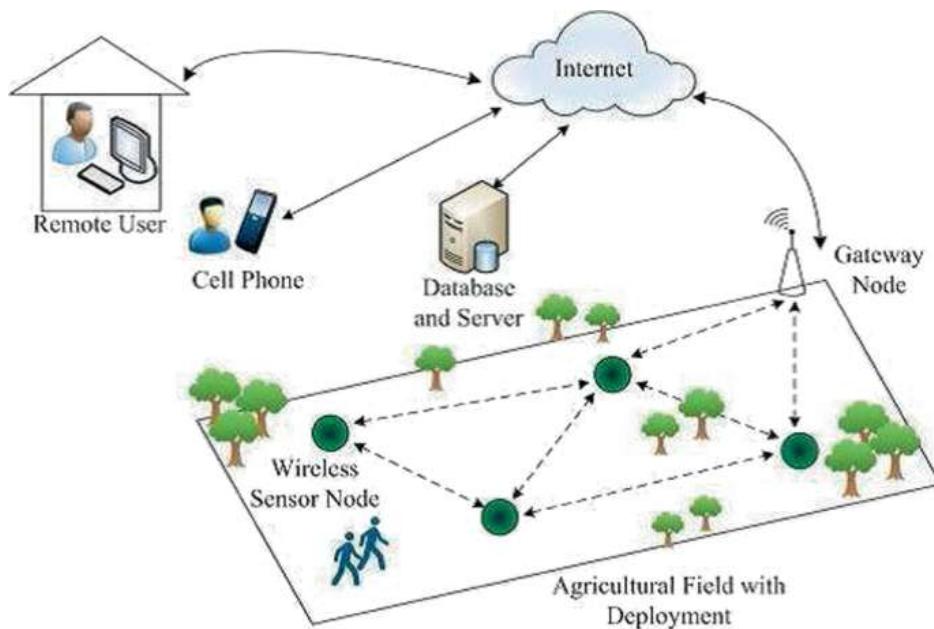
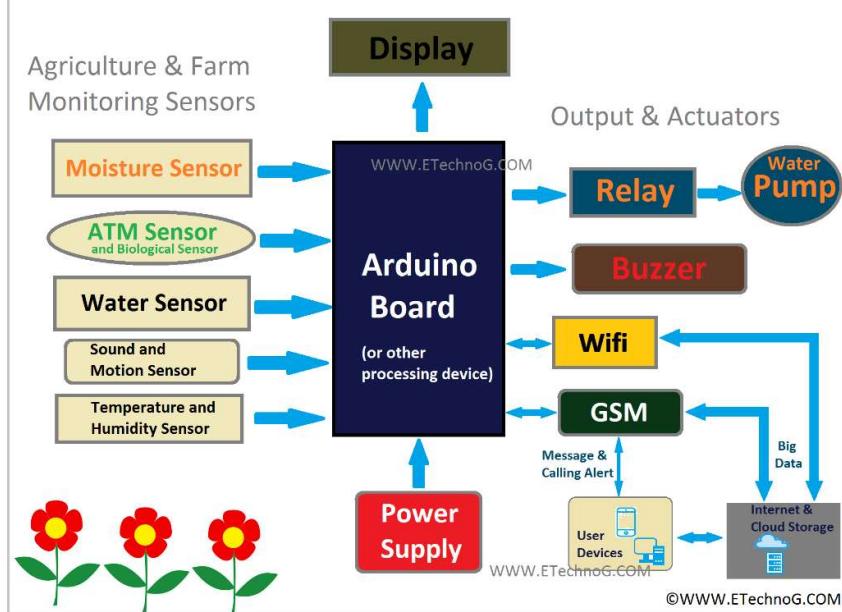


Figure. 01 IoT Based Smart Agriculture Block Diagram



IoT-Based Smart Agriculture System

Overview

The system integrates **wireless sensor nodes**, **gateway nodes**, **database servers**, and **remote users** through the **Internet** to collect, transmit, and analyze data from agricultural fields in

real time. This helps farmers make data-driven decisions about irrigation, soil health, and crop management.

Main Components

1. Wireless Sensor Nodes

- **Function:**

Deployed across the agricultural field to collect environmental parameters such as:

- Soil moisture
- Temperature
- Humidity
- Light intensity
- pH level

- **Characteristics:**

- Battery-powered, low energy consumption
- Equipped with transceivers for data transmission
- Form a mesh network to relay data to the gateway node

2. Gateway Node

- **Function:**

Acts as a **bridge** between the wireless sensor network and the Internet.

- Collects data from all sensor nodes
- Performs local processing or filtering
- Transmits aggregated data to the **server** via the Internet

- **Technologies Used:**

- Wi-Fi, LoRa, Zigbee, or cellular connectivity

3. Database and Server

- **Function:**

Stores, processes, and manages the data received from the gateway node.

- Performs data analytics
- Generates reports and alerts
- Hosts a web or cloud application for remote access

- **Technologies Used:**

- Cloud platforms like AWS IoT, Azure IoT, or ThingSpeak
- SQL/NoSQL databases for structured/unstructured data

4. Internet Connectivity

- **Function:**

Provides communication between the **gateway**, **server**, and **remote users**.

- Enables real-time monitoring and control
- Allows remote users to access the system via web or mobile apps

- **Requirements:**

- Reliable broadband or cellular Internet
- Low latency and secure communication (e.g., HTTPS, MQTT protocols)

5. Remote User Interface

- **Function:**

Provides an interactive dashboard for farmers or researchers.

- Displays live data and analytics
- Sends alerts or notifications (e.g., irrigation needed)

- Allows remote configuration of sensor parameters
- **Access Devices:**
 - Computers, tablets, or cell phones
 - Connected through web browsers or dedicated mobile apps

Connectivity Requirements

Component	Communication Type	Protocol/Technology	Purpose
Sensor Nodes ↔ Gateway Node	Wireless (short-range)	Zigbee, LoRa, Bluetooth, RF	Data collection from field sensors
Gateway Node ↔ Internet	Wireless/Wired (long-range)	Wi-Fi, LTE, Ethernet	Data transmission to cloud/server
Internet ↔ Server	IP-based	HTTP, MQTT, CoAP	Data transfer and cloud analytics
Server ↔ Remote User	Web/Mobile Interface	HTTPS, REST API	Data visualization and remote control

Advantages

- Real-time environmental monitoring
- Reduced manual labor and operational costs
- Improved crop yield through data-driven insights
- Remote accessibility for farmers and researchers