模块 14

简介：实时系统

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教学目标：

理解 如何使用优先级中断来创建实时系统
探索 接口开关的不同技术
学习 如何在 GPIO 输入引脚上生成端口中断
设计、构建和测试系统
创建用于碰撞检测的实时系统

需要预先学习的模块：模块 8， 9，10 和 13
•开关接口（模块 8）
•时间延迟 （模块 9）
•SysTick 周期性中断（模块 10）
•Timer_A 周期性中断（模块 13）

推荐阅读材料：

• Volume 1 Sections 9.1, 9.2, 9.3, 9.4, and 9.5
Embedded Systems: Introduction to the MSP432 Microcontroller ISBN: 978-1512185676, Jonathan Valvano, copyright (c) 2017
• Volume 2 Sections 4.5, 5.1, 5.2, 5.3, 5.4, and 5.5
Embedded Systems: Real-Time Interfacing to the MSP432 Microcontroller, ISBN: 978-1514676585, Jonathan Valvano, copyright (c) 2017

以前我们将**实时系统（real-time system）**定义为具有有限延迟的系统。换句话说，**延迟（latency）**是请求服务与启动服务之间的时间，它总是小于可接受的限制。根据情况，我们可以交替地将实时定义为具有有限的**响应时间（response time）**。例如，对于机器人上的碰撞检测，我们将响应时间定义为碰撞（表示请求服务的碰撞传感器硬件边缘）与电机停止的时间（服务完成）之间的时间。为了实现实时，我们将配置碰撞传感器以请求触摸中断。

需要多个软件任务的系统的基本方法是部署多线程。一个软件**线程（thread）**是传统的主程序，大部分时间都在运行。该线程将实施高级策略。中断将用于创建其它线程。 SysTick 周期性中断将测量来自线传感器的数据。在模块 13 中，我们研究了如何使用 Timer_A 执行周期性任务。在本单元中，我们将学习如何使用 I / O 引脚产生的边沿触发中断。

端口 1 - 6 上的任何引脚都可以请求中断。我们可以在输入信号的上升或下降时配置中断请求。 如果碰撞开关是负逻辑接口，则下降沿表示发生了碰撞。 中断通过全局变量与其它线程通信。在部署多个中断时，如果多个事件重合，我们使用优先级来整理服务顺序。这种碰撞检测是一项非常高优先级的任务，因此我们将其配置为高优先级事件。

在本实验中，碰撞将引起电机停止并设置全局错误标志。主程序将识别此事件，然后执行适当的操作，例如将机器人转动 90 度并再次继续前进。在实验中，可以选择解决一个非常简单的系统级机器人挑战。

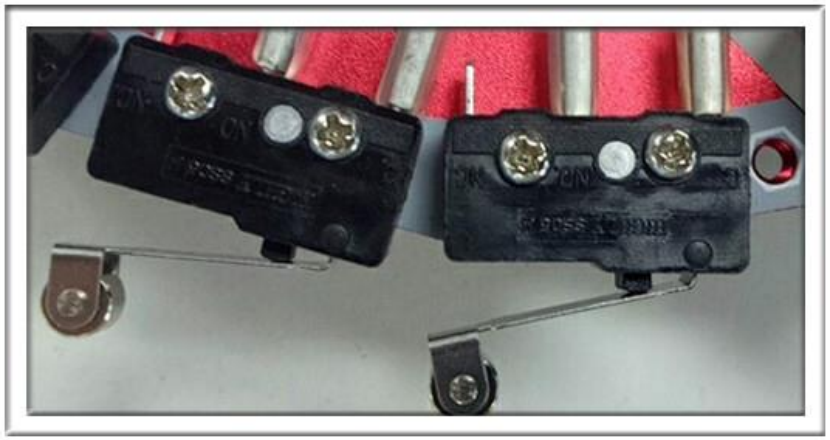

图 1. 位于机器人前部的碰撞传感器。

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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265