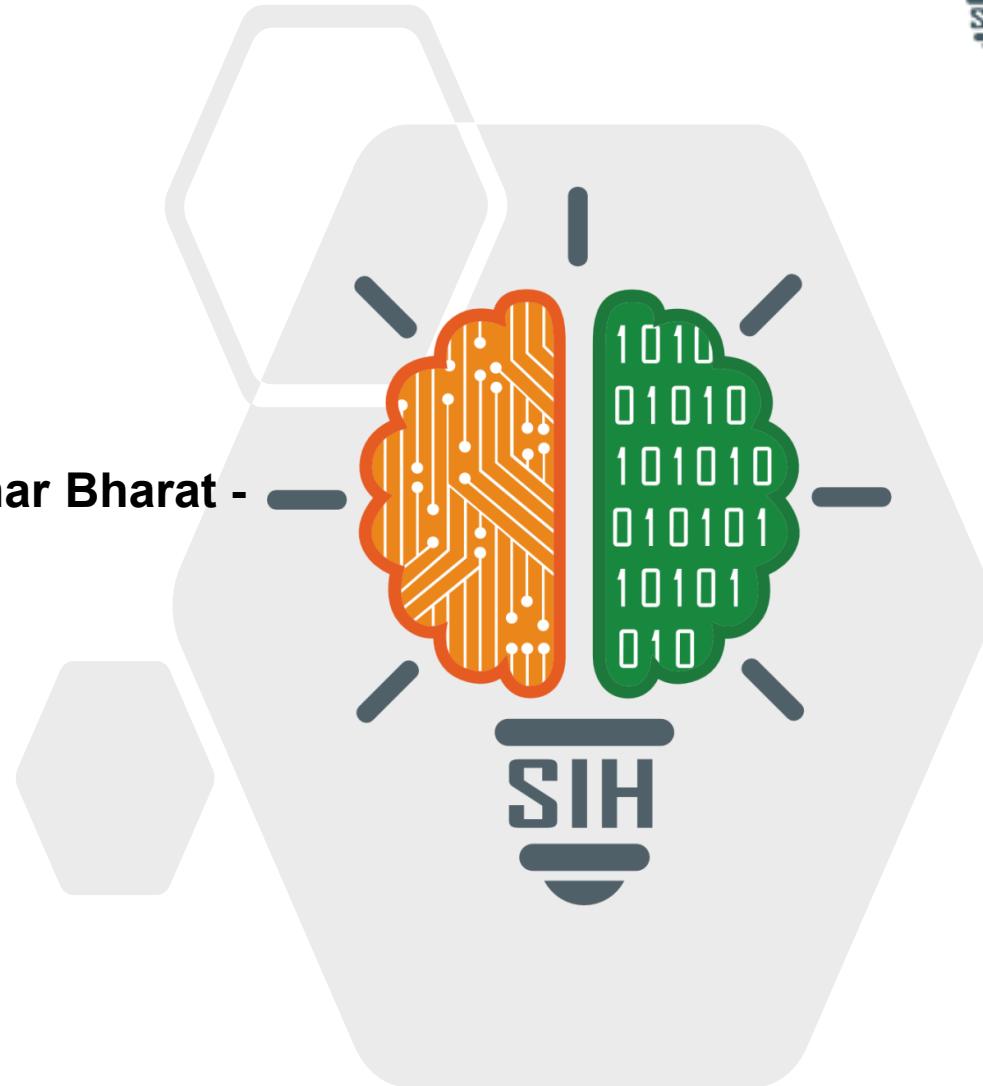


SMART INDIA HACKATHON 2025



- **Problem Statement ID – 25139**
- **Problem Statement Title-**
Student Innovation: Swadeshi for Atmanirbhar Bharat - Disaster Management
- **Theme- Disaster Management**
- **PS Category- Software**
- **Team ID- 92160**
- **Team Name- Obstacle Breakers**





Sahayoga Mesh: Community Lifeline for Disaster Management



IDEA / SOLUTION :

Implementation of a decentralized mesh network for transmitting critical, structured survival data in zero-network disaster zones.

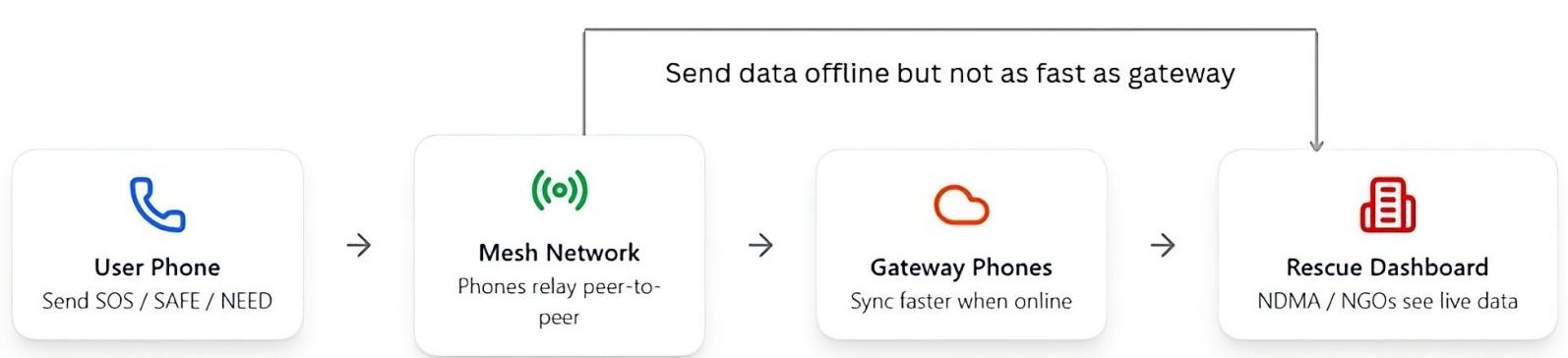
- People can send short, structured messages like **SAFE**, **NEED**, **SOS** for quick help.
- Every phone becomes a **signal carrier** (store-and-forward), passing the message along until it reaches farther areas.
- Special **gateway phones** will upload collected messages to the main server as soon as they get even a little internet.
- The app is made for **emergencies first** – it saves battery with a low-power mode and supports **all regional languages** for local users.

Problem Resolution :

- Builds a peer-to-peer lifeline when networks fail, so no one is left alone.
- Turns disaster zones into real-time data maps using smart mesh networking.

Unique Value Propositions (UVP) :

- Shares clear survival messages (SAFE, NEED, SOS) instead of normal chat.
- Every phone helps build a self-healing, citizen-powered network.
- Sends data from offline users to online aid dashboards.
- Works without any external network, with a simple one-tap regional languages interface.





TECHNICAL APPROACH



Mesh Protocol Development:

Uses Wi-Fi Direct and custom JSON packets with unique IDs for loop-free, low-power message hopping.

Mobile Application Development:

React Native – Framework used for building the cross-platform app, designed with three modules: UI, Networking, and Gateway Sync.

Encryption and Security:

TLS/SSL for all gateway-to-server communication, with native device file-system encryption for secure data storage.

Backend & Cloud Infrastructure:

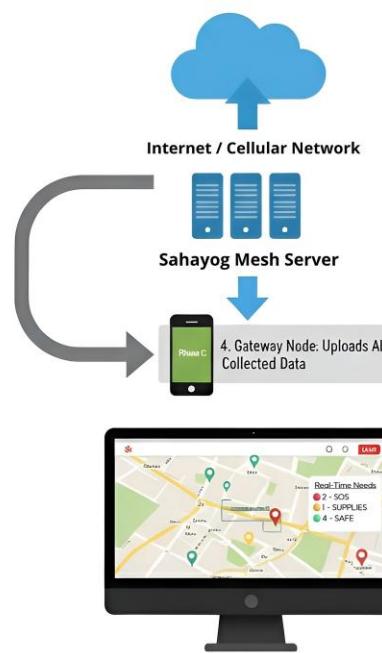
Node.js & Express.js – High-performance REST APIs for data ingestion. MongoDB – NoSQL database with geospatial features to store and query victim location data efficiently.

SAHAYOG MESH: COMMUNITY LIFELINE

PHASE 1: OFFLINE MESH NETWORK (STORE-AND-FORWARD)



GATEWAY 2: GATEWAY NODE & ONLINE SYNC



CRITICAL DATA FLOW: OFFLINE MESH

CRITICAL DATA FLOW: OFFLINE MESH

GATEWAY ONLINE COMMAND



FEASIBILITY AND VIABILITY



Analysis of Feasibility :

- ❖ **Technical:** Wi-Fi Direct/Bluetooth mesh + structured SOS packets
- ❖ **Financial:** Low-cost (open-source, smartphones available)
- ❖ **Market:** Citizens, NDMA/NDRF, NGOs
- ❖ **Operational:** Zero-setup, low training, easy deployment in disaster-prone regions.

Potential Challenges & Risks :

- ☒ **Technical:** Limited mesh range, battery drain, false SOS risk.
- 💰 **Financial:** Scaling infra cost, reliance on govt adoption.
- 👥 **Market:** Awareness + perception as “just another app.”
- ⚙️ **Operational:** Terrain issues, training for responders.

Strategies for Overcoming

- 💡 **Methods/Principles:** Hybrid mesh (Wi-Fi + BLE), low-power “disaster mode,” digital signing for SOS.
- 📊 **Algorithms:** Priority-based message queue (SOS > NEED > SAFE).
- 🏛️ **Strategies:** Govt + telecom CSR partnerships, regional language UI, pre-install in govt/NGO devices.



IMPACT AND BENEFITS



Potential Impact

Positive:

- **Improvement** – Faster rescue coordination & structured survival data.
- **Economical** – Low-cost, works on existing smartphones.
- **New Opportunities** – Integration with NDMA, telecom CSR, NGOs.
- **Social Benefits** – Empowered citizens, reduced panic, trust in community networks.

Negative:

- **Cost** – Scaling infra (cloud, deployment).
- **Tech Adoption Issues** – Initial resistance, need awareness/training.

Benefits of the Solution

Social:

- Improved access to rescue in disconnected zones.
- Community empowerment through structured status sharing.
- Reduction in chaos & duplication of relief efforts.

Economic:

- More productive relief operations (prioritized SOS = faster action).
- Reduced wastage of resources (supplies sent where needed).
- Opportunity for market partnerships (CSR, govt adoption).

Environmental:

- Energy efficiency via disaster mode & low-power design.
- Reduced waste of relief materials through better tracking.
- Supports sustainable disaster management practices.



RESEARCH AND REFERENCES



Research:

- ❖ Disaster Trends in India: Odisha & coastal regions face frequent cyclones & floods → demand for resilient communication.
- ❖ Mesh Networking: Proven in crisis zones (Hurricane Sandy, Nepal Earthquake) → shows reliability when infrastructure fails.
- ❖ Ground Reality: NDMA & NDRF reports emphasize the gap in last-mile communication during disasters.

Reference:

- ❖ NDMA India – National Disaster Management Authority Guidelines \ <https://ndma.gov.in/>
- ❖ SOS — Self-Organization for Survival: Introducing Fairness in Emergency Communication to Save Lives <https://arxiv.org/abs/2006.02825>
- ❖ Enabling disaster-resilient communication using multi-hop device-to-device framework <https://link.springer.com/article/10.1007/s11276-020-02481-2>

Comparison with Existing Apps

Feature / App	Sahayoga Mesh (Your Project)	Bridgefy	FireChat / FireChat Alerts	Briar	Serval Mesh
Structured Emergency Messages	✓ (Safe / Need / SOS + checklist + GPS)	✗ (Unstructured chat)	✗ (Generic alerts only)	✗ (Unstructured text/posts)	✗ (Generic messaging only)
Multi-hop Forwarding	✓ (Data-mule phone-to-phone)	✓ (Relay hopping)	✓ (Mesh relay)	✓ (Bluetooth/Wifi peer-to-peer)	✓ (Strong multi-hop mesh)
Gateway / Online Sync	✓ (Uploads via gateway node)	⚠ Partial (some sync)	⚠ Partial (depends)	✓ (Syncs when internet available)	⚠ Limited
Localization & Disaster UX	✓ (Odia support, crisis interface)	✗ (Not disaster/local focused)	✗ (No local language/disaster UX)	⚠ Some UX thought, not disaster-focused	✗ (No disaster UX focus)
Low-Power / Disaster Mode	✓ (Planned low power/disaster mode)	✗ (No dedicated mode)	✗ (Not described)	✗ (No dedicated mode)	✗ (Not described)
Minimal Setup	✓ (Auto-start, no login/pairing)	✓ (Minimal, turn on Bluetooth)	✓ (Simple, minimal setup)	✗ (No login needed)	✓ (Minimal registration)
Aggregated Needs Map	✓ (Planned visual map for rescuers)	✗	✗	✗	✗
Encryption & Security	⚠ Planned (transit + storage)	⚠ Some encryption, not full	⚠ Basic security	✓ Strong privacy & encryption	✓ Strong encryption/privacy