Empowering Women in STEM through Community and AI

CODEX ENIGMA

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1.The Problem: The Invisible Disadvantage

Despite rising enrollment, women in STEM at IITK face a critical **"Safety-Growth" disconnect**, where systemic isolation and implicit bias stifle true professional advancement.The first barrier is **environmental isolation,** due to **lack of safe information flow**. When confronted with toxic lab cultures or harassment, students face an impossible choice: **suffer in silence,** or utilize formal reporting channels that often **compromise their identity and risk damaging their academic records.** This lack of a verified, yet anonymous infrastructure prevents the sharing of vital institutional safety data. Furthermore, without blind, skill based networking, high potential women are frequently excluded from competitive project teams due to pre-existing, male dominated social cliques.

This exclusion creates a vicious cycle that manifests as a **professional confidence gap**. Sociological conditioning leads qualified women to unconsciously **minimize their achievements**, utilizing passive language in their resumes (e.g., "assisted" instead of "architected") and adopting apologetic tones in professional communication. Additionally, a lack of transparent data regarding fair market value causes these students to systematically **undervalue their labor during job offers**. Currently, general purpose career tools fail to detect these specific linguistic and financial biases, leaving women to navigate the competitive workforce with a self imposed, invisible disadvantage.

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2. Proposed Solution: The LumaCircle Platform

LumaCircle is conceptualized as a **unified, dual-module ecosystem** engineered to directly address the challenges in psychological security and career advancement faced by women pursuing STEM at IIT Kanpur . It replaces the fragmented approach of existing campus resources and external applications with a **centralized "Safety & Growth" infrastructure**, specifically tailored for the IITK environment.

Module 1: Community Infrastructure for Secure Academic and Personal Discourse

1.1 Community Chat & RBAC System: The IITK Verified Safe Space

We engineer a **Verified Safe Space**: a women-only, highly moderated **chat environment** backed by a robust **Role Based Access Control (RBAC)** system. To resolve the tension between institutional verification and personal safety, accounts are validated strictly via institutional IITK email but operate within encrypted channels (e.g., **#incident-reporting, #academic-struggles**) where identifying metadata is detached from the user's display identity.

Roles such as "Student Member", "Admin" and "Alumnae Mentor" govern permissions, allowing for **candid, low-risk discussions about sensitive topics**, from academic

struggles in courses to incidents of harassment without fear of social blowback or administrative retaliation affecting their records.

1.2 The Compatibility-First Team Formation Engine: Optimizing Project Success

This engine addresses the isolation disproportionately affecting female students within IITK's competitive academic environment by layering a **sophisticated matchmaking algorithm over user profiles**. For every "team request" (e.g., for a B.Tech project, a competition, or a research group), the system computes a compatibility score based on critical factors: **skill overlap, mutual time availability, and experience mix**. This ensures a balance of seniors and beginners to foster vertical mentorship among women. Results are sorted by score to suggest optimal groupings, directly countering the exclusion of women from informal, male-dominated peer networks. Users retain the flexibility to browse manually and invite peers to private team chats for final confirmation.

1.3 MentorMesh: The Context-Aware Knowledge Graph for IITK Alumnae Guidance

MentorMesh integrates a searchable **directory of alumni and senior students** directly into the community interface, ensuring guidance is **context-aware and immediately accessible**. Unlike generic external requests, system-routed inquiries for mentorship automatically **include specific, relevant tags** (e.g., "Resume for ML roles in the US," "Navigating a Toxic lab environment," "Coping with the Core curriculum workload"). The search engine filters mentors by **expertise**, **graduation batch, current location/industry, and language**, streamlining the connection process and aligning with best practices for women-in-STEM mentorship.

1.4 LabExperience Hub: Transparent Evaluation of Research and Project Environments

This feature serves as a transparent, crowdsourced platform for **evaluating campus research and project experiences** within IITK departments. It aggregates **anonymous, verified reviews** to capture crucial data often overlooked by administration.Specifically, it utilises **Numeric Culture Fields** where users provide direct 1–5 ratings for **inclusivity, constructive feedback style, workload clarity, safety practices, and overall comfort for women** within the lab/project team.

Module 2: The AI Career & Bias Assistant: Localizing Professional Confidence and Fair Compensation

2.1 Resume Enhancer: Countering Underevaluation

This tool actively counters the sociological tendency among women to underplay achievements on professional documents. The engine performs **Semantic Analysis** to scan for minimizing language (e.g., "helped with," "assisted," "partially completed"), using **Power-Verb Injection** to suggest **high-impact, professional replacements** (e.g., converting "worked on the project's backend" to "Architected server-side infrastructure," or "assisted in the experiment" to "Led data collection and analysis").

2.2 The Market Value Regression Model (Fair Salary & CPI Predictor)

This predictive model is trained on historical, anonymized data regarding **alumnae stipends, CPI, and project/thesis complexity**. By inputting their current **Skill Se**t and **Academic Standing** (e.g., CPI/department), users receive a calculated **"Fair Market Range"** for internships and entry-level roles. The statistical confidence derived from this model provides a hard data anchor, empowering users to **evaluate market fairness** and **accept internship and placement offers with clarity**.

2.3 Sentinel Mirror: Real-Time Professional Communication Guardrails

Sentinel acts as a professional communication coach, analyzing text inputs for **critical professional communications** (e.g., emails to professors, peer feedback, professional chat) **before transmission**. Using **sentiment analysis and rule-based classifiers**, it detects overly apologetic tones, minimizing language, or perceived microaggressions, visually highlighting problematic segments (e.g., "potentially condescending tone"). The system offers multiple rewrite options depending on the necessary severity: **"Gentle Reply"** for low-risk interactions, **"Neutral-Assertive"** for clearly setting academic boundaries, and **"Escalation-Ready"** drafts that emphasize documentation and policy references.

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3. Techstack

Frontend - **Next.js** (App Router)
Backend - **Supabase** (Postgres + Auth + Realtime + Storage)
AI_Layer - **Hugging Face Inference API** +**Google Perspective API**
Hosting:

- Frontend + API routes → Vercel
- Database, auth, storage → Supabase
- LLM calls → Open Source Models

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4. System Architecture

The platform is built on a streamlined **Next.js** (App Router) **architecture** hosted on **Vercel**. Instead of juggling multiple complex microservices, the Frontend handles everything. It connects directly to **Supabase**, which acts as our **all-in-one backend**—handling login, data, and routing—so we don't need a heavy, separate API gateway.

The Community Infrastructure Module uses **Supabase Realtime** to power the Chat Service. We handle the "women-only" access and anonymity logic directly inside the database (**Postgres**) using security policies, rather than maintaining a custom **WebSocket** server. For Team Formation and Mentorship, we avoided complex graph databases and instead use smart **Postgres queries and vector search** to match users based on skills and roles effectively.

The AI Career & Bias Assistant lives right inside the **Next.js API layer**. It acts as a bridge that takes user inputs and routes them to cost-optimized services:

- Resume Rewriting is handled by the **Hugging Face Inference API**, utilizing powerful, free/low-cost open-source models (like Mistral).
- Bias Checking (Sentinel Mirror) is routed to the specialized and free **Google Perspective API** for reliable and dedicated bias scoring.
- Salary Estimation is performed by a **Postgres Function** using factual, stored data and heuristics along with an LLM's help.

The final documents and data are then stored securely in **Supabase Storage**, keeping the whole system fast and lightweight.

Module 1 – Community Platform

Uses Supabase + Next.js

Chat → Supabase Realtime channels
Teams → Postgres tables
Mentor Mesh → relational tables
Lab Rating → simple table + UI
Moderation → RLS + admin routes
Anonymous posts → special table with hashed identity
File uploads → Supabase storage

Module 2 – AI Tools

Integrated in Next.js via /api/* routes.

Resume Enhancer → Hugging Face API
Salary Predictor → Postgres Function + LLM
Sentinel Mirror → Google Perspective API

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5. Project Timeline:LumaCircle Implementation

(December 15, 2025 - February 8, 2026)

Phase 1: Core Infrastructure & Heavy Logic

Date: Dec 15 - Jan 4

- **Foundation & Security**: Initialize Next.js (App Router) and Supabase. Implement RBAC (Student/Admin roles) and "Identity Detachment" logic to secure the verified-anonymous bridge.
- **Module 1 Core (Safe Space & Teams)**: Build the Realtime Chat backend using Supabase channels and develop the Team Formation Engine (compatibility algorithm matching skills + availability) using Postgres vector search.

- **Module 2 Core (AI Resume Enhancer)**: Integrate Hugging Face Inference API to handle semantic analysis and "Power-Verb Injection" logic, completing the most complex AI integration before classes begin.

Phase 2: Feature Expansion & Integration

Dates: Jan 5 - Jan 25

- **Data-Driven Modules**: Implement the Salary Predictor (Postgres Function for "Fair Market Range") and the LabExperience Hub (CRUD forms for numeric culture ratings).
- **Guidance Tools**: Integrate Google Perspective API for the Sentinel Mirror (bias detection) and build the MentorMesh directory with "Context-Aware" search filters.
- **Integration & Troubleshooting**: Connect all UI components to their backends, test the "Women-Only" access controls, and conduct a "Bug Bash" to fix edge cases in the AI responses.

Phase 3: Finalization & Delivery

Dates: Jan 26 - Feb 8

- **Documentation**: Finalize the GitHub repository, API documentation, and system architecture diagrams.
- **Launch**: Deploy the production build to Vercel.
- **Buffer Period:** Reserved time to address unforeseen critical bugs or deployment failures.
