Hardware Overview

- Processor: ARM Cortex-M4 32-bit RISC core optimized for low-power, real-time operation
- Clock Speed: 80 MHz
- Memory: Internal RAM 128 KB or better, Internal Flash 1 MB or more
- Connectivity:

  - ARDUINO® Uno V3 Compatibility:
    - Digital I/O
    - I2C
    - SPI
    - UART
    - Analog I/O
    - PWM
    - On-Board Capabilities:
  - Debugger/Programmer: On-board debugger/programmer with USB re-enumeration capability (mass storage, Virtual COM port, debug port)
  - User Input/Output:
    - User programmable LEDs and button
    - MCU current measurement point
  - USB Power Management: Efficient USB power management for easy integration

Key Concepts – Edge AI Board

1. **Edge AI**: Processor designed to handle complex AI algorithms at the edge, enabling real-time processing without cloud dependency
2. **Low-Power Operation**: ARM Cortex-M4 core optimized for low-power applications, ideal for battery-operated devices
3. **Connectivity and Expansion**: Supports ARDUINO® Uno V3 with I2C, SPI, UART, PWM, and other peripherals
4. **Real-Time Processing**: High clock speed and internal memory ensure efficient AI model execution and data processing

Note: Specifications are subject to change, Photos shown above are Indicative, Actual Product can Vary.

5. **USB Management**: USB power management and re-enumeration enhance flexibility for device connection and data handling

Experiment List

1. **Basic STM32 Programming on In-Built LED**
   - Objective: Learn STM32 basics by toggling an onboard LED
   - Key Concepts: STM32CubeIDE setup, GPIO configuration, LED control, delay functions
2. **Toggling an LED Using a USR Button**
   - Objective: Configure the onboard user button to control an LED
   - Key Concepts: GPIO input configuration, button state detection, LED toggling
3. **Toggling an LED Using Interrupt**
   - Objective: Implement interrupt-based input handling for the user button
   - Key Concepts: External interrupts, ISR, event-driven programming
4. **Serial Communication Protocol (UART)**
   - Objective: Implement UART communication between the Edge AI board and a PC
   - Key Concepts: UART configuration, data transmission, serial debugging
5. **Serial Communication Protocol (UART) with Printf**
   - Objective: Send formatted data from the Edge AI board to a PC via UART
   - Key Concepts: UART data formatting, debugging techniques, serial monitoring
6. **Sensor Data Logging Methodology (Method 1)**
   - Objective: Design a methodology for acquiring sensor data
   - Key Concepts: Sensor initialization, data logging, storage
7. **Sensor Data Logging Methodology (Method 2)**
   - Objective: Implement an alternative data logging method optimized for AI training
   - Key Concepts: Real-time sensor data processing, data optimization
8. **Running a Data Logger Code and Building an AI Model**
   - Objective: Collect data and train an AI model for classification
   - Key Concepts: Data collection, ML model training, real-time classification
9. **Image Classification with Pre-Trained Models**
   - Objective: Classify images using pre-trained deep learning models
   - Key Concepts: Image classification, transfer learning, model evaluation
10. **Real-Time Emotion Recognition**
    - Objective: Recognize and classify emotions from facial expressions using the camera module
    - Key Concepts: Emotion classification, facial feature extraction, AI model deployment
11. **Audio Scene Classification Using Machine Learning**
    - Objective: Implement a model to classify various sounds
    - Key Concepts: Feature extraction, sound classification, ML model
12. **Gesture Recognition Using Motion Sensor Data**
    - Objective: Train and deploy a gesture recognition model using motion sensor data
    - Key Concepts: Gesture classification, motion sensor data, TensorFlow Lite
13. **Vibration-Based Predictive Maintenance Using Machine Learning**
    - Objective: Detect and classify abnormal vibration patterns
    - Key Concepts: Anomaly detection, predictive maintenance, AI-powered fault detection
14. **1-Class Model for Ultrasonic Sensor Data**

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- Objective: Use NanoEdge AI to detect irregularities in ultrasonic sensor data
- Key Concepts: One-class classification, ultrasonic sensor data, anomaly detection

Platform and Workstation Details

- Training Environment Setup:
  - Display: 4-inch capacitive touch LCD for user interaction
  - Connectivity: USB OTG, I2C, SPI, UART for external device interfaces
  - Power Supply: USB or external sources for stable operation
  - Enclosure: Plastic enclosure for durability and industrial protection

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