

# AI for Bharat Hackathon

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Team Name : Empower Panchayat

Team Leader Name : Anshul Jain

Problem Statement : PS03 - AI for Rural Innovation & Sustainable Systems

## Brief about the Idea:

### WHAT

eGramSabha is an AI-powered platform by Empower Panchayat that digitises Gram Sabha governance -- democratizing AI to ensure marginalized rural citizens receive transparent, accountable local governance.

Aligned with Article 40 and the 73rd Constitutional Amendment, it addresses real challenges panchayats face: inadequate administrative support, insufficient training, and lack of digital infrastructure -- by bringing AI-driven competence building directly to the Gram Panchayat level.

It combines face recognition auth, multilingual voice input, LLM-powered meeting intelligence, and smart agenda creation across three role-based portals (Citizen, Official, Admin) -- strengthening community participation and enabling transparent resource administration.

### INNOVATION

#### Configurable AI Provider Architecture

- Strategy Pattern lets deployments switch AI backends
- Supports multiple cloud & open-source AI services
- Change one env variable -- no code changes needed

#### Purpose-Built for Rural India

- Face auth for citizens who cannot type passwords
- Voice-first issue creation in native languages
- Low-bandwidth optimized, async AI processing

#### Open Source (Apache 2.0)

- Supports Digital India and e-Panchayat initiatives

## Solution Overview:

### How is it different?

- No existing platform combines face-auth + voice input + AI meeting intelligence
- Face recognition replaces passwords -- an accessibility breakthrough for low-literacy users
- Multiple STT providers with configurable fallback options
- LLM transcription uses expert rural development prompts for domain accuracy

### How does it solve the problem?

- Citizens speak issues in native language -- AI transcribes, corrects, translates automatically
- AI clusters similar issues into structured multilingual agendas (significant effort reduction)
- Meeting recordings become formal Minutes in multiple languages simultaneously
- Complete lifecycle: Reported → Agenda → Discussed → Resolved

### USP

- Configurable AI providers -- switch backends with one env variable
- Purpose-built for rural India: face auth, voice-first, multilingual
- Open-source under Apache 2.0 license, cloud-agnostic deployment

## Key Features:

### Face Recognition Auth

- Client-side biometric face recognition
- Liveness detection (anti-spoofing)
- High-accuracy face matching engine

### Multilingual Voice Input

- Citizens speak in native language
- Multiple STT provider support
- LLM correction with domain prompts

### AI Meeting Intelligence

- Auto MOM in multiple languages from audio
- Smart agenda clusters similar issues
- Async processing with scheduled pipelines

### Three Role-Based Portals

- Citizen: face login, voice issues, RSVP
- Official: meetings, agenda, MOM, export
- Admin: onboarding, bulk import, config

### Configurable AI Providers

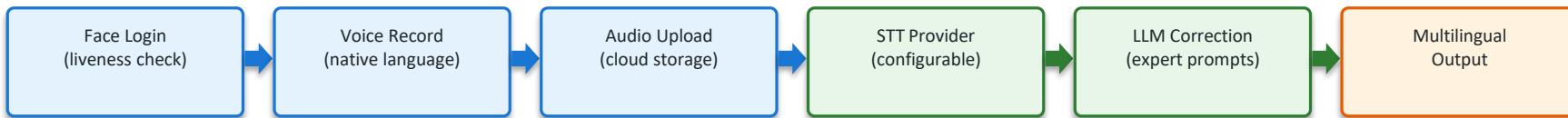
- Strategy Pattern + Factory design
- LLM: Configurable cloud providers
- STT: Configurable speech providers

### Complete Governance Workflow

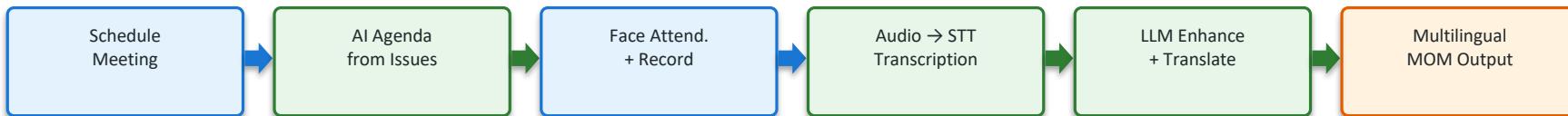
- Issue lifecycle tracking end-to-end
- Role-based access control with data isolation
- PDF/CSV export with Hindi + letterhead

## Process Flow -- AI Pipeline:

### CITIZEN ISSUE CREATION FLOW



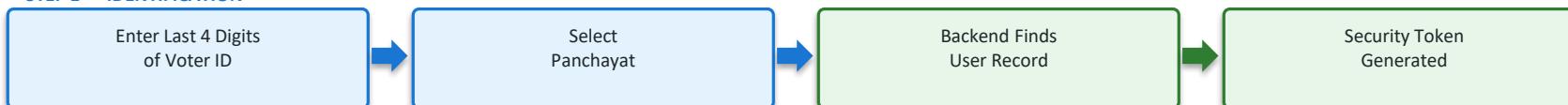
### MEETING INTELLIGENCE FLOW



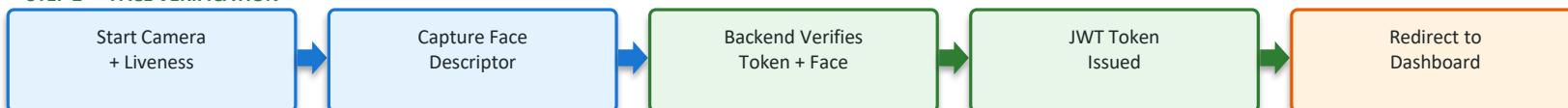
Async Processing Architecture: All AI operations run asynchronously with database-backed state tracking. Each request returns immediately with a `request_id` and polling URLs. The pipeline supports: progress checkpoints at defined milestones • automatic retry with configurable attempts • resume from last successful stage • TTL-based cleanup • Scheduled jobs orchestrate the full pipeline (transcription polling, agenda generation, translation at configurable intervals).

## Citizen Authentication Flow:

### STEP 1 — IDENTIFICATION



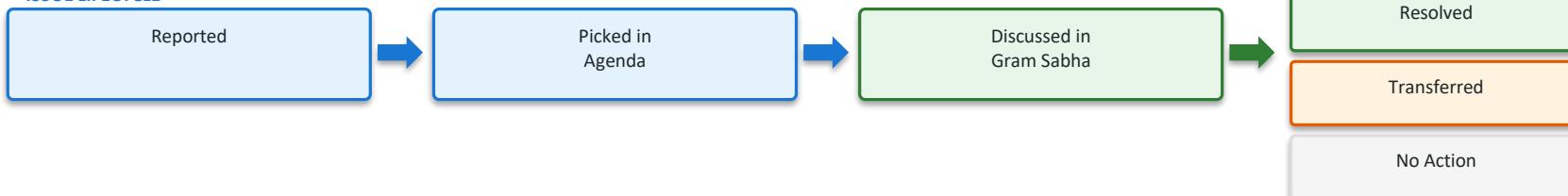
### STEP 2 — FACE VERIFICATION



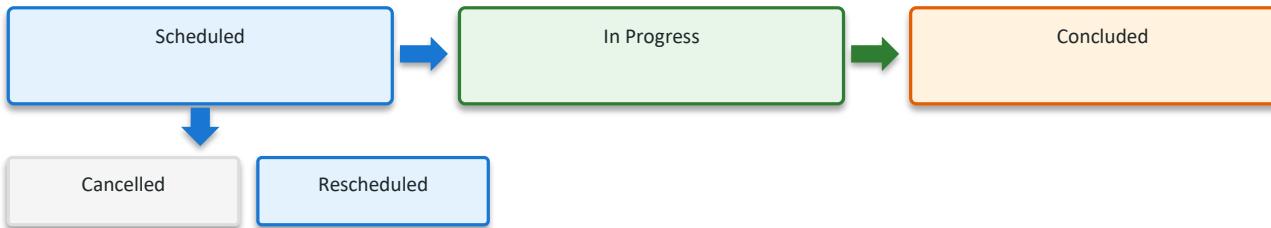
Security: No face images stored on server -- only mathematical descriptors for privacy. Liveness detection (blink + head movement) prevents photo/video spoofing. Time-limited security tokens with separate JWT secrets per user type. All communication over HTTPS with encrypted data in transit.

## Issue & Meeting Lifecycles:

### ISSUE LIFECYCLE

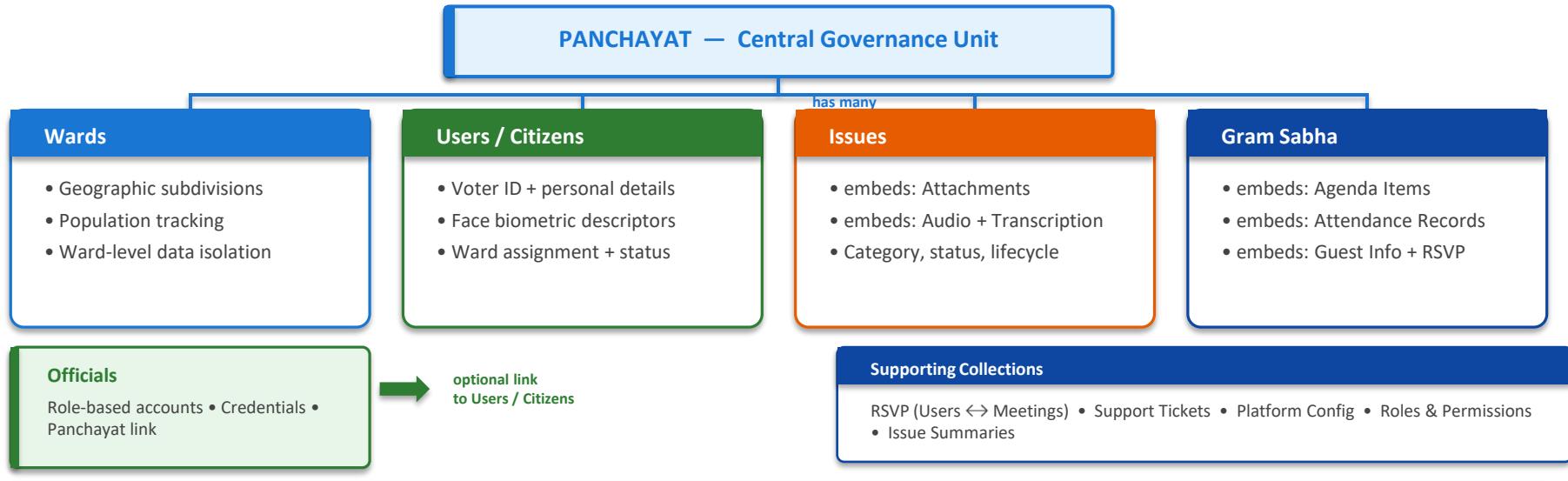


### MEETING LIFECYCLE



Issue Categories: Culture & Nature • Infrastructure • Earning Opportunities • Basic Amenities • Social Welfare Schemes • Other | Meeting Features: RSVP management • Face-based attendance • Quorum tracking • AI agenda generation • Multilingual MOM export

## Data Architecture & Relationships:



Storage: MongoDB document database with file storage for binary data (face images, audio recordings, letterheads). Separate async tracking database for AI request lifecycle. Compound + text indexes for optimized query patterns.

## Application Portals:

### Citizen Portal

- **Face Login:** liveness detection verified
- **Voice Issues:** record audio in native language
- **Issue Tracking:** real-time status dashboard
- **Meeting RSVP:** confirm attendance + history
- **Multilingual:** bilingual UI (English + Hindi)

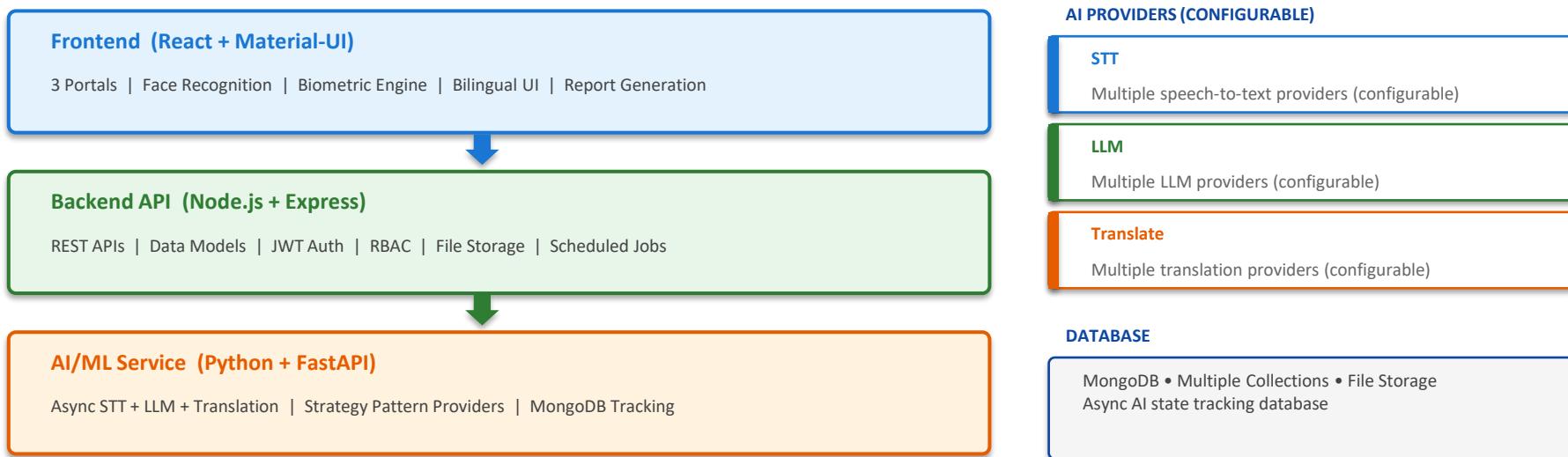
### Official Portal

- **Issue Mgmt:** status workflow Reported → Resolved
- **Meeting Scheduler:** RSVP tracking + quorum mgmt
- **AI Agenda:** auto-generated from citizen issues
- **AI MOM:** multilingual minutes from recordings
- **Export:** PDF/CSV with letterhead + Hindi fonts

### Admin Portal

- **Onboarding:** panchayat setup with LGD codes + wards
- **Bulk Import:** CSV citizen registration + dedup
- **Officials:** manage accounts + RBAC role assignment
- **Config:** face thresholds, liveness, platform settings
- **Analytics:** system-wide registration + usage statistics

## System Architecture:



Deployment: Docker Compose (containerized microservices) • Health checks + restart policies • Reverse proxy • Cloud-agnostic -- runs on any cloud or Kubernetes cluster

## Technologies Used:

### Frontend

- React + Material-UI (MUI)
- Face recognition engine
- PDF generation, internationalization
- Client-side biometric processing
- Bilingual UI (English + Hindi)

### Backend

- Node.js + Express + MongoDB ODM
- MongoDB with file storage
- JWT authentication + secure hashing
- Auto-generated API documentation
- Scheduled job processing

### AI / ML Service

- Python + FastAPI
- Async MongoDB driver
- Multiple STT providers (Indian languages)
- Multiple LLM providers (configurable)
- Audio processing pipeline

### Cloud Services + Infra

- Cloud LLM APIs (configurable provider)
- Cloud STT services (Indian languages)
- Cloud translation services (optional)
- Docker Compose + Reverse Proxy
- Cloud SDKs for provider integration

## Estimated Implementation Cost:

eGramSabha is fully open-source (Apache 2.0) -- Zero licensing cost

### Infrastructure

- Cloud VM instance for hosting
- MongoDB free tier available for pilot
- Docker deployment minimizes ops cost

### AI Services (Pay-per-use)

- Open-source models with free tiers
- Regional STT provider programs
- Cloud LLM: pay-per-use token pricing
- Cloud STT: pay-per-use audio pricing

### Cost Optimization

- Switch providers via env variable
- Free-tier for pilots, cloud at scale
- Mix-and-match STT + LLM providers

Target: Serve panchayats across India with infrastructure that adapts to budget constraints through configurable AI provider selection.

## Impact, Scalability & Innovation:

### Rural Impact

- Gram Panchayats across India
- Millions of rural citizen beneficiaries
- Face auth removes literacy barrier
- Voice-first in native languages
- Supports Digital India initiative

### Scalability

- Stateless services scale horizontally
- Cloud-agnostic, runs on any platform
- Separate DB for transactional + AI
- Configurable cloud providers
- Database replica set + sharding ready

### AI Innovation

- Multiple STT provider pipeline
- Expert rural development LLM prompts
- Smart issue-to-agenda clustering
- Multilingual MOM from single recording
- Strategy + Factory provider pattern

Future Roadmap: Native mobile apps • SMS/WhatsApp notifications • Offline sync • Government portal integration (e-Panchayat, LGD) • Voice-first navigation • Predictive analytics

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