Presentation On :

IoT-Based Smart Agriculture System & Crop Health Monitoring System using ML

Of

Bachelor of Engineering

In

Information Technology

by

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"Without farmers, no country can progress."

Content

"Soil is our canvas, crops our art."

Introduction

This **IoT-based smart agriculture system** helps farmers monitor **soil, weather, and crop health** using **sensors and image processing**. It collects real-time data on **moisture, pH, temperature, and humidity**, displaying insights on an **LCD or mobile website / Applications**.
AI-powered disease detection provides **instant recommendations** for irrigation, fertilization, and pest control. By integrating **IoT, cloud computing, and AI**, the system enables **precision farming**, optimizes resource use, and enhances crop yield, ensuring **sustainable agriculture**.

"The land is our inheritance, and we must protect it for future generations."

Objective

- Real-Time Monitoring & Data Collection.
- Smart Irrigation & Organic Fertilization.
- Improve Decision-Making for Farmers
- Reduce Crop Loss and Increase Yield.
- Develop a Scalable and User-friendly Application for Farmers.
- Prediction modelling for crop health.

Literature Survey

- Ramesh M et al. (2022): Provides a broad analysis of IoT in agriculture, suggesting AI/ML integration but lacks experimental results.
- Y. Muhamad (2021): Highlights IoT opportunities in farming with a focus on data privacy but lacks technical implementation.
- V. Sharma & R. Patel (2023): Reviews modern IoT trends in precision farming and proposes blockchain use, but omits cost analysis.
- J. Santos & D. Lima (2021): Offers a systematic IoT review with solid structure but no regional case studies; recommends edge computing.
- M. Ali et al. (2022): Categorizes IoT use in smart farming, with future scope in image processing, though limited on disease detection.

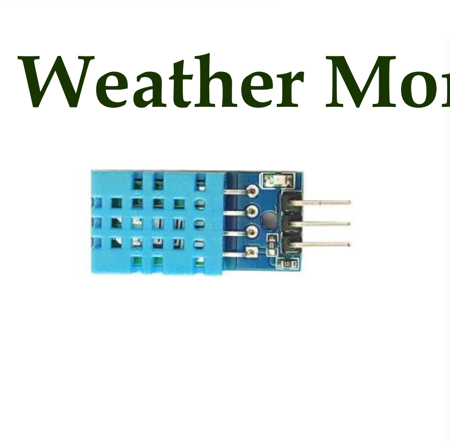
Hardware Component

Microcontroller & Communication :

- Arduino UNO

Sensors for Soil & Weather Monitoring :

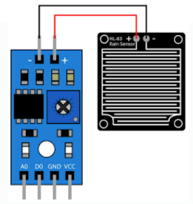
- DHT11/DHT22



- Soil pH Sensor

- NPK Sensor

- Rain Sensor



Display & Power Supply :

- LCD Display

- Battery

Software & Technologies Used

Programming Languages: Python, JavaScript

Development Tools: Arduino IDE, Firebase.

Machine Learning & AI: TensorFlow, OpenCV.

Image Processing: CNN, ResNet 50, SVM, KNN, Decision Tree.

Communication Protocols: WiFi, HTTP.

Cloud & Database: Google Firebase

Web/Mobile Development: React, Flask, HTML, CSS, JavaScript.

Working Principle of the System

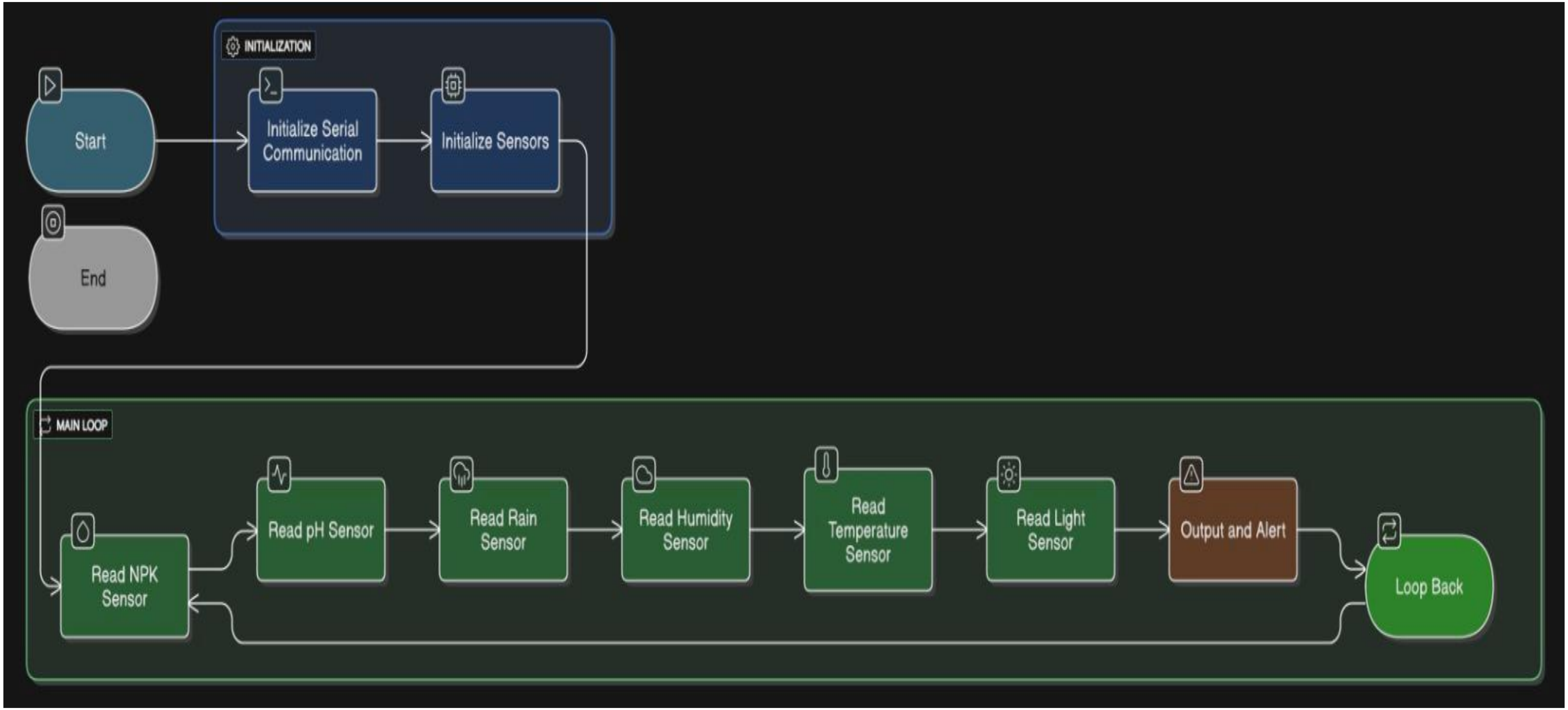
Software (Streamlit Application):

- User Interface: Provides a web-based platform for manual environmental data input and plant image uploads.
- AI Classification (Resnet50): Analyzes uploaded images for diseases, suggests optimal crops based on provided conditions, and generates treatment remedies.
- Image Segmentation (U-Net): Identifies and highlights diseased areas on plant images.

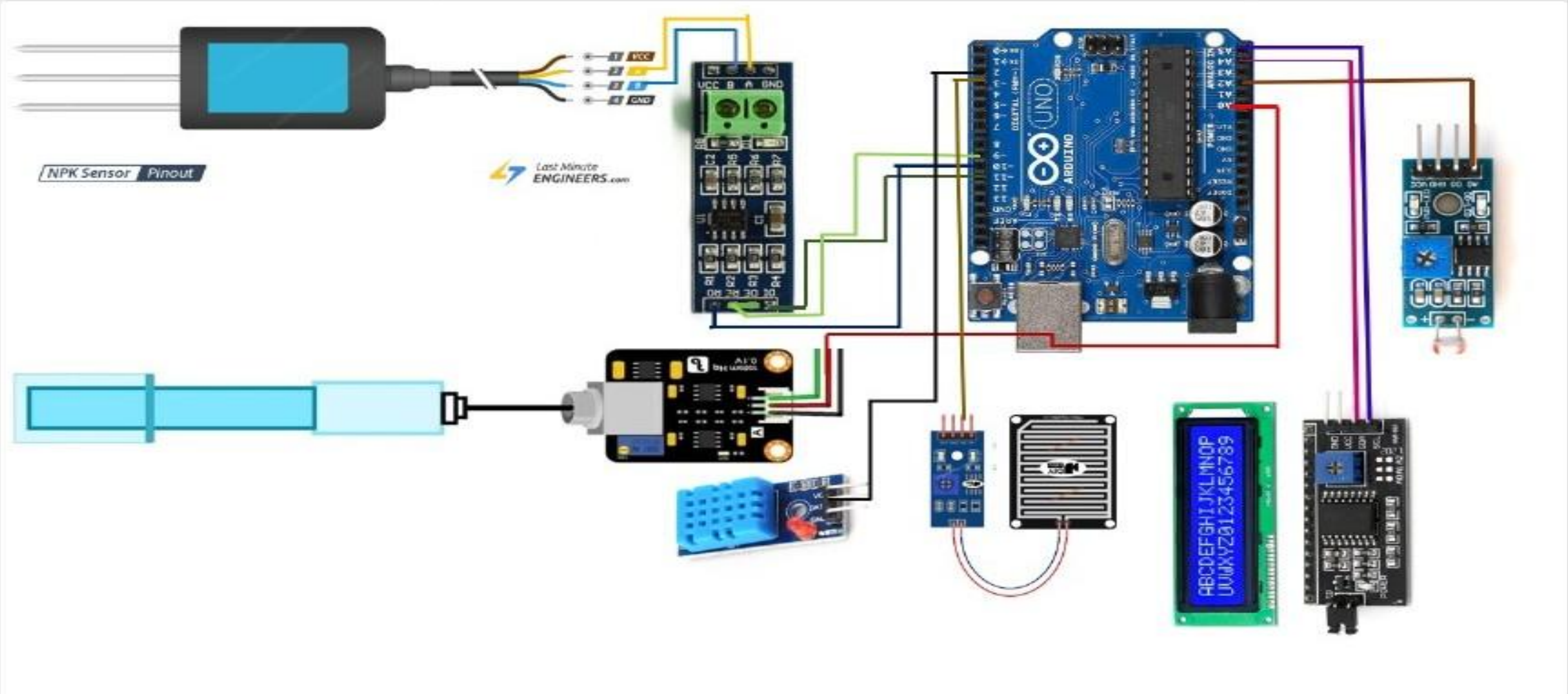
Hardware (Arduino Sensor System):

- Sensor Data Collection: Arduino microcontroller reads real-time NPK, pH, Rain, Temperature, Humidity, and Light data from connected sensors.
- Local Display: Outputs collected sensor values to an attached LCD and a Serial monitor for immediate feedback.

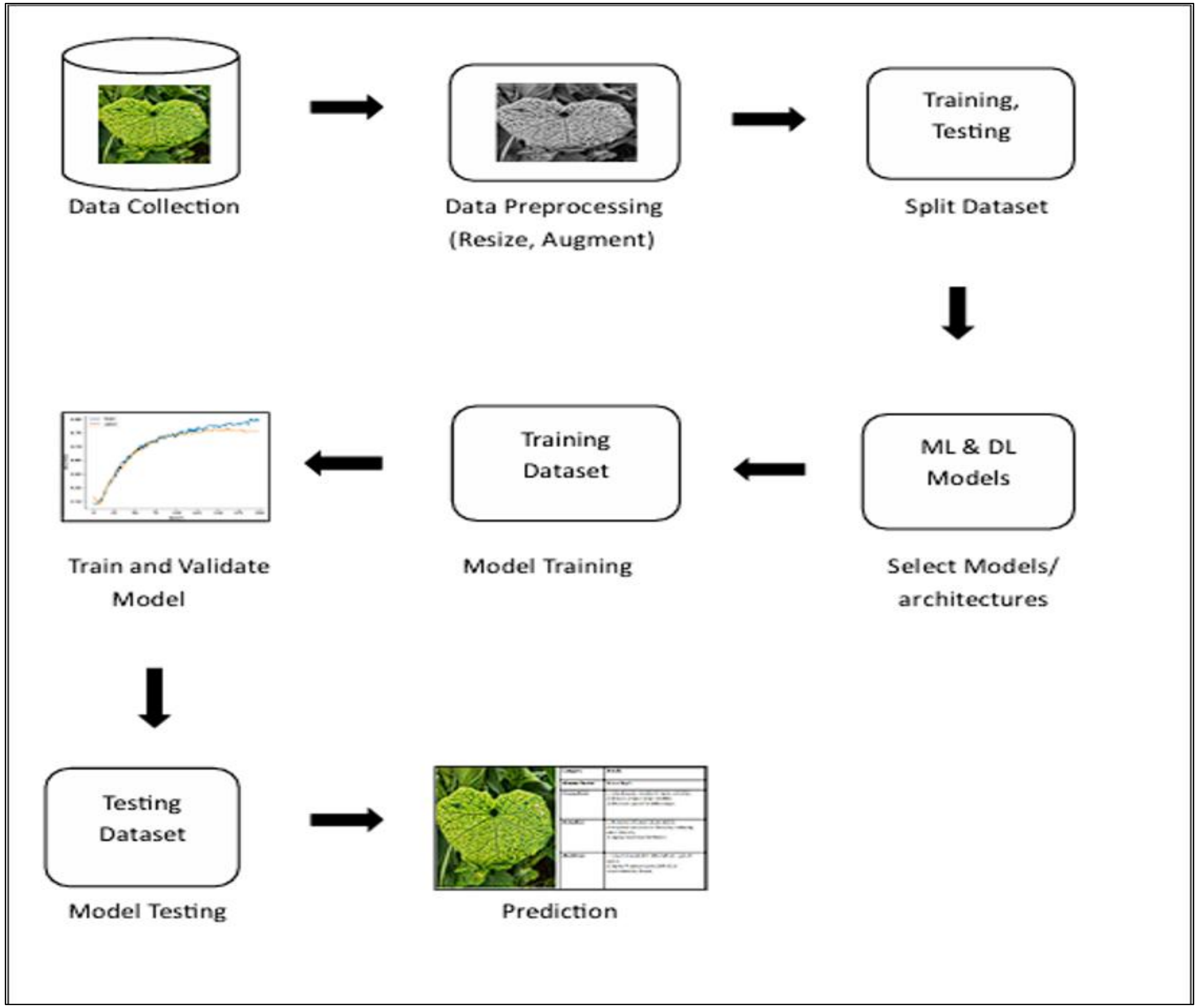
Flow Chart for the Arduino IOT Module



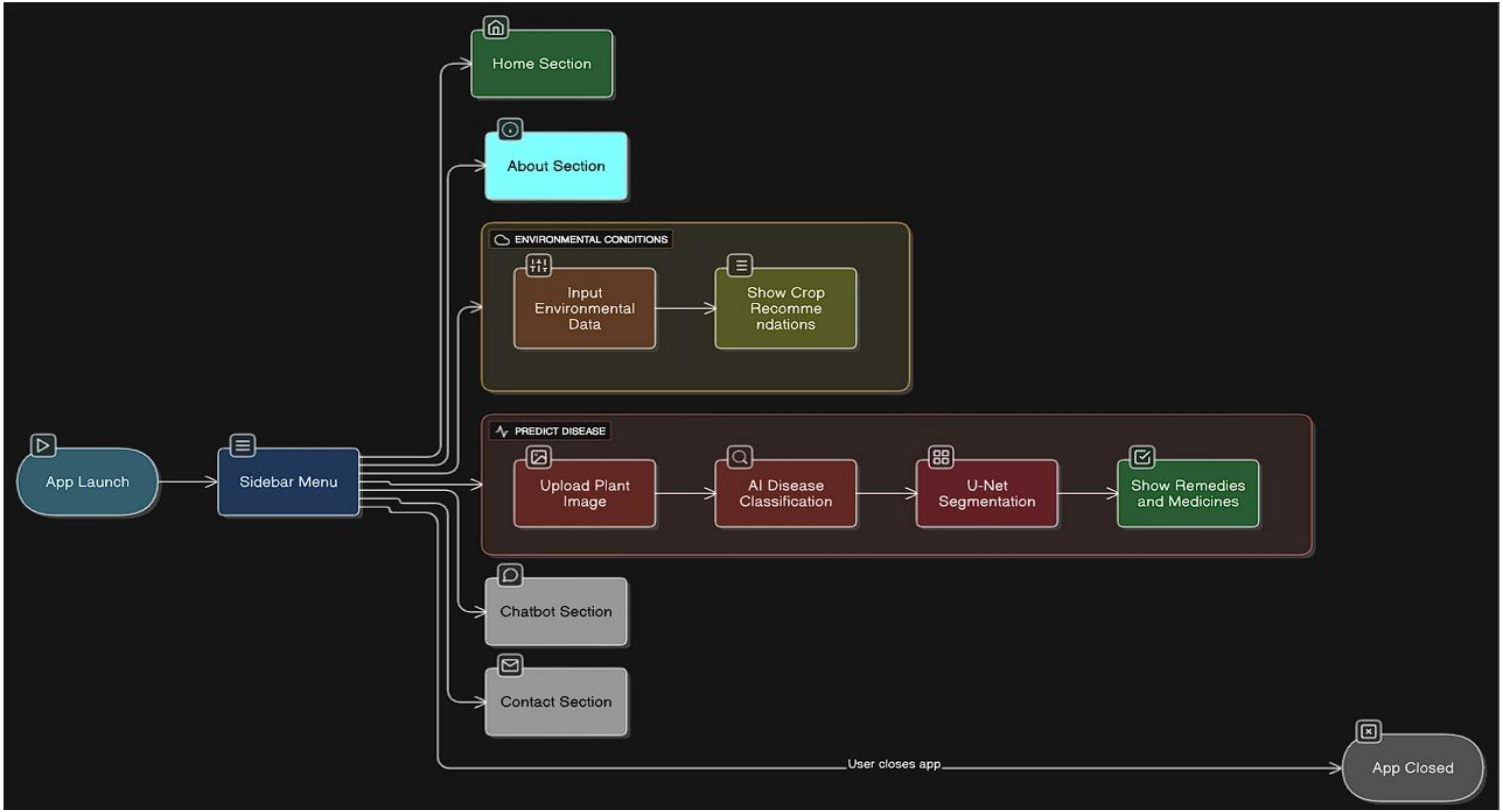
Working Principle of IOT Module



Working Principle of ML & DL Model

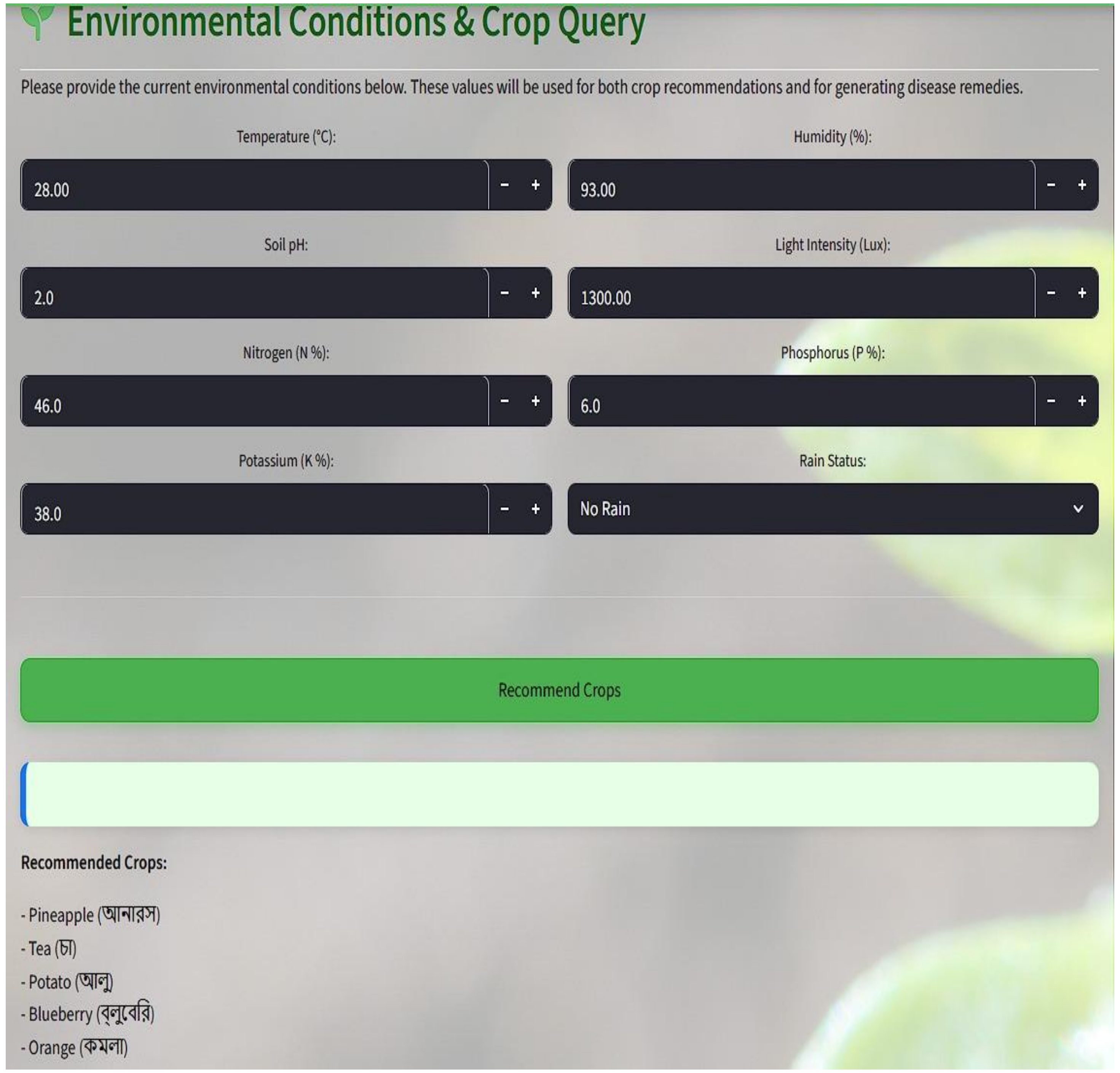


Flow Chart for software section



Results & Discussion

- ➢ The real-time output from our IoT-based agriculture monitoring system was successfully displayed on an LCD screen
- ➢ The weather conditions & values were processed by the crop recommendation system.



Results & Discussion

- A sample image is uploaded to the our disease classification & remedy prediction system.
- Here also environmental conditions applied.

Uploaded Image

Results & Discussion

➢ **The disease classification and remedy prediction models analysed the input and provided following output bellow -**

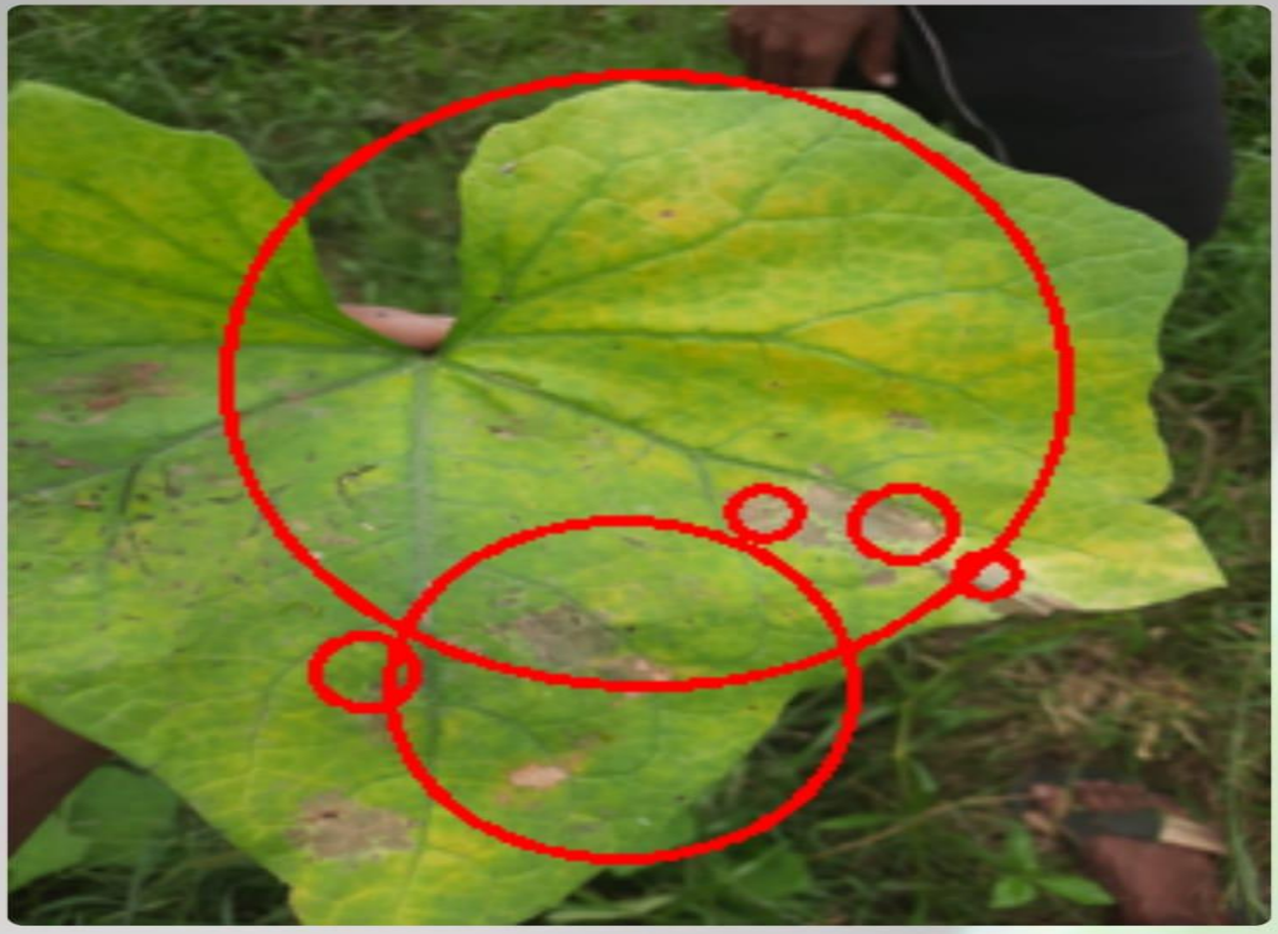
AI Prediction:

Squash Leaf Spot (কুমড়া পাতার দাগ)

Confidence: 97.58%

Current Environmental Conditions (from above section):
Temp: 25.0C, Humidity: 65.0%, pH: 6.5
Light: 10000 Lux, NPK: N10.0% P5.0% K15.0%
Rain: No Rain

Segmented Disease Region:



Detected Infections (Circles show detected infections)

Precautions:

1. Ensure proper spacing between plants to promote air circulation and reduce humidity.
2. Water plants at the base to avoid wetting the foliage, minimizing fungal spread.
3. Regularly inspect plants for early signs of leaf spot and remove affected leaves promptly.
4. Practice crop rotation to prevent pathogen buildup in the soil.
5. Improve soil drainage to prevent waterlogging and reduce disease favorable conditions.
6. Sanitize gardening tools regularly to prevent disease transmission.

Medicines:

1. Apply copper-based fungicides according to the product label instructions.
2. Use chlorothalonil-based fungicides as an alternative, following recommended dosages.
3. Consider mancozeb-based fungicides for broader spectrum disease control.
4. Employ bio-fungicides containing Bacillus subtilis for organic disease management.

Advantages

- **Real-time Monitoring:** Immediate access to soil, weather, and crop data.
- **Increased Accuracy:** Precise NPK, pH, and environmental data helps better crop planning.
- **Resource Optimization:** Efficient use of water, fertilizer, and labor.
- **Improved Productivity:** Smart suggestions lead to better crop yield.
- **Scalable & Customizable:** Can be expanded with more sensors and features.

Dis-advantages

- **Initial Cost:** High setup cost for sensors and devices.
- **Internet/Power Dependency:** System may fail in remote areas with poor connectivity.
- **Maintenance Required:** Sensors and hardware need regular upkeep.
- **Technical Skills Needed:** Farmers may need training to use the system effectively.
- **Sensor Limitations:** Accuracy may vary based on sensor quality and calibration.

Future Scope

- **Live Data Integration:** Implement automatic live sensor data display in our webpage.
- **Chatbot Integration:** Use machine learning to predict crop diseases, yield, and best planting practices.
- **Mobile App:** Develop a user-friendly app for farmers to monitor data and receive suggestions in real-time.
- **Multi-Language Support:** Add regional language support for broader usability among rural farmers.
- **Advanced Sensors:** Include additional sensors (e.g., soil moisture, CO_2, leaf color) for more detailed insights.
- **Wider Connectivity:** Enable long-range communication using LoRa, GSM, or NB-IoT for remote farms.
- **Agriculture Ecosystem:** An interconnected system of farmers, sensors, software, weather data, soil analysis, crop monitoring, market access, and support services that work together to optimize farming outcomes.

Conclusion

- The project successfully demonstrates a smart agriculture system using IoT and sensor technologies.
- Real-time monitoring of key parameters like temperature, humidity, soil pH, NPK values, light intensity, and rainfall was achieved.
- The system provides accurate data for crop recommendation and soil health analysis.
- Farmers can make informed decisions, reduce manual efforts, and improve productivity.
- This solution is scalable, cost-effective, and beneficial for precision farming and sustainable agriculture.

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Feedback & Suggestion

Thank You