availability → Sync changes

UC-P013: Update Booking Status

- Actor: Service Provider, Customer

- Main Flow: Select booking → Update status → Add notes → Notify customer

- Status Types: Confirmed, En route, In progress, Completed

UC-P014: Mark Service as Completed

- Actor: Service Provider

- Main Flow: Select active booking → Mark complete → Request payment → Submit completion

**Communication & Location**

UC-P015: Communicate with Customer

- Actor: Service Provider, Customer

- Main Flow: Access booking chat → Send messages → Receive responses → Maintain communication

UC-P016: Share Location with Customer

- Actor: Service Provider, Customer, Location Services

- Main Flow: Enable location sharing → Customer receives updates → Navigate to customer location

UC-P017: Navigate to Customer Location

- Actor: Service Provider, Location Services

- Main Flow: Get customer address → Open navigation → Follow route → Arrive at location

**Earnings & Financial**

UC-P018: View Earnings Dashboard

- Actor: Service Provider

- Main Flow: Access earnings → View statistics → Analyze trends → Export reports

UC-P019: Request Payout

- Actor: Service Provider, Payment Gateway

- Main Flow: View available balance → Request withdrawal → Confirm bank details → Submit request

UC-P020: View Transaction History

- Actor: Service Provider

- Main Flow: Access financial section → View all transactions → Filter by type/date

**Performance & Reviews**

UC-P021: View Customer Reviews

- Actor: Service Provider

- Main Flow: Access reviews section → Read customer feedback → Respond if needed

UC-P022: Respond to Customer Reviews

- Actor: Service Provider, Customer

- Main Flow: Select review → Write response → Submit reply → Customer receives notification

UC-P023: View Performance Analytics

- Actor: Service Provider

- Main Flow: Access analytics → View KPIs → Analyze trends → Identify improvement areas

- KPIs: Response time, Completion rate, Customer satisfaction, Earnings

**3.3 SYSTEM ADMINISTRATOR USE CASES**

**User Management**

UC-A001: Manage User Accounts

- Actor: System Administrator

- Main Flow: View user list → Search users → Modify accounts → Apply changes

- Actions: Suspend, Activate, Delete, Reset password

UC-A002: Handle User Disputes

- Actor: System Administrator, Customer, Service Provider

- Main Flow: Receive complaint → Investigate issue → Contact parties → Resolve dispute

UC-A003: Monitor User Activity

- Actor: System Administrator

- Main Flow: Access monitoring dashboard → View activity logs → Identify patterns → Take action

**Provider Management**

UC-A004: Review Provider Applications

- Actor: System Administrator, Service Provider

- Main Flow: Access pending applications → Review documents → Make decision → Notify applicant

UC-A005: Verify Provider Credentials

- Actor: System Administrator

- Main Flow: Check documents → Validate certificates → Conduct background check → Update status

UC-A006: Manage Provider Performance

- Actor: System Administrator

- Main Flow: Monitor provider metrics → Identify issues → Take corrective action → Update records

**Platform Operations**

UC-A007: Configure System Settings

- Actor: System Administrator

- Main Flow: Access admin panel → Modify settings → Test changes → Apply configuration

UC-A008: Monitor System Performance

- Actor: System Administrator

- Main Flow: View system metrics → Analyze performance → Identify bottlenecks → Optimize system

UC-A009: Manage Content and Categories

- Actor: System Administrator

- Main Flow: Add/edit service categories → Update content → Moderate listings → Publish changes

**Security & Compliance**

UC-A010: Handle Security Incidents

- Actor: System Administrator

- Main Flow: Detect incident → Investigate threat → Implement countermeasures → Document incident

UC-A011: Generate Compliance Reports

- Actor: System Administrator, Regulatory Systems

- Main Flow: Extract required data → Generate reports → Review accuracy → Submit to authorities

UC-A012: Audit System Activities

- Actor: System Administrator

- Main Flow: Run audit queries → Review logs → Identify anomalies → Generate audit reports

**Financial Management**

UC-A013: Monitor Financial Transactions

- Actor: System Administrator, Payment Gateway

- Main Flow: Review transaction logs → Identify issues → Investigate discrepancies → Resolve problems

UC-A014: Process Refunds and Disputes

- Actor: System Administrator, Customer, Payment Gateway

- Main Flow: Review refund request → Verify claim → Process refund → Update records

UC-A015: Generate Financial Reports

- Actor: System Administrator

- Main Flow: Extract financial data → Create reports → Analyze trends → Share with stakeholders

**3.4 SUPER ADMINISTRATOR USE CASES**

**System Administration**

UC-SA001: Manage Administrator Accounts

- Actor: Super Administrator

- Main Flow: Create admin accounts → Assign roles → Set permissions → Monitor admin activity

UC-SA002: Configure Security Policies

- Actor: Super Administrator

- Main Flow: Define security rules → Implement policies → Monitor compliance → Update as needed

UC-SA003: Manage System Infrastructure

- Actor: Super Administrator

- Main Flow: Monitor servers → Scale resources → Apply updates → Ensure high availability

**Emergency Management**

UC-SA004: Handle System Emergencies

- Actor: Super Administrator

- Main Flow: Detect emergency → Assess impact → Implement emergency procedures → Coordinate response

UC-SA005: Activate Disaster Recovery

- Actor: Super Administrator

- Main Flow: Assess disaster → Execute recovery plan → Restore services → Verify system integrity

**4. USE CASE RELATIONSHIPS**

**4.1 INCLUDE RELATIONSHIPS**

UC-C014 (Create Service Booking) INCLUDES:

├── UC-C015 (Select Schedule)

├── UC-C016 (Enter Service Details)

└── UC-C025 (Select Payment Method)

UC-C001 (Register Account) INCLUDES:

├── UC-C002 (Verify Phone Number)

└── UC-C003 (Complete Profile Setup)

UC-C007 (Search for Services) INCLUDES:

└── UC-C008 (Apply Search Filters)

UC-P001 (Register as Service Provider) INCLUDES:

└── UC-P002 (Upload Verification Documents)

**4.2 EXTEND RELATIONSHIPS**

UC-C018 (Modify Booking) EXTENDS:

├── Reschedule Booking

└── Cancel Booking

UC-C007 (Search for Services) EXTENDS:

├── Voice Search

└── Image-based Search

UC-C028 (Rate and Review Service) EXTENDS:

├── Add Photos to Review

└── Report Service Issues

UC-P011 (Decline Booking Request) EXTENDS:

└── Suggest Alternative Provider

**4.3 GENERALIZATION RELATIONSHIPS**

Authentication Use Cases:

├── UC-C001 (Customer Registration)

├── UC-P001 (Provider Registration)

└── UC-A001 (Admin Account Management)

Communication Use Cases:

├── UC-C021 (Customer Chat)

├── UC-P015 (Provider Communication)

└── UC-C022 (Voice Communication)

Payment Use Cases:

├── UC-C024 (Make Payment)

├── UC-P019 (Request Payout)

└── UC-A014 (Process Refunds)

**5. SYSTEM INTERACTIONS & DATA FLOW**

**5.1 Critical Use Case Sequences**

**Booking Creation Flow**

1. Customer → UC-C014 (Create Service Booking)

2. System → Validate availability with Provider

3. System → UC-C024 (Process Payment) with Payment Gateway

4. System → UC-C023 (Send Notification) to Provider

5. Provider → UC-P010 (Accept Booking Request)

6. System → UC-C023 (Notify Customer) of acceptance

7. Provider → UC-P016 (Share Location) during service

8. Customer → UC-C020 (Track Provider Location)

9. Provider → UC-P014 (Mark Service Complete)

10. Customer → UC-C028 (Rate and Review Service)

**Emergency Response Flow**

1. Customer → UC-C030 (Activate SOS Emergency)

2. System → Contact Emergency Services

3. System → UC-C032 (Notify Emergency Contacts)

4. System → UC-A010 (Log Security Incident)

5. Administrator → UC-A002 (Handle Emergency Response)

**5.2 Cross-System Integrations**

**Payment Processing Integration**

SmartSheba System ↔ Payment Gateways:

- UC-C024, UC-C025 (Customer Payments)

- UC-P019 (Provider Payouts)

- UC-A013 (Transaction Monitoring)

- UC-A014 (Refund Processing)

**AI/ML Service Integration**

SmartSheba System ↔ AI Services:

- UC-C033 (AI Chatbot Interactions)

- UC-C034 (Image Recognition)

- UC-C035 (Recommendation Engine)

- UC-C010 (Personalized Suggestions)

**Location Services Integration**

SmartSheba System ↔ Location Services:

- UC-C020 (Customer Tracking)

- UC-P016 (Provider Location Sharing)

- UC-P017 (Navigation Services)

- UC-C030 (Emergency Location Services)

**6. NON-FUNCTIONAL REQUIREMENTS MAPPED TO USE CASES**

**6.1 Performance Requirements**

* **UC-C007 (Search Services)**: < 500ms response time
* **UC-C020 (Track Location)**: Real-time updates every 10 seconds
* **UC-C024 (Make Payment)**: < 3 seconds transaction processing
* **UC-C033 (AI Chatbot)**: < 300ms response time

**6.2 Security Requirements**

* **UC-C001, UC-P001 (Registration)**: Multi-factor authentication
* **UC-C024 (Payment)**: PCI DSS compliance
* **UC-A010 (Security Incidents)**: Real-time threat detection
* **UC-SA002 (Security Policies)**: End-to-end encryption

**6.3 Scalability Requirements**

* **All Customer Use Cases**: Support 1M+ concurrent users
* **UC-C014 (Booking Creation)**: Handle 100K+ daily bookings
* **UC-A008 (System Monitoring)**: Auto-scaling based on load
* **UC-SA003 (Infrastructure)**: Multi-region deployment

**6.4 Availability Requirements**

* **All Critical Use Cases**: 99.95% uptime
* **UC-C030 (Emergency SOS)**: 100% availability requirement
* **UC-SA005 (Disaster Recovery)**: < 15 minutes RTO
* **UC-A008 (Performance Monitoring)**: 24/7 monitoring

**7. USE CASE PRIORITIZATION MATRIX**

**Priority 1 (Critical - MVP)**

Customer Essential:

- UC-C001 (Register Account)

- UC-C007 (Search for Services)

- UC-C014 (Create Service Booking)

- UC-C024 (Make Payment)

- UC-C028 (Rate and Review Service)

Provider Essential:

- UC-P001 (Register as Service Provider)

- UC-P010 (Accept Booking Request)

- UC-P014 (Mark Service as Completed)

- UC-P019 (Request Payout)

Admin Essential:

- UC-A004 (Review Provider Applications)

- UC-A008 (Monitor System Performance)

**Priority 2 (Important - Phase 2)**

- UC-C020 (Track Service Provider)

- UC-C021 (Chat with Provider)

- UC-C030 (Activate SOS Emergency)

- UC-P016 (Share Location with Customer)

- UC-A001 (Manage User Accounts)

**Priority 3 (Enhanced - Phase 3)**

- UC-C033 (Use AI Chatbot)

- UC-C034 (Upload Problem Image)

- UC-C035 (Get Personalized Recommendations)

- UC-P023 (View Performance Analytics)

This comprehensive use case analysis provides the foundation for SmartSheba's enterprise-grade development, ensuring all stakeholder needs are captured and properly prioritized for systematic implementation following big tech company standards.

**SmartSheba - Data Modeling & Database Schema Design**

**Enterprise-Grade Database Architecture**

**1. ENTITY-RELATIONSHIP DIAGRAM (ERD) - TEXT FORMAT**

**1.1 CORE ENTITIES**

┌─────────────────────────────────────────────────────────────────────────────┐

│ SMARTSHEBA ERD OVERVIEW │

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ENTITIES:

├── User (Primary entity for all system users)

├── UserProfile (Extended user information)

├── ServiceProvider (Provider-specific data)

├── ServiceCategory (Service classification)

├── Service (Individual service offerings)

├── Booking (Service booking transactions)

├── Payment (Financial transactions)

├── Review (Customer feedback)

├── Chat (Communication records)

├── Location (Geographic data)

├── EmergencyContact (Safety contacts)

├── Document (Verification files)

├── Notification (System alerts)

├── AIInteraction (AI chatbot logs)

├── ImageAnalysis (Computer vision data)

├── SystemLog (Audit trails)

└── Configuration (System settings)

**1.2 DETAILED ENTITY RELATIONSHIPS**

**Primary Relationships Chain**

User (1) ──── (1) UserProfile

│

├── (1) ──── (0..n) ServiceProvider

│

├── (1) ──── (0..n) Booking ──── (1) ServiceProvider

│ │

│ └── (1) ──── (0..n) Payment

│

├── (1) ──── (0..n) Review ──── (1) ServiceProvider

│

├── (1) ──── (0..n) Chat ──── (1) Booking

│

└── (1) ──── (0..n) EmergencyContact

**Service & Category Relationships**

ServiceCategory (1) ──── (0..n) Service ──── (1) ServiceProvider

│

└── (0..n) ──── (1) Booking

**Location & Geographic Relationships**

Location (1) ──── (0..n) User

│

├── (0..n) ──── ServiceProvider

│

└── (0..n) ──── Booking

**AI & Analytics Relationships**

User (1) ──── (0..n) AIInteraction

│

└── (0..n) ImageAnalysis ──── (0..1) Booking

**Security & Audit Relationships**

User (1) ──── (0..n) Document

│

└── (0..n) SystemLog ──── (0..1) Booking

└── (0..1) Payment

**1.3 COMPREHENSIVE RELATIONSHIP MATRIX**

| **Entity A** | **Relationship** | **Entity B** | **Cardinality** | **Foreign Key** | **Business Rule** |
| --- | --- | --- | --- | --- | --- |
| User | owns | UserProfile | 1:1 | user\_id | Every user has one profile |
| User | becomes | ServiceProvider | 1:0..1 | user\_id | Users can become providers |
| User | creates | Booking | 1:0..n | customer\_id | Users can book multiple services |
| User | writes | Review | 1:0..n | customer\_id | Users can review services |
| User | has | EmergencyContact | 1:0..n | user\_id | Users can have multiple emergency contacts |
| User | uploads | Document | 1:0..n | user\_id | Users can upload verification docs |
| ServiceProvider | offers | Service | 1:0..n | provider\_id | Providers offer multiple services |
| ServiceProvider | receives | Booking | 1:0..n | provider\_id | Providers get multiple bookings |
| ServiceProvider | gets | Review | 1:0..n | provider\_id | Providers receive reviews |
| ServiceCategory | contains | Service | 1:0..n | category\_id | Categories have multiple services |
| Booking | has | Payment | 1:0..n | booking\_id | Bookings can have multiple payments |
| Booking | generates | Chat | 1:0..n | booking\_id | Bookings can have chat threads |
| Booking | results\_in | Review | 1:0..1 | booking\_id | Bookings can have one review |
| Location | serves | User | 1:0..n | location\_id | Locations serve multiple users |
| Location | covers | ServiceProvider | 1:0..n | service\_area\_id | Providers serve multiple locations |
| User | interacts\_with | AIInteraction | 1:0..n | user\_id | Users have AI conversations |
| User | submits | ImageAnalysis | 1:0..n | user\_id | Users upload images for analysis |

sequenceDiagram

participant C as Customer App

participant AG as API Gateway

participant US as User Service

participant SS as Service Catalog

participant BE as Booking Engine

participant PS as Provider Service

participant AI as AI Engine

participant NS as Notification Service

participant PG as Payment Gateway

participant LS as Location Service

Note over C,LS: Customer Service Booking Flow

C->>+AG: POST /api/v1/auth/login

AG->>+US: Validate credentials

US-->>-AG: JWT tokens

AG-->>-C: Authentication successful

C->>+AG: GET /api/v1/services/categories

AG->>+SS: Fetch service categories

SS-->>-AG: Service categories list

AG-->>-C: Display 15 service categories

C->>C: Select service category & describe problem

alt AI Problem Detection

C->>+AG: POST /api/v1/ai/analyze-problem (image/text)

AG->>+AI: Process problem description/image

AI->>AI: Computer vision + NLP analysis

AI-->>-AG: Problem classification + recommendations

AG-->>-C: Suggested service type & providers

end

C->>+AG: GET /api/v1/location/current

AG->>+LS: Get user location

LS-->>-AG: GPS coordinates

AG-->>-C: Location confirmed

C->>+AG: POST /api/v1/services/search

Note right of AG: Search params: category, location, timeSlot

AG->>+SS: Search available providers

SS->>+PS: Filter by availability & location

PS-->>-SS: Available providers list

SS->>+AI: Rank providers by ML algorithm

AI-->>-SS: Ranked provider recommendations

SS-->>-AG: Top 10 providers

AG-->>-C: Display provider options

C->>C: Select provider & time slot

C->>+AG: POST /api/v1/bookings

Note right of AG: Booking details: providerId, serviceType, scheduledAt

AG->>+BE: Create booking request

BE->>+PS: Check provider availability

PS-->>-BE: Availability confirmed

BE->>BE: Generate booking ID

BE->>+NS: Send booking notification to provider

NS-->>-BE: Notification sent

BE-->>-AG: Booking created (status: PENDING)

AG-->>-C: Booking confirmation

Note over PS,C: Provider Response Flow

PS->>+AG: POST /api/v1/bookings/{id}/accept

AG->>+BE: Update booking status

BE->>BE: Status: PENDING → CONFIRMED

BE->>+NS: Notify customer of acceptance

NS-->>-BE: Customer notified

BE->>+PS: Assign provider to booking

PS-->>-BE: Provider assigned

BE-->>-AG: Booking status updated

AG-->>-PS: Assignment confirmed

BE->>+NS: Send booking details to customer

NS-->>-C: Booking confirmed notification

Note over C,PG: Payment Processing Flow

C->>+AG: POST /api/v1/payments/initialize

AG->>+PG: Initialize payment

PG->>PG: Select optimal gateway (bKash/Nagad)

PG-->>-AG: Payment URL & transaction ID

AG-->>-C: Redirect to payment gateway

C->>+PG: Complete payment

PG->>PG: Process payment

PG-->>-C: Payment successful

PG->>+AG: POST /webhook/payment-confirmation

AG->>+BE: Update booking payment status

BE->>BE: Payment status: PENDING → COMPLETED

BE-->>-AG: Payment confirmed

AG-->>-PG: Webhook acknowledged

Note over PS,C: Service Execution Flow

PS->>+AG: POST /api/v1/bookings/{id}/start-service

AG->>+BE: Update booking status

BE->>BE: Status: CONFIRMED → IN\_PROGRESS

BE->>+LS: Start real-time tracking

LS-->>-BE: Tracking enabled

BE->>+NS: Notify customer service started

NS-->>-C: Service in progress notification

BE-->>-AG: Status updated

AG-->>-PS: Service start confirmed

loop Real-time Updates

PS->>+AG: POST /api/v1/location/update

AG->>+LS: Update provider location

LS->>+BE: Location update

BE->>+NS: Send location to customer

NS-->>-C: Provider location update

BE-->>-LS: Update acknowledged

LS-->>-AG: Location stored

AG-->>-PS: Update confirmed

end

PS->>+AG: POST /api/v1/bookings/{id}/complete

AG->>+BE: Mark service complete

BE->>BE: Status: IN\_PROGRESS → COMPLETED

BE->>+NS: Request customer review

NS-->>-C: Service completion + review request

BE-->>-AG: Service marked complete

AG-->>-PS: Completion confirmed

C->>+AG: POST /api/v1/reviews

AG->>+BE: Submit review & rating

BE->>+PS: Update provider rating

PS-->>-BE: Rating updated

BE-->>-AG: Review submitted

AG-->>-C: Review confirmation

Note over C,LS: Process Complete

flowchart TD

Start([Customer Opens App]) --> CheckAuth{User Authenticated?}

CheckAuth -->|No| Login[User Login/Register]

CheckAuth -->|Yes| ServiceCat[Browse Service Categories]

Login --> OTP[Enter OTP Verification]

OTP --> VerifyOTP{OTP Valid?}

VerifyOTP -->|No| Login

VerifyOTP -->|Yes| ServiceCat

ServiceCat --> SelectCat[Select Service Category<br/>Plumbing, Electrical, Cleaning, etc.]

SelectCat --> ProblemDesc[Describe Problem]

ProblemDesc --> AIAnalysis{Use AI Analysis?}

AIAnalysis -->|Yes| UploadMedia[Upload Image/Video<br/>of Problem]

AIAnalysis -->|No| ManualSearch[Manual Service Search]

UploadMedia --> CVAnalysis[Computer Vision Analysis]

CVAnalysis --> NLPProcess[NLP Problem Classification]

NLPProcess --> AIRecommend[AI Generated Recommendations]

AIRecommend --> ServiceSearch

ManualSearch --> ServiceSearch[Search Available Providers]

ServiceSearch --> LocationCheck[Get Current Location]

LocationCheck --> FilterProviders[Filter by Location & Availability]

FilterProviders --> MLRanking[ML-based Provider Ranking]

MLRanking --> DisplayProviders[Display Top 10 Providers]

DisplayProviders --> SelectProvider{Select Provider?}

SelectProvider -->|No| DisplayProviders

SelectProvider -->|Yes| CheckAvail[Check Real-time Availability]

CheckAvail --> Available{Provider Available?}

Available -->|No| DisplayProviders

Available -->|Yes| BookingDetails[Enter Booking Details<br/>Date, Time, Special Instructions]

BookingDetails --> CreateBooking[Create Booking Request]

CreateBooking --> NotifyProvider[Notify Provider]

NotifyProvider --> ProviderResp{Provider Response?}

ProviderResp -->|Decline| DisplayProviders

ProviderResp -->|Accept| BookingConfirmed[Booking Confirmed]

ProviderResp -->|Timeout 15min| AutoCancel[Auto-cancel Booking]

AutoCancel --> DisplayProviders

BookingConfirmed --> PaymentReq{Payment Required?}

PaymentReq -->|No| WaitService[Wait for Service Time]

PaymentReq -->|Yes| SelectPayment[Select Payment Method<br/>bKash, Nagad, Card]

SelectPayment --> ProcessPayment[Process Payment]

ProcessPayment --> PaymentStatus{Payment Success?}

PaymentStatus -->|No| PaymentFailed[Payment Failed]

PaymentFailed --> SelectPayment

PaymentStatus -->|Yes| PaymentConfirmed[Payment Confirmed]

PaymentConfirmed --> WaitService

WaitService --> ServiceTime{Service Time Arrived?}

ServiceTime -->|No| TrackProvider[Track Provider Location]

TrackProvider --> WaitService

ServiceTime -->|Yes| ServiceStart[Provider Starts Service]

ServiceStart --> ServiceProgress[Service In Progress]

ServiceProgress --> EmergencyCheck{Emergency Needed?}

EmergencyCheck -->|Yes| SOSActivate[Activate SOS<br/>Alert Emergency Contacts]

EmergencyCheck -->|No| ServiceContinue[Continue Service]

SOSActivate --> EmergencyResponse[Emergency Response<br/>SMS + Call + Location]

EmergencyResponse --> ServiceContinue

ServiceContinue --> ServiceComplete{Service Completed?}

ServiceComplete -->|No| ServiceProgress

ServiceComplete -->|Yes| ServiceDone[Mark Service Complete]

ServiceDone --> PaymentRelease[Release Payment to Provider]

PaymentRelease --> ReviewRequest[Request Customer Review]

ReviewRequest --> SubmitReview{Submit Review?}

SubmitReview -->|Yes| WriteReview[Write Review & Rating]

SubmitReview -->|No| BookingComplete[Booking Complete]

WriteReview --> UpdateRating[Update Provider Rating]

UpdateRating --> BookingComplete

BookingComplete --> End([Process End])

%% Parallel Emergency Process

ServiceProgress --> MonitorSafety[Monitor Safety Features]

MonitorSafety --> SafetyAlert{Safety Alert?}

SafetyAlert -->|Yes| AutoSOS[Auto-trigger SOS]

SafetyAlert -->|No| MonitorSafety

AutoSOS --> EmergencyResponse

%% Styling

classDef startEnd fill:#e1f5fe,stroke:#01579b,stroke-width:3px

classDef process fill:#f3e5f5,stroke:#4a148c,stroke-width:2px

classDef decision fill:#fff3e0,stroke:#e65100,stroke-width:2px

classDef aiProcess fill:#e8f5e8,stroke:#2e7d32,stroke-width:2px

classDef emergency fill:#ffebee,stroke:#c62828,stroke-width:3px

class Start,End startEnd

class Login,OTP,ServiceCat,SelectCat,ProblemDesc,ManualSearch,ServiceSearch,LocationCheck,FilterProviders,DisplayProviders,BookingDetails,CreateBooking,NotifyProvider,BookingConfirmed,SelectPayment,ProcessPayment,PaymentConfirmed,WaitService,ServiceStart,ServiceProgress,ServiceContinue,ServiceDone,PaymentRelease,ReviewRequest,WriteReview,UpdateRating,BookingComplete,TrackProvider process

class CheckAuth,VerifyOTP,AIAnalysis,SelectProvider,Available,ProviderResp,PaymentReq,PaymentStatus,ServiceTime,ServiceComplete,SubmitReview,SafetyAlert decision

class UploadMedia,CVAnalysis,NLPProcess,AIRecommend,MLRanking aiProcess

class SOSActivate,EmergencyResponse,AutoSOS,MonitorSafety emergency

stateDiagram-v2

[\*] --> Draft : Customer starts booking

state "Booking Lifecycle" as BookingFlow {

Draft --> Pending : submit\_booking\_request

Draft --> Cancelled : customer\_cancels

Pending --> Confirmed : provider\_accepts

Pending --> Rejected : provider\_declines

Pending --> Expired : timeout\_15\_minutes

Pending --> Cancelled : customer\_cancels

Rejected --> Draft : select\_new\_provider

Rejected --> Cancelled : customer\_gives\_up

Expired --> Draft : retry\_with\_same\_provider

Expired --> Cancelled : customer\_abandons

Confirmed --> Provider\_Assigned : auto\_assignment

Confirmed --> Cancelled : customer\_cancels\_with\_penalty

Confirmed --> Payment\_Pending : payment\_required

Payment\_Pending --> Payment\_Failed : payment\_fails

Payment\_Pending --> Confirmed : payment\_successful

Payment\_Failed --> Cancelled : max\_payment\_attempts\_reached

Payment\_Failed --> Payment\_Pending : retry\_payment

Provider\_Assigned --> In\_Progress : provider\_starts\_service

Provider\_Assigned --> Cancelled : provider\_no\_show

Provider\_Assigned --> Rescheduled : reschedule\_request

Rescheduled --> Provider\_Assigned : new\_time\_confirmed

Rescheduled --> Cancelled : reschedule\_rejected

In\_Progress --> On\_Hold : temporary\_pause

In\_Progress --> Emergency\_Active : sos\_triggered

In\_Progress --> Completed : service\_finished

In\_Progress --> Disputed : complaint\_raised

On\_Hold --> In\_Progress : service\_resumed

On\_Hold --> Cancelled : service\_abandoned

Emergency\_Active --> In\_Progress : emergency\_resolved

Emergency\_Active --> Cancelled : emergency\_cancellation

Disputed --> In\_Progress : dispute\_resolved\_continue

Disputed --> Cancelled : dispute\_resolved\_cancel

Disputed --> Under\_Review : escalate\_to\_admin

Under\_Review --> Completed : admin\_approves\_completion

Under\_Review --> Cancelled : admin\_cancels\_booking

Under\_Review --> Refund\_Processing : admin\_orders\_refund

Completed --> Reviewed : customer\_submits\_review

Completed --> Payment\_Released : auto\_payment\_release\_24h

Reviewed --> Payment\_Released : review\_processed

Payment\_Released --> Archived : archive\_after\_30\_days

Cancelled --> Refund\_Processing : refund\_eligible

Cancelled --> Archived : no\_refund\_required

Refund\_Processing --> Refunded : refund\_successful

Refund\_Processing --> Refund\_Failed : refund\_unsuccessful

Refunded --> Archived : archive\_refunded\_booking

Refund\_Failed --> Under\_Review : escalate\_refund\_issue

Archived --> [\*]

}

state "Provider State Management" as ProviderFlow {

state "Provider Status" as ProviderStatus {

Offline --> Online : provider\_comes\_online

Online --> Busy : provider\_accepts\_booking

Online --> Offline : provider\_goes\_offline

Busy --> Available : service\_completed

Busy --> Offline : provider\_goes\_offline\_while\_busy

Available --> Busy : new\_booking\_accepted

Available --> Online : no\_active\_bookings

}

}

state "Emergency System States" as EmergencyFlow {

Normal --> Alert\_Triggered : emergency\_button\_pressed

Normal --> Auto\_Alert : safety\_anomaly\_detected

Alert\_Triggered --> Dispatching : send\_emergency\_notifications

Auto\_Alert --> Dispatching : auto\_emergency\_protocol

Dispatching --> Response\_Active : emergency\_contacts\_notified

Dispatching --> Failed : notification\_delivery\_failed

Failed --> Retry\_Dispatch : retry\_emergency\_notifications

Retry\_Dispatch --> Response\_Active : notifications\_successful

Retry\_Dispatch --> Escalated : max\_retries\_exceeded

Response\_Active --> Monitoring : emergency\_responder\_en\_route

Response\_Active --> Resolved : false\_alarm\_confirmed

Monitoring --> Resolved : emergency\_resolved

Monitoring --> Escalated : no\_response\_from\_contacts

Escalated --> Resolved : admin\_intervention\_successful

Resolved --> Normal : return\_to\_normal\_operations

}

state "User Authentication States" as AuthFlow {

Unauthenticated --> Registering : start\_registration

Unauthenticated --> Logging\_In : start\_login

Registering --> OTP\_Verification : registration\_details\_submitted

Logging\_In --> OTP\_Verification : credentials\_validated

Logging\_In --> Login\_Failed : invalid\_credentials

Login\_Failed --> Logging\_In : retry\_login

Login\_Failed --> Account\_Locked : max\_attempts\_exceeded

OTP\_Verification --> Authenticated : otp\_verified

OTP\_Verification --> OTP\_Failed : invalid\_otp

OTP\_Failed --> OTP\_Verification : retry\_otp

OTP\_Failed --> Registration\_Failed : max\_otp\_attempts

Registration\_Failed --> Unauthenticated : return\_to\_start

Authenticated --> Session\_Active : session\_established

Session\_Active --> Session\_Expired : token\_timeout

Session\_Active --> Logged\_Out : user\_logout

Session\_Expired --> Unauthenticated : require\_reauth

Logged\_Out --> Unauthenticated : session\_cleared

Account\_Locked --> Unauthenticated : account\_unlocked\_by\_admin

}

state "Payment Processing States" as PaymentFlow {

Payment\_Initialized --> Gateway\_Selected : select\_payment\_method

Gateway\_Selected --> Processing\_bKash : bkash\_selected

Gateway\_Selected --> Processing\_Nagad : nagad\_selected

Gateway\_Selected --> Processing\_Card : card\_selected

Processing\_bKash --> Payment\_Success : bkash\_payment\_confirmed

Processing\_bKash --> Payment\_Gateway\_Failed : bkash\_payment\_failed

Processing\_Nagad --> Payment\_Success : nagad\_payment\_confirmed

Processing\_Nagad --> Payment\_Gateway\_Failed : nagad\_payment\_failed

Processing\_Card --> Payment\_Success : card\_payment\_confirmed

Processing\_Card --> Payment\_Gateway\_Failed : card\_payment\_failed

Payment\_Gateway\_Failed --> Retry\_Payment : retry\_same\_gateway

Payment\_Gateway\_Failed --> Fallback\_Gateway : try\_alternative\_gateway

Retry\_Payment --> Payment\_Success : retry\_successful

Retry\_Payment --> Final\_Payment\_Failed : max\_retries\_exceeded

Fallback\_Gateway --> Payment\_Success : fallback\_successful

Fallback\_Gateway --> Final\_Payment\_Failed : all\_gateways\_failed

Payment\_Success --> Settled : payment\_settlement\_complete

Final\_Payment\_Failed --> Booking\_Payment\_Failed : update\_booking\_status

Settled --> [\*]

Booking\_Payment\_Failed --> [\*]

}

note right of BookingFlow

Main booking state machine

Handles complete booking lifecycle

from creation to archival

end note

note right of EmergencyFlow

Emergency response system

Handles SOS and safety alerts

with automatic escalation

end note

note right of PaymentFlow

Payment processing with

multiple gateway support

and fallback mechanisms

end note