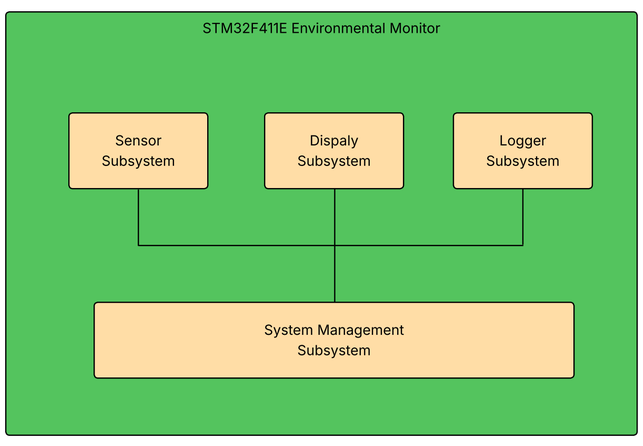

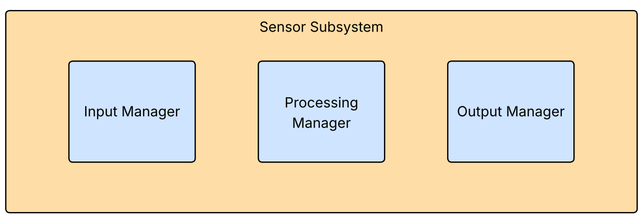

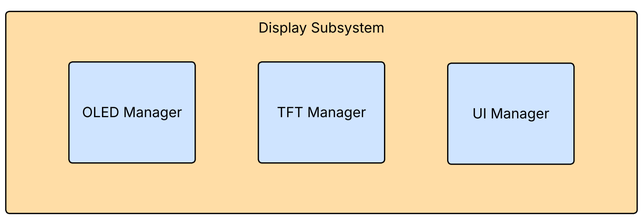

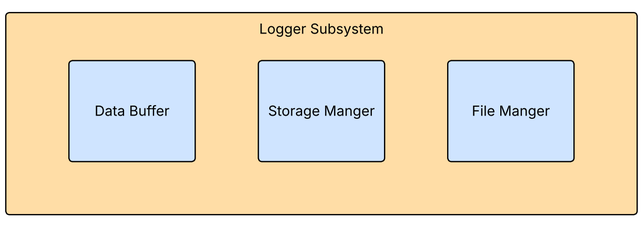

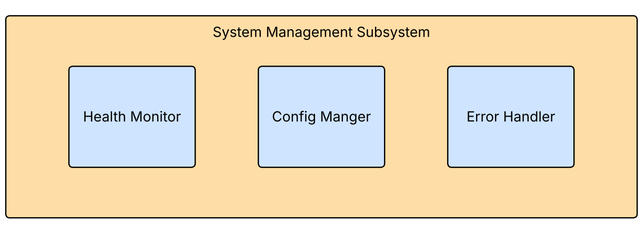

Sensor Subsystem Files

Input Manager

// File: sensor_input.c / sensor_input.h

Functions:
- sensor_input_init() // Initialize all sensor interfaces
- sensor_read_sound() // Read sound sensor via ADC
- sensor_read_motion() // Read PIR sensor via GPIO
- sensor_read_potentiometer() // Read potentiometer via ADC
- sensor_calibrate_all() // Calibrate all sensors
- sensor_input_task() // FreeRTOS task for sensor reading

Processing Manager

// File: sensor_processing.c / sensor_processing.h

Functions:
- sensor_process_init() // Initialize processing algorithms
- sensor_apply_filters() // Apply noise filtering
- sensor_check_thresholds() // Check alarm thresholds
- sensor_debounce_motion() // Debounce motion detection
- sensor_calculate_averages() // Calculate moving averages
- sensor_generate_events() // Generate system events

Output Manager

// File: sensor_output.c / sensor_output.h

Functions:
- sensor_output_init() // Initialize actuator outputs
- sensor_control_rgb_led() // Control RGB LED states
- sensor_control_buzzer() // Control buzzer activation
- sensor_control_fan() // Control fan operation
- sensor_control_relays() // Control relay switching
- sensor_output_task() // FreeRTOS task for actuator control

Display Subsystem Files

OLED Manager

// File: display_oled.c / display_oled.h

Functions:
- oled_init() // Initialize OLED display
- oled_clear_screen() // Clear display buffer
- oled_write_text() // Write text to display
- oled_draw_graph() // Draw sensor data graphs
- oled_update_display() // Update physical display
- oled_set_contrast() // Adjust display contrast

TFT Manager

// File: display_tft.c / display_tft.h

Functions:
- tft_init() // Initialize TFT display
- tft_clear_screen() // Clear TFT buffer
- tft_draw_rectangle() // Draw geometric shapes
- tft_write_text() // Write text with fonts
- tft_draw_bitmap() // Display bitmap images
- tft_set_backlight() // Control backlight
- tft_update_display() // Refresh display content

UI Manager

// File: display_ui.c / display_ui.h

Functions:
- ui_init() // Initialize UI system
- ui_create_main_screen() // Create main dashboard
- ui_create_sensor_screen() // Create sensor detail screen
- ui_create_settings_screen() // Create settings screen
- ui_handle_input() // Handle user input
- ui_update_values() // Update displayed values
- ui_display_task() // FreeRTOS task for UI updates

Logger Subsystem Files

Data Buffer

// File: logger_buffer.c / logger_buffer.h

Functions:
- buffer_init() // Initialize circular buffer
- buffer_write_data() // Write sensor data to buffer
- buffer_read_data() // Read data from buffer
- buffer_is_full() // Check if buffer is full
- buffer_is_empty() // Check if buffer is empty
- buffer_get_count() // Get number of entries
- buffer_clear() // Clear all buffer data

Storage Manager

// File: logger_storage.c / logger_storage.h

Functions:
- storage_init() // Initialize SD card interface
- storage_mount_card() // Mount SD card file system
- storage_create_file() // Create new log file
- storage_write_data() // Write data to SD card
- storage_read_data() // Read data from SD card
- storage_delete_old_files() // Delete old log files
- storage_get_free_space() // Get available storage space

File Manager

// File: logger_file.c / logger_file.h

Functions:
- file_init() // Initialize file management
- file_create_csv() // Create CSV format file
- file_write_header() // Write CSV header
- file_write_record() // Write data record
- file_close() // Close file properly
- file_generate_filename() // Generate timestamped filename
- file_logger_task() // FreeRTOS task for file logging

System Mangement Files

Health Monitor

// File: system_health.c / system_health.h

Functions:
- health_init() // Initialize health monitoring
- health_check_memory() // Check memory usage
- health_check_tasks() // Check task status
- health_check_peripherals() // Check peripheral status
- health_report_status() // Generate health report
- health_handle_errors() // Handle system errors
- health_monitor_task() // FreeRTOS task for health monitoring

Config Manager

// File: system_config.c / system_config.h

Functions:
- config_init() // Initialize configuration
- config_load_defaults() // Load default settings
- config_save_settings() // Save settings to EEPROM
- config_load_settings() // Load settings from EEPROM
- config_set_thresholds() // Set sensor thresholds
- config_get_parameter() // Get configuration parameter
- config_validate_settings() // Validate configuration

Error Handler

// File: system_error.c / system_error.h

Functions:
- error_init() // Initialize error handling
- error_log_event() // Log error events
- error_get_last_error() // Get last error code
- error_clear_errors() // Clear error log
- error_handle_critical() // Handle critical errors
- error_recovery_attempt() // Attempt system recovery
- error_handler_task() // FreeRTOS task for error handling