**Smart Plant Monitoring System Report**

#### Introduction

The Smart Plant Monitoring System is a revolutionary approach to modern agriculture, leveraging IoT and AI technologies to optimize plant health and crop yield. This system monitors key environmental indicators such as soil moisture, temperature, and nutrient levels, and provides real-time insights to farmers for informed decision-making.

#### Problem Statement

Modern farming requires efficient monitoring and management practices to optimize crop yield and resource utilization. Farmers often face challenges in remotely monitoring farm conditions and making informed decisions for irrigation and fertilization.

#### Solution Overview

Our solution is a farmer-centric mobile app that integrates Arduino Uno with sensors for soil moisture, temperature, and crop health. The app utilizes an Intel-based Wi-Fi module for seamless communication and the Intel AI Analytics Toolkit for data analysis and prediction models. The system establishes a feedback loop for adaptive farming practices and employs Intel-based edge computing for real-time decision-making.

#### Key Features

1. **Real-time Monitoring**: Sensors collect data on soil moisture, temperature, humidity, light intensity, and crop health, providing farmers with real-time updates on farm conditions.
2. **AI-powered Predictions**: The Intel AI Analytics Toolkit analyzes sensor data to make predictions for optimal irrigation and fertilization, helping farmers maximize crop yield.
3. **Alerts and Notifications**: The app sends alerts and notifications to farmers for critical conditions such as low soil moisture or pest infestation.
4. **Historical Data Analysis**: Farmers can access historical data for informed decision-making and trend analysis.
5. **User-friendly Interface**: The mobile app features a user-friendly interface for easy navigation and data visualization, making it accessible to farmers of all skill levels.

**Implementation Plan**

1. **Hardware Setup**: Connect sensors to Arduino Uno according to their datasheets and integrate the Intel-based Wi-Fi module for communication.
2. **Software Development**:
   * Write code to read sensor data and send it to the cloud using the Intel-based Wi-Fi module.
   * Develop AI models on the Intel AI Analytics Toolkit to analyze sensor data and make predictions.
   * Implement a feedback loop in the mobile app to adjust farming practices based on AI predictions.
   * Use Intel-based edge computing for real-time data processing and decision-making.
   * Design and develop the mobile app using Intel tools and technologies for Android and iOS platforms.

**Utilizing Intel oneAPI and MKL for Enhanced AI Models in Smart Farming**

* For our smart farming project, we have leveraged Intel's powerful toolkits, specifically the Intel oneAPI and Intel Math Kernel Library (MKL), to enhance our AI models and accelerate computations. The Intel oneAPI toolkit provides a comprehensive and unified programming model for heterogeneous computing, allowing us to seamlessly utilize different hardware accelerators such as CPUs, GPUs, and FPGAs. This flexibility ensures that our AI models can take full advantage of the available hardware resources, optimizing performance and efficiency.
* Additionally, the Intel MKL provides a set of highly optimized mathematical functions for various tasks, including linear algebra, signal processing, and statistical analysis. By using the MKL, we can speed up computations, improve numerical accuracy, and enhance the overall performance of our AI algorithms. This is crucial for real-time applications in smart farming, where timely and accurate data analysis is essential for making informed decisions.
* In conclusion, the integration of Intel oneAPI and MKL into our smart farming project has been instrumental in enhancing our AI models and improving the efficiency of our system. These toolkits have enabled us to achieve faster computation times, better performance, and ultimately, more reliable predictions for plant health and resource allocation.

#### AI Algorithms Used

In this project, we are using a neural network for binary classification to predict plant health based on various indicators.

1. **Objective:** The project aims to predict plant health based on various indicators and provide optimal resource allocation suggestions.
2. **Data Generation:** Synthetic data is generated for indicators like soil moisture, temperature, nutrient levels, pest activity, oxygen levels, manure requirements, and weed presence.
3. **Model:** A feedforward neural network is used for binary classification, with 7 input features, 1 hidden layer with ReLU activation, and 2 output units for healthy/unhealthy classification.
4. **Training:** The model is trained using the Adam optimizer and cross-entropy loss function over 100 epochs.
5. **Evaluation:** Model performance is evaluated using a test set, and a classification report is generated using scikit-learn's classification\_report function.
6. **Prediction:** The trained model is used to predict plant health status for new samples.
7. **Feedback:** Based on the prediction, feedback is provided on whether the plant is healthy or needs attention.
8. **Resource Allocation:** Optimal resource allocation suggestions are provided based on the plant health indicators.
9. **User Interaction:** Users can input plant health indicators to get predictions and suggestions for optimal resource allocation.
10. **Technology Stack:** The project uses NumPy for data generation, scikit-learn for model evaluation, and PyTorch for implementing the neural network model.

**Benefits**

* **Increased Yield**: The solution helps farmers maximize crop yield by providing real-time monitoring and AI-powered predictions.
* **Resource Efficiency**: Efficient use of water and fertilizers minimizes waste and reduces environmental impact.
* **Cost Savings**: Early detection of issues and optimized resource use lead to cost savings for farmers.

**Conclusion**

Our Smart Farming Solution leverages IoT and AI technologies to empower farmers with real-time monitoring and data-driven decision-making capabilities. By integrating Intel tools and technologies, we aim to revolutionize modern farming practices and contribute to sustainable agriculture.