FreeRTOS:
A brief introduction With Arduino

Engr. Hamza Ali Imran
Design & Verification Engineer

Git Repository
https://github.com/engrhamzaaliimran/FreeRTOSArduino

Outlines

- Introduction
- Multi-tasking and scheduling - Basics
- Queues
- Task Suspension / Resume
- Mutex
- Recommended Resource

Multi-tasking and Scheduling

With FreeRTOS (an RTOS), logical functions are placed into separate tasks that run independently

Two types of task-scheduling

- Preemptive multitasking
  - Time slice
  - Blocked
  - Yields control explicitly
- Cooperative multitasking (coroutines)

  Current task runs until it gives up control

Helloworld Program

https://github.com/engrhamzaaliimran/FreeRTOSArduino/blob/master/helloWorld.cpp

Queues

Message-queue facility provides a safe way to communicate a complete message

It limits the length of the queue so that a sending task can't use up all the memory

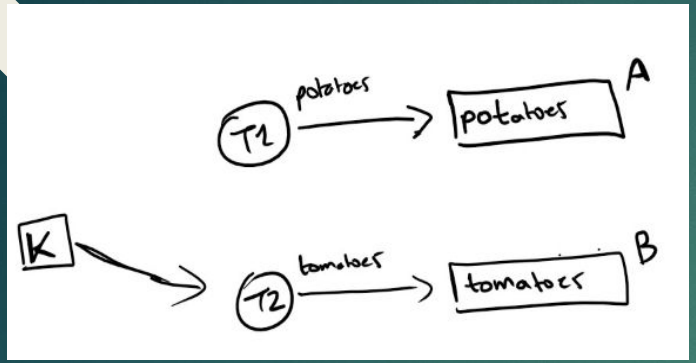
By using a predetermined queue length, the task adding messages becomes blocked until space is available

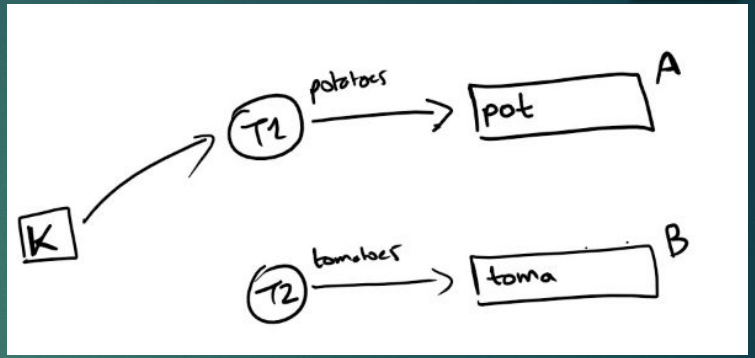
Example Program

https://github.com/engrhamzaaliimran/FreeRTOSArduino/blob/master/queue.cpp

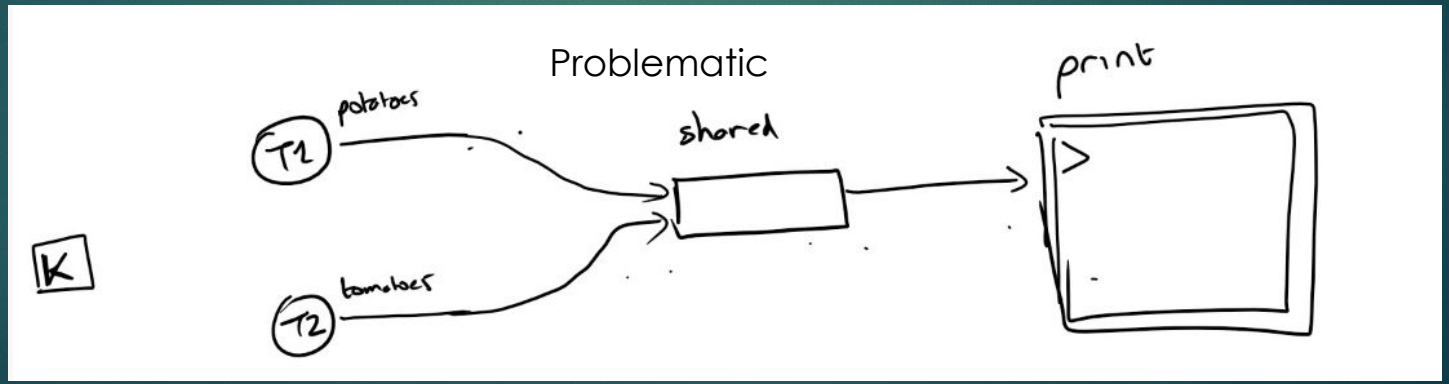
Mutex

Not Problematic





Problematic



Mutex

Mutex is like a lock which one puts on some shared resource before using it so that if the context switches during the processing the shared resource which could have some task being done partially, stays safe until the control come back to the original task. Following tutorial explains with example

https://github.com/engrhamzaaliimran/FreeRTOSArduino/blob/master/Mutex_use_concurency_issue_resolved.cpp

Recommended Resources

There are not much resource available for FreeRTOS with Arduino as case study. Most common option available are ARM Cortex-M3 and M4. Based boards majority stuff is same. Following are links to good resources.

Youtube Tutorial Videos (STM32-Cortex M4 based board)

https://www.youtube.com/watch?v=7efj3bJbGbk&list=PLEfMFrwVdbPYzMgeaLiFRb4ogjV8m3lt6

A detailed book (STM32-M3 based Board "Blue Pill")

https://drive.google.com/file/d/1Ls2HDznlPQs7w3KtBpnF01dkDZNX3FXU/view?usp=sharing