FreeRTOS CMSIS V2 Message Queue Temperature Pipeline

Scenario

A smart home HVAC controller where one task samples room temperature, another task sends readings to a central hub over UART, and a monitoring task triggers a buzzer if the temperature exceeds safe thresholds. The RTOS ensures reliable task scheduling and communication.

Project statement

Implement a CMSIS-RTOS V2 (FreeRTOS) pipeline where SensorTask samples LM35 and posts timestamped messages to a message queue; CommTask dequeues and sends messages over UART; MonitorTask supervises health and commands buzzer alerts.

Required hardware

- STM32F446RE Nucleo; LM35; buzzer;

Success criteria

- FIFO message delivery with no message loss under nominal UART latency.
- Proper UART mutexing and queue sizing documented.
- Integration with tickless idle or Idle hook to allow low-power behavior.

Tasks to be performed

- Define tasks, priorities, stack sizes, and CMSIS V2 message queue depth.
- Implement SensorTask to sample ADC, timestamp, and push message to queue.
- Implement CommTask to dequeue, mutex UART, and transmit.