# AIoT Programming Introductory Equipment

## for Learning IoT, Data Science, and Machine Learning
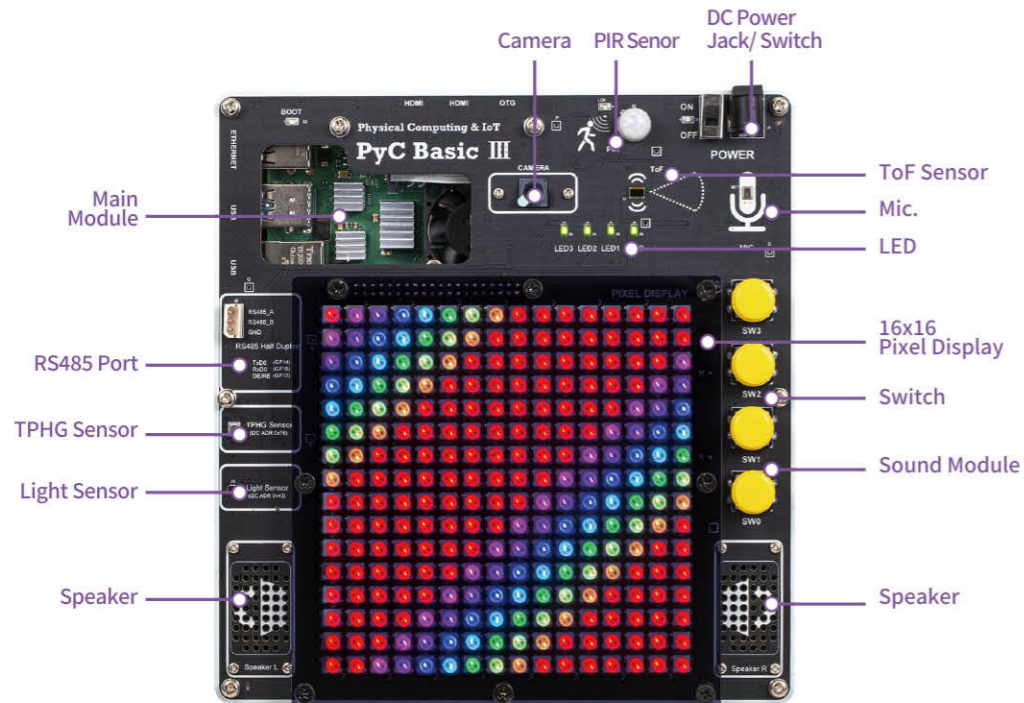
**PyC Basic Ⅲ**



## ◎ Training Contents

### Introduction to Data Science and Artificial Intelligence in IoT Environment (Python version)

- **PyC Basic Ⅲ Practice Environment**
- **IoT Sensor Control**
- **IoT Communication**

  MQTT Practice

  MQTT Based Sensor

  Control Practice

  Cloud and Smartphone Connected Practice

- **Data Analysis and Visualization Library**

  NumPy and Fast Multidimensional Matrix

  Calculation Practice Pandas, Time Series and Table Data Analysis Practice

  Matplotlib and Data Visualization Practice

- **Introduction to Artificial Intelligence**

  Linear Regression Practice

  Logistic Regression Practice
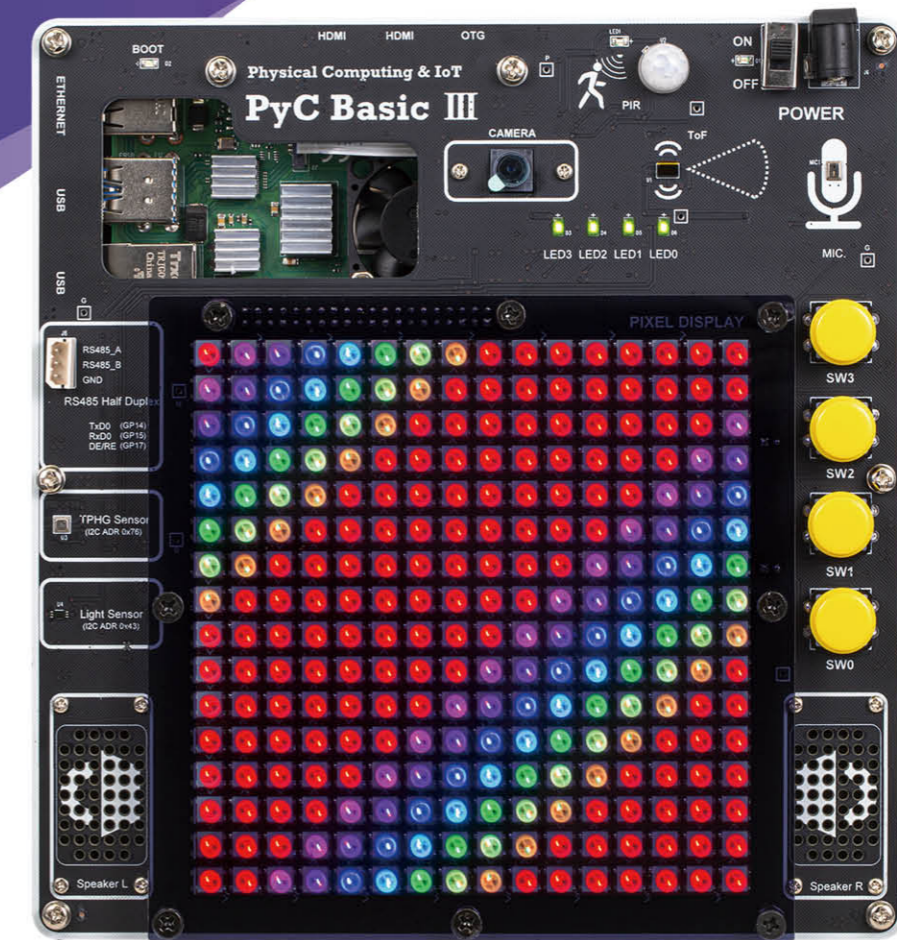
  Perceptron Practice

  ANN Practice

## ◎ Layout



- Camera
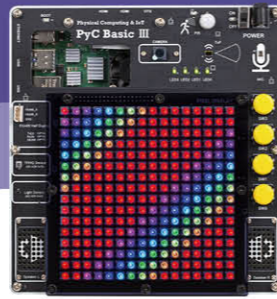- PIR Senor
- DC Power Jack/ Switch
- Main Module
- RS485 Port
- TPHG Sensor
- Light Sensor
- Speaker
- ToF Sensor
- Mic.
- LED
- 16x16 Pixel Display
- Switch
- Sound Module
- Speaker

## ◎ Component



PYC Basic Ⅲ

Platform USB (include OS image and Tools) 1EA

5V 5A Power Adapter 1EA

Micro SD Adapter 1EA

USB to Ethernet Adapter 1EA

Ethernet Cable 1EA

User Guide book 1EA

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# PyC Basic Ⅲ



- Introductory AIoT programming equipment for learning IoT, Data Science, and Machine Learning
- It consists of a high-performance, low-power ARM quad core processor module and various input/output devices optimized for learning as a single board so that sensor data can be collected and analyzed in real time or predicted through model definition in an AIoT environment
- Provides various input devices such as ADC-based distance measurement, illumination level, noise level, and motion detection and I²C-based proximity, ambient light, color, gesture, temperature and humidity, etc. in order to improve understanding of embedded interface
- Provided various output devices such as from basic LED to OLED that can output text or simple graphic and RGB Type 16x16 Pixel Display with colorful lighting effects in order to support visualization of analyzed or predicted sensor data
- Provides Gigabit Ethernet, dual-band Wi-Fi (2.4GHz, 5GHz), and Bluetooth 5.0 in order to remotely control the training equipment with a smartphone or tablet in an IoT connectivity environment
- Provides a dedicated learning environment based on a web browser that supports both Python and Google block coding platform, Blockly in order to increase the convenience of AIoT programming and use on PC and tablet
- Provides OS that optimizes Debian Linux for ARM-based IoT, data science, and machine learning and Pop library supporting reliable hardware abstraction

## ◎ Operating Program

| List | | Specifications |
|---|---|---|
| Linux OS | 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 PyC Basic Ⅲ | Output Object | Leds, PiezoBuzzer, OLed, PixelDisplay |
| | Input Object | Switchs, UltraSonic, Potentiometer, Cds, Sound, Psd. Pir, Gesture, TempHumi, |
| | AI | Linear Regression, Logistic Regression, Perceptron, ANN |

## ◎ Hardware Specification

| List | | Specifications |
|---|---|---|
| Base Board | Size | 174 x 184mm |
| | Power | 5V 5A |
| Main Module | CPU | ARM Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.8GHz |
| | Memory | LPDDR4-3200 4GB |
| | Connectivity | Gigabit Ethernet, Wi-Fi 2.4G & 5G 802.11ac, Bluetooth 5.0, BLE |
| | USB | USB 3.0 2port, 2.0 2port |
| | HDMI | micro-HDMI 2port (up to 4kp60 supported) |
| | Codec | H.265 (4kp60 decode), H264 (1080p60 decode, 1080p30 encode) |
| | Graphics | OpenGL ES 3.0 |
| | Data Storage | 32 GB Micro SD |
| | GPIO | 40 pin GPIO header (fully backwards compatible with previous boards) |
| | Display | 2-lane MIPI DSI display port |
| | Camera | 2-lane MIPI CSI camera port |
| | Power supply | 5V DC via USB-C connector, 5V DC via GPIO header |
| Peripheral | LED x 4EA | Color: Red<br>Interface: GPIO<br>Operating Voltage: 3.3V |
| | Switch x 4EA | Interface: GPIO<br>Operating Voltage: 3.3V |
| | Pixel Display | Color: pixel RGB<br>IC: WS2811<br>Pixel: 256 EA (16 x 16)<br>Operating Voltage: 5V<br>Power: 0.3W/pixel<br>Waterproof level: Non-waterproof<br>Interface: GPIO (Serial protocal)<br>Size: 110 x 110mm |
| | PIR Sensor | I/O Interface : Digital Out<br>Sensing Range : 110°<br>Spectral Response : 5 ~ 14 um |
| | TOF Sensor | I/O Interface : I²C<br>940 nm laser VCSEL<br>Measures absolute range up to 2 m<br>Eye Safe : Class 1 laser device compliant with latest standard IEC 60825-1:2014 - 3rd edition |
| | TPHG Sensor | I/O Interface : I²C<br>Temperature Measure : -40 ~ 85℃<br>Humidity Measure : 0 ~ 100%r.H.<br>Pressure range : 300 ~ 1100hPa<br>VOC Measure : Ethane, Ethanol, Acetone, Carbon Monoxide, Butadiene, methyl |
| | Light Sensor | I/O Interface : I²C<br>Illuminance to digital converter<br>Wide range : 1 ~ 65535(lx) |
| | RS485 Port | I/O Interface : RxD, TxD, DE<br>RS485 Control Device |
| | Sound Block | USB Audio Module<br>1ch Microphone<br>Omni-directional<br>Sensitivity: -42dBV<br>Stereo Speaker 2W |
| | Camera | Image Sensor: Sony IMX219<br>Resolution: 8M pixel native resolution sensor (3280 x 2464 pixel static images)<br>Video: 1080p30, 720p60 and 640x480p90<br>Linux Integration: V4L2 driver available<br>Focal length: 3.04 mm<br>Horizontal field of view: 62.2 degrees<br>Vertical field of view: 48.8 degrees<br>Focal ratio (F-Stop): 2.0 |