



IoT-powered Smart Farming for Soil Moisture and Crop Health

•TEAM 13

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Introduction to Smart Farming



Overview of Smart Agriculture



Definition of Smart Agriculture

Smart agriculture refers to the integration of advanced technologies such as IoT, artificial intelligence, and data analytics into farming practices.

This approach optimizes agricultural productivity and sustainability through precise monitoring and automation of



Importance of Technology in Farming

Technology plays a crucial role in modern farming by enhancing efficiency, improving crop yields, and enabling actionable insights.

By leveraging data-driven approaches, farmers can make informed decisions, reduce resource waste, and adapt to



Benefits of IoT in Agriculture

IoT in agriculture provides real-time data on soil conditions, crop health, and weather patterns.

This allows for timely interventions through automated systems, lessens labor costs, and promotes sustainable farming practices, ultimately leading to higher productivity

Significance of Soil Moisture and Crop Health

01

Role of Soil Moisture in Crop Growth

Soil moisture is a vital factor influencing crop growth as it affects nutrient uptake and photosynthesis. Adequate soil moisture levels ensure optimal plant growth, enhance yield, and mitigate stress during periods of drought.

02

Link between Crop Health and Yield

Healthy crops are more productive, as their physiological processes are optimized for energy conversion and nutrient uptake. The relationship between crop health and yield is direct; healthier plants exhibit higher resistance to pests and diseases, leading to better harvests.

03

Challenges Faced in Traditional Farming

Traditional farming faces multiple challenges, including inefficient water use, unpredictable weather patterns, and a lack of timely data for decision-making. These factors can lead to reduced productivity and environmental degradation.

/02 Dataset Overview



Source of the Dataset

IoT-based Monitoring System

The dataset originates from an IoT-based Smart Agriculture Plant Health Monitoring system that employs numerous sensors to gather real-time data about environmental conditions affecting agriculture.



Environmental and Soil Sensors

Various environmental and soil sensors record critical parameters such as temperature, humidity, soil moisture, light intensity, and other factors, ensuring comprehensive monitoring of crop health and soil conditions.

Details about Data Collection

Continuous Data Transmission

Data collected by the sensors is transmitted continuously to a cloud platform (Thingspeak), enabling real-time monitoring and immediate response to changing conditions in the field.

01

Calibration of Sensors

Sensors are routinely calibrated to ensure their accuracy and reliability in measuring key parameters. This precision is crucial for making data-driven decisions regarding irrigation, fertilization, and pest management.

02

Local Analysis and Cloud Storage

The dataset is stored both in a cloud-based platform for ease of access and visualization and in MS Excel for local analysis. This dual storage approach ensures data integrity and enables diverse analysis options.

03

/03 Data Characteristics



Observations in the Dataset

01

Number of Observations

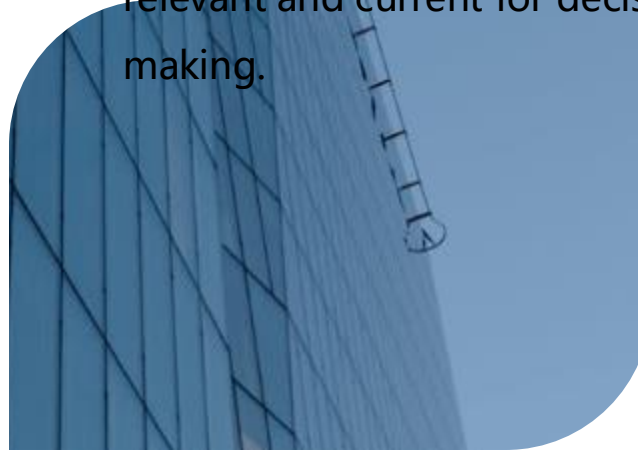
The dataset comprises several thousand observations that capture various environmental parameters over time. Each observation reflects specific field conditions at the moment of data capture.



02

Nature of Data Collection

Data collection is designed to be continuous and consistent, utilizing a robust network of IoT sensors that updates the dataset in real-time. This guarantees that the information is relevant and current for decision-making.



03

Dataset Size and Format

The overall dataset is approximately 150 KB in size, which, while small, contains detailed metrics essential for monitoring soil and crop health. The compact size allows for efficient data handling and processing.



Key Variables in the Dataset



01 Soil Moisture and Temperature

Soil moisture indicates the water content in the soil, critical for evaluating irrigation needs. Temperature readings reflect both soil and ambient conditions, affecting plant physiological processes directly.

02 Humidity and Light Intensity

Humidity levels affect both plant transpiration and disease susceptibility, while light intensity influences photosynthesis rates, hence crop development and final yield.

03 Water Quality and Flow Rate

Water TDS reflects the quality of irrigation water, impacting nutrient availability, whereas the water flow rate is a critical factor in efficient irrigation management.

/04

IoT Application/System Functionality



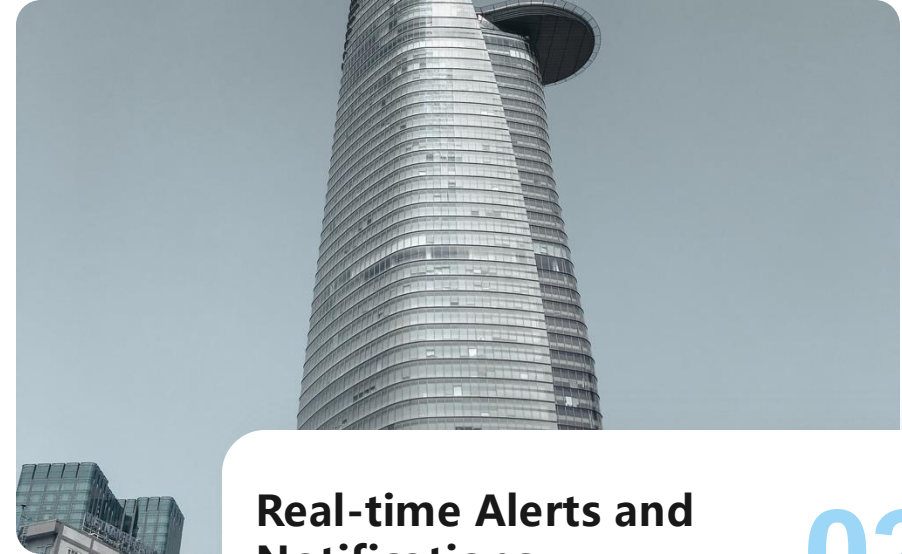
Automation and Real-time Monitoring



Automated Irrigation System

If the soil moisture drops below a predetermined threshold, the system automatically activates irrigation processes. This kind of automation is essential for optimizing water usage and ensuring crop health.

01



Real-time Alerts and Notifications

The system is designed to generate real-time alerts for anomalies such as temperature spikes or low moisture levels, providing farmers with critical information that allows for timely intervention.

02

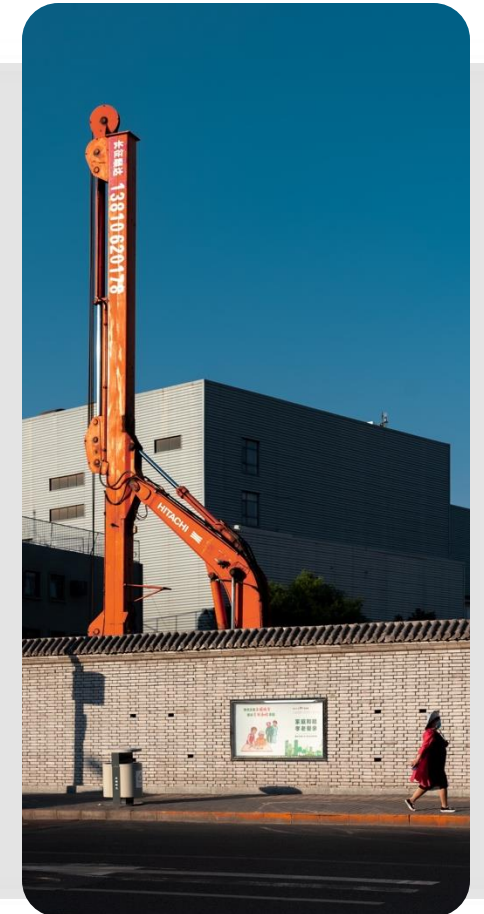
Decision-making Support for Farmers

Actionable Insights from Data

By converting raw data into actionable insights, farmers are empowered to make informed decisions about irrigation schedules, pesticide applications, and other management practices, enhancing overall farm productivity.

Improving Resource Management

The insights derived from real-time data allow for better resource allocation, potentially reducing costs related to water, fertilizer, and labor, while simultaneously improving crop outputs.



/05 Industry Fit and Trends



Smart Agriculture Industry Overview



Current Trends in Agriculture

The smart agriculture industry is witnessing trends such as precision farming, using data analytics, and IoT technologies that promote sustainable practices and optimize farm management processes.



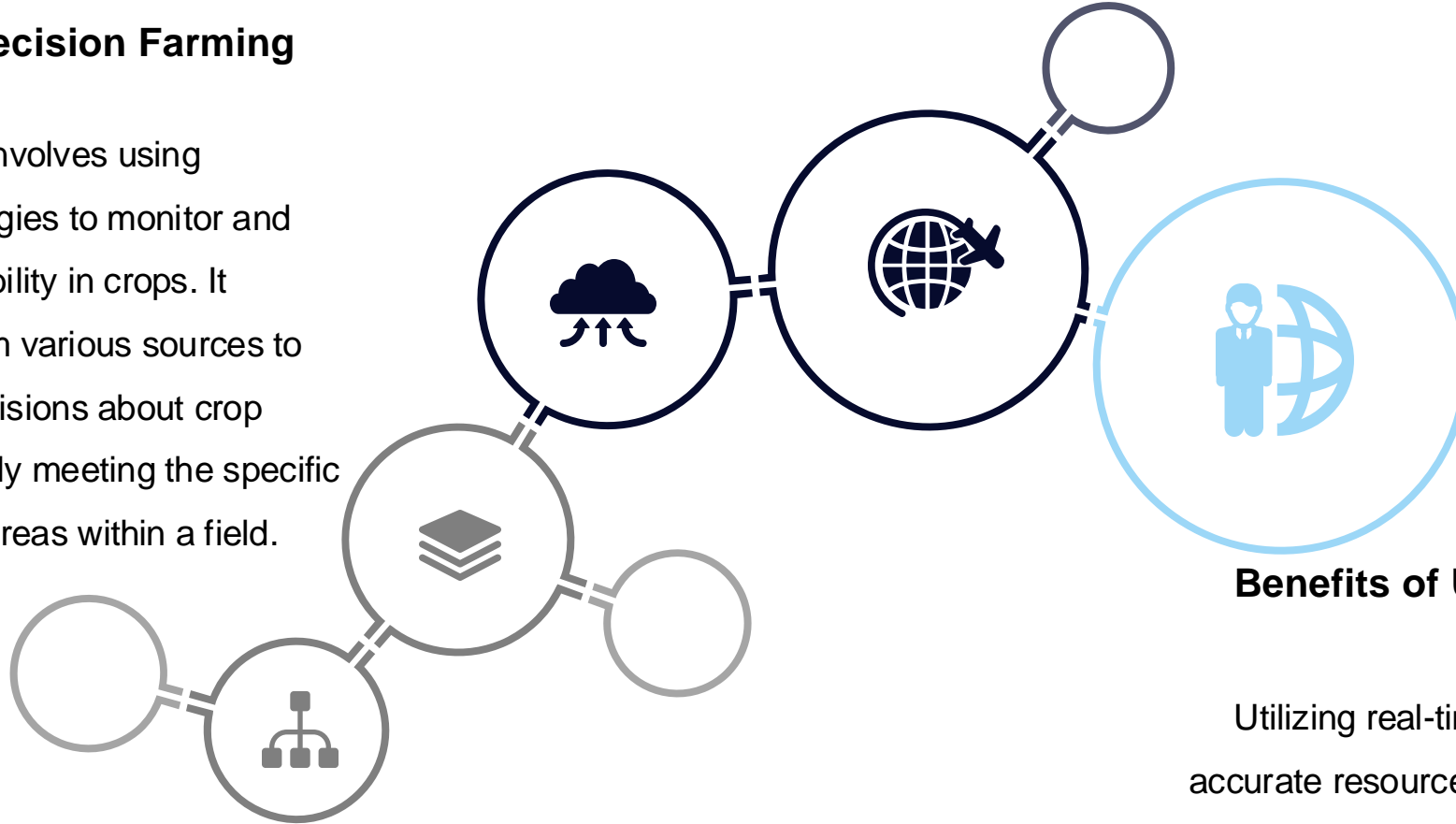
Role of IoT in Industrial Sectors

IoT applications extend beyond agriculture into various industrial sectors, enhancing operational efficiency and promoting resource conservation through data-driven decision-making frameworks.

Precision Farming

Definition of Precision Farming

Precision farming involves using advanced technologies to monitor and manage field variability in crops. It leverages data from various sources to make informed decisions about crop production, precisely meeting the specific needs of different areas within a field.



Benefits of Utilizing Real-time Data

Utilizing real-time data leads to more accurate resource application—such as water and fertilizers—significantly reducing waste and improving overall productivity while supporting sustainable agricultural practices.

/06

Future Directions and Conclusion



Potential Advancements in Smart Farming

01.

Emerging Technologies in IoT

Emerging technologies such as AI-driven analytics and machine learning will further enhance the capabilities of IoT systems in agriculture, predicting trends and providing deeper insights into crop health and environmental conditions.

02.

Sustainable Practices for Crop Health

Integrating IoT with sustainable practices can improve soil health and biodiversity, ensuring long-term viability of agricultural lands while meeting the demands of an increasing global population.

Summary of Key Points

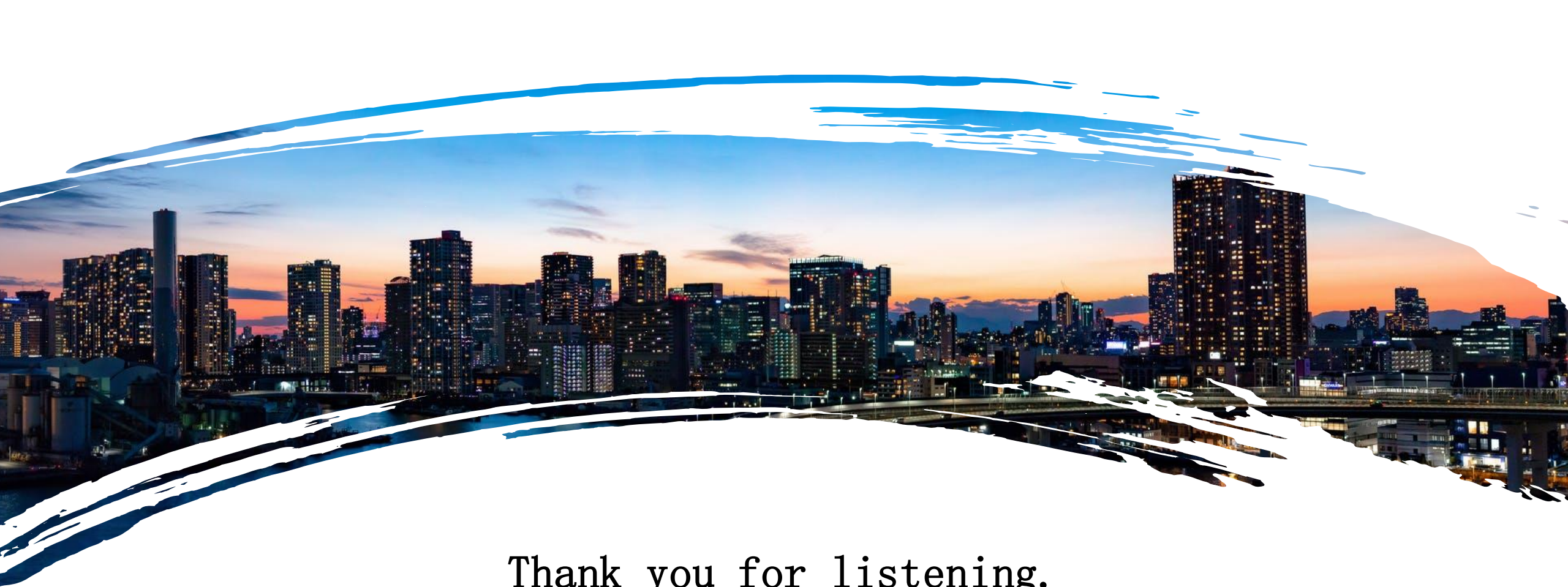
Importance of IoT in Agriculture

IoT is reshaping traditional farming practices, providing tools that allow for precise monitoring and intervention, ultimately leading to increased efficiency, productivity, and sustainability in agriculture.



Call to Action for Farmers and

Farmers and agricultural businesses are encouraged to adopt IoT solutions and data management practices, unlocking the potential for innovative agricultural methodologies that promote environmental stewardship and economic viability.



Thank you for listening.

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