THADOMAL SHAHANI ENGINEERING COLLEGE

THADOMAL SHAHANI TSEC ENGINEERING COLLEGE | CodeTantra

PRESENTS

NEED FOR CODE 4.0

Dominate the race track of innovation

PROBLEM STATEMENTS

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GENERAL INSTRUCTIONS

- Read the problem statements carefully
- All the teams should make a Github repository and name it as follows : NFC4_<TEAMNAME>
- We Recommend you to update Repositories every 2 hours
- It is Forbidden to plagiarize or reuse previously published content. If found upon inspection that the project has reused code that was not revealed with the submission, the project will be disqualified
- You are free to use any data sets you find appropriate for the respective Problem statements

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SOCIAL CAUSE

1. Safety & Sustainability Platform for Coal Mining

Problem Statement:
Coal mining remains an integral part of India's energy mix, providing fuel for thermal power and heavy industries. However, the sector is often criticized for being unsafe, inefficient, and environmentally harmful. Mining companies frequently lack real-time visibility into operational parameters, safety compliance, and environmental metrics. Site accidents, outdated tracking of S&T (Science & Technology)/R&D projects, and lack of data on carbon emissions result in productivity losses, regulatory penalties, and unsustainable practices. As India moves toward climate commitments and net-zero goals, there is an urgent need for digital transformation in this sector.Participants are expected to build a platform that enhances coal mine operations by enabling real-time monitoring of worker safety and equipment, digitizing the tracking of innovation and R&D initiatives, and quantifying environmental impact, particularly carbon emissions. The expected outcome is a unified web or mobile-based system that increases transparency, ensures regulatory compliance, and assists coal companies on the path toward carbon neutrality.

Key Functionalities:

- Real-Time Monitoring Dashboard: Worker location tracking, machinery status, environmental sensor data (air quality, gas leaks, etc.).
- Safety Protocol Alerts: AI-generated alerts for non-compliance, danger zones, or lack of protective equipment.
- Digital Management of R&D/S&T Projects: Project lifecycle tracking, budget vs. utilization, outcomes, and timeline tracking.
- Carbon Footprint Estimation Tool: Auto-calculate emissions based on equipment usage, fuel, material logistics.
- Carbon Neutrality Simulator: Suggest emission reduction alternatives (e.g., bio-reclamation, cleaner fuels).
- Automated Reports for Ministry/Policy Submission: Export insights for government audit/review.
- Offline Sync for Remote Sites: Data collection even without internet; syncs upon reconnection.
- Worker App with Incident Reporting: Mobile interface for ground-level workers to report near-misses, hazards.
- **Compulsory Functionality: Use agentic AI to simulate real-time worker safety and carbon monitoring through autonomous digital twin agent**

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SOCIAL CAUSE

2. Offline-First PWA for Remote Villages

Problem Statement:
Over 65% of India's population lives in rural areas, many without reliable internet. This digital divide limits access to vital services like healthcare, education, and agricultural support. Though government and NGO programs exist, their digital nature makes them inaccessible offline. Villagers often can't access entitlements, online learning, or maintain digital records.
The task is to design a mobile-friendly Progressive Web App (PWA) that works fully offline—letting users access content, store data locally, and sync when online. It should support education, agriculture, and health, empowering teachers, farmers, and community workers for real-time service delivery.

Key Functionalities:

- Offline Functionality: Full data entry, learning modules, and service access without internet.
- Education Module: Local language video/text/audio lessons, quizzes, and certificate-based tracking.
- Healthcare Module: First-aid guides, maternal/child health tips, vaccination alerts, local clinic directory.
- Agriculture Module: Crop calendars, weather alerts, fertilizer usage guides, AI chatbot for FAQs.
- Auto Sync: Secure sync to central servers when device connects to internet.
- Local Storage Encryption: Ensure user data privacy in offline mode.
- Multilingual and Voice Support: Hindi, Marathi, tribal dialects; TTS and voice input for low-literacy users.
- NGO/Govt Integration: Syncs with national/state dashboards when online.
- **Compulsory Functionality: Embed agentic AI assistants for offline access to health, education, and agriculture services.**

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SOCIAL CAUSE

3. Crop Disease Prediction and Farmer Support System

Problem Statement:
Crop failure from plant diseases is a major challenge for Indian farmers, worsened by limited access to expert advice and disease awareness. This leads to pesticide misuse, lower yields, and economic loss. With rising smartphone use in rural areas, there's an opportunity to offer smart, early disease detection tools.
Participants must build a mobile-friendly AI solution where farmers upload crop images to get instant disease diagnosis and treatment tips. The app should also link them to local nurseries, agri-experts, and region-specific farming advice. The goal is a user-friendly tool that reduces losses, boosts productivity, and supports digital agriculture.

Key Functionalities:

- Photo-Based Disease Detection: ML model for image classification of plant leaf symptoms.
- Diagnosis Confidence Score: Confidence % and similar images.
- Treatment Recommendation Engine: Organic/inorganic remedies, pesticide guidance, dosage tracking.
- Agri-Expert Connect: In-app appointment booking or chat with local certified advisors.
- Geolocation-Based Nursery Finder: Nearby input dealers or plant medicine shops.
- Seasonal Care Reminders: Irrigation, pruning, pest alerts by crop and geography.
- Multilingual UI & Voice Input: For accessibility to low-literacy farmers.
- Offline Data Collection: Photo capture and symptom logging without network.
- **Compulsory Functionality: Introduce local farm-level AI agents that diagnose crop issues and autonomously suggest targeted remedies.**

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SOCIAL CAUSE

4. Cognitive Retraining App for Children with Disabilities

Problem Statement:
Children with cognitive or developmental disabilities such as ADHD, autism spectrum disorder, or learning disabilities often require structured interventions to improve memory, attention, problem-solving, and behavior. Unfortunately, access to professional therapy is limited, expensive, and geographically unavailable to many families, especially in rural or lower-income settings. As a result, caregivers are left without guidance or tools to support their child's development at home. This problem statement aims to create a computerized cognitive training platform for children with special needs that is flexible, adaptive, and accessible. The system should offer daily mental exercises tailored to individual capabilities and progression speed, and assist parents with guidance, encouragement, and analytics. The expected outcome is an interactive web or mobile solution that acts as a home-based therapist for families and helps bridge gaps in access to specialized care.

Key Functionalities:

- Adaptive Exercise Engine: Puzzles, memory games, attention-building tasks based on child’s age and ability.
- Progress Analytics Dashboard: Graphs showing improvement across cognitive domains.
- Parental Guidance Layer: Recommendations for reinforcement, calming techniques, and environment design.
- Gamified Rewards: Stars, badges, avatars to maintain motivation.
- Accessible Interface: Color-coded, minimal distraction, dyslexia-friendly fonts.
- Multilingual and Voice Interaction: Instructions in native language; voice input/output.
- Offline Mode: Daily practice even without internet.
- Therapist Portal (Optional): Professionals can monitor progress remotely.
- **Compulsory Functionality: Each child is paired with a personalized learning agent that adapts cognitive exercises to ability and progress**

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SOCIAL CAUSE

5. Employment & Skill Development Platform for the Disadvantaged

Problem Statement:
Millions in India—especially from tribal, rural, minority, and marginalized urban groups face barriers to employment due to digital illiteracy, lack of skills, mobility issues, and discrimination. Existing schemes often fail due to poor execution and lack of coordinated support.
Participants must create an inclusive employment platform for disadvantaged users. It should assess skills, provide local or remote learning, connect users with mentors, and help secure jobs or internships. The platform must also address transport, childcare, and language challenges—offering humane, localized support for skill-building and placement.

Key Functionalities:

- Skills Assessment Tool: Quick aptitude + interest profiler to suggest learning paths.
- Modular Learning Hub: Short courses in digital literacy, communication, trade skills.
- Mentorship Matchmaking: Local/online mentor directory by sector.
- Job Board with Filters: Verified employers hiring locally; gig work, apprenticeships.
- Barrier Identification and Support: Childcare, transport, digital access needs tagged.
- Social Service Referrals: Link to nearby shelters, legal aid, nutrition schemes.
- Multilingual Interface: With accessibility features (text-to-speech, keyboard nav).
- Community Mobilization Toolkit: For NGOs to onboard new users in bulk.
- **Compulsory Functionality: Integrate career advisor agents that recommend skilling paths, mentors, and jobs based on aptitude and goals**

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SOCIAL CAUSE

6. Grievance Reporting Platform for Minimum Wage Workers

Problem Statement:
Workers in unorganized sectors—including daily wage laborers, domestic workers, factory staff, and sanitation workers—often face exploitation, withheld wages, unsafe work conditions, and harassment. However, fear of retaliation, job loss, or intimidation by employers prevents them from filing complaints or seeking redress. Further, language, literacy, and lack of digital access make formal grievance portals inaccessible. Participants are tasked with creating a secure, anonymous, and user-friendly platform that enables workers to submit complaints without revealing their identity, and ensures that these complaints are routed to relevant support organizations or grievance redressal authorities. The platform must protect the complainant's identity and still allow resolution tracking. The expected outcome is a scalable digital grievance redressal solution that gives voice to the voiceless, strengthens worker protections, and builds trust in digital justice mechanisms

Key Functionalities:

- Anonymous Complaint Submission: No login; voice/text input.
- Grievance Routing Engine: Send to NGO, labor officer, company’s internal committee.
- Tracking Code System: Workers can check status using unique reference ID.
- Voice-to-Text Support: For illiterate workers; dialect transcription.
- Evidence Upload: Optional images, recordings (blurred/masked metadata).
- Data Protection & Encryption: End-to-end encryption for all complaints.
- Multilingual Interface: Hindi, Marathi, Bengali, etc.
- NGO/Admin Panel: For triaging, assigning, and resolving complaints.
- **Compulsory Functionality: Use agentic AI to ensure safe, anonymous complaint handling with escalation agents activated based on severity**

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SOCIAL CAUSE

7. Secure Workplace Harassment Reporting System for Women

Problem Statement:
Despite the existence of PoSH (Prevention of Sexual Harassment) laws, many women in both formal and informal workplaces refrain from reporting harassment due to lack of privacy, fear of retaliation, stigma, or absence of safe reporting mechanisms. Often, when incidents do occur, the victim lacks evidence or documentation, and is unaware of how to escalate the issue legally or emotionally. Develop a digital tool that empowers women to privately log harassment incidents, safely store evidence (text, audio, screenshots), and either report anonymously or delay the submission until they feel secure. The solution must offer pathways to NGOs, legal professionals, and workplace redressal bodies. The expected outcome is a privacy-first app or web system that fosters early reporting, reduces emotional burden, and strengthens organizational accountability toward gender safety.

Key Functionalities:

- Incident Logger: Audio recordings, screenshots, time-stamped notes with auto-encryption.
- Delayed Submission Option: Choose to send after X days.
- Anonymous/Identified Toggle: Report with or without name.
- Legal Aid & NGO Linkages: Connect to local counselors, PoSH committees, or legal services.
- Multilingual Support: Interface and legal documents in major Indian languages.
- Dashboard for HR/NGOs: Case intake and secure access controls.
- Evidence Vault: Encrypted digital locker with limited-time access sharing.
- SOS Chatbot: Support chat for emotional or legal queries.
- **Compulsory Functionality: Incorporate generative AI to help users draft narratives, and agentic AI to manage evidence securely and escalate when needed**