Google Cloud

H2S

AI for Impact

APAC Hackathon 2024

A social-first initiative

Registration Deadline: Sun 17 November 2024

Team Details

Team name: **Nataraja**

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Problem Statement: **Forcasting Natural Disasters**

Brief about the idea :

The **Household Weather Monitoring System** leverages cost-effective IoT weather sensors and cutting-edge AI technologies to collect and analyse hyper-localized weather data. This innovative solution delivers real-time updates, disaster forecasts, and actionable insights, enabling households and local authorities to make data-driven decisions. By decentralizing traditional weather monitoring, the system addresses the challenges of large-scale meteorological predictions, providing precise insights into microclimate variability for improved preparedness and resource optimization.

How different is it from any of the other existing ideas?

This solution stands out from existing ideas in the following ways:

- **Household-Level Data Collection:** Unlike traditional systems that rely on large-scale meteorological data, this solution focuses on collecting hyper-localized data directly from households, ensuring greater accuracy and relevance.
- **AI-Driven Precision:** It leverages advanced AI algorithms for pattern recognition, enabling highly accurate disaster forecasting and early warning systems.
- **Community-Centric Insights:** By integrating crowdsourced data aggregation, the system fosters a collaborative network, providing actionable, community-driven insights that benefit households and local authorities alike.

How will it be able to solve the problem?

By leveraging cutting-edge technology, the system bridges the gap between large-scale weather forecasts and household-level preparedness.

- **Localized and Timely Alerts:** The system delivers precise, real-time weather updates and disaster alerts tailored to specific households. This significantly reduces response times during emergencies, empowering users to take timely actions and mitigate risks effectively.
- **Actionable Insights for Daily Activities:** Leveraging AI-driven analysis, the solution provides practical, customized recommendations to households. These insights help optimize energy usage, safeguard properties, and prepare for adverse weather conditions, improving overall safety and convenience.

USP of the Proposed Solution?

This solution combines cutting-edge technology with a community-driven approach to address the limitations of existing weather monitoring systems. Its unique features make it highly impactful and accessible.

- **Affordable and Scalable:** The solution uses low-cost IoT devices, making it accessible to households across diverse economic backgrounds. Its scalable design ensures seamless integration into both urban and rural settings.
- **AI-Powered Insights:** Advanced AI-driven analytics provide precise weather trend predictions and disaster forecasting, enabling users to make informed decisions with confidence.
- **Community-Centric Approach:** By leveraging crowdsourced data, the system fosters collaboration among users, generating actionable insights that benefit both individuals and the broader community.

Target Implemented Areas :

The Household Weather Monitoring System is designed to address challenges in disaster preparedness and weather forecasting across diverse regions. Below are the suggested implementation areas:

- **Urban Areas Prine to Flooding and Extreme weather** : Impact – Provides real-time flood alerts and heatwave warnings, helping densely populated areas prepare effectively.
  Example - Mumbai, Jakarta, Manila
- **Rural Agricultural Regions** : Impact – Assists farmers with precise weather forecasts, Improving crop managements, Irrigation schedules, and pests control strategies.
  Example – Bihar (India), Great plains (USA)
- **Coastal Regions vulnerable to cyclones** : Impact – Enable early cyclone tracking and tailored evacuations plans to minimize property damage and casualties.
  Example – Odisha (India), Florida (USA)
- **Remote and undeserved communities** – Impact – Provides affordable, localized weather data in area in area with limited access to centralized forecasting system.
  Example – Tribal regions in Jharkhand (India), Sub Saharan Regions
- **Educations and research pilots :** Impact - Validate AI models and foster further innovations through research collaboration.
  Example - Universities and research centers focusing on climate studies.

By implementing the system in these areas, we aim to showcase its adaptability, scalability, and potential for significant real-world impact.

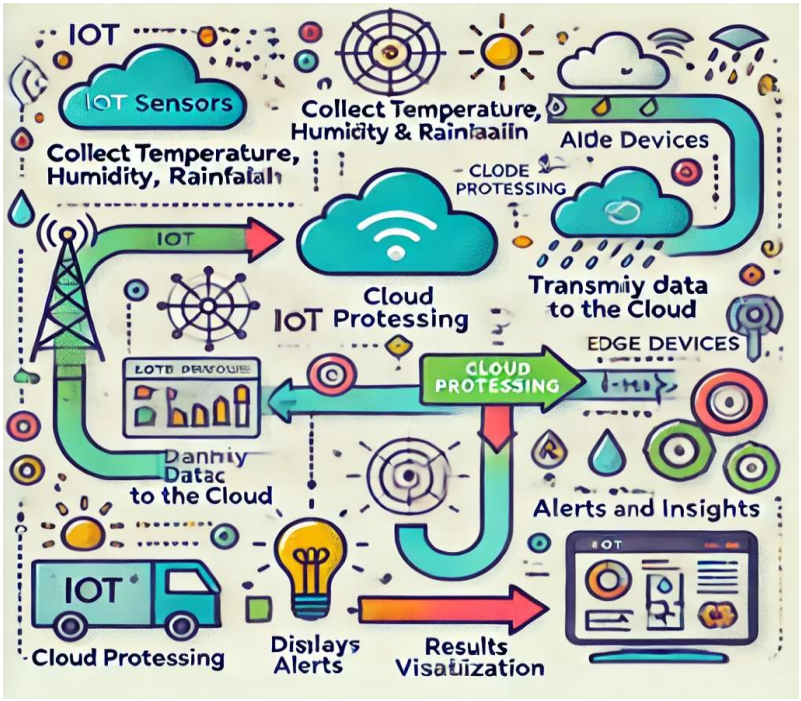
List of Features Offered by the Solution :

- **Real-Time Weather Updates:** Provides hyper-localized weather data analysis with instant alerts, ensuring users stay informed about current conditions in their specific areas.
- **Disaster Forecasting:** Offers advanced early warning systems for potential floods, storms, and heatwaves, enabling households to prepare and respond effectively.
- **Customized Alerts:** Delivers tailored notifications based on individual household preferences and needs, enhancing user relevance and convenience.
- **Energy Optimization Suggestions:** Generates actionable insights to help households optimize energy usage and conserve resources during extreme weather conditions.
- **Interactive Dashboard:** Features an intuitive and user-friendly interface for visualizing weather trends, forecasts, and actionable recommendations.
- **Crowdsourced Data Network:** Aggregates data from multiple households to improve accuracy and reliability, creating a collaborative and community-driven ecosystem.

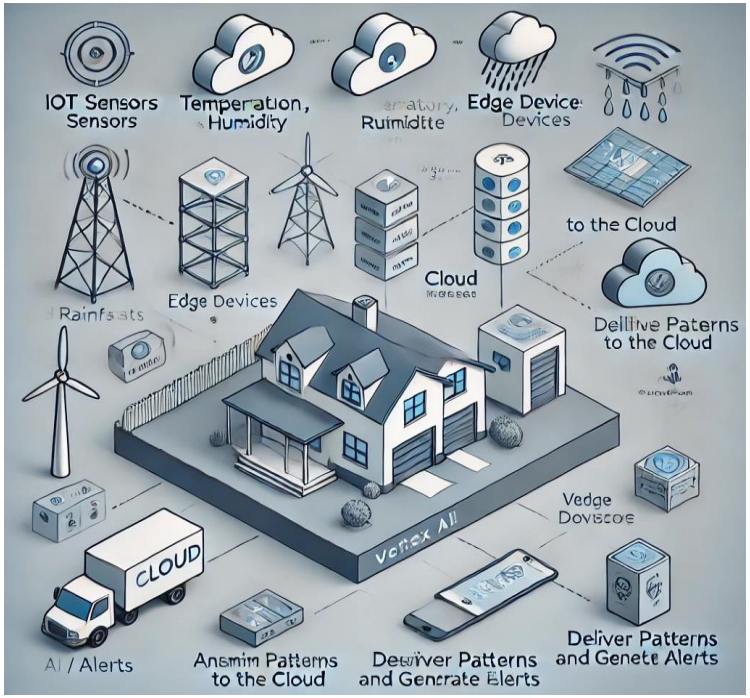
Process Flow Diagram :

- **IoT Sensors:** Devices installed in households collect real-time weather data, including temperature, humidity, and rainfall.
- **Edge Devices:** Securely transmit the collected data to a centralized cloud storage system, ensuring minimal latency and high reliability.
- **Cloud Processing:** AI-powered models analyze the transmitted data to identify patterns, detect anomalies, and generate accurate weather forecasts.
- **Results Visualization:** Processed insights and alerts are displayed on intuitive dashboards and mobile apps, enabling users to access information effortlessly and make actionable decisions.
- **Community Feedback Loop:** Aggregated data from multiple households is utilized for long-term trend analysis, improving the accuracy of AI models and fostering a collaborative, community-driven ecosystem.

Wireframes/Mock diagrams of the proposed solution :



Architecture diagram of the proposed solution :



Technologies to be used in the solution :

- **IoT (Internet of Things):** Utilized for data collection through sensors for temperature, humidity, and rainfall monitoring.
- **Google Gen AI Tools:** Leveraging Vertex AI for predictive analysis and anomaly detection to gain actionable insights from the collected data.
- **Cloud Platforms:** Google Cloud will be employed for efficient data storage, processing, and scaling of applications.
- **Dashboards:** Data visualization will be built using **Tableau** or **Power BI** to present real-time analytics and trends.
- **Mobile App Development:** The user interface and interaction will be developed using **Flutter** or **React Native** for cross-platform compatibility.

Phased Implementation Approach

To ensure the effective rollout of the Household weather Monitoring system, the following phase implementation plan is proposed :

- **Phase 1 : Pilot Development -**
  - Target a small urban Neighborhood or Rural community.
  - Equip 20-30 household with IoT Sensors and gather Feedback on system usability and data accuracy.

- **Phase 2 : Regional Scaling -**
  - Expand the solutions to larger communities or district based on the success of the Pilot Phase.
  - Incorporate additional features like air quality monitoring or agricultural insights.

- **Phase 3 : National/Global Scaling -**
  - Partner with Government agencies, and Private Organizations to deploy the system in disaster-prone areas.

This phased approach ensures scalability and adaptability, catering to the specific needs of diverse regions while minimizing risks during initial implementation.

Use Case of Google Gen AI Tools :

- **Vertex AI:** Used for training localized weather prediction models and performing anomaly detection to forecast weather patterns and identify irregularities in the data.
- **Gemini AI:** Generates personalized alerts and provides actionable insights based on weather data, offering tailored notifications to users.
- **Gemma:** Handles real-time user queries regarding weather conditions, offering immediate and accurate responses to enhance user experience.

Estimated Implementation Cost :

- **IoT Devices:** $20 - $50 per household, depending on the type and number of sensors required (temperature, humidity, rainfall).
- **Cloud Services:** $500/month for initial scaling on Google Cloud, covering data storage and processing needs.
- **Development Costs:** $10,000 - $15,000 for app, dashboard, and AI integration, including development of user interfaces and backend systems.

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Thank You