**Phase 2: Innovation & Problem Solving**

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**Title: AI-Driven Natural Disaster Prediction &Management System**

**Innovation in Problem Solving:**

* In this Phase, we aim to build an AI, IoT, and cloud-based system to enhance disaster prediction, real-time warnings, evacuation planning, and post-disaster recovery, prioritizing marginalized communities and those with varying literacy and tech access.

**Core Problems to Solve:**

1. **Inaccurate Early Warnings:** Existing systems lack real-time data and regional specificity.

2. **Information Accessibility Gap**: Vulnerable groups (children, elderly, rural populations) miss critical warnings due to technological or literacy barriers.

3**. Disjointed Response Infrastructure**: Poor interagency coordination and lack of real-time shelter and transportation information hinder response efforts.

4. **Communication Disruptions**: Network failures during disasters impede essential information exchange.

5. **Inadequate Damage Reporting**: Citizens lack a direct channel to report damage and request assistance.

**Suggested Innovative Solutions:**

1. **AI-driven Disaster Prediction Engine:**

* **Overview:**Historical cyclone/flood data, weather patterns, IMD/USGS satellite API trained AI model.
* **Innovation**: Real-time improvement in accuracy using machine learning and local weather anomaly crowd-sourced integration. Additionally, it identifies trees at risk of falling and suggests trimming recommendations to mitigate infrastructure damage.
* **Tech Stack:** Python, TensorFlow, OpenWeatherMap API, IoT, satellite data streams.

2. **Multi-Platform Alert System (Low-Tech Friendly):**

* **Overview**: Voice message, color-coded signal, and push notification alert system.
* **Innovation**: Allows even illiterate or visually/hearing-impaired individuals to comprehend danger levels and instructions.
* **Tech Stack:** Mobile, React Native, multilingual TTS, IVRS (phone calls)

3**. Dynamic Evacuation Route & Shelter Mapping**

* **Overview**: Dynamic route update based on roadblocks, waterlogging, and traffic information.
* **Innovation**: Booking system incorporated for local shelters; gives priority to elderly, children, and disabled.
* **Tech Stack**: Google Maps API, GeoJSON, RFID tags for shelter entry.

4. **Community Feedback & Post-Disaster Recovery Reporting**

* **Overview:** Users' interface to report broken roads, power outages, or missing individuals.
* **Innovation**: Crowdsourced data to enable authorities to deliver services quicker.
* **Tech Stack**: Angular for dashboard, Firebase for real-time updates, AI image recognition for photo damage reporting.

**Implementation Strategy:**

1. **Development of the AI Engine:**

* Past cyclone/flood data is cleaned and inputted into the model.
* Over time, predictions get better based on local reports and live weather APIs.

2. **Construction of Inclusive Alert Systems:**

* English voice alert prototypes.
* Visual color-coded warning charts embedded in mobile/web app.

3. **Shelter & Evacuation Mapping:**

* Integration with local maps and crowd reports to offer real-time safe zones.

4. **Community Reporting Dashboard:**

* Authority dashboard filters for urgency and geolocation tags reports.

**Challenges & Solutions:**

1. **Network Failure**: Solved through Bluetooth mesh and offline caching solutions.
2. **Low User Tech Literacy**: Easy interfaces, voice instructions, and local language support.
3. **Prediction Errors**: Ongoing data feedback loop and expert model training enhance accuracy.
4. **Mistrust in Tech**: Explanatory model behavior and human-in-the-loop verification establish trust.

**Expected Outcomes:**

1. **Accurate, Real-Time Predictions**: Aids in saving lives with AI-fueled early warnings.

2. **Universal Alert System**:Alerts come to all – young, elderly, rural, and tech-incompetent.

3. **Enhanced Coordination**:Up-to-date shelter and transport information facilitates easier evacuations.

4. **Resilience by the Community**: Citizens are empowered to be active contributors and fixers.

5. **Disaster Recovery Speed-up**: Damage information facilitates quick response from government and NGOs.

**Next steps:**

1**. Prototype Pilot:** Pilot test alert system, shelter reservation, and feedback loop with a specified community in Tamil Nadu.

2**. Interoperability with Government Systems**:Integrate with IMD and disaster management teams in the local areas.

3**. Field Testing**: Install a test system within a cyclone-hit coastal village.

4**. Scalability Design**: Design infrastructure for large-scale real-time predictions as well as traffic of users.

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