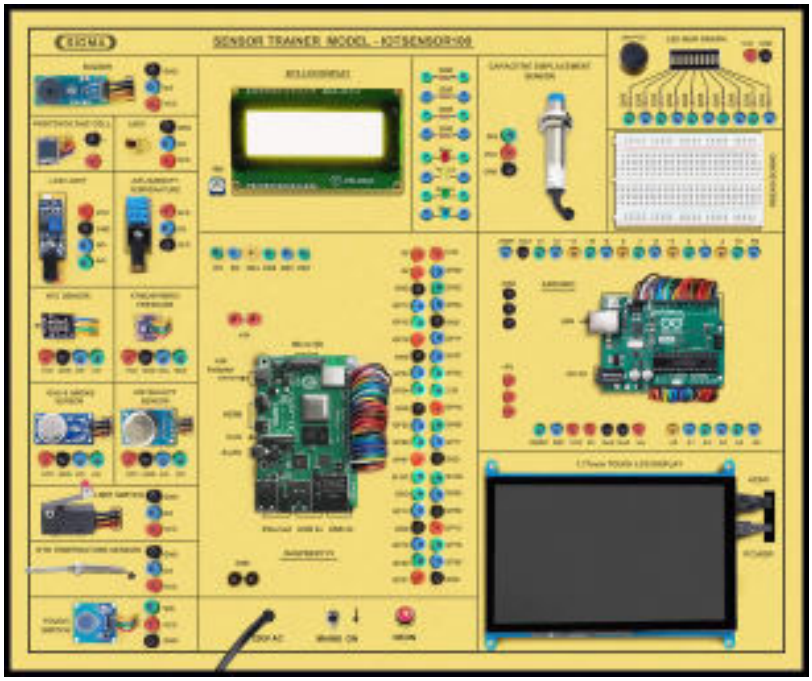
AI ENHANCED IOT TRAINER

MODEL-AI-IOT100

SPECIFICATIONS



This AI Enhanced IoT Application Setup Trainer has been designed with a view to provide practical and experimental knowledge of Internet of Things (IOT) and Artificial Intelligence (AI, ML, DL and NLP) with Sensors programing with Raspberry, Arduino and Jetson IOT Boards.

SPECIFICATIONS

A. Main Specs

1. Following Parts and Modules are assembled on Single PCB of size - 24 Inch x 20 Inch.
2. The complete circuit diagram is screen printed on component side of the PCB with circuit and Parts at the same place.
3. The PCB with components on front side is fitted in elegant wooden box having lock and key arrangement.
4. Modules and Parts should be removable without desodlering for easy repair / replacement
5. The acrylic cover is fitted on PCB to safeguard main parts.

B. IOT Trainer Nodes: - 3 Nos

6. Three IOT Trainer Nodes consisting of Arduino UNO 4 Minima Microcontroller
7. CPU : ARM Cortex-M4 CPU
8. Memory : 256 KB Flash Memory, 32 KB SRAM, 8 KB Data Memory (EEPROM)
9. Speed : 48 MHz
10. Ethernet : Arduino Shilled - 100 MHz
11. USB : USB 2. 0 - Micro – C
12. Digital Analog Converter - DAC
13. Communication : GPIO Connector
    UART : Pin D0, D1
    I2C : Pin A4, A5, SDA, SCL
    SPI : Pin D10-D13, ICSP header
    CAN : Pin D4, D5, External transceiver is required
14. Real-time Clock – RTC
15. Sensor interfacing
16. XBee interfacing
17. Power Supply : 5V,1 A USB-C

C. IOT Trainer Nodes: - 2 Nos

1. Two IOT Trainer Node consisting of Arduino Zero Microcontroller and ESP32 Wifi NodeMCU
2. Arduino Zero : Cortex-M0+ - SAMD21
3. ESP32 : Dual Core Tensilica LX6 CPU at up to 240MHz
   : WiFi and Bluetooth
4. XBee interfacing
5. Sensor interfacing
6. USB
7. UART, I2C, SPI, GPIO interfacing Connector

D. Artificial Intelligent Embedded GPU Node: - Jetson Orin Nano Board

1. Hardware:

1. AI Performance : 40 TOPS
2. GPU : 1024-Core NVIDIA Ampere Architecture GPU with 32 Tensor Cores
3. GPU Frequency : 625 MHz
4. CPU : 6-Core Arm® Cortex®-A78AE v8.2 64-bit CPU 1.5MB L2 + 4MB L3
5. CPU Frequency : 1.5 GHz
6. Memory : 8 GB 128-bit LPDDR5 68 GB/s
7. Storage : SD Card Slot & External NVMe via M.2 Key M
8. Video Encode : 1080p30 Supported via CPU 1-2 Cores with Software
9. Video Decode : 1x 4K60 (H.265), 2x 4K30 (H.265), 5x 1080p60 (H.265), 11x 1080p30
10. Camera Connectors : 2x MIPI CSI-2 - 22-pin Camera Connectors
11. Ethernet : Gigabit Ethernet, M.2 Key E
12. Display Port : 1x Display Port - DP 1.2 (+MST) Connector
13. USB : 4 x USB Type-A 3.2 Gen2, USBC- Supports Recovery Mode
    USB Type-C connector for UFP
14. PCIe : M.2 Key M slot with x4 PCIe Gen3
    M.2 Key M slot with x2 PCIe Gen3
    M.2 Key E slot
15. GPIO : 20x2 GPIO Interface Header,
    12-pin button Header, GPIO, I2C, I2S, SPI, UART, PWM
16. Fan Header : Fan with 4 Pin Fan Header
17. SD Card Slot : microSD slot
18. DC power Jack : 19V DC, 2.4A Power Supply - Barrel Type 2.1 mm
19. Hard Disk : 128GB nVME SSD with pre-loaded Linux OS

With pre-configured image which is again used as edge computing setup
With Tools like OpenCV, Tensor RT, CUDA

20. USB Camera : Logitech 270
21. Mouse : Logitech USB Mouse
22. Keyboard : Logitech USB Keyboard
23. Hard Disk : Pre-configured nVME SSD

2. Software:

1. AI/DL-Examples :
   Error detection using Deep Learning Inference,
   People detection and counting using Deep Learning in IoT network.
2. IOT protocols :
   CoAP, MQTT, REST, WSN, Ethernet (IPV4), Zigbee, WI-FI, Bluetooth
3. Cloud Services :
   Web Services,
   Event Trigger Management Services,
   Security management
   Dynamic Allocation
4. Sensor software
   Driver Development,
   Microcontroller Interface,
   Communication,
   Calibration etc
5. Languages:
   C- C++, JAVA Script, Python, XML
6. Echo System
   ARM Cortex, Linux, Mbed, RTOS, OSGi Framework, EclipseIDE, GNU Toolchain
7. Examples Supports:
   Using serial and Ethernet protocols,
   Using wireless protocols (BLE & Wi-FI),
   Using Cloud Services,
   Using Database,
   Using Voice control,
   Using Personal Cloud Platform,
   Using WSN,
   Using AI-DL

E. Embedded Gateway: - Raspberry Microcontroller – Pi 4

1. Microcontroller Board:

1. CPU : Quad Core 1.2GHz Cortex A53 64 Bit CPU
2. RAM : 1 GB
3. Memory : 32GB
4. OS : Open Source Linux
5. Wifi : Dual-Band 2.4/5.0 GHz Wireless LAN, Bluetooth 5.0,
6. Ethernet : Gigabit Ethernet RJ45 Port
7. USB Ports : USB 2.0 – 2 Ports, USB 3.0 – 2 Ports
8. Display : Micro HDMI Port – 2 Nos
9. Sound : 2 × micro HDMI Interface ports
10. Power : 5V, 3A DC via USB-C Connector
11. On Board 32 GB SD Memory Card with all Codes and Libraries
12. This Embedded gateway able to connect to the nodes and transmit data to the cloud.
    The necessary image containing cloud services compatible for IoT should is ported on the board.
    Also the procedure to configure the same should be provided to end user.
13. All-in-One GPIO Boards: 5 Nos
    Designed to suit the experimentation of IoT applications to featuring

2. Modules and Hardware:

1. On-Board LED : 8 Nos
2. LCD Display : 16x2 Character LCD,
3. Seven Segment Display : 2 Digit 7-segment display,
4. Push Switches : 4 general purpose keys
5. Keyboard Matrix : 2 x 2 Matrix Keyboard,
6. EEPROM Board : I2C and SPI based EEPROM
7. Motors : Stepper Motor and DC Motor with Driver interface
8. Relays : 2 Channel Relay output
9. ADC : 2 channel ADC input using potentiometer
   And unity gain amplifier for protection
10. Voice Control : Voice enabled control using Amazon Alexa on Echo Device
    And Google Application on mobile device.
11. Router : Wifi Router with Power Adaptor to connect to Internet
12. Bluetooth : Bluetooth module for connecting the node to embedded gateway
    to explore BLE Feature.

3. Sensors:

1. A portable sensor kit with facility to interface with following Sensors
2. Temperature and Humidity – DHT11 sensor to log data on IOT gateway using Wi-Fi protocol.
3. IMU10DOF Sensor
4. Ultrasonic Sensor
5. Vibration Sensor
6. PIR Sensor
7. Soil Moisture Sensor
8. Dust Sensor
9. Reed Relay Sensor
10. Sunlight Sensor
11. Sensor Software

To sense Data of Sensors and posting it to cloud.

The set of sensors are compatible with nodes and provided with proper connectivity options like base board where the sensors are mounted.

The sensors are compatible with I2C, SPI protocols etc.

The sensors are pluggable directly to the IoT nodes

4. Other Parts:

1. Sensor Modules : RFID Sensor and Finger Print Sensor module for IOT application like Attendance system which uses database in IOT.
2. WSN Zigbee Trainer : Setup compatible with ARM Cortex M4 IoT Nodes and Gateway
3. Motors : Two unit of Stepper motor and Two unit of +5V DC motor for demonstration of cloud based control using IoT application

F. Training and Demonstration

1. Training & Demonstration of various IoT Test-Cases using Serial Gateway & Ethernet Gateway,
2. Examples using sensors,
3. Examples using Services like email, twitter, SMS etc
4. Examples using Wireless protocol & Database
5. Examples using Voice Control using Amazon Alexa Echo devices & Google assistance
6. Examples using Personal Cloud platform
7. Examples using wireless sensor network(WSN)
8. Examples using AI-DL
9. An Ecliplse IDE configured for IoT applications provided for entire lab for programming using cortexM4 Platform.
10. An Arduino IDE configured for IoT applications provided for entire lab for programming using CortexM0+ Platform.
11. Softcopy for Workbook / Manual featuring Basic examples to get started with the target board as well as examples to use internet and communicate with cloud, with detailed working procedures are provided with the setup.

G. Accessories

1. All Cables and Adaptors
2. Pen Drive : 16 GB with All Codes and Soft copy of Manual
3. E-Books for IOT Subject : 100 Nos. in PDF Format
4. Mp4 Video for IOT Subject : 100 Nos
5. Online Cloud/Server Services : For 2 Years on Cloud Server
6. Live Training at College : For 2 Days for 4 Hours per Day
7. After Sale Training support : By Online Zoom Meeting or By Whatsapp Video Call

EXPERIMENTS

1. Examples using Serial Gateway

1. Write a program to monitor on board ADC Potentiometer on CORTEX board.
2. Write a program to monitor on board temperature sensor on CORTEX board.
3. Write a program to implement switches for toggling LEDs.
4. Write a program to implement relay.
5. Write a program to implement Buzzer.
6. Write a program to implement DC motor.
7. Write a program to implement Stepper motor.

2. Examples using Ethernet Gateway

8. Write a program to monitor on board ADC Potentiometer on CORTEX board.
9. Write a program to monitor on board temperature sensor on CORTEX board.
10. Write a program to implement switches for toggling LEDs.
11. Write a program to implement relay.
12. Write a program to implement Buzzer.
13. Write a program to implement DC motor.
14. Write a program to implement Stepper motor.

3. Examples using Sensors

15. Write a program to implement reed click as switch to turn LEDs On and off.
16. Write a program to implement vibra sense click to ring buzzer for 5 seconds.
17. Write a program to implement water sensor to ring buzzer for 5 seconds and show rain detection on OpenHAB.
18. Write a program to implement moisture sensor to monitor humidity in soil.
19. Write a program to implement PIR motion Grove to detect motion and ring buzzer for 5 Seconds.
20. Write a program to implement dust sensor to monitor concentration of dust or smoke.
21. Write a program to implement Touch key click and display on OpenHAB which key is pressed also switch on and off 4 LEDs.
22. Write a program to implement ultrasonic ranger grove to monitor distance in meters.
23. Write a program to interface 10DOF and monitor x,y,z values as well as side, orientation and pressure.
24. Write a program to interface Sunlight sensor and monitor UV, VIS, IR values.

25. Write a program to interface current and voltage sensor values.

Examples using Services

26. Write a program to cross communicate between CORTEX boards (one is serial gateway and other is Ethernet) in such way that changing ADC on serial should print value on Ethernet board and vice versa, note to set trigger ADC value over 1000.
27. Write a program to add trigger to send email if ADC value is above certain level or below.
28. Write a program to add trigger to send twitter message if ADC is above certain level or below.
29. Write a program to add trigger to send SMS with message bird if ADC is above certain level or below.

4. Examples using Wireless protocol

30. Write a program to interface Bluetooth and Ultrasonic Ranger Grove to monitor distance and send to OpenHAB.
31. Write a program to interface Bluetooth and implement DC Motor.
32. Write a program to interface WIO node and Temperature and Humidity sensor and monitor values on OpenHAB.

5. Examples using Database

33. Write a program to monitor on board ADC Potentiometer on CORTEX board and store values in InfluxDB and visualize it using
34. Write a program to store and restore Relay state from MapDB.

6. Examples using Voice Control

35. Write a program to control LEDs using Alexa Echo Dot.
36. Write a program to control relay using Alexa Echo Dot.
37. Write a program to control Buzzer using Alexa Echo Dot.
38. Write a program to control DC motor using Alexa Echo Dot.
39. Write a program to control Stepper motor using Alexa Echo Dot.

7. Examples using Voice Control

40. Write a program to control LEDs using Google Assistance.
41. Write a program to control relay using Google Assistance.
42. Write a program to control Buzzer using Google Assistance.

43. Write a program to control DC motor using Google Assistance.
44. Write a program to control Stepper motor using Google Assistance.

8. Examples using Personal Cloud platform

45. Write a program to control LEDs using OpenHAB service running on Amazon cloud.
46. Write a program to control Relays using OpenHAB service running on Amazon cloud.

9. Examples using wireless sensor network (WSN)

47. Program to configure the node for peer to peer communication
48. Program to setup and configure mesh network
49. Program to demonstrate concepts like auto discovery, self-healing the network etc…

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