

Functional Requirements Document (FRD)

API Development and Integration – I-STEM Platform

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1. Introduction

1.1 Purpose of the Document

This document describes the **functional requirements** for the Application Programming Interfaces (APIs) to be developed for the I-STEM platform. The APIs will allow secure, role-based access to the services offered by I-STEM, enabling external systems (government, academia, industry) to interact with I-STEM programmatically.

1.2 Scope

The APIs will expose the following functionalities:

- User and institution management
 - Facility and equipment discovery
 - Booking and scheduling
 - Billing and payment
 - Feedback and reporting
 - Secure access and data privacy
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2. System Overview

I-STEM is a platform that maps R&D infrastructure and enables sharing of scientific facilities. The new API layer will expose I-STEM's backend services for:

- Real-time booking and facility usage tracking
 - Programmatic access to institutional data
 - Integration with other platforms (research councils, universities, private labs)
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3. Actors and Roles

Role	Description
API Consumer	Government bodies, research platforms, universities, startups, and third-party systems using the API
I-STEM Admin	Internal I-STEM operations staff managing access and monitoring
Facility Admin	Individuals managing institutional equipment and scheduling
End User	Registered researcher, scientist, or student using facilities via their own system

4. Functional Requirements

Each requirement below includes a **requirement ID**, **title**, **description**, **priority**, and **acceptance criteria**.

4.1 User Authentication and Access Control

ID	FR-001
Title	User Authentication
Description	Users must be able to authenticate using OAuth 2.0 or token-based login. Admin roles should have extended privileges.
Priority	High
Acceptance Criteria	Token issued and validated correctly; access controlled via RBAC for all APIs

4.2 Institution and User Profile Management

ID	FR-002
Title	Fetch User Profile
Description	An authenticated user should be able to retrieve their profile information including institution and role.

ID	FR-002
Priority	High
Acceptance Criteria	JSON response with profile fields (Name, Email, Role, Institution ID)
ID	FR-003
Title	Update Institution Profile
Description	Admins should be able to update metadata for their institution.
Priority	Medium
Acceptance Criteria	PUT/PATCH endpoint updates institution details and returns confirmation

4.3 Facility & Equipment Search

ID	FR-004
Title	Equipment Discovery
Description	APIs should return searchable and filterable lists of available facilities.
Priority	High
Acceptance Criteria	Filters: location, type, availability, host institution, cost per hour
ID	FR-005
Title	Equipment Details
Description	API to return metadata, images, manuals, and contact info for a specific equipment ID
Priority	High
Acceptance Criteria	All data fields populated correctly for equipment_id input

4.4 Booking and Scheduling

ID	FR-006
Title	Create Booking
Description	An authenticated user can create a booking request for available time slots.
Priority	High
Acceptance Criteria	Booking entry created; email confirmation sent to user and facility admin

ID	FR-007
Title	Check Equipment Availability
Description	Return available time slots for a given equipment ID and date range
Priority	High
Acceptance Criteria	Accurate list of free time slots; booked slots not shown

ID	FR-008
Title	Cancel/Reschedule Booking
Description	User can cancel or modify a previously made booking, if within allowed time frame
Priority	Medium
Acceptance Criteria	Booking status changes and reflected in user's booking history

4.5 Billing and Payment

ID	FR-009
Title	Generate Invoice
Description	Generate invoice based on usage duration, equipment cost/hour, and applicable taxes
Priority	High
Acceptance Criteria	JSON invoice response with amount, tax breakdown, invoice ID
ID	FR-010
Title	Payment Callback
Description	System should accept callbacks from BharatKosh/PayGov to update payment status
Priority	High
Acceptance Criteria	Payment status field updated in booking record; log entry created

4.6 Feedback and Ratings

ID	FR-011
Title	Submit Feedback
Description	User can submit qualitative feedback and numeric rating after facility usage
Priority	Medium
Acceptance Criteria	Feedback submitted only for completed bookings; moderation supported
ID	FR-012
Title	Fetch Ratings

ID	FR-012
Description	Aggregate and recent feedback for an equipment/facility should be accessible
Priority	Low
Acceptance Criteria	JSON array of ratings with optional filters by date or user type

4.7 Reporting and Analytics

ID	FR-013
Title	Usage Reports
Description	Admin users can fetch reports of equipment usage, by institution or facility
Priority	Medium
Acceptance Criteria	Report generated in JSON/CSV with filters (date range, user, facility ID)
ID	FR-014
Title	Booking Summary
Description	Summarize bookings made by a user or institution over a selected time period
Priority	Low
Acceptance Criteria	Summary report with counts, costs, and durations grouped by month/equipment

4.8 Notifications and Events

ID	FR-015
Title	Send Booking Confirmation Email

ID	FR-015
Description	System sends email notifications to users and admins upon successful booking
Priority	Medium
Acceptance Criteria	Email sent to registered address within 5 minutes of booking creation
ID	FR-016
Title	Webhook Integration
Description	Support optional webhook event push to subscribed systems (booking created, status updated)
Priority	Low
Acceptance Criteria	Proper payload pushed to registered webhook URL when event occurs

5. Data Model Summary

Entities:

- User
- Institution
- Equipment
- Booking
- Invoice
- Feedback
- Report

Relationships:

- Each booking is associated with one user and one equipment.
- Each equipment belongs to one institution.
- One institution can have many users and many equipment items.

6. Assumptions

- All external systems consuming the APIs will follow published authentication and security protocols.
 - Backend data (users, institutions, equipment) will be managed by I-STEM staff/admins.
 - All feedback and ratings will be subject to moderation if flagged.
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7. Constraints

- All APIs must adhere to government data protection laws and MeitY standards.
 - Only HTTPS connections are allowed.
 - API limits: 100 requests/minute per user by default (configurable).
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8. Dependencies

- Integration with I-STEM's existing backend database
- Payment gateways
- Email and SMS gateway services