Fingerprint Module Library

- Core Functionality: Fingerprint enrollment, matching, and template storage using an event-driven architecture

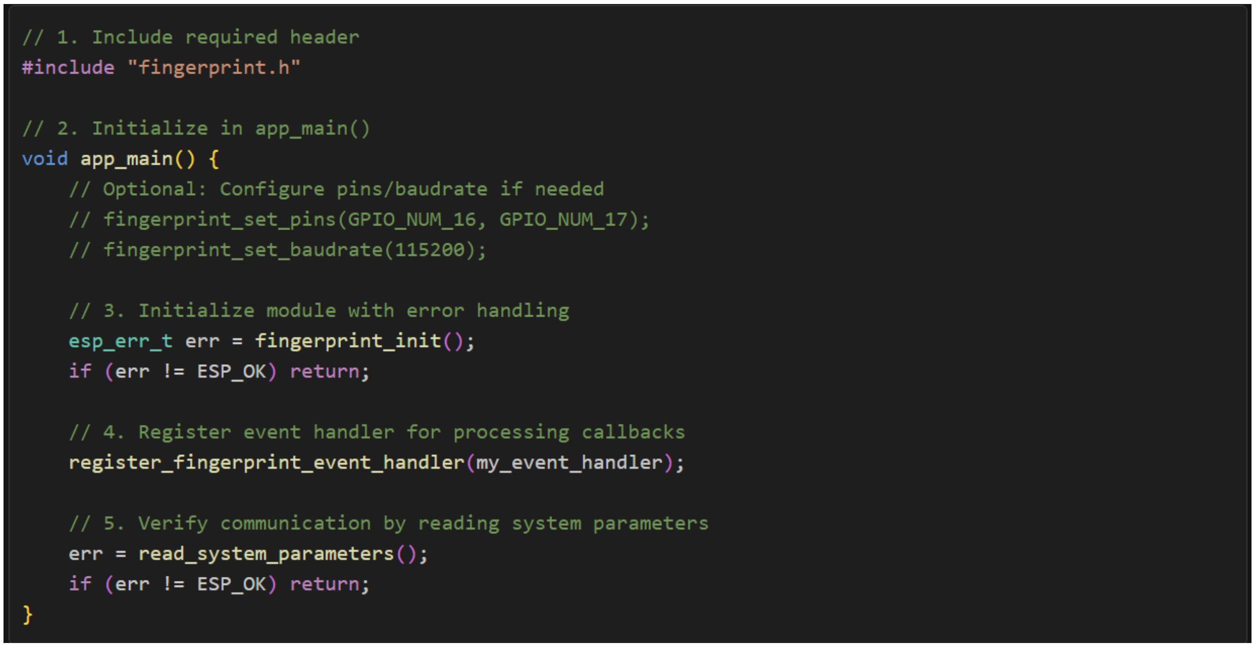
- Hardware Requirements:
  - UART communication at 57600 bps (adjustable 9600-115200 bps)
  - Pin connections: TX→GPIO6, RX→GPIO5, INT→GPIO15, VIN→GPIO9
  - 3.3V power supply

- Software Requirements:
  - ESP-IDF v4.x+ framework
  - FreeRTOS for asynchronous operations
  - Standard ESP32 toolchain

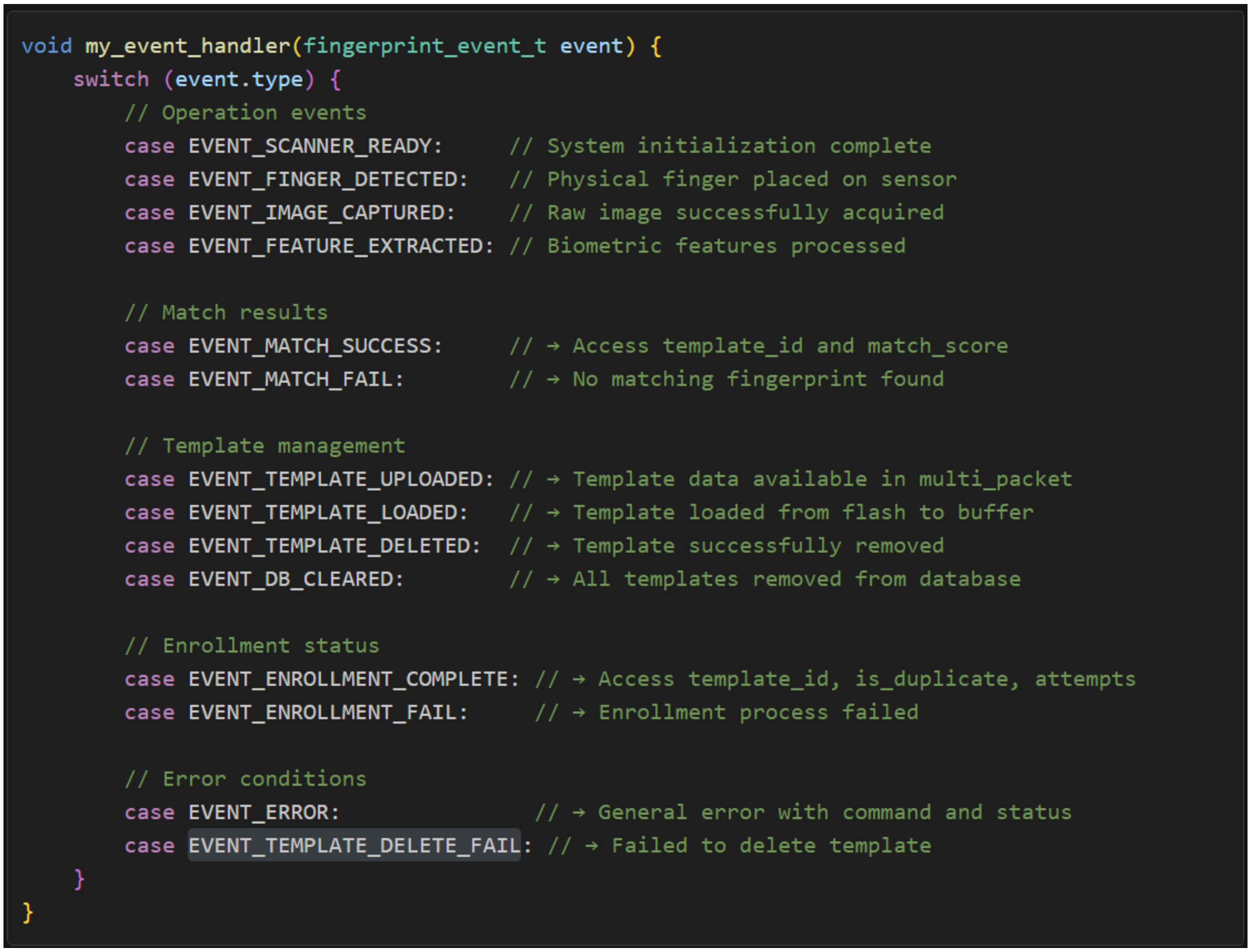
- Memory Requirements:
  - Buffer sizes (RX_BUF_SIZE = 1024)
  - Template buffer size (4096 bytes)
  - Task stack sizes (8192 bytes for read task, 4096 bytes for others)

- Core Operations:
  - Enroll: Use enroll_fingerprint(location) to add new fingerprints to a specific storage slot
  - Verify: Call verify_fingerprint() to match a scanned fingerprint against the database
  - get_enrolled_count() - Check how many templates are stored
  - delete_fingerprint(id) - Remove a specific template
  - clear_database() - Delete all templates
  - backup_template(id) - Export a template to ESP32 memory. Data is stored in event.multipacket->template_data and event.multipacket->packets
  - restore_template_from_multipacket(id, data) - Import a previously backed up template. Use event.multipacket as an argument in parameter data because this function will access the packets inside the multipacket.

- Software Initialization:

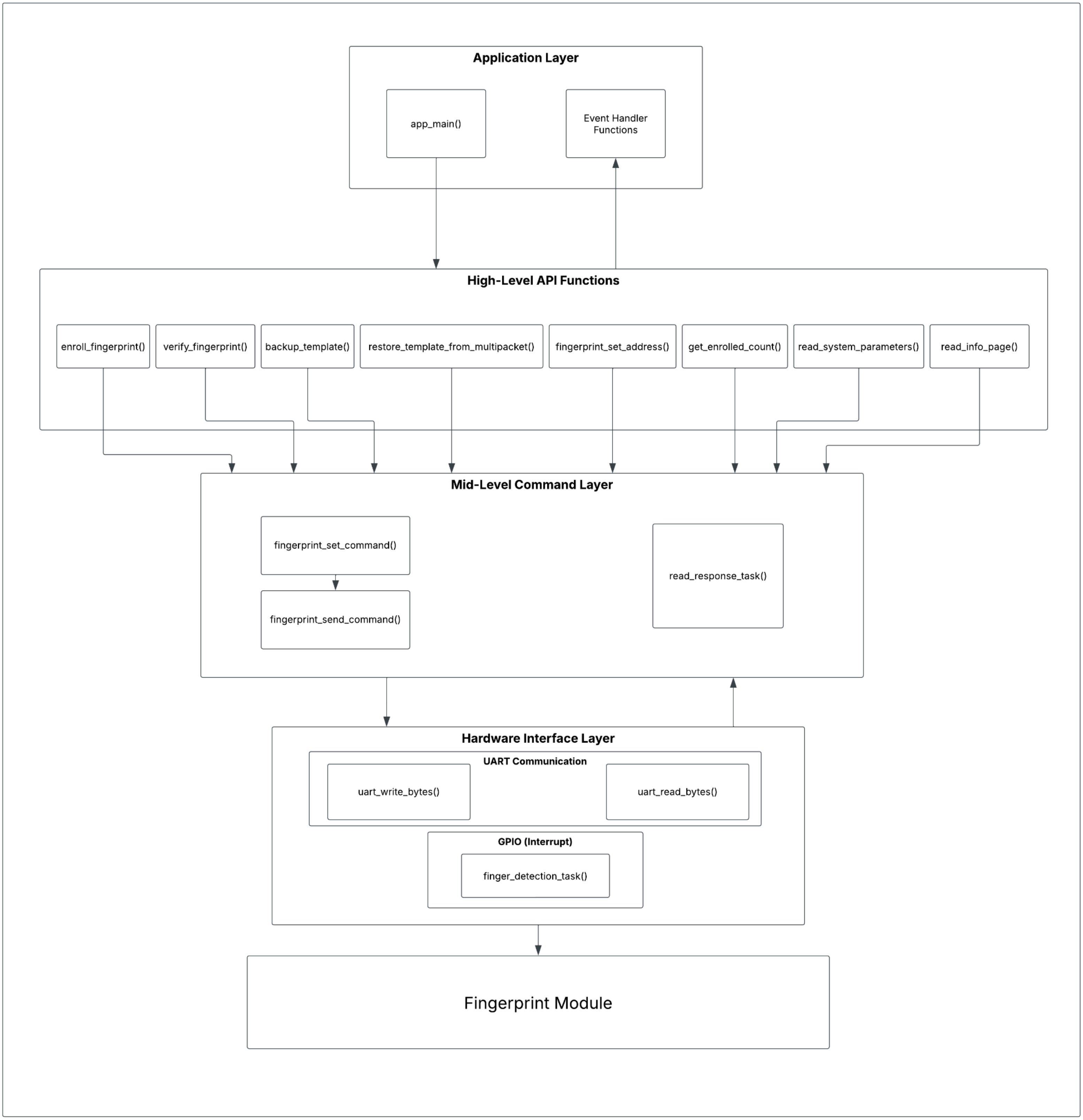


```
// 1. Include required header
#include "fingerprint.h"

// 2. Initialize in app_main()
void app_main() {
    // Optional: Configure pins/baudrate if needed
    // fingerprint_set_pins(GPIO_NUM_16, GPIO_NUM_17);
    // fingerprint_set_baudrate(115200);

    // 3. Initialize module with error handling
    esp_err_t err = fingerprint_init();
    if (err != ESP_OK) return;

    // 4. Register event handler for processing callbacks
    register_fingerprint_event_handler(my_event_handler);

    // 5. Verify communication by reading system parameters
    err = read_system_parameters();
    if (err != ESP_OK) return;
}
```



```
void my_event_handler(fingerprint_event_t event) {
    switch (event.type) {
        // Operation events
        case EVENT_SCANNER_READY:      // System initialization complete
        case EVENT_FINGER_DETECTED:    // Physical finger placed on sensor
        case EVENT_IMAGE_CAPTURED:     // Raw image successfully acquired
        case EVENT_FEATURE_EXTRACTED: // Biometric features processed

        // Match results
        case EVENT_MATCH_SUCCESS:      // → Access template_id and match_score
        case EVENT_MATCH_FAIL:         // → No matching fingerprint found

        // Template management
        case EVENT_TEMPLATE_UPLOADED: // → Template data available in multi_packet
        case EVENT_TEMPLATE_LOADED:    // → Template loaded from flash to buffer
        case EVENT_TEMPLATE_DELETED:   // → Template successfully removed
        case EVENT_DB_CLEARED:         // → All templates removed from database

        // Enrollment status
        case EVENT_ENROLLMENT_COMPLETE: // → Access template_id, is_duplicate, attempts
        case EVENT_ENROLLMENT_FAIL:     // → Enrollment process failed

        // Error conditions
        case EVENT_ERROR:               // → General error with command and status
        case EVENT_TEMPLATE_DELETE_FAIL: // → Failed to delete template
    }
}
```

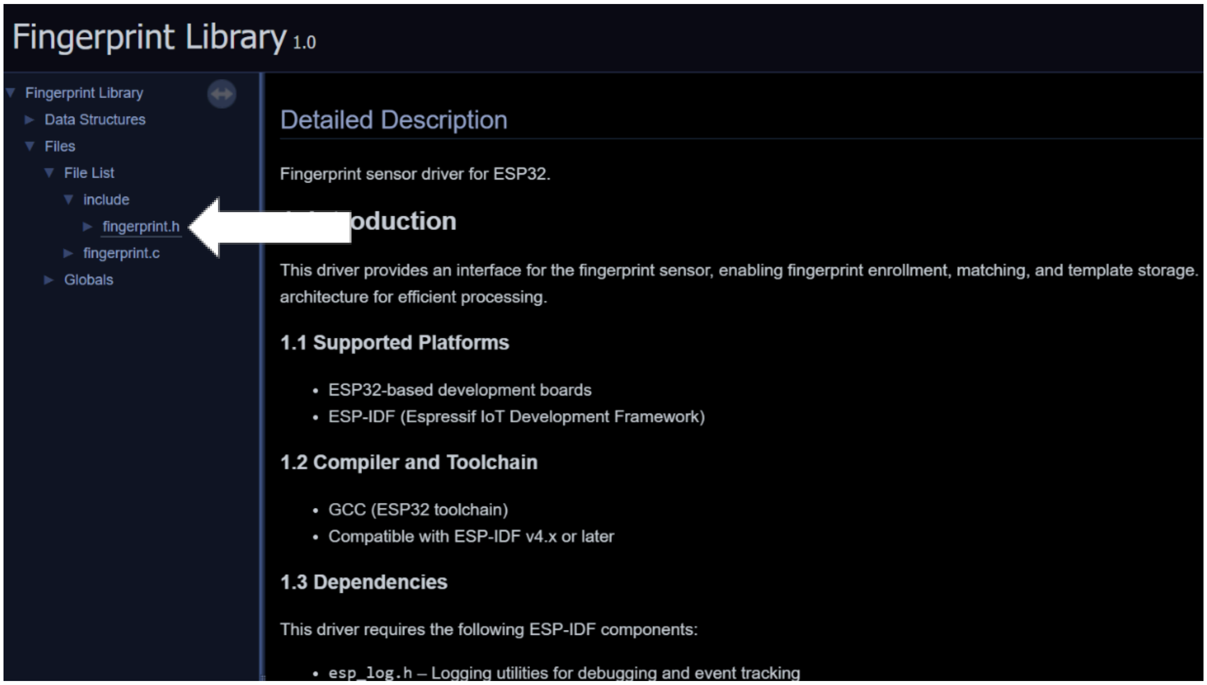
- Diagram:


Application Layer
app_main()
Event Handler Functions
High-Level API Functions
enroll_fingerprint()
verify_fingerprint()
backup_template()
restore_template_from_multipacket()
fingerprint_set_address()
get_enrolled_count()
read_system_parameters()
read_info_page()
Mid-Level Command Layer
fingerprint_set_command()
fingerprint_send_command()
read_response_task()
Hardware Interface Layer
UART Communication
uart_write_bytes()
uart_read_bytes()
GPIO (Interrupt)
finger_detection_task()
Fingerprint Module

Detailed documentation is provided called “fingerprint_documentation.html” in the same directory.

After clicking the .html file find the fingerprint.h:

Fingerprint Library→Files→File List→include→fingerprint.h



Detailed Description

Fingerprint sensor driver for ESP32.

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This driver provides an interface for the fingerprint sensor, enabling fingerprint enrollment, matching, and template storage. architecture for efficient processing.

1.1 Supported Platforms

- ESP32-based development boards
- ESP-IDF (Espressif IoT Development Framework)

1.2 Compiler and Toolchain

- GCC (ESP32 toolchain)
- Compatible with ESP-IDF v4.x or later

1.3 Dependencies

This driver requires the following ESP-IDF components:

- `esp_log.h` – Logging utilities for debugging and event tracking