Executive Summary

Integration of IoT in Irrigation; *Kanad*

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The agricultural industry plays a vital role in sustaining human life. However, traditional irrigation practices have resulted in the excessive use of non-renewable resources such as water, energy, and fertilizers from fossil fuels, causing soil fertility degradation and subsequent crop production decline. To address this issue, we propose a precision agriculture system, Kanad, which employs advanced technologies to optimize water usage and conserve this precious resource.

Kanad is a deep learning neural network-based Internet of Things (IoT)-enabled intelligent irrigation system designed to predict soil moisture levels using a long short-term memory network (LSTM). This machine learning component improves its accuracy with each entry, enabling farmers to use water more wisely than traditional sprinkler irrigation systems. Furthermore, Kanad uses sensors to collect data from the farm field, which is processed by a convolutional neural network (CNN) to predict potential crop diseases and suggest appropriate fertilizers based on soil conditions. ***Kanad*** is a more efficient farming system that has four parts to it:

- **Smart Irrigation** - Data collection through sensors in the farm field.
- **Crop Suggestion** - Using the NPK sensors in our physical IoT module provided to the farmer, farmers can detect NPK (Nitrogen, Phosphorus, Potassium) levels in the soil. Then farmers can enter these values in our web application along with the name of the state, and our deep learning network will utilize this data to suggest crops best suited for that specific soil.
- **Fertilizer Suggestion** - Using the same NPK levels, a separate machine learning can suggest farmers appropriate fertilizers according to the condition of their soil, as assessed NPK levels.
- **Crop Disease Prediction** - Farmers can use the same web application to enter the images of their crops.
- Using CNN (Convolutional Neural Network) our deep learning model will give the name of the potential disease that the crop might have. Currently, this machine learning model has an accuracy of 95.25% so it gives correct predictions almost all of the time.

One unique feature of Kanad is the crop suggestion module, which utilizes NPK (Nitrogen, Phosphorous, Potassium) sensors to detect nutrient levels in the soil. Based on this information and the farmer's location, our deep learning network suggests crops best suited for that specific soil, promoting sustainable and efficient agriculture practices.

Kanad's computational capabilities can accurately calculate the water needs of specific plants/crops based on atmospheric conditions such as humidity and soil moisture, providing optimum irrigation times and conserving water. Compared to other competitive systems such as FANNN and T-based sprinklers, Kanad shows better reliability and water-saving performance using IoT and maintaining optimum soil moisture.

As the world experiences more extreme weather events, Kanad can integrate a heavy rainfall prediction module using IoT technology. This can further optimize water usage by allowing the system to drain excess water before it causes damage to the crops.

We will continue to gather feedback from potential users and use various production validation concepts to improve the system's performance. We have also begun collaborating with local farming administrations to expand user testing and refine our approach to address the critical issue of water conservation in agriculture.