Use Case: AI-Powered Extreme Weather Advisor in Bangladesh

Overall Objective

To strengthen the resilience of drought impacted farmer communities in Bangladesh, by deploying an AI-powered extreme weather advisor. This virtual assistant would support farmers by providing localized information, and actionable mitigation steps for drought-related risks. This aims to improve resilience and reduce exposure to extreme weather events by leveraging new AI driven information, ultimately benefiting farmers and rural communities.

Rationale

Climate change is increasing the frequency of extreme weather events such as hail, heatwaves, droughts, and wildfires, creating an urgent need for timely, localized early warnings. Roughly 60% of Bangladesh's population lives in rural areas, with livelihoods heavily reliant on agriculture, fisheries, and livestock. Bangladesh is highly susceptible to disasters due to its socioeconomic characteristics and exposure to climate change. Drought critically affects the agricultural economy, particularly in the northwestern region. Droughts are frequent, jeopardizing water availability and food security. Bangladesh is well positioned to leverage its high mobile network coverage, with over 99% of the population covered by 3G networks. Affordability of data mobile broadband services is also estimated at 0.66% of GNI (gross national income) per capita, which is better than the global average of 1.24% of GNI per capita.

The United Nations (UN) Secretary General launched the Early Warnings for All (EW4All) initiative in 2022, which stipulates that by 2027, every person in the world should be protected by an early warning system (although this would require consistent use of the AI driven chatbot by farmers communities). Bangladesh is one of the first 30 particularly at-risk countries selected for roll-out activities of the EW4All initiative.

Mobile phone penetration in Bangladesh is very high, with mobile connections exceeding the total population. The EW4All initiative comprises the four foundational pillars of early warning systems: **Pillar 1:** Disaster risk knowledge (UNDRR), **Pillar 2:** Detection, observation, monitoring, analysis and forecasting (WMO), **Pillar 3:** Warning dissemination and communication (ITU), and **Pillar 4:** Preparedness and response capabilities (IFRC). Through this initiative a roadmap for early warnings

was developed. Although it is imperative to thoroughly address these pillars, the AI Powered Extreme Weather Advisor only addresses this in part (i.e. part of Pillars 1, 3 and 4).

The AI-powered Extreme Weather Advisor will enhance drought mitigation and preparedness for farmers communities. This chatbot will provide tailored alerts and guidance, integrating current indicators, forecasts, and advisories to offer timely mitigation steps like water conservation and crop management. While primarily intended for Bangladesh's agricultural communities, it can benefit other drought-affected stakeholders indirectly.

Personas

- **Subsistence Farmer:** Amari is a 35 year-old subsistence farmer living in a remote agrarian village located in Bangladesh, about 100 kilometres from the capital. He lives in a modest mud house supporting a family of 6 which includes his wife, two kids and his ageing parents. His family is completely dependent on the food he grows and a small income he earns by selling surplus produce at the nearest market, which is around 5 kms away from the village. He cultivates a small plot of land using traditional farming practices and is dependent on rainfall-fed subsistence agriculture, growing crops and fruits during the rainy season. Water for farming and household needs are met by a nearby seasonal stream and a shallow borewell which often dries up during the hot summer. In recent years, the country has witnessed unpredictable rainfall patterns with uncertain onset of the wet season, erratic rainfall and prolonged periods of dry spell. All this has resulted in poor crop yields and higher failure of crops due to insufficient rainfall, soil degradation, water scarcity, leading to rising food insecurity within the region. Traditionally, Amari could rely on indigenous knowledge and practices to plan his planting and harvesting, but the current climate variability has made these methods unreliable.

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1 https://www.aciar.gov.au/publication/aop2024/south-asia-region-program/bangladesh

2 https://www.sciencedirect.com/science/article/abs/pii/S0022169423010387

3 Raisa Afrin, Rumana Sultana, Md. Shafiul Alam, A Comprehensive analysis of drought vulnerability in the Barind region of Bangladesh: A socio-ecological systems approach, Ecological Indicators, Volume 160, 2024, 111863, ISSN 1470-160X, URL: https://www.sciencedirect.com/science/article/pii/S1470160X24003200

4 ITU DataHub. Country profiles: Bangladesh. URL: https://datahub.itu.int/data/?e=BGD

Amari lacks access to reliable and practical information on adapting his current farming practices in the face of increasing droughts and shifting climate patterns. While he occasionally receives tips from fellow farmers or local traders, such as switching to different crop types or adjusting planting times, he is unsure about the accuracy, scientific soundness and suitability of the advice for his land. This makes him feel uncomfortable about making farming decisions that may impact his family's food supply and income. Traveling to the nearest agricultural extension office in the regional town can be time consuming, expensive, and disruptive, especially since he cannot afford to be away from the farm for long. Amari has access to a basic smartphone, but limited knowledge of app usage. He fears that without clear, localized guidance, he might plant too early or too late or invest in seeds that won't survive the season. All these uncertainties make adapting to climate change feel overwhelming for Amari. The lack of reliable information, limited mobility, and constant fear of losing his crops leave him uncertain about what to trust and how to move forward.

Key Features (Minimum Viable Product)

- **Mobile-Friendly, Accessible, and Multi-Channel:** The chatbot is optimized for mobile use and accessible across multiple channels—primarily WhatsApp (widely used in Bangladesh), with optional support for SMS, Facebook, and other messenger apps.

- **Multi-Lingual:** The languages to be supported by the chatbot are specifically 1) English and 2) Bengali (AKA Bangala)

- **Integrated Weather-Based Advisory:** The chatbot should combine real-time and forecasted weather data with proven agricultural best practices from trusted sources such as manuals, handbooks, and government extension materials. This integration will enable the chatbot to deliver timely, context-specific advice—such as when to irrigate, apply fertilizer, or delay planting—based on both current weather conditions and agronomic guidance tailored to the farmer's crop, location, and farming stage.

- **Clear, Actionable, and Tailored Guidance:** The chatbot should deliver easy-to-understand, non-technical advice focused on immediate, practical actions farmers can take. For more complex tasks, the guidance should be broken down into simple, step-by-step instructions. All recommendations must be tailored to the specific needs of the

farmer (e.g., determining the timing of irrigation, selecting drought-tolerant crops, etc.) to ensure relevance and effectiveness.

- **Push Notifications and Warnings:** Admins (Bangladesh Meteorological Department) can schedule alerts to be sent to users (Farmers) on topical events (e.g. extreme weather) or such notifications and warnings can be automated based on weather data.

Optional Features

- **General Population Considerations:** Ability to share advisories or raise-awareness about drought as relevant to the general public (i.e. fire prevention, water conservation, UV protection). Any benefit to the general population will be contingent on the data ingested into the solution. The primary focus is on farmers

- **Voice-Enabled Interface:** Many smallholder farmers may have low literacy levels. A voice-based interface would allow them to speak their questions and receive spoken answers.

- **Feedback and Continuous Improvement Mechanism:** Expected solutions will significantly contribute to creating a library of open-source codes. National weather agencies and agromet services can either implement these codes or use them to develop their own systems, which lowers the barrier to AI integration in delivering early warnings. This also complements National weather agencies' services in providing personalized risk mitigation for impending or occurring droughts in various ways.

Expected Benefits

- **Improved reach of Information:** Citizens (especially farmers) would have immediate access to accurate and up-to-date public weather information and advisory, that is contextualized for their own specific needs on the fly.

- **Personalized Recommendations:** Personalization based on geographic or demographic parameters leads to more tailored and applicable information which individuals are more likely to follow.

- **Location-tailored Approach:** For public weather institutions, the system can amplify usage of available data and information in a complementary manner which increases action based on the weather agencies forecasts and national emergency protocols.

- **Better outcomes for farmers:** The confluence of local weather information and warnings with specific best practices for farmers managing specific crops at specific times of the year, including key mitigation strategies for them in the face of unusual or impending weather events that can impact their output, will help with preparation and mitigation to drive better outcomes.

- **Evidence-Based Decision Making for Policy Makers:** Aggregated data on farmer needs, usage trends, and system feedback supports data-driven planning and policy formulation at both local and national levels.