ARTIFICIAL INTELLIGENCE

Home Automation with Voice Agent

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SUBMITTED TO

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INTRODUCTION & ABSTRACT

This IoT-based project automates and monitors household and agricultural environments using an **Arduino Uno R3**.

The system merges two domains—Smart Home and Smart Farming—responding to environmental data (light, moisture, motion, etc.) in real-time to trigger appropriate actions like automated irrigation and security alerts.

KEY OBJECTIVES

Automation

Automate daily home and farm tasks to reduce manual labor.

Efficiency

Improve resource usage, specifically electricity and water conservation.
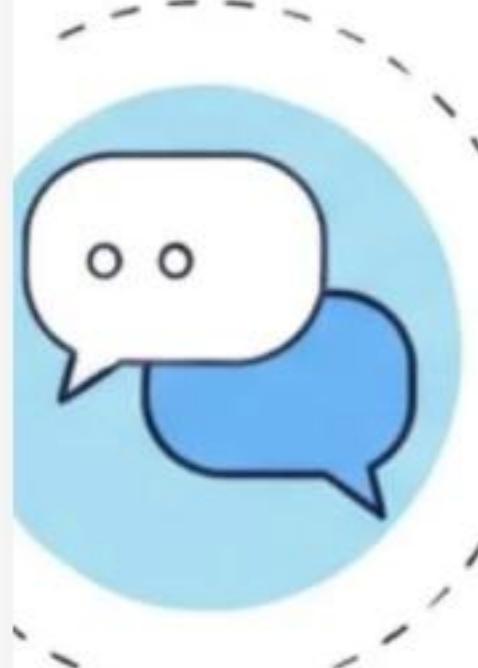
Safety

Enhance security using sensors for fire, gas leakage, and intruders.
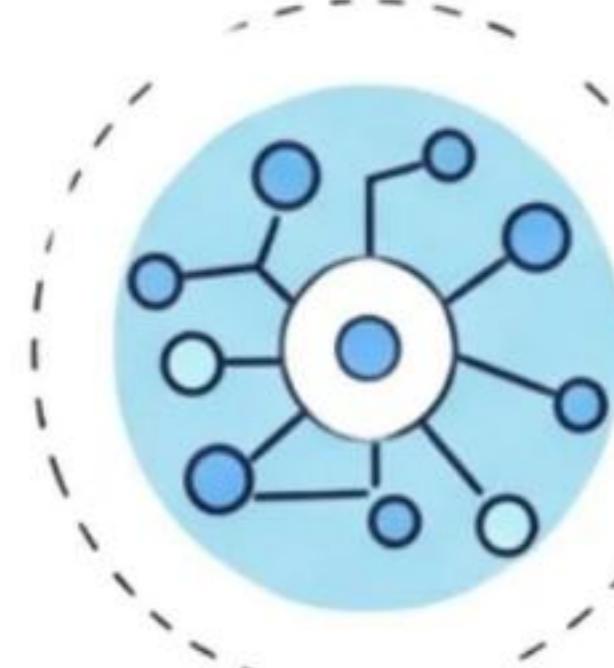
AGENT-BASED ARCHITECTURE

## Core AI Technologies & Features

...ersational AI

Voice Recognition

Natural Language Processing

User Frie... Interfac...

Hybrid Intelligent Agent

- ✓ **Reactive AI:** Rule-based automation for immediate safety tasks.

- ✓ **Cognitive AI:** LLM-based reasoning for complex human interaction.

- ✓ **Perception:** Sensors acting as digital eyes and ears.

- ✓ **Action:** Actuators (Servos, Motors) executing decisions.

NLP & LANGUAGE UNDERSTANDING

NLP enables machines to understand, interpret, and reason over human language using neural models.

ASR

OpenAI Whisper: Converts acoustic signals into textual representations for processing.

LLM Core

Acts as the brain, resolving ambiguous commands and maintaining context across interactions.

Tool Use

Converts abstract reasoning (JSON) into physical actions via Arduino actuators.

THE PERCEPTION-ACTION LOOP

LOOP

Continuous feedback
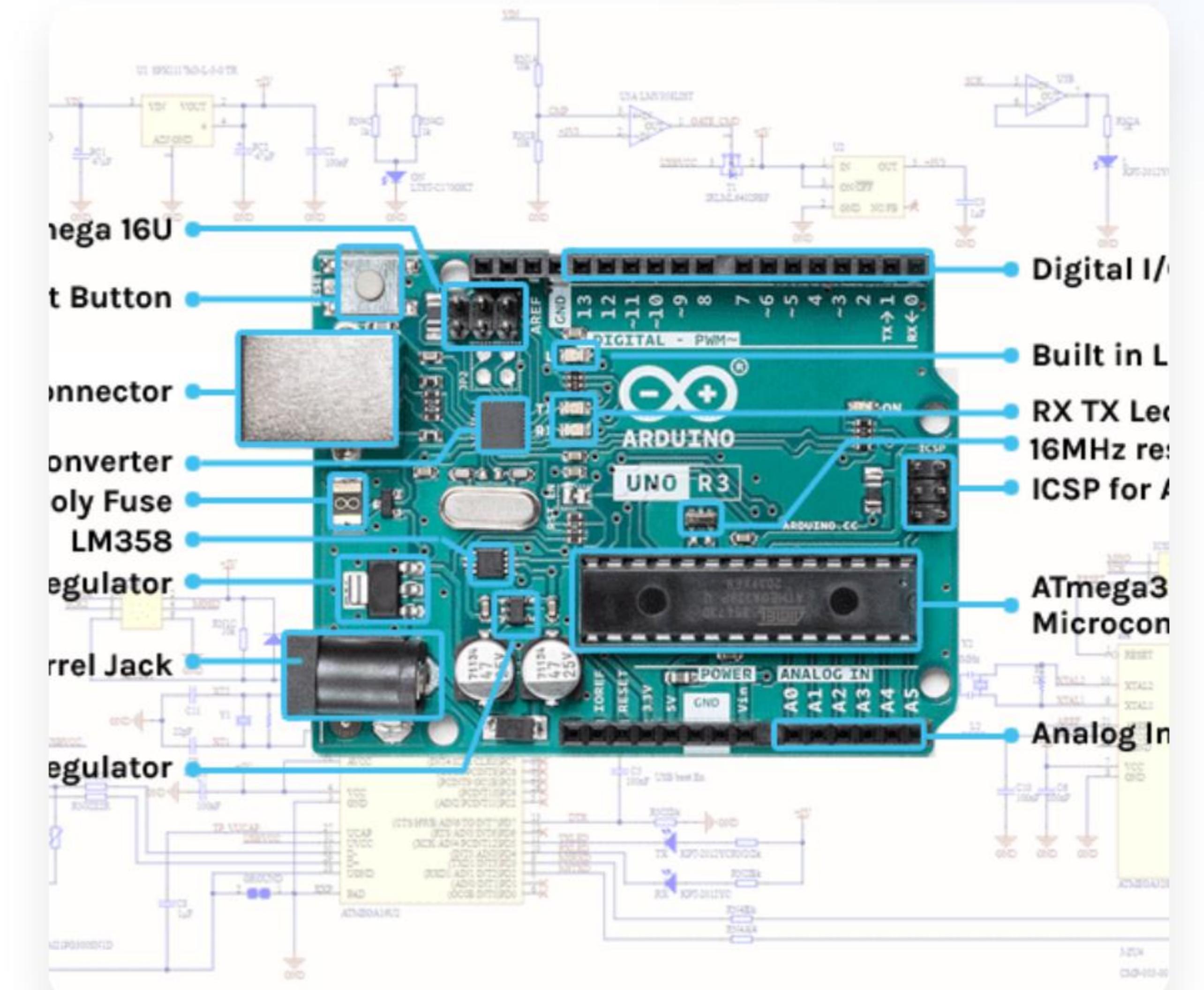
The system operates on a fundamental AI loop:

Perceive (Sensor Data) → **Interpret** (AI Analysis) → **Decide** (Logic) → **Act** (Hardware Trigger) → **Feedback**

Context-Aware Computing: The system adapts decisions based on time (day/night), user habits, and environmental states.

HARDWARE COMPONENTS

Component	Quantity	Function
Arduino Uno R3	1	Master Controller
HC-SR04 Ultrasonic	2	Distance & Water Level
DHT22 Sensor	1	Temp & Humidity
MQ2 Smoke Sensor	1	Gas/Smoke Detection
Servo Motors	2	Garage & Clothes Cover
Soil Moisture	1	Agriculture Monitoring

SYSTEM MODULES (PART 1)

Smart Lighting

LDR measures ambient light. Turns on LEDs automatically when darkness is detected.

Garage Auto

Ultrasonic sensor detects vehicles; Servo motor opens the door contactlessly.
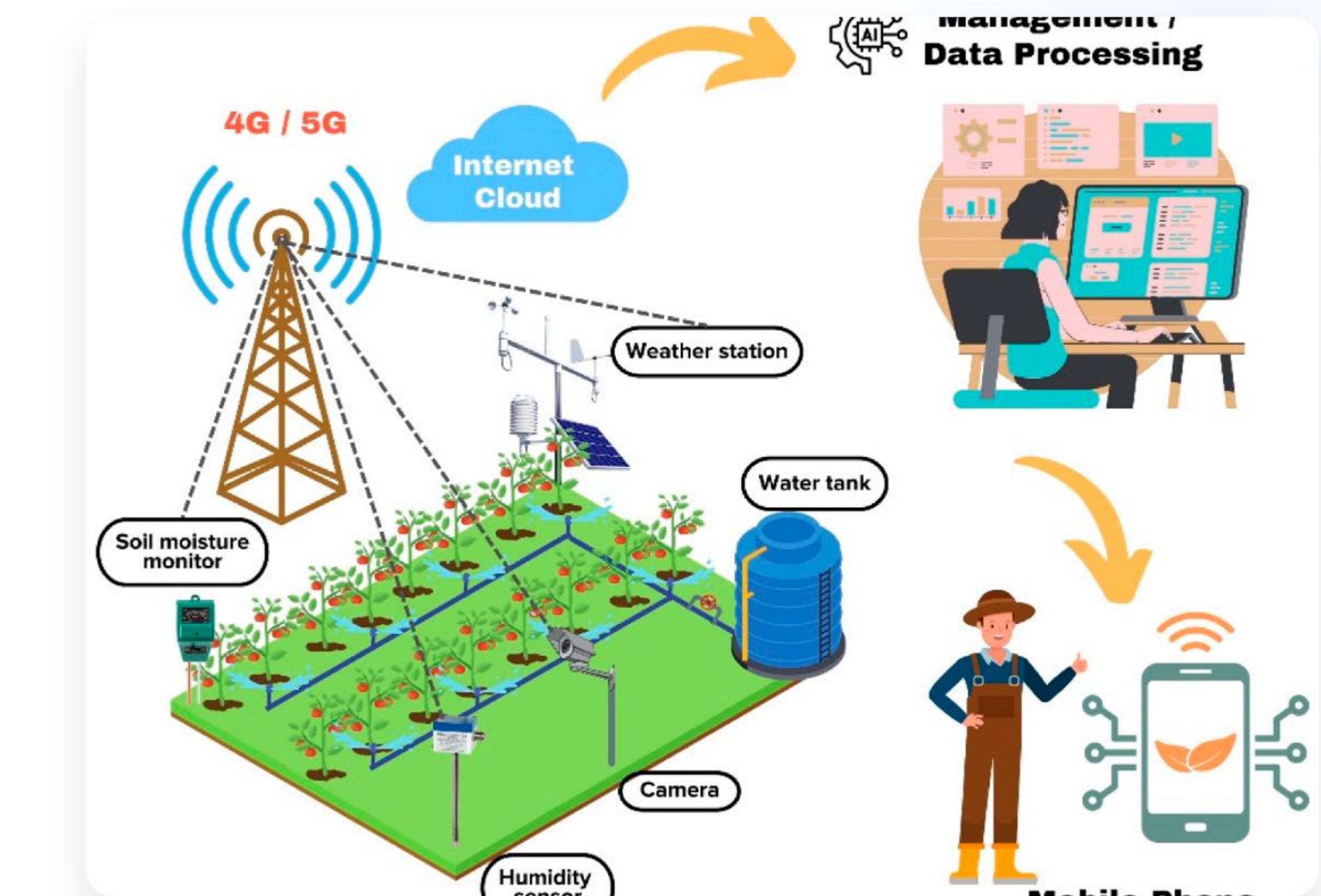
Security Alert

PIR Motion sensor activates a buzzer when movement is detected in the house.

SYSTEM MODULES (PART 2)

Agriculture & Safety

- ✅ **Rain Detection:** Rain sensor triggers servo to cover clothes drying outdoors.

- ✅ **Soil Irrigation:** Soil moisture sensor triggers water pump when ground is dry.

- ✅ **Fire & Smoke:** Flame and MQ2 sensors trigger loud alarms and visual alerts (Red LEDs).

TECHNICAL SPECIFICATIONS: PIN MAPPING

Pin	Connected Component
A0	LDR Sensor
A1	MQ2 Smoke Sensor
A5	Soil Moisture Sensor
D3	Night LED
D6	Garage Servo

Pin	Connected Component
D7	Rain Sensor
D9	Flame Sensor
D11	Buzzer (Shared)
D12	Fire Alert LED
D13	PIR Motion Sensor

COMMUNICATION PROTOCOLS

One-Wire

The **DHT22** sensor uses a single-wire digital protocol to send precise climate data.

PWM

Pulse Width Modulation is used for smooth control of Servo motors (Garage/Clothes).

Pulse Timing

Ultrasonic sensors calculate distance using the flight time of acoustic waves.

CONCLUSION

This **Smart Home and Agriculture System** demonstrates how affordable microcontrollers can automate real-life activities.

By integrating AI with IoT sensors, we create a safe, efficient, and responsive environment that reduces manual labor and enhances safety for homes and farms alike.

Q&A

Thank you for your attention!
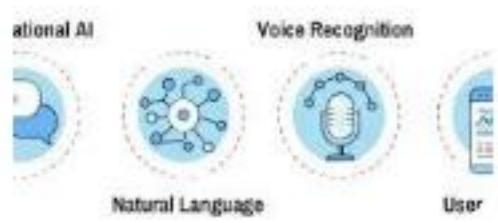
Team Members: Obaidullah, Moiz, Ali Afzal

IMAGE SOURCES
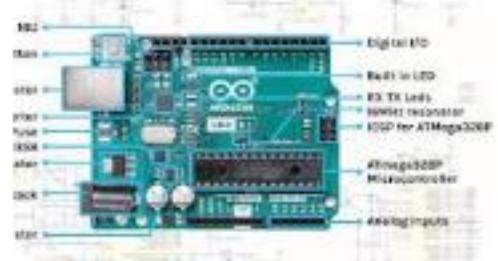
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