Software Requirements Specification 2: BookForMe

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November 8, 2025

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1 System Block Diagram

1.1 System Block Diagram

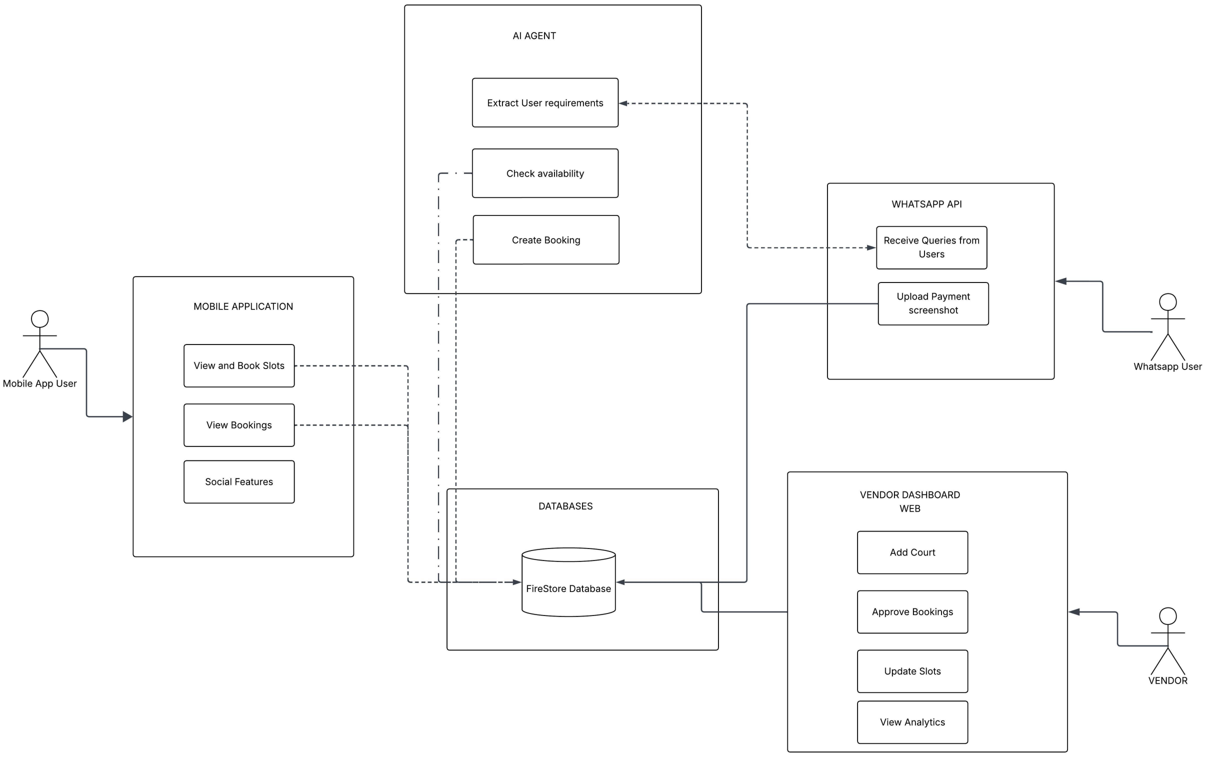


Figure 1: System Block Diagram for BookForMe Platform

1.2 Description of Components

The BookForMe system follows a modular, service-oriented architecture composed of two primary layers: **Frontend Layer** and a **Backend/API Layer**.

- **User Mobile Application (Frontend)**
  Developed using **React Native**, this component is the native mobile app for customers. It allows users to browse vendors, book services, and interact with all social features (profiles, chat, forums, matchmaking). It communicates with the backend via RESTful APIs.

- **Vendor Dashboard (Frontend)**
  A secure administrative mobile app, also built with **React Native**. It allows vendors to manage their business profile, view their consolidated calendar, manually **approve pending payments**, and link their external **WhatsApp API** account.

- **AI Agent Backend**
  The core intelligent engine of the platform, built in **Python**. This service is responsible for:

  - Managing the **WhatsApp Webhook** to receive and send messages/images.
  - Utilizing a **trained NLU model** for bilingual Natural Language Understanding (NLU).
  - Executing the core **agentic logic** (decision-making).
  - Enforcing **concurrency control** (via Firestore Transactions) for all bookings.

- **Cloud Firestore Database**
  Acts as the central NoSQL data repository. It stores all persistent data: user/vendor profiles, service listings, real-time availability, bookings, social data (friends, forum posts), and the **conversation state** for the AI Agent. Its real-time capabilities are leveraged for instant updates.

- **WhatsApp Business API**
  The primary communication channel for the AI Agent. It enables two-way, asynchronous conversation with users on the vendor's behalf. The AI Agent receives **webhooks** (for text and images) and sends replies via this API.

- **Authentication and Security Layer**
  Firebase Authentication is used to manage all user and vendor identities. **OAuth 2.0** is used for the vendor-side WhatsApp API integration. All communication between components is secured via HTTPS/TLS.

Overall, the architecture enforces modularity, concurrency control (via Firestore Transactions), and horizontal scalability via cloud deployment (e.g., Render, Firebase Cloud Functions).

2 Project Plan

2.1 Objectives

The overarching objectives of the BookForMe project are to:

1. Develop a **centralized booking platform** connecting users and vendors across informal service domains.
2. Implement an intelligent **AI Receptionist** (vendor-side) capable of processing WhatsApp-based booking requests using Natural Language Understanding (NLU).
3. Implement a **Conversational Search Agent** (user-side) to provide an advanced, query-based interface for filtering and finding vendors.
4. Foster an integrated **social community** by implementing features for user profiles, friends, direct messaging, forums, and a matchmaking/ranking system.
5. Design a scalable, secure backend integrated with **Firestore** and the **WhatsApp Business API**.
6. Deliver a seamless, user-friendly **React Native** frontend (User App & Vendor Dashboard) ensuring accessibility, reliability, and real-time synchronization.

2.2 Team Roles and Responsibilities

- **M. Ahmad Hanif (Project Lead)** — Leads system architecture and AI Receptionist integration with Firestore. Responsible for development and functioning of the NLU pipeline. Oversees project roadmap, documentation, and delivery milestones.
- **Jazib Waqas (Backend Engineer)** — Responsible for backend architecture, database integration, and implementation of booking, vendor, and authentication APIs. Leads WhatsApp API integration and ensures secure communication between the conversational agent and backend services.
- **Taha Hunaid Ali (Frontend Developer)** — Develops and maintains user-facing and vendor dashboards using **React Native**. Works on real-time interface features such as chat, leaderboard, and vendor analytics visualization. Coordinates frontend–backend linkage and deployment readiness.
- **Muhammad Taqi (AI Engineer)** — Works on the design and development of the NLU pipeline, focusing on intent detection, slot extraction, and model fine-tuning. Collaborates on AI Receptionist integration and ensures accurate handling of bilingual booking queries.

2.3 Monthly Timeline

Month	**Tasks**	**Deliverables**
November: Foundation Phase	• Finalize *SRS 1, SRS 2 & SDS* and complete the literature review. • Build an initial dataset for booking requests and vendor replies. • Design and implement a low-fidelity UI prototype for early validation. • Set up GitHub repositories and development environments.	• Approved SRS Document. • Preliminary Bilingual Dataset. • Prototype User Interface (Login, Vendor Discovery).
December: Baseline Model and Backend Setup	• Train baseline NLU models for intent detection and slot extraction. • Implement backend integrations using Firestore.	• Baseline NLU Model. • Defined Database Schema. • Minimal Working Booking System (Storage & Retrieval).
January: AI Receptionist and WhatsApp Integration	• Fine-tune the NLU pipeline for improved bilingual performance. • Implement the AI Receptionist for WhatsApp-based booking processing. • Introduce concurrency control, safety checks, and backend error handling. • Refine frontend booking and profile management interfaces.	• Functional AI Receptionist for End-to-End Conversational Booking. • Working WhatsApp-to-Database Data Flow. • Enhanced User Dashboard with Profile Management.
February: Vendor Tools and Social Features	• Develop vendor-side tools: analytics dashboard, calendar availability, and payment confirmation. • Implement social features: matchmaking, chat, and leaderboard. • Optimize bilingual model responses through retraining and error analysis.	• Fully Functional Vendor Dashboard. • Active Chat, Matchmaking, and Leaderboard Features. • Optimized Bilingual NLU Model.

Month	Work (Objectives)	Deliverables
March: Integration, Optimization, and Testing	• Integrate user and vendor interfaces with backend services. • Implement Google Sheets API for vendor booking synchronization. • Conduct unit, integration, and system testing; optimize for performance. • Perform UX testing and benchmarking.	• Fully Integrated BookForMe Platform. • Stable End-to-End Workflow (User ↔ AI Receptionist ↔ Vendor). • Detailed Test Reports and Benchmark Metrics.
April: Final Deployment and Submission	• Conduct pilot testing with selected vendors. • Deploy production-ready system on Firebase with secured integrations. • Prepare final documentation, technical report, and presentation.	• Production-Ready Deployment. • Final Project Report and Presentation Deck. • Complete Submission Package for Evaluation.

Table 1: Project Timeline and Deliverables Overview

2.4 Risks and Mitigation Strategies

The following table outlines the major technical, operational, and organizational risks identified during the development of the *BookForMe* system, along with corresponding mitigation strategies and recommended timelines.

Risk	**Mitigation Strategy**	**Timeline**
API Rate Limits (WhatsApp)	Implement exponential backoff and retry policies; throttle outbound requests; batch operations where possible; cache responses; request higher quotas in advance.	Ongoing
Data Consistency and Race Conditions (Concurrent Bookings)	Use Firestore transactions and idempotency keys; apply optimistic locking; implement short-lived reservation holds to avoid double-booking.	Jan-Feb
Bilingual NLU Failure (English–Urdu / Roman Urdu)	Collect diverse bilingual data; use transfer learning; continuous retraining with error logs; add fallback rule-based handlers.	Nov-Dec
Security Breaches / Key Exposure	Store credentials in Google Secret Manager; rotate keys; restrict IAM roles; enforce HTTPS and TLS; audit repository commits for sensitive data.	Ongoing
System Latency / NLU Inference Delay	Profile model inference; cache frequent queries; use async jobs for long responses; horizontally scale backend on Firebase Cloud Functions.	Jan-Feb
Cloud Cost Overrun (Firestore Reads / Functions Invocations)	Estimate cost per call; use batched reads; denormalize where appropriate; add billing alerts and caps in Firebase.	Ongoing
UX / Usability Shortcomings	Conduct iterative usability testing; analyze clickstream and drop-off metrics; refine prototype flows accordingly.	Mar-Apr

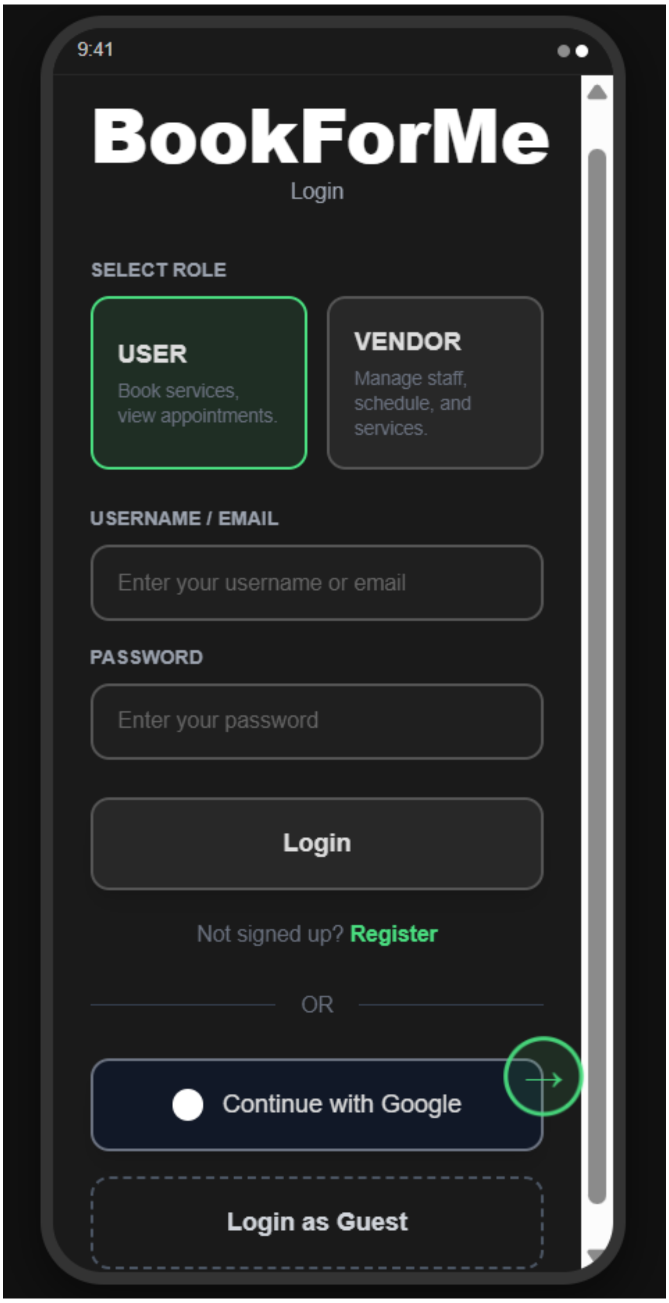
Table 2: Project Risks, Mitigation Strategies, and Recommended Timelines

3 Wireframes

3.1 Overview

These mockups are created using HTML/CSS and serve as a blueprint for frontend implementation. They are grouped by user flow and include the customer registration, booking, social, vendor management, and integration processes.

3.2 Customer Registration & Authentication Flow



9:41

BookForMe

Login

SELECT ROLE

USER
Book services, view appointments.

VENDOR
Manage staff, schedule, and services.

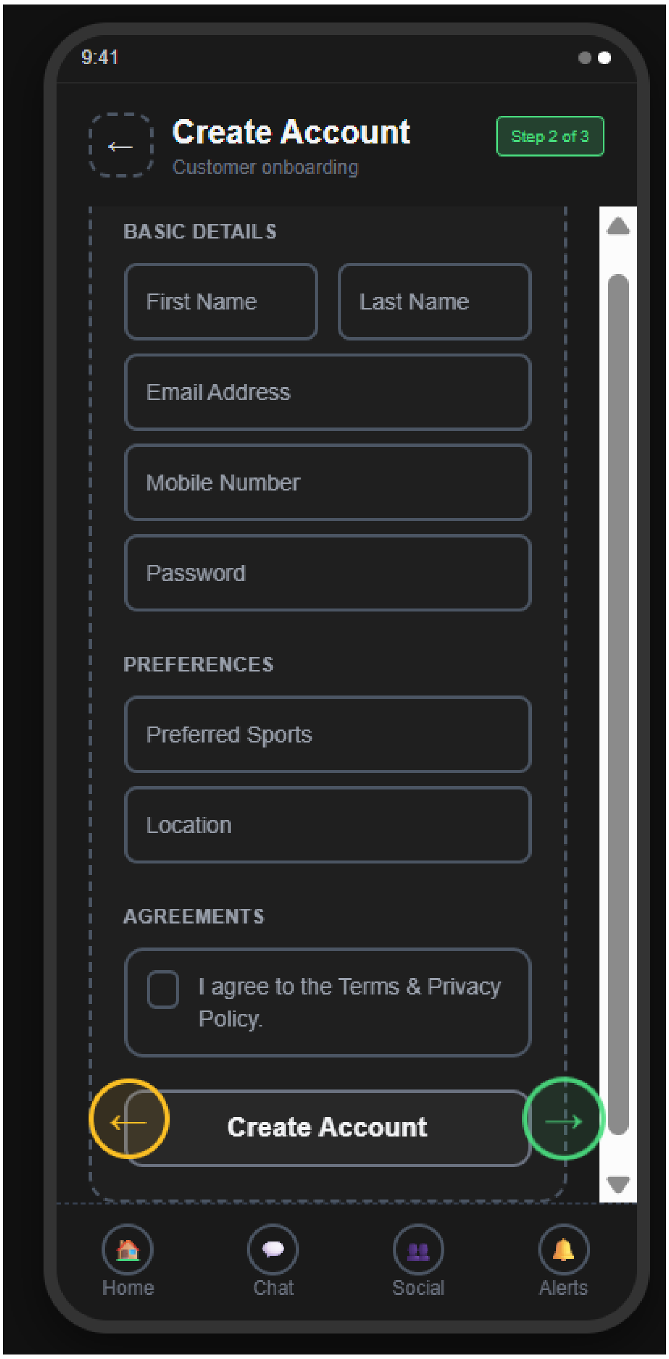
USERNAME / EMAIL

Enter your username or email

PASSWORD

Enter your password

Figure 2: Customer Registration Flow (1/3): **Login / Role Selection.** Unified sign-in with role toggle and quick auth options.



9:41

← **Create Account**

Customer onboarding

Step 2 of 3

BASIC DETAILS

First Name

Last Name

Email Address

Mobile Number

Password

PREFERENCES

Preferred Sports

Location

AGREEMENTS

□ I agree to the Terms & Privacy Policy.

← **Create Account** →

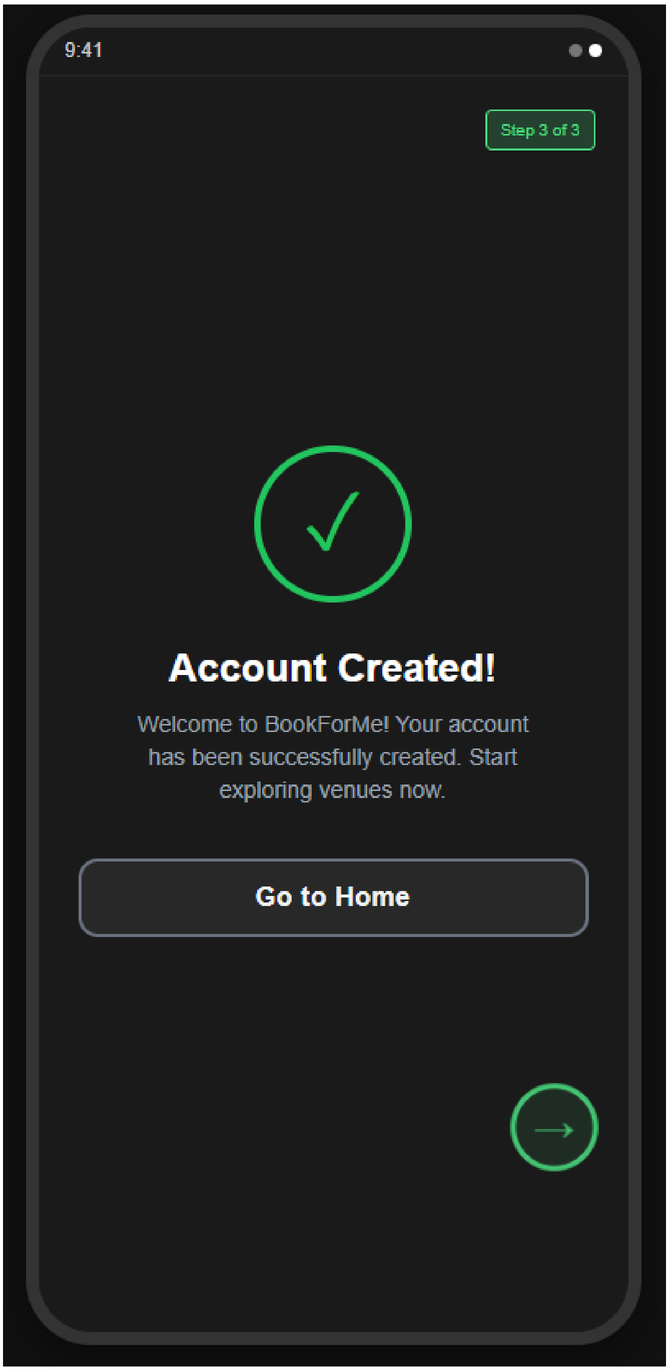
Home

Chat

Social

Alerts

Figure 3: Customer Registration Flow (2/3): **Customer Registration Form.** Collects personal details, contact info, and preferences.



9:41

Step 3 of 3

Account Created!

Welcome to BookForMe! Your account has been successfully created. Start exploring venues now.

Figure 4: Customer Registration Flow (3/3): **Registration Success.** Account creation confirmation with navigation options.

3.3 Customer Discovery & Booking Flow

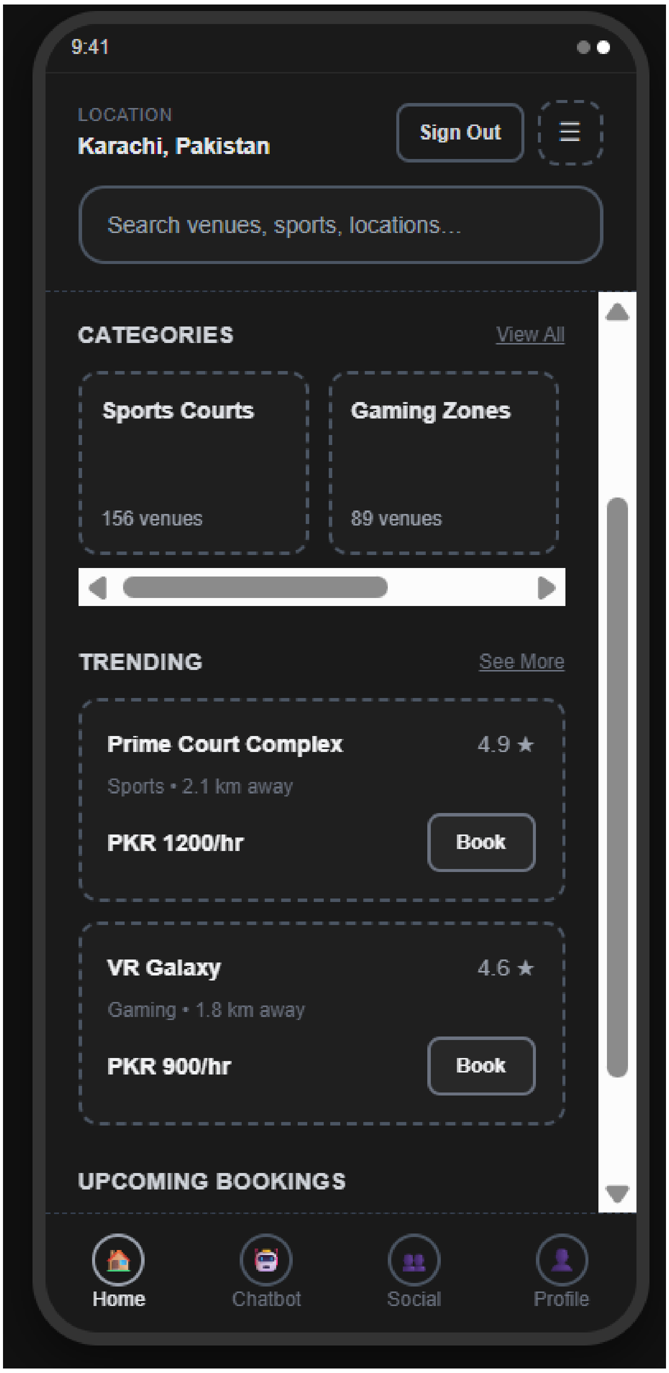


Figure 5: Customer Booking Flow (1/4): **Customer Home.** Discovery hub with search, categories, and trending venues.

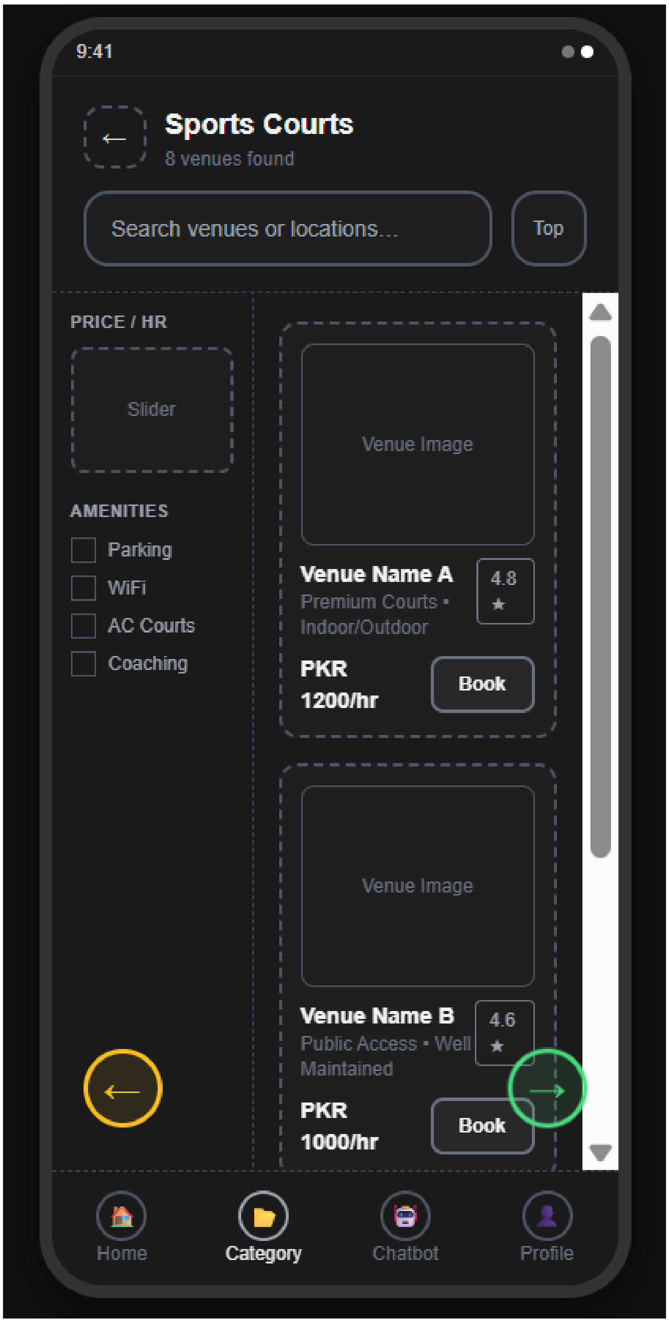
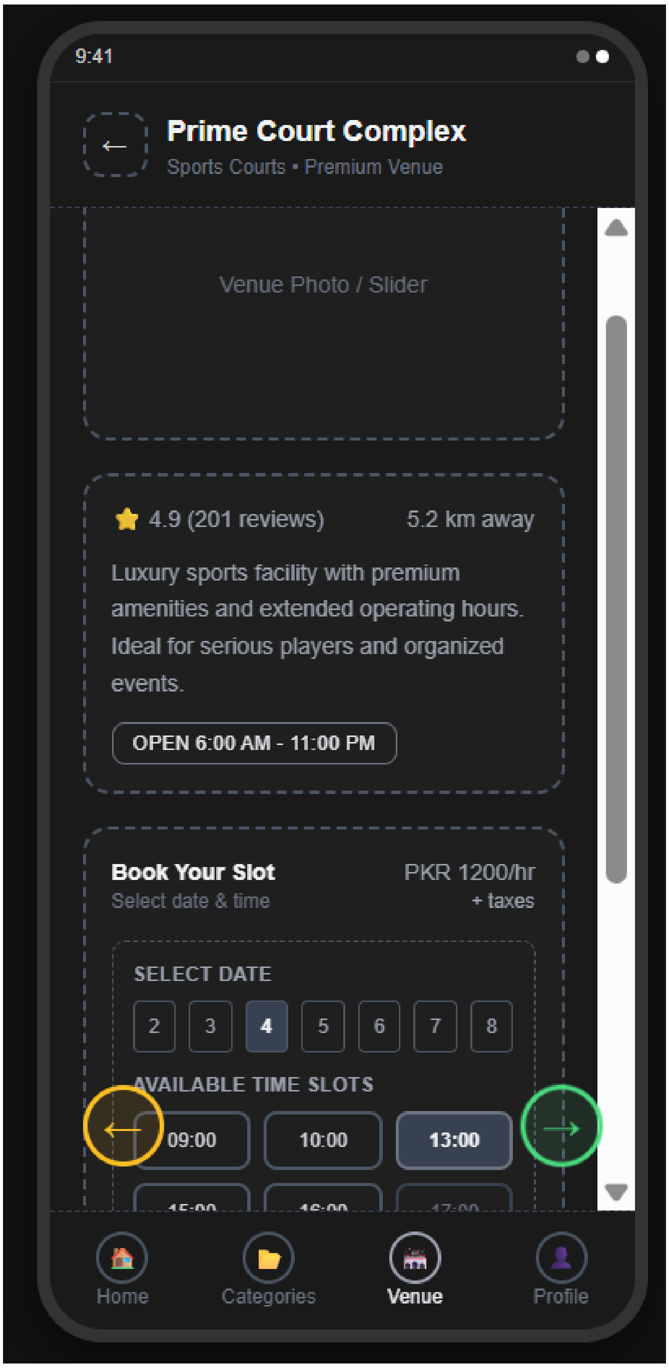


Figure 6: Customer Booking Flow (2/4): **Category Listing.** Filterable list of venues with price and amenity filters.



9:41

←

Prime Court Complex

Sports Courts • Premium Venue

Venue Photo / Slider

⭐ 4.9 (201 reviews) 5.2 km away

Luxury sports facility with premium amenities and extended operating hours. Ideal for serious players and organized events.

OPEN 6:00 AM - 11:00 PM

Book Your Slot PKR 1200/hr

Select date & time + taxes

SELECT DATE

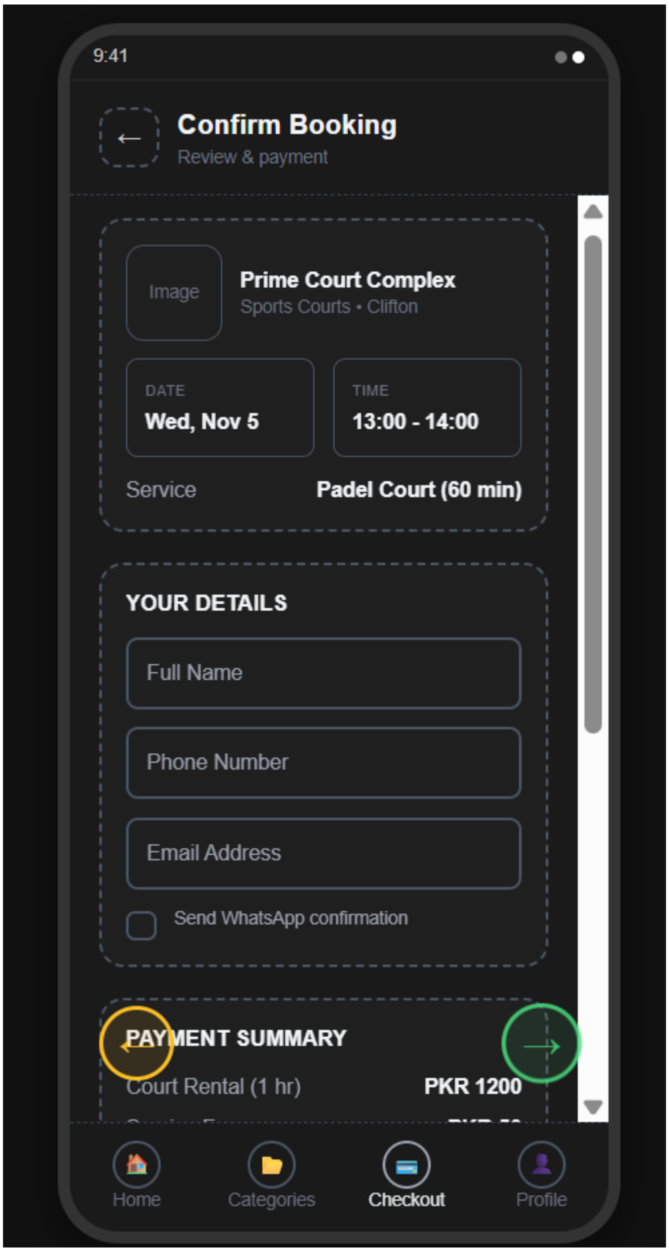
2 3 **4** 5 6 7 8

AVAILABLE TIME SLOTS

09:00 10:00 **13:00**

15:00 16:00 17:00

Figure 7: Customer Booking Flow (3/4): **Vendor Detail.** Individual venue profile with reviews, amenities, and slot selection.



9:41

←

Confirm Booking

Review & payment

Image

Prime Court Complex

Sports Courts • Clifton

DATE	TIME
Wed, Nov 5	13:00 - 14:00

Service	Padel Court (60 min)

YOUR DETAILS

Full Name

Phone Number

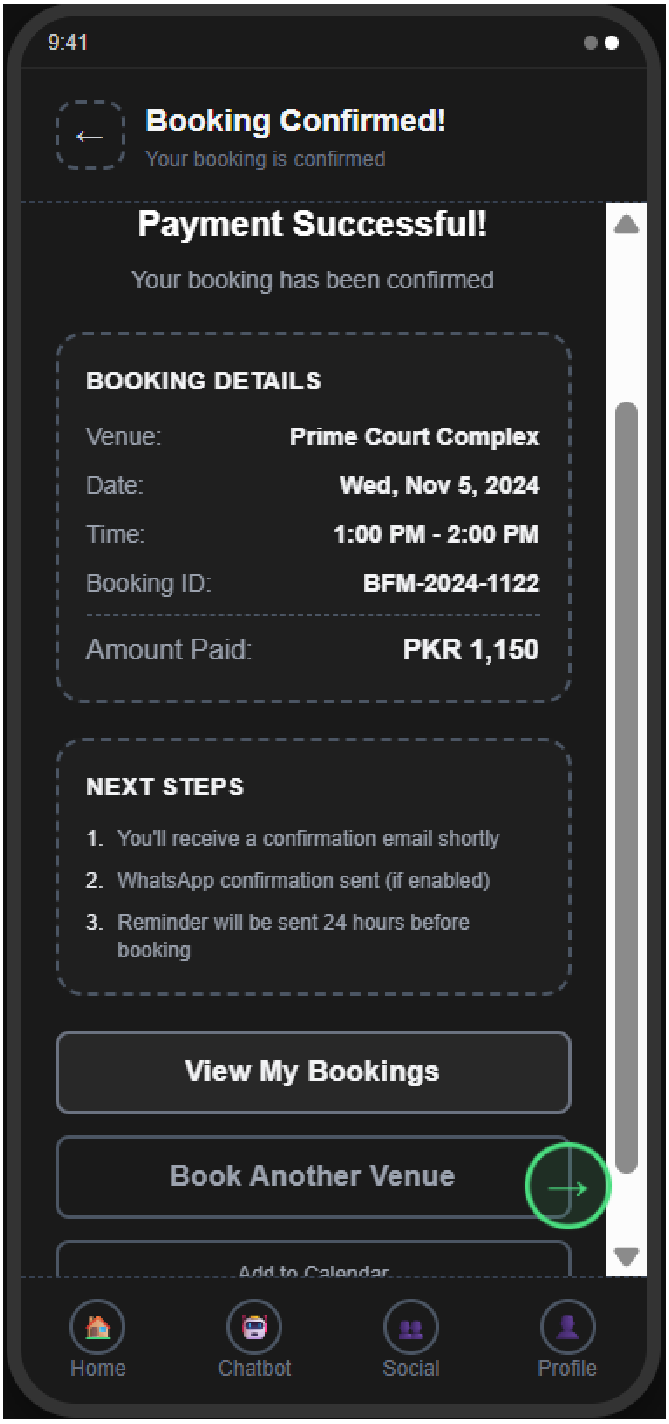
Email Address

□ Send WhatsApp confirmation

PAYMENT SUMMARY

Court Rental (1 hr)	PKR 1200

Figure 8: Customer Booking Flow (4/4): **Booking & Payment.** Booking summary, customer info entry, and payment selection.



Payment Successful!

Your booking has been confirmed

BOOKING DETAILS

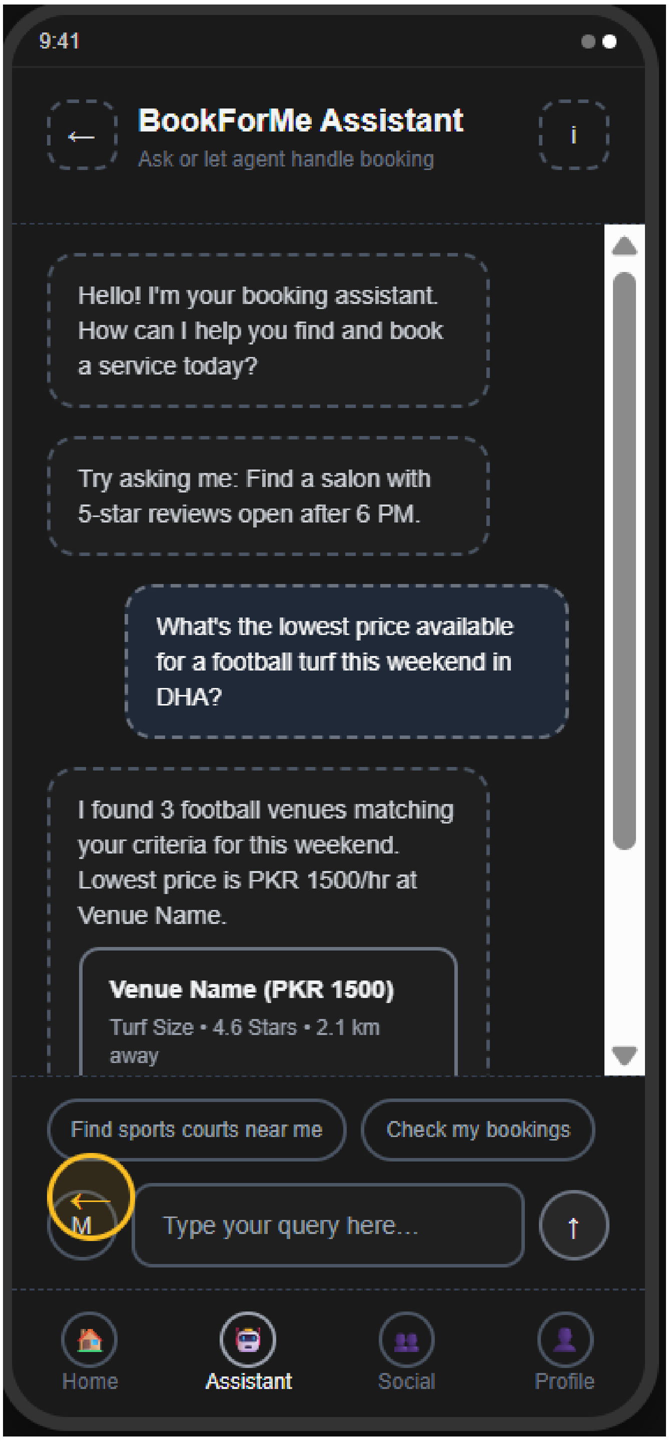
Venue:	Prime Court Complex
Date:	Wed, Nov 5, 2024
Time:	1:00 PM - 2:00 PM
Booking ID:	BFM-2024-1122
Amount Paid:	PKR 1,150

NEXT STEPS

1. You'll receive a confirmation email shortly
2. WhatsApp confirmation sent (if enabled)
3. Reminder will be sent 24 hours before booking

Figure 9: Payment Success (1/1): **Booking Confirmation.** Final success screen with receipt, booking details, and next steps.

3.4 AI Chatbot & Social Hub Flows


9:41

BookForMe Assistant

Ask or let agent handle booking

Hello! I'm your booking assistant. How can I help you find and book a service today?

Try asking me: Find a salon with 5-star reviews open after 6 PM.

What's the lowest price available for a football turf this weekend in DHA?

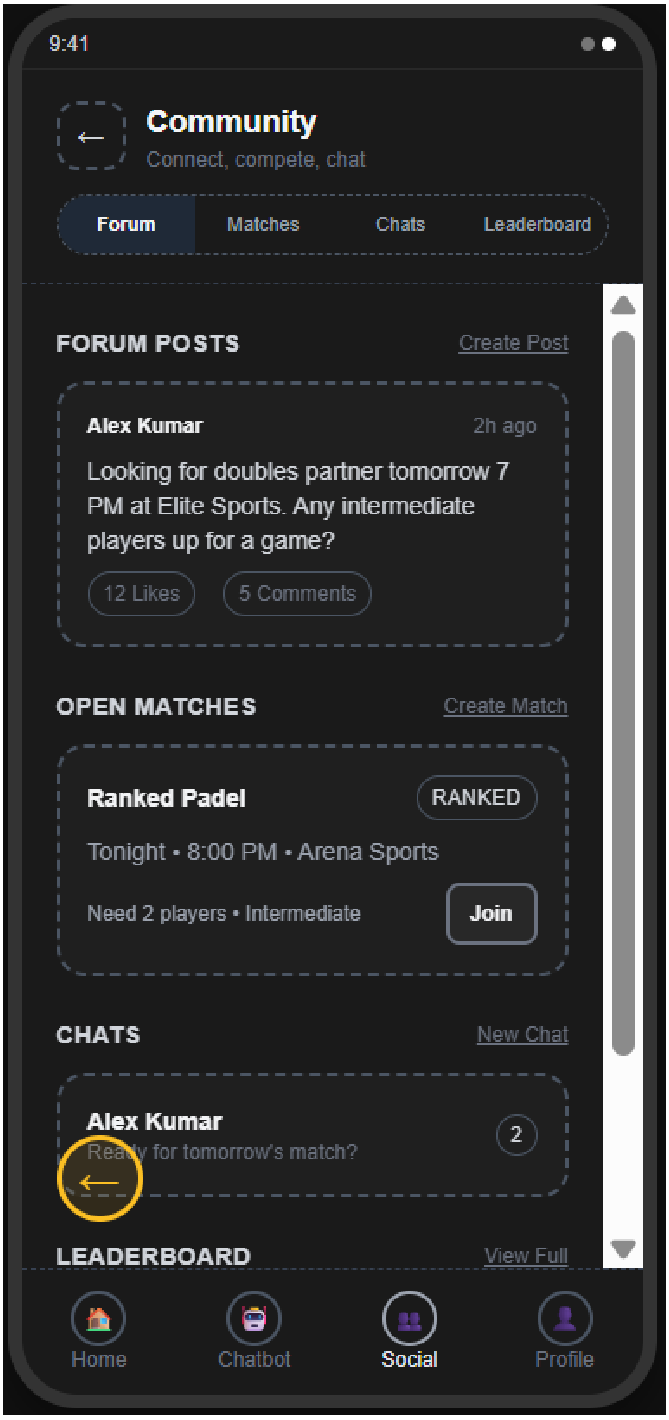
I found 3 football venues matching your criteria for this weekend. Lowest price is PKR 1500/hr at Venue Name.

Venue Name (PKR 1500)

Turf Size • 4.6 Stars • 2.1 km away

Figure 10: **AI Chatbot:** Conversational assistant for recommendations, bookings, and FAQs.

3.5 Notifications & Customer Profile



9:41

←

Community

Connect, compete, chat

FORUM POSTS

Alex Kumar 2h ago

Looking for doubles partner tomorrow 7 PM at Elite Sports. Any intermediate players up for a game?

OPEN MATCHES

Ranked Padel RANKED

Tonight • 8:00 PM • Arena Sports

Need 2 players • Intermediate

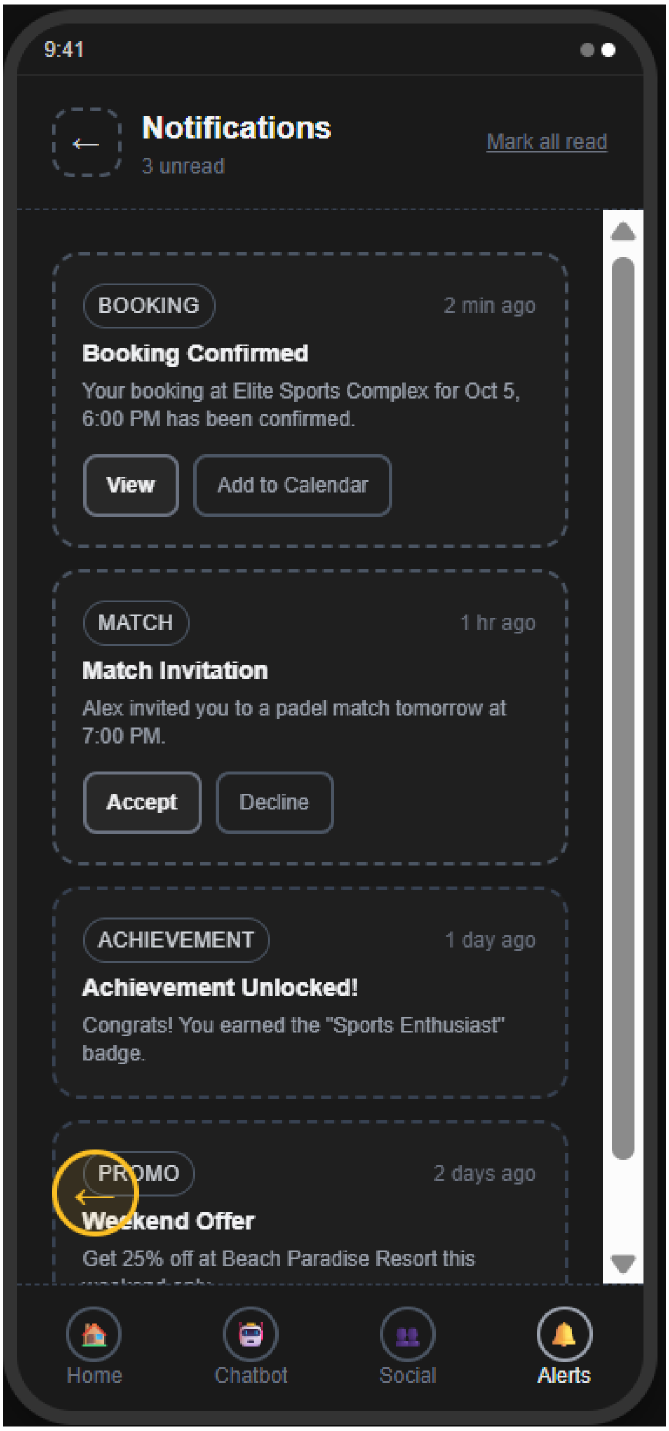
CHATS

Alex Kumar 2

Ready for tomorrow's match?

LEADERBOARD

Figure 11: **Social Hub:** Tabbed community space for Forum, Open Matches, Chats, and Leaderboard.



← Notifications

3 unread

Mark all read

BOOKING 2 min ago

Booking Confirmed

Your booking at Elite Sports Complex for Oct 5, 6:00 PM has been confirmed.

MATCH 1 hr ago

Match Invitation

Alex invited you to a padel match tomorrow at 7:00 PM.

ACHIEVEMENT 1 day ago

Achievement Unlocked!

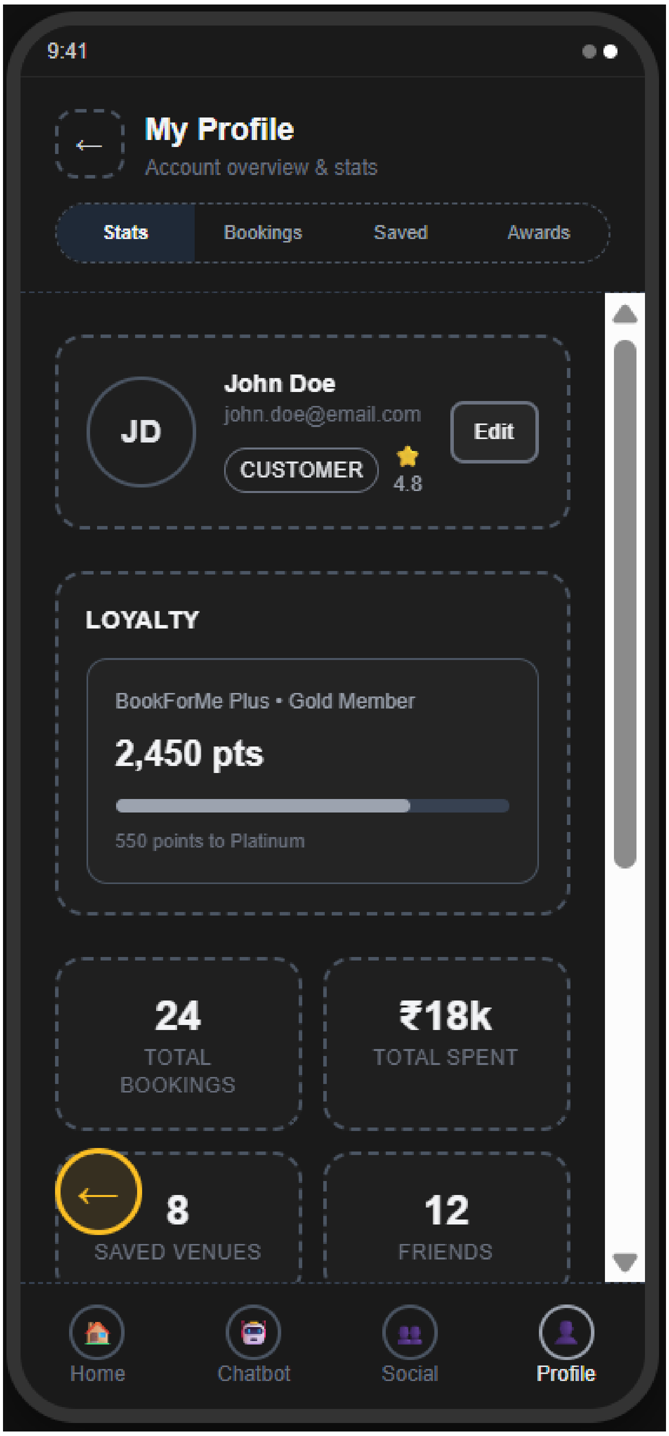
Congrats! You earned the "Sports Enthusiast" badge.

PROMO 2 days ago

Weekend Offer

Get 25% off at Beach Paradise Resort this

Figure 12: **Notifications:** Feed of booking, social, and promotional alerts.



9:41

←

My Profile

Account overview & stats

Stats | Bookings | Saved | Awards

JD

John Doe

john.doe@email.com

CUSTOMER ⭐ 4.8

Edit

LOYALTY

BookForMe Plus • Gold Member

2,450 pts

550 points to Platinum

24 TOTAL BOOKINGS

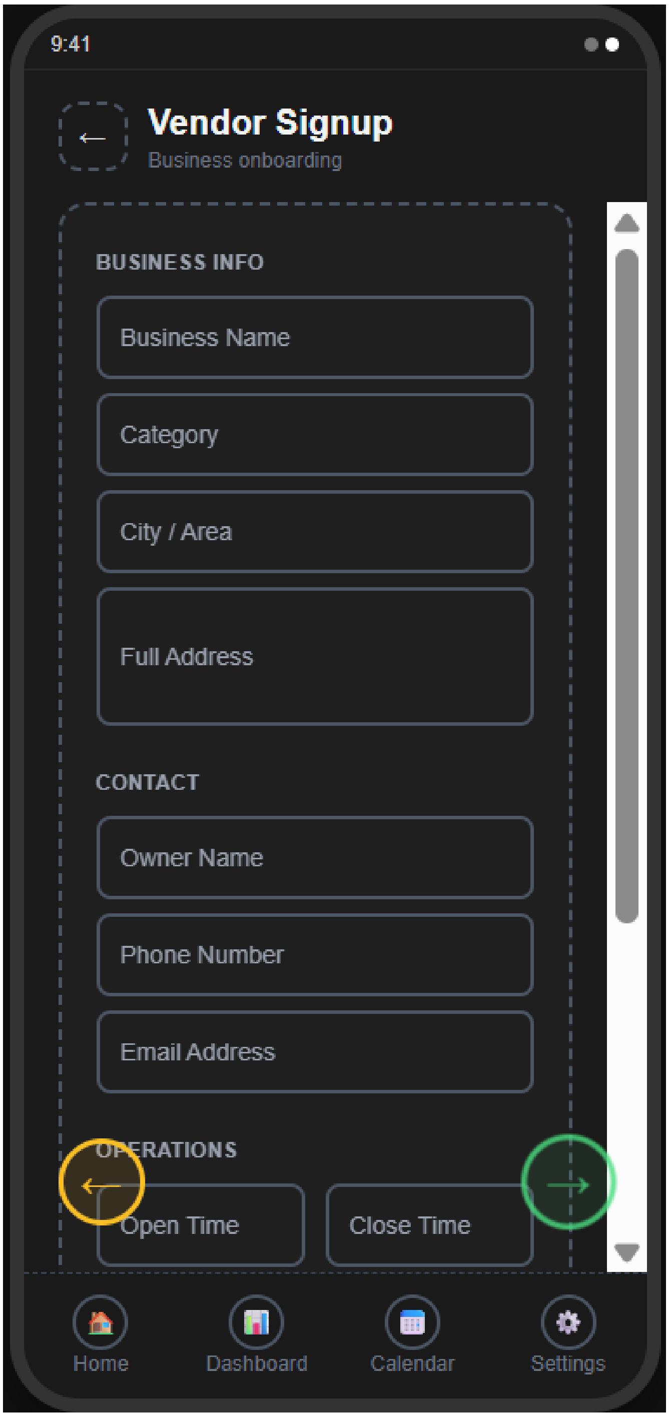
₹18k TOTAL SPENT

8 SAVED VENUES

12 FRIENDS

Figure 13: **Customer Profile:** Account overview with stats, bookings, saved venues, and settings.

3.6 Vendor Registration & Management Flow



9:41

Vendor Signup

Business onboarding

BUSINESS INFO

Business Name

Category

City / Area

Full Address

CONTACT

Owner Name

Phone Number

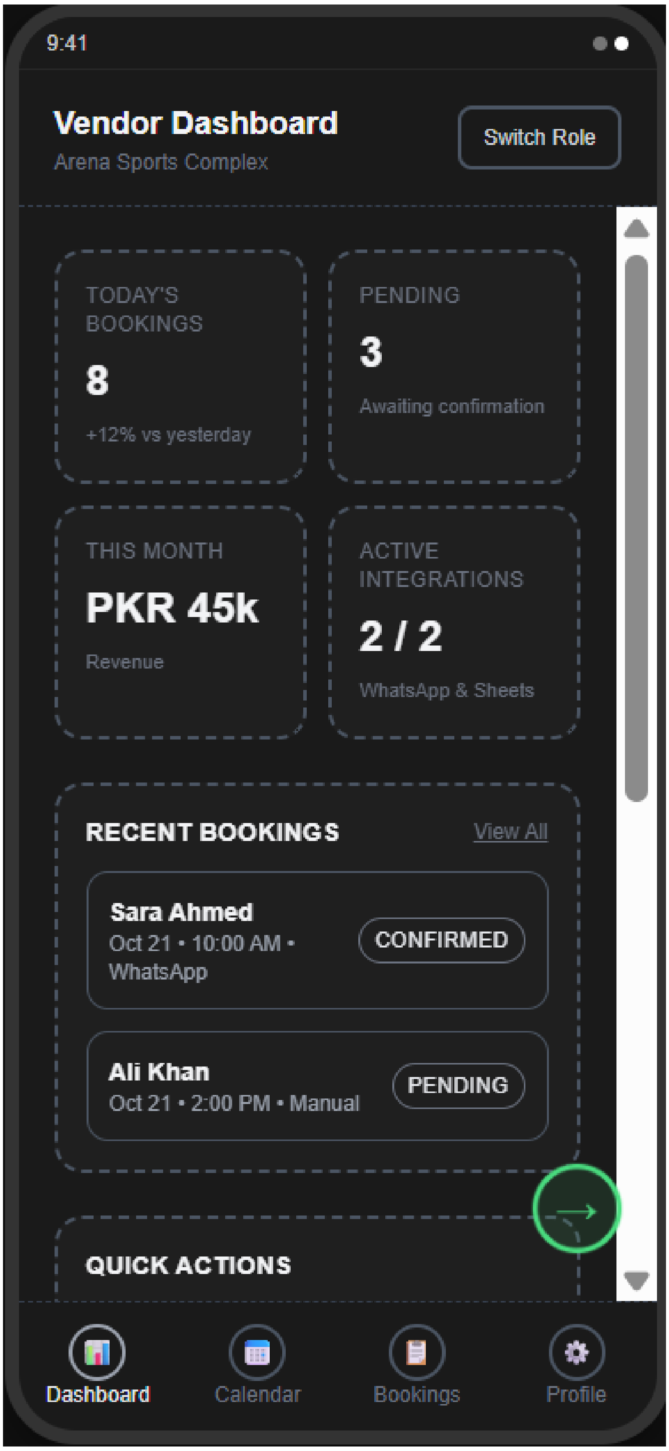
Email Address

OPERATIONS

Open Time

Close Time

Figure 14: Vendor Flow (1/5): **Vendor Registration.** Form for business information, categories, and verification.



9:41

Vendor Dashboard

Arena Sports Complex

Switch Role

TODAY'S BOOKINGS

8

+12% vs yesterday

PENDING

3

Awaiting confirmation

THIS MONTH

PKR 45k

Revenue

ACTIVE INTEGRATIONS

2 / 2

WhatsApp & Sheets

RECENT BOOKINGS

View All

Sara Ahmed

Oct 21 • 10:00 AM • WhatsApp

CONFIRMED

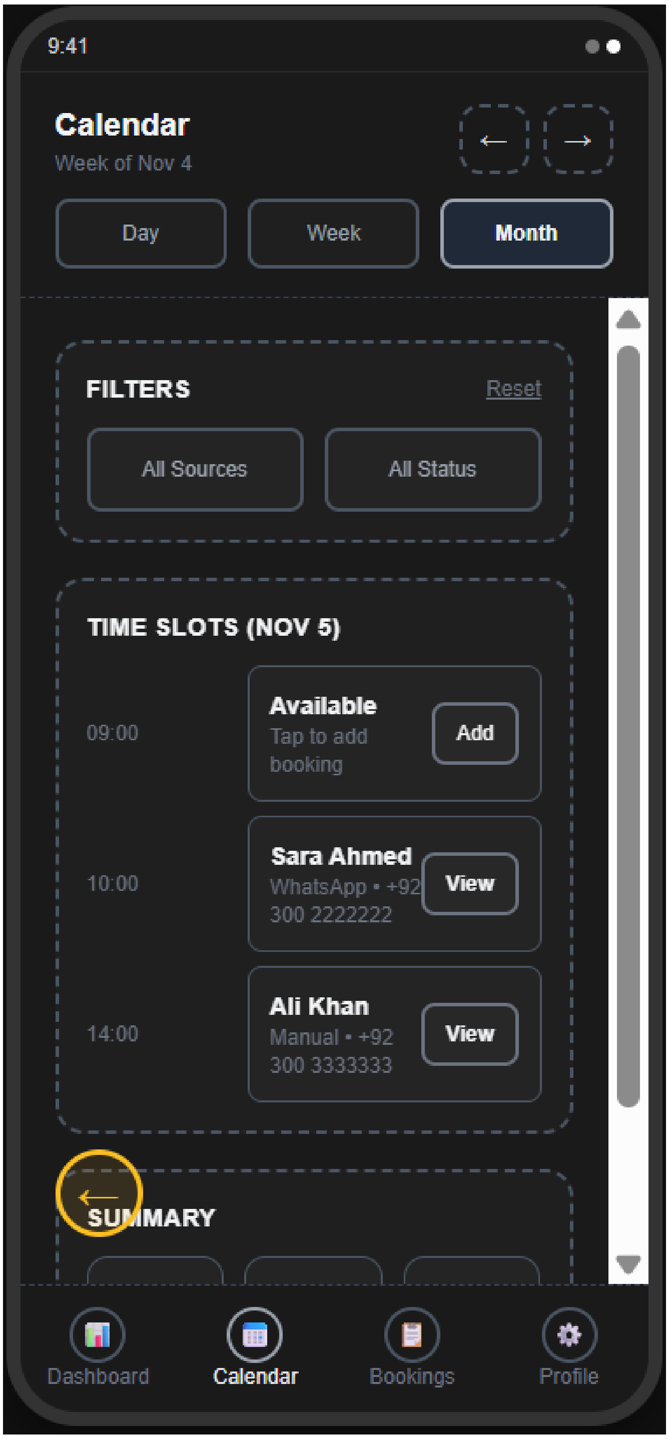
Ali Khan

Oct 21 • 2:00 PM • Manual

PENDING

QUICK ACTIONS

Figure 15: Vendor Flow (2/5): **Vendor Dashboard.** At-a-glance analytics, recent activity, and integration status.


9:41

Calendar

Week of Nov 4

← →

Day | Week | Month

FILTERS Reset

All Sources | All Status

TIME SLOTS (NOV 5)

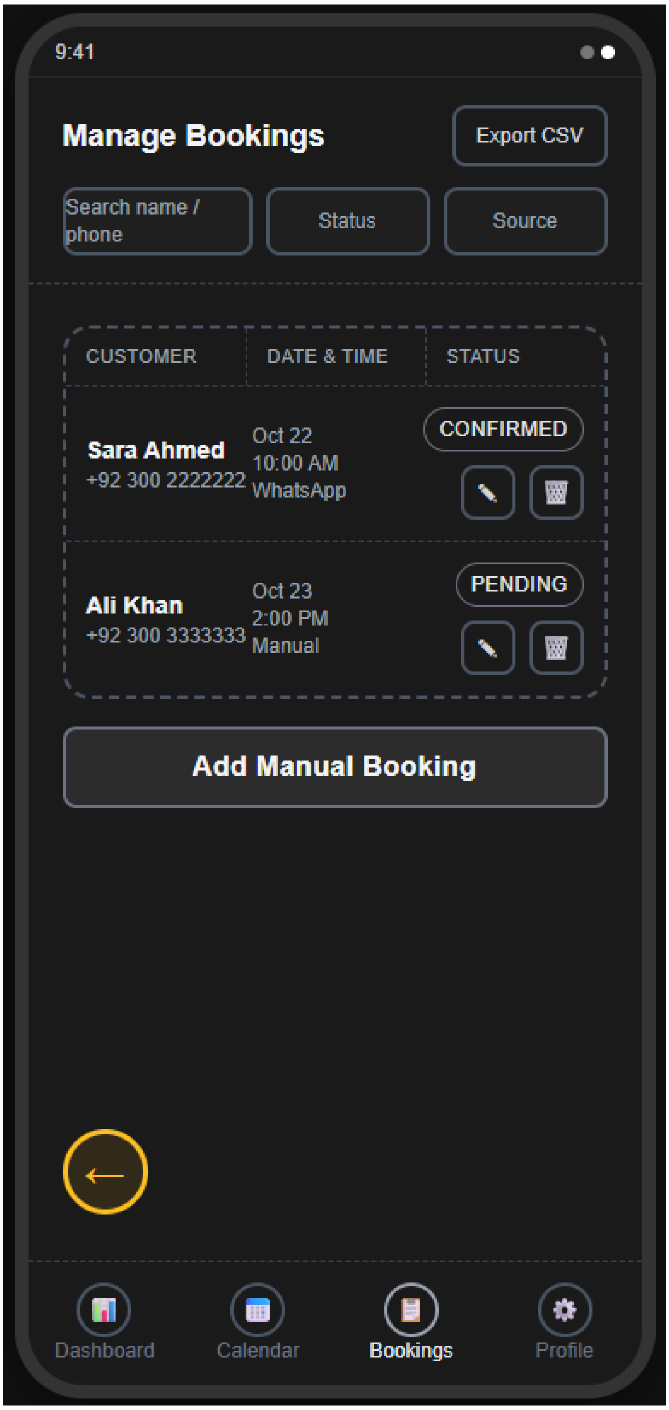
09:00 Available
Tap to add booking
Add

10:00 Sara Ahmed
WhatsApp • +92 300 2222222
View

14:00 Ali Khan
Manual • +92 300 3333333
View

←
SUMMARY

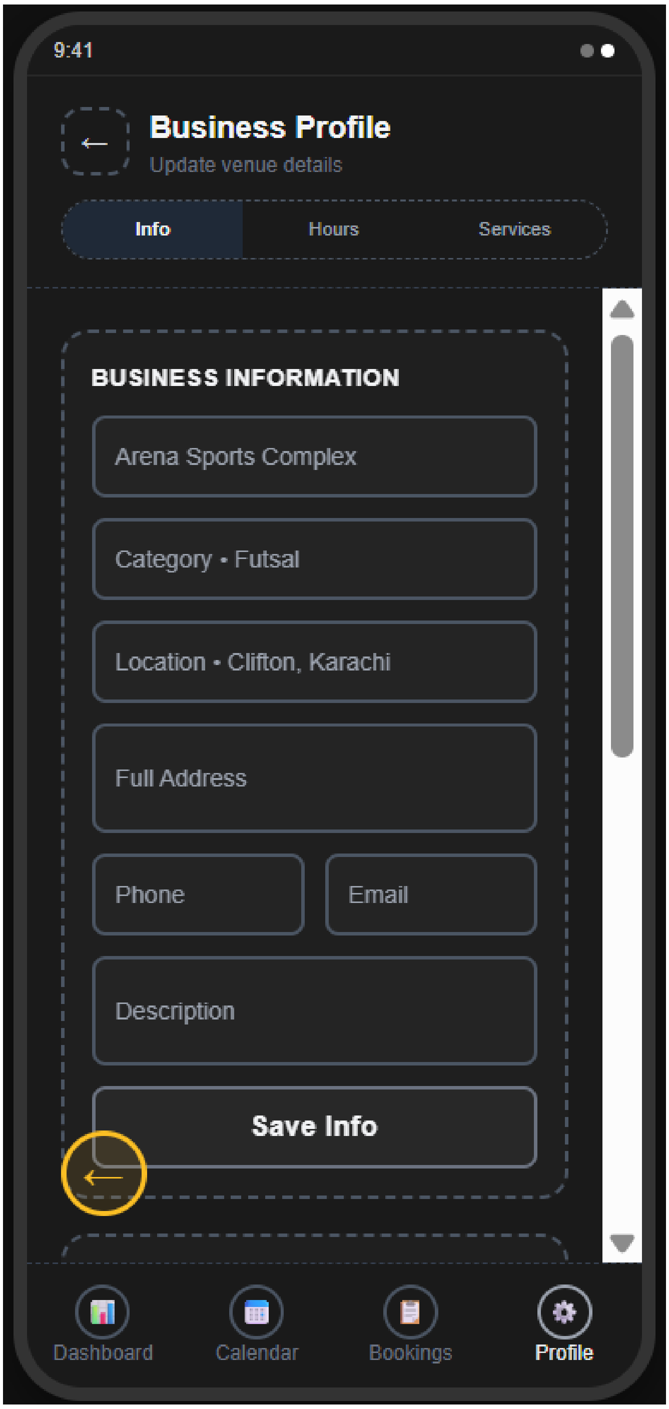
Figure 16: Vendor Flow (3/5): **Vendor Calendar.** Calendar view of bookings with source/status filters and slot management.



Manage Bookings

CUSTOMER	DATE & TIME	STATUS
Sara Ahmed +92 300 2222222	Oct 22 10:00 AM WhatsApp	CONFIRMED
Ali Khan +92 300 3333333	Oct 23 2:00 PM Manual	PENDING

Figure 17: Vendor Flow (4/5): **Manage Bookings.** Tabular management of all bookings with search, filters, and manual entry.



9:41

← **Business Profile**

Update venue details

BUSINESS INFORMATION

Arena Sports Complex

Category • Futsal

Location • Clifton, Karachi

Full Address

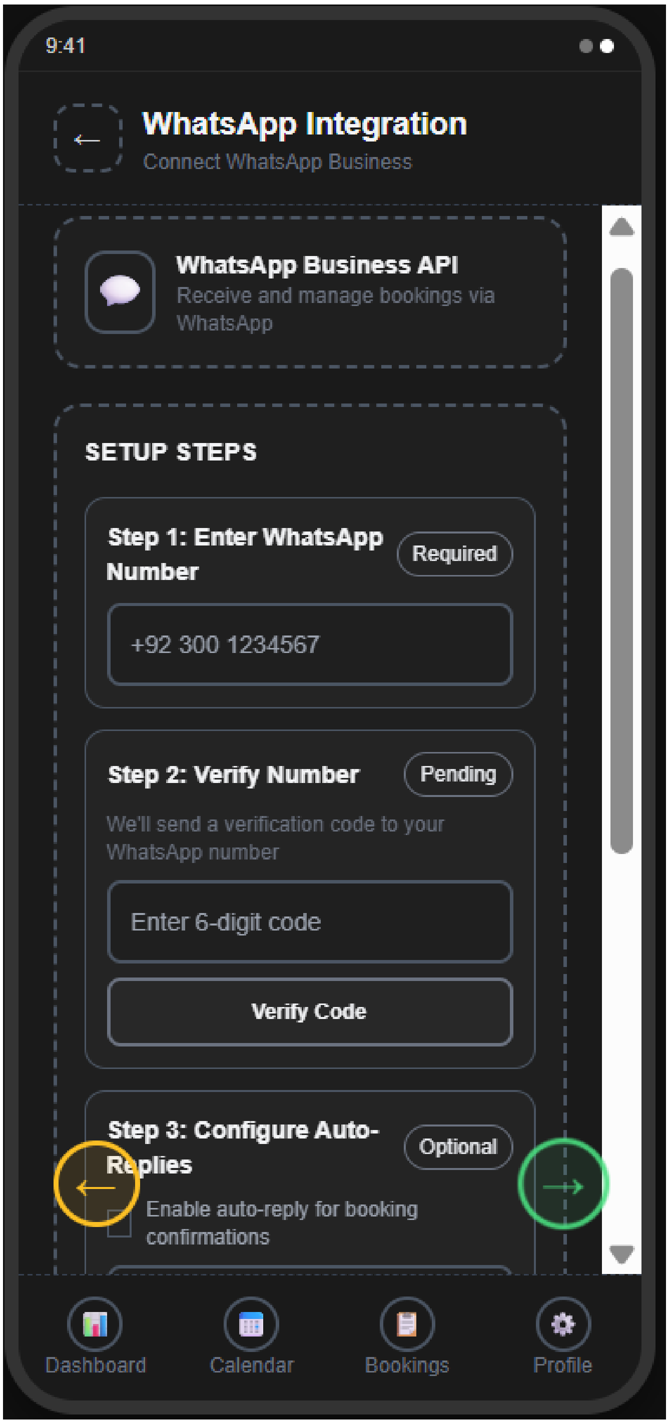
Phone

Email

Description

Figure 18: Vendor Flow (5/5): **Business Profile.** Configuration for business info, hours, services, pricing, and media.

3.7 Integration Flows (WhatsApp & Google Sheets)



9:41

WhatsApp Integration

Connect WhatsApp Business

WhatsApp Business API

Receive and manage bookings via WhatsApp

SETUP STEPS

Step 1: Enter WhatsApp Number — Required

+92 300 1234567

Step 2: Verify Number — Pending

We'll send a verification code to your WhatsApp number

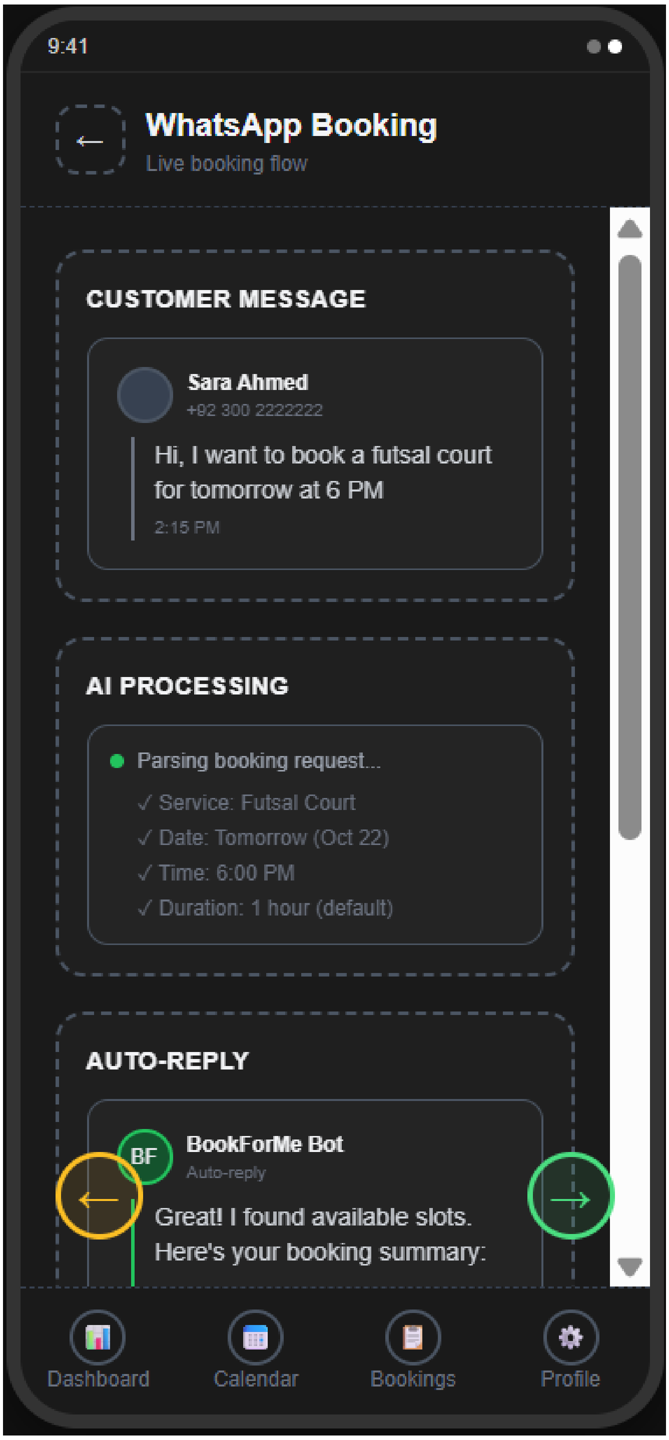
Enter 6-digit code

Verify Code

Step 3: Configure Auto-Replies — Optional

□ Enable auto-reply for booking confirmations

Figure 19: Integration Flow (1/2): **WhatsApp Integration Setup.** Connecting WhatsApp Business API and configuring auto-replies.



9:41

WhatsApp Booking

Live booking flow

CUSTOMER MESSAGE

Sara Ahmed

+92 300 2222222

Hi, I want to book a futsal court for tomorrow at 6 PM

2:15 PM

AI PROCESSING

● Parsing booking request...

✓ Service: Futsal Court

✓ Date: Tomorrow (Oct 22)

✓ Time: 6:00 PM

✓ Duration: 1 hour (default)

AUTO-REPLY

BookForMe Bot

Auto-reply

Great! I found available slots. Here's your booking summary:

Figure 20: Integration Flow (2/2): **WhatsApp Booking Flow.** AI parsing a customer message and creating a booking.