

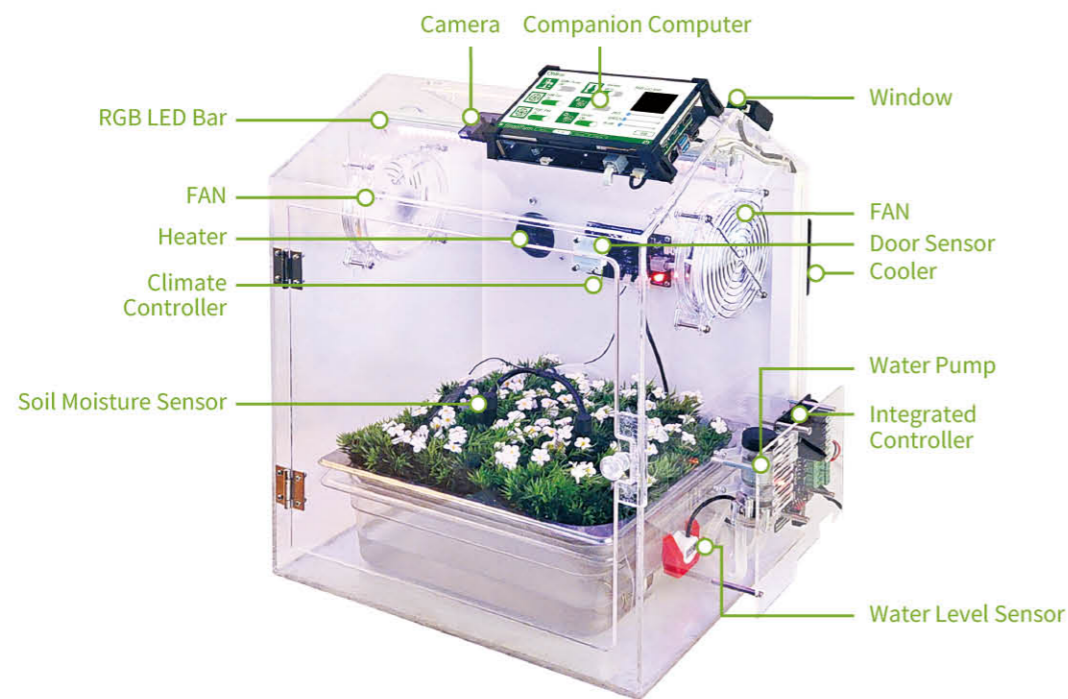
IoT Smart Farm Coding Training Equipment

Smart Farm II

Training Contents

- Overview of SmartFarm
- Training Environment Configuration for Smart Farm II Simulator
- Smart Farm II Simulator Control
- Automatic Smart Farm II Control
- SmartFarm II Control Using LoRa Communication
- SmartFarm II Simulator GUI Application
- SmartFarm II Application Project
 - Human Audio Interface Control
 - MQTT-based SmartFarm II Control
 - OpenCV-based SmartFarm II Surveillance Camera Control
 - SmartFarm II Artificial Intelligence Application

Layout



Components



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Smart Farm II



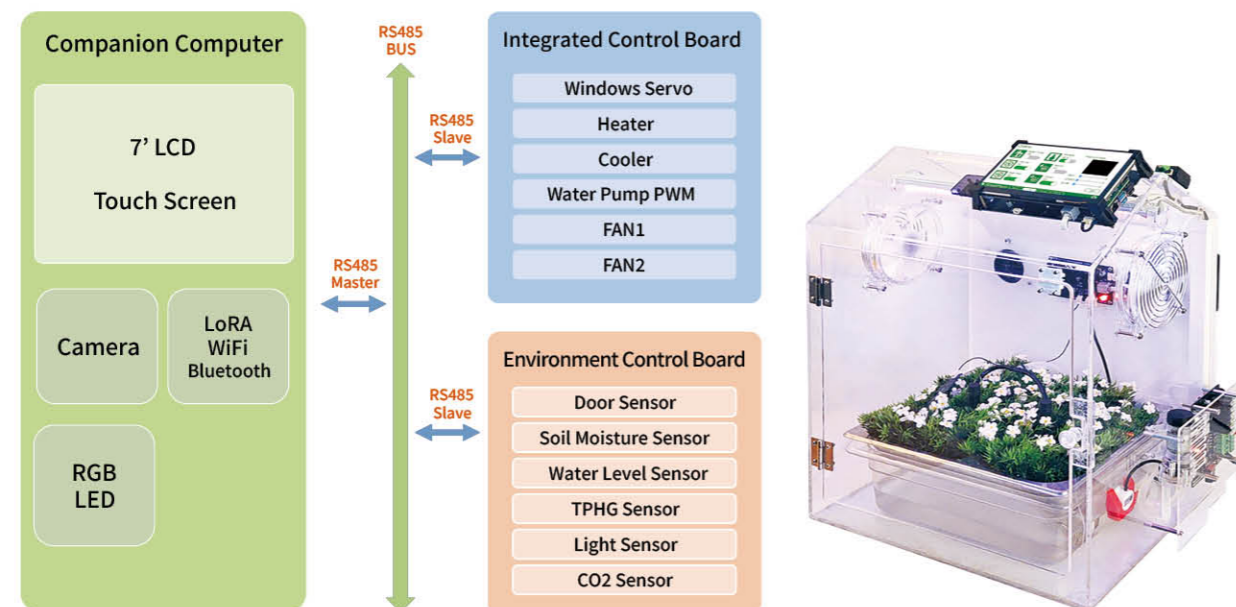
- Smart Farm Simulator Based on Glass Greenhouse. Practice of Sensor and Actuator Control and Artificial Intelligence Applications in IoT Environment
- Consists of a companion computer, environmental controller, and integrated controller. Interconnected via RS485 communication bus
- The companion computer, which operates with a high-performance ARM quad-core processor and a 7-inch touch screen, is linked to the integrated controller and environmental controller through HMI
- Companion computer is equipped with speaker, high-resolution Auto Focus(AF) camera, LED bar, and Ethernet/Wi-Fi/Bluetooth/LoRa modules to implement various user interfaces including artificial intelligence applications
- The environmental controller operates with FreeRTOS on the STM32 MCU and processes light, temperature, humidity, atmospheric pressure, Volatile Organic Compounds (VOC), soil moisture, water level detection, door opening detection, and CO₂ sensor data
- The integrated controller operates with FreeRTOS on the STM32 MCU and controls the water pump, heater, cooler, ventilation fan (DC motor), and ceiling window (serial bus servomotor)
- Supports a public integrated development environment based on Visual Studio Code for professional application development
- Provides a high-level smart farm control library implemented in Python for user convenience
- Provides Python-based smart farm control learning contents

Software Specification

List	Specifications
Companion Computer	Linux Kernel aarch64 5.x
	CLI Zsh with Oh-My-Zsh, Tmux, powerlevel10k thema, Powerline fonts
	Tool Chain GCC (c, c++), JDK, Node JS, Python3, Cling, Clang
	Connectivity SSH Server, Bluez, MQTT Server(Mosquitto), Blynk Server,
	Multimedia OpenCV 4
Data Science & AI Numpy, Matplotlib, Pandas, Scipy, Seaborn, Scikit-learn	
Pop Library with Smart Farm II	Output Object Leds, PiezoBuzzer, OLed, PixelDisplay
	Input Object Switch, UltraSonic, Potentiometer, Cds, Sound, Psd. Pir, Gesture, TempHumi,
	AI Linear Regression, Logistic Regression, Perceptron, ANN

Hardware Specification

Consists of Companion Computer, Environment Control Board, and Integrated Control Board



Hardware Specification

List	Specifications
Body	Size Body: 400 x 300 x 500(mm) Flowerpot : 325 x 265 x 30(mm) Water Tank : 325 x 265 x 100(mm)
	Power 12V/10A Adapter
	Function Human Machine Interface(HMI)
	CPU Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.8GHz
Companion Computer	Memory 4GB LPDDR4-3200 SDRAM
	Communication · RS485 : Differential Signal Transmission Multipoint Communication: up to 32 drivers and 32 receivers Long-Distance Transmission: up to 1200 meters Data Rates: up to 10Mb/s
	· Wifi / Bluetooth 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE, Gigabit Ethernet
	· LoRA 168 dB maximum link budget. Programmable bit rate up to 300 kbps. High sensitivity: down to -148 dBm. Frequency: 915MH
	7'inch TFT LCD with TouchScreen, Speaker IPS Resolution : 1024 x 600 Capacitance Touch Screen
Light Control	12MP Camera Resolution : 12MP (4056 x 3040 pixel) HDR, Phase Detection Auto Focus (PDAF) Field of View: 120 degrees diagonal (16:9 aspect ratio)
	RGB LED Strip Each pixel of the three primary color can achieve 256 brightness display, completed 16777216 color full color display, and scan frequency not less than 400Hz/s. Cascading port transmission signal by single line. Send data at speeds of 800Kbps. I/O Interface : PWM Control
	Auto Controller Cortex M3 32bit MCU 72MHz, 128 Kbytes of Flash memory, 20 Kbytes of SRAM
Climate Controller	RS485 Driver
	Light Sensor Measurement Range: 1 - 65535 lux Interface: I ² C
	TPHG Sensor 4-in-1 environmental sensor that measures gas, pressure, humidity, and temperature. Temperature Sensor: -40°C to +85°C, accuracy: ±1°C Pressure Sensor: 300 - 1100 hPa, accuracy ±0.12 hPa Humidity Sensor: 0 - 100% relative humidity, accuracy ±3% Gas Sensor: Indoor air quality monitoring, breath analysis I/O Interface : I ² C
	CO ₂ Sensor Range: 0 ppm - 40,000 ppm Accuracy : ±(40 ppm + 5% of measured value) for 400 ppm to 2000 ppm, ±(50 ppm + 5% of measured value) for 2000 ppm to 40000 ppm Response time : 5 sec I/O Interface : I ² C
Integrated Controller	Water Level Sensor Response time: 500ms Sensitivity: 0 ~ 13mm Waterproof performance: IP67 I/O Interface : Digital output
	Soil Moisture Soil moisture level by capacitive sensing I/O Interface : Analog output
	Door Sensor Normally Open Reed Switch I/O Interface : Digital output
	Auto Controller Cortex M3 32bit MCU 72MHz, 128 Kbytes of Flash memory, 20 Kbytes of SRAM
	RS485 Driver
Water Pump	Water Pump Power : 6W (12V, 0.5A) Flow rate : 1.8L / Minute Mini Sprinkler 2ea MOSFET Driver I/O Interface : GPIO Control
	FAN 2 fans for intake / exhaust Power : 12V/0.15A FAN Speed : 1500RPM LED Light I/O Interface : GPIO Control
	Windows Angle 0° ~120°, Serial Bus Servo Motor Working voltage : 9 ~ 12.6V Torque : 20kg.cm Stall Current : 3A Servo accuracy : 0.2°
	Heater Heating element: PTC Power : 12V/10A MOSFET Driver I/O Interface : GPIO Control
	Cooler Peltier thermoelectric module 40mm fan Power : 12V/6A MOSFET Driver I/O Interface : GPIO Control