PROD-E-G HACKATHON SUBMISSION

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Problem Statement

- India's water inefficiency in agriculture is unsustainable. As per the reports from SIWI, India has only 4% of the world's water resources, even though it has 18% of the world's population.
- India's agriculture is among the least efficient users of water in the world. Example : On average, it takes 5,600 liters of water to produce 1 kg of rice in India, compared to only 355 liters in China which is staggering 93% reduction. This inefficiency leads to massive water wastage, which is unsustainable, particularly in regions where water scarcity is a growing problem. I have witnessed this first-hand in my own family, as my grandfather has faced significant water shortages on our farm.
- Traditional irrigation systems flood fields without considering factors like soil moisture or weather conditions, exacerbating the issue of water wastage.

Proposed Solution

Product Name: AquaSmartAgri

- **AquaSmartAgri** is an intelligent, end-to-end Smart Irrigation System designed to optimize water usage in agriculture by leveraging **IoT** (Internet of Things), **AI** (Artificial Intelligence), real-time environmental data and data received from IMD (India Meteorological Department).
- It ensures water is used only when and where needed, thus reducing water wastage, increasing crop yield, and conserving precious resources.
- The product(**AquaSmartAgri**) is especially targeted at large farms (that are used for producing large scale export agri goods) in water-scarce regions, where inefficient irrigation leads to excessive water use.
- **AquaSmartAgri Lite** (similar set-up with less resources) is targeted at small agricultural land owners (which is prevalent in Indian context).

Key Components

1. **IoT-Enabled Sensors**
2. **AI-Based Predictive System**
3. **Automated Irrigation Control**
4. **Mobile & Web Application**

Key Components of Product

IoT-Enabled Sensors

- Soil Moisture Sensors: Deployed in the field to continuously monitor soil moisture levels in real-time.
- Environmental Sensors: Measure humidity, temperature, and sunlight, providing comprehensive data about the farm's micro-climate.
- Water Flow Meters: Monitor water usage to track the amount of water delivered to different sections of the farm.

AI-Based Predictive System

- AI Algorithms: Use historical data, current sensor readings, and weather forecasts to predict the exact amount of water needed for each crop.
- Weather Integration: Incorporates weather forecasts to adjust irrigation schedules dynamically. For example, irrigation is paused if rain is predicted.
- Crop-Specific Optimization: Tailors irrigation levels based on crop type, growth stage, and local environmental conditions.

Automated Irrigation Control

- Smart Irrigation Valves: Automatically open and close based on AI-driven irrigation schedules. These valves are connected to both drip and sprinkler irrigation systems for efficient water distribution.
- Zone-Based Irrigation: Allows for precise control of water distribution across different zones of the farm based on real-time data, ensuring that only areas requiring water receive it.

Mobile & Web Application

- Real-Time Monitoring: Farmers can monitor their irrigation system in real-time through a mobile or web interface, with data on soil moisture, weather, and water consumption.
- Remote Control: Enables farmers to manually control the system or override automatic settings when needed.
- Alerts & Notifications: Sends alerts if there are anomalies, such as a sudden drop in soil moisture or unexpected weather conditions.

Technology Stack & Resources Used

Hardware:

- Soil moisture sensors, environmental sensors, and water flow meters.
- Smart irrigation valves connected via wireless communication (LoRa, Zigbee).
- Centralized gateway to collect sensor data and communicate with the cloud.

Software:

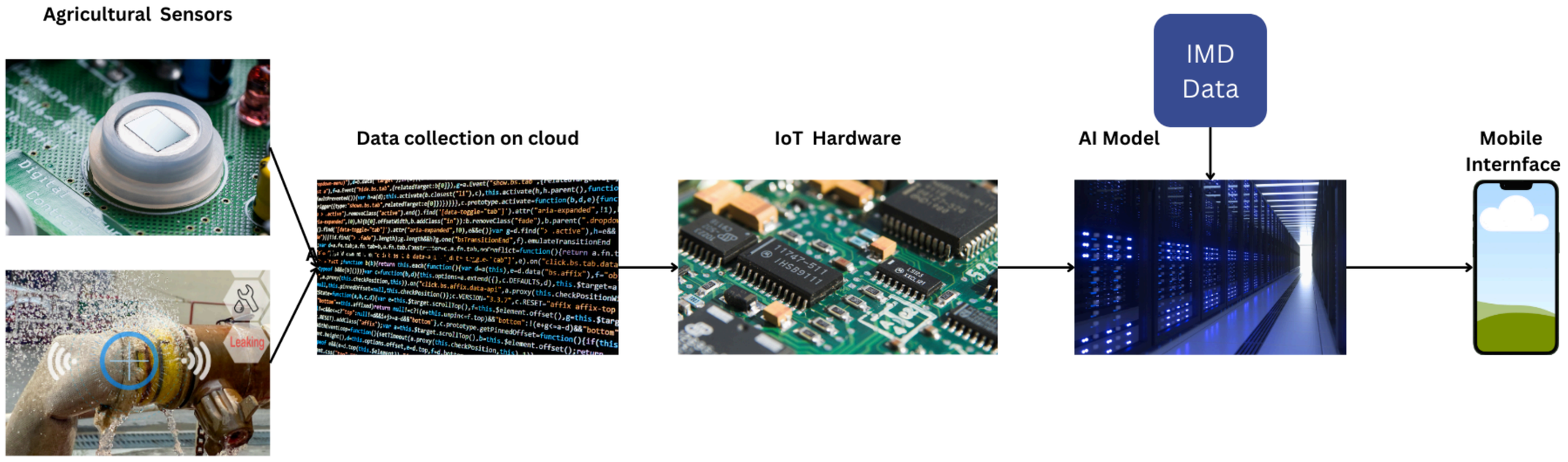
- AI-based predictive analytics engine for dynamic water scheduling (based on crop type, weather data, soil condition & humidity etc)
- Cloud-based platform (**thingspeak**) for real-time data collection and storage.
- Mobile app or web page (built using Flutter/React Native) for simplified user interaction and remote control.

Communication:

- Wireless technologies such as LoRa for long-range communication between sensors and the centralized gateway.
- Wi-Fi/GSM for cloud communication and app/web integration.

Prototype *Link*

Pictoral representation of whole product from farm to mobile app



Effectiveness

Water Conservation:

- Potential to reduce water consumption by **30-40%** through precise, need-based irrigation.
- Helps close the gap between India's average water consumption for crops like rice, sugarcane & cotton and the more efficient practices in countries like China & Israel.

Cost Efficiency:

- Reduces operational costs by optimizing water use and reducing the need for water storage and distribution infrastructure.
- Long-term savings on water bills and increased crop yield/export due to better hydration management.

Scalability:

- Large Farms: The system's modularity makes it scalable to large agricultural operations, covering multiple zones of land with tailored irrigation schedules.
- With adoption of technology & government subsidy, this can be adapted by small-scale farms as well where ***Digital India Campaign*** will be crucial for rapid adoption across India.

Sustainability:

- Supports sustainable farming practices by minimizing resource waste, preserving groundwater levels, and ensuring long-term soil health.
- It can directly impact ***National Water Mission*** of achieving water use efficiency by 20%.

Use Cases

Large Agricultural Enterprises:

- Larger farms can benefit from more sophisticated sensor networks and predictive AI, customizing the system for different crops across diverse landscapes. This results in increased yields and significant reductions in water use, particularly in water-intensive crops like rice (over 20% of the country's total agricultural exports), sugarcane & cotton.
- For AquaSmartAgri, we’ll install various sensors to increase accuracy using localisation of data collection.

Small Family Farms:

- Farmers can set up a cost-effective version of AquaSmartAgri (Lite- version) with basic sensors and smart irrigation valves. This provides immediate water savings and ensures that crops like rice, groundnut, wheat, and vegetables get optimal hydration without excess water use.
- For AquaSmartAgri Lite, we’ll use data from IMD (India meteorological department) & train our AI model for better yield, water management & planning of next season as well.

Thank You

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