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AIOT TESTBED II

| Physical AI-based Smart Home Control System |

HANBACK ELECTRONICS
Since 1984

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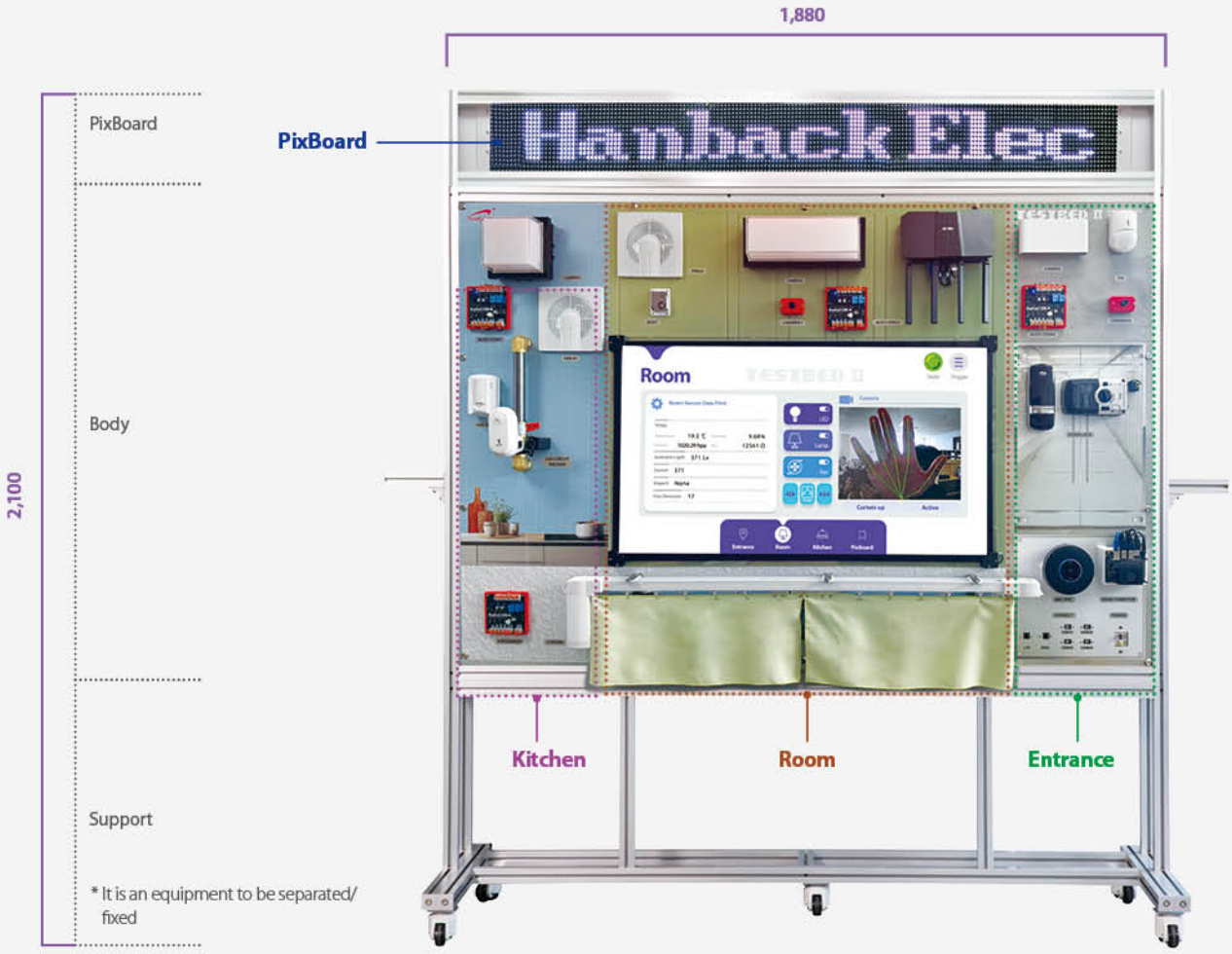
AIOT TESTBED II



Block Diagram

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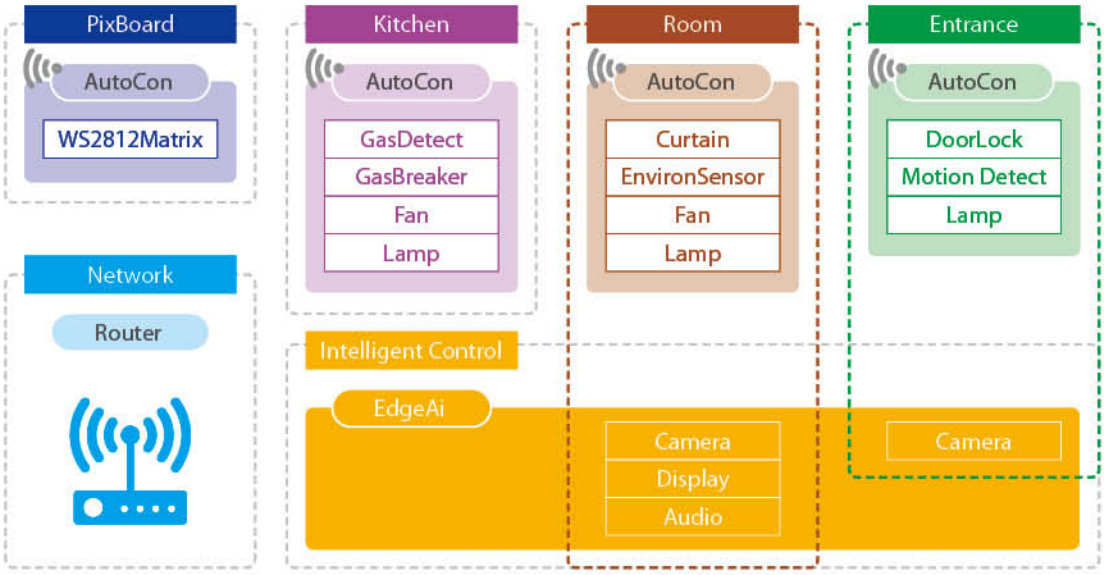

Software Specifications

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List		Specifications
AutoCon	Embedded Runtime Environment for MCU	MicroPython V1.26, upyboard
	Pop plus Library for MCU	Multiple control components (WS2812Matrix, Relay, ServoMotor, SR04 etc)
		Zsh, Tmux, Peco, powerlevel9k thema, Powerline fonts
Intelligent Integrated Controller	Embedded Runtime Environment for Application Processor	Openbox with X-Server, Tint2, conky, Oh-My-Zsh, tmux
	IoT Service	MQTT Broker, Things board
	User Authentication and Security	cryptography, pyotp, qrcode
	AI Service	PyTorch / TensorFlow / ONNX Runtime(TensorRT EP)
		DeepStream Perception(PeopleNet/YOLO), VLM Inference, Zero-Shot Detection
		Grounding DINO (GDINO), VLM Video Summarization & Analytics AI
		Riva Speech AI Embedded (ASR/TTS)
	Pop plus Library for TestBed	WS2812Matrix, GasDetect, GasBreaker, Fan, Lamp, Curtain, Tphg, Light
		DoorLock, MotionDetect, Camera, Audio
Intelligent Integrated Control Program	Implementing integrated physical AI control with DeepStream Perception and Riva Speech Embedded in the PySide6 GUI environment	
	Implemented 2FA user authentication and authorization management, and AES-based data encryption	
	It is implemented to control physical components equally regardless of local/remote distinction, enabling simultaneous execution of integrated control programs on the Intelligent Integrated Controller and PC	

Hardware Specifications

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List			Specifications
Entrance Zone	AutoCon		Dual Core ARM Cortex-M33
			Wi-Fi, Bluetooth
			Relay, Motor Driver, GPIO
			led, switch, Tphg, Ambient, 3-Axis
	Camera		High signal-to-noise ratio (SNR)
			Built-in 2D Dynamic Defect Pixel Correction (DPC)
			Phase Detection Autofocus (PDAF) for rapid autofocus
			QBC Re-mosaic function
			HDR mode (up to 3 mega-pixel output)
	Lamp	Entrance lamp	AC 220V LAMP with Feedback
	MotionDetect		Passive Infrared method
	DoorLock		Limit Switch for Feedback
Room Zone	AutoCon		Dual Core ARM Cortex-M33
			Wi-Fi, Bluetooth
			Relay 2/ Motor Driver/ GPIO
			led, switch, Tphg, Ambient, 3-Axis
	Touch Display		43 inch LCD
			IR touch screen
	Camera		High signal-to-noise ratio (SNR)
			Built-in 2D Dynamic Defect Pixel Correction (DPC)
			Phase Detection Autofocus (PDAF) for rapid autofocus
			QBC Re-mosaic function
			HDR mode (up to 3 mega-pixel output)
	Audio		Microphone
			Speaker
	Lamp	Room Lamp	AC 220V LAMP with Feedback
	Fan		AC 220V Fan + LED(Active Fan) with feedback
	Curtain		Electric Curtain
			Limit Switch for feedback
	Environmental Sensor		Ambient light
			Tphg(Temperature, Press, Humidity, Gas), Dust Sensor

List			Specifications
Kitchen Zone	AutoCon		Dual Core ARM Cortex-M33
			Wi-Fi, Bluetooth
			Relay 2/ Motor Driver/ GPIO
			led, switch, Tphg, Ambient, 3-Axis
	Lamp	Kitchen Lamp	AC 220V LAMP with Feedback
	Fan	Air Circulator	AC 220V Fan + LED(Active Fan) with feedback
	GasDetect	LPG Gas Detection	Yellow LED flashes and alarm sound
	GasBreaker	GAS Valve Control	GAS Valve moving by geared Motor
			Limit switch for feedback
PixBoard	AutoCon		Dual Core ARM Cortex-M33
			Wi-Fi, Bluetooth
			PIO0, PIO1, PIO2, LED Power
	WS2812Matrix		16 x 160 RGB LED Display
Network Router		WAN	10/100/1000Mbps x1
		LAN	10/100/1000Mbps x8
Intelligent Integrated Controller			Arm-Cortex V8 64-bit, 16 GB LPDDR5
			Ampere GPU 1024 CUDA cores + 32 Tensor cores, 100 TOPs
			256 GB M.2 NVMe SSD
			1000 BASE-T Ethernet, 2.4G/5GHz dual-band Wi-Fi, Bluetooth 5.0 standard
Body		Size	1,880 x 2,100 x 300 mm
		Power	AC 220V Input

Product Features

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A Physical AI–based smart home control system training platform, modularized into four zones—Entrance, Room (indoor), Kitchen, and Pixel Board—on a rectangular panel built with large aluminum-profile frames
Sensors and actuators in each zone are driven by a high-performance MCU, supporting standard interfaces such as I^2C/PWM/GPIO and real-time control loops
An intelligent unified controller equipped with a CUDA-accelerated edge supercomputer supports high-performance inference and multimodal perception/control services
The intelligent unified controller provides a large touchscreen–based HMI/GUI runtime, enabling easy composition of system monitoring dashboards and control scenarios
With a camera and digital microphone (array), supports AI human–machine interfaces (HMI) such as vision/audio-based user recognition and command processing
The high-performance MCU and intelligent unified controller are interconnected over a TCP/IP network via a router; with Internet access, secure remote connectivity and control scenarios can be configured
Provides the Pop plus library, which controls physical components through a unified API regardless of local or remote deployment (device abstraction, event-subscription I/O)
Provides an open-source MQTT broker supporting SSL/TLS-based encrypted communication and authentication, with standard QoS and topic-level access control (ACL) configuration
Provides an integrated Python/MicroPython development environment, including real-time logs/serial console, firmware transfer, and package-management workflows
Provides sample implementations for IoT security training, including 2FA-based user authentication/authorization and AES-based encryption
Provides Blynk examples for building remote-control GUIs on Android/iOS without coding
Provides integrated Physical AI control examples based on PySide6, DeepStream Perception, and Riva Speech Embedded

Educational Content

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- TestBed Overview
- Foundations of Smart Home Deployment
  - Smart Home Overview and Deployment
  - Control of lighting, ventilation fans, doors, curtains, and LED display boards
  - Sensor data acquisition
  - Foundations of Firmware Design
  - Threads, asynchronous control, and protocols
- User Interface (HMI)
  - MQTT-based message schema and topic design
  - GUI programming
  - Building a real-time monitoring system
  - Sensor data visualization and remote control
  - Anomaly detection and alerting
- Smartphone Integration and Monitoring
  - Mobile app–based remote control
- Cloud IoT Integration
  - Integration with open-source IoT clouds
  - Cloud dashboard development
  - Data visualization
- Security and Privacy
  - Certificate-based secure network communication
  - 2FA-based user authentication and access control
  - Vision-based user authentication
  - Data encryption and decryption
- Computer Vision and AI-Driven Control
  - OpenCV
  - Machine learning
  - Classification algorithms and data processing
  - OpenCV-based classification logic implementation
  - MediaPipe-based classification logic implementation
  - Voice-driven automated control
- Automation Logic Design and Implementation (Capstone Project)
  - Conditional behavior programming
  - Scenario-based control

Product Configuration

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AIoT TestBed II

USB Repeater Cable 5M

220V Power Cable

USB A to B Cable

Ethernet Cable

Platform USB

(Include OS Image and Tools)

User Guide book