RTOS

A real-time operating system (RTOS) is an operating system that runs multi-threaded applications and can meet real-time deadlines.

An operating system is a piece of software that runs on a computer or microcontroller that accomplishes a number of important functions.

Real time operating system or RTOS offers many of the same functions as general purpose operating systems but they are designed so that the scheduler can guarantee meeting timing deadlines.

First, it’s in charge of scheduling background tasks and user applications. In most operating systems, dozens of background processes are executing at the same time, and probably you usually have several applications opened on your phone or computer at the same time. Operating system figures out how to give slices of time to each of these processes so that everything appears to be happening concurrently. Microcontroller-based systems only have a single processing core, but a need to execute multiple tasks. In applications where tasks need to appear to be executing at the same time or concurrently, the use of an RTOS makes sense. An RTOS can have multiple tasks simultaneously in memory and can switch between them based on events and priorities.

Second, it manages a number of virtual resources like files, libraries, and folders allowing applications and processes to access them when needed.

Third, it can manage or provide device drivers for your system, these drivers allow the system to read and write on an external disc, respond to keyboard or mouse input or draw graphics on your monitor.

You’re probably familiar with general purpose operating systems like windows, mac OS, Linux, IOS, and android. Most operating systems are designed with human interaction as the most important feature, so the schedule is designed to prioritize such tasks additionally the scheduler is often non-deterministic which means we can't know exactly which task will execute, and that’s called pre-emption. Pre-emption is the ability of an operating system to temporarily suspend a task in order to execute a higher-priority task. If the embedded is currently running, an RTOS is the go-to operating system. The nature of most RTOS systems is to determine which tasks should be executing at any given time based on the priority of the task and system conditions.

Before deciding to go with an RTOS, it should be taken in mind how much RAM and also Flash space is available. RTOS takes up 8 to 10 KB Flash space that is not much, but if the microcontroller has only 16KB of Flash space, so there is no room for the application code.

Furthermore, RTOS includes synchronization tools by default as Mutexes that can be used to protect a shared resource and Semaphores that can be used to signal and synchronize tasks and message queues to transfer data between tasks. Moreover, RTOS is compatible with  Many of the third-party stacks and tools, and that accelerates software development.

Last but not least, RTOS is available for every microprocessor or application as well as creating tasks and utilizing its tools easy and very powerful.

Tragic results would result from improper utilization of RTOS, so the developers should be aware analyzing their tasks.