



模块 13

简介： 定时器



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教学目标：

理解 定时器及其在嵌入式系统中的应用

接口 使用硬件 PWM 的直流电机

创建 多线程软件使用多个周期性中断

设计 机器人指令向前移动，向左转，向右转，向后移动

需要预先学习的模块： 模块 9, 10 和 12

- 脉冲宽度调制（模块 9）
- SysTick 周期性中断（模块 10）
- 电机的机械和电气接口（模块 12）

推荐阅读材料：

- Volume 1 Sections 8.7, and 9.7
- **Embedded Systems: Introduction to the MSP432 Microcontroller, ISBN: 978-1512185676, Jonathan Valvano, copyright (c) 2017**
- Volume 2 Sections 6.2, 6.3, and 6.5
- **Embedded Systems: Real-Time Interfacing to the MSP432 Microcontroller, ISBN: 978-1514676585, Jonathan Valvano, copyright (c) 2017**

该模块与上一个模块（模块 12）一起开发机器人，使其移动。回到第 9 模块，您使用调暗 LED 的脉冲宽度调制创建了软件。您现在将用硬件生成的 PWM 替换软件生成的 PWM。更具体地说，您将在 MSP432 微控制器上配置定时器硬件。这将允许系统以非常小的软件开销调整传送到机器人上的直流电机的功率。软件将初始化时间，设置 PWM 周期和初始占空比。硬件定时器将自动创建 PWM 输出。软件只有在系统希望改变应用的功率或改变方向时才需要执行。

回到第 10 模块，您创建了两个线程：主程序和 SysTick ISR。在此模块中，您将使用硬件定时器创建其它周期性线程。拥有多个线程允许您以模块化方式增加系统的复杂性。

MSP432 微控制器具有独立于 SysTick 的定时器。输入捕获模式用于对输入信号（模块 16）进行时间测量，测量转速计（实验 16）的周期。MSP432 微控制器有四个通用定时器模块（General Purpose Timer Modules），称为 Timer_A。每个定时器都有一个 16 位计数器和 7 个相关的捕获/比较寄存器。

在本实验中，您将使用 Timer A0 为电机接口创建两个 PWM 输出，您将使用 Timer A1 创建一个可供机器人探险家使用的附加周期性中断。您将在模块 16 中稍后使用 Timers A2 和 A3 来连接两个转速计。

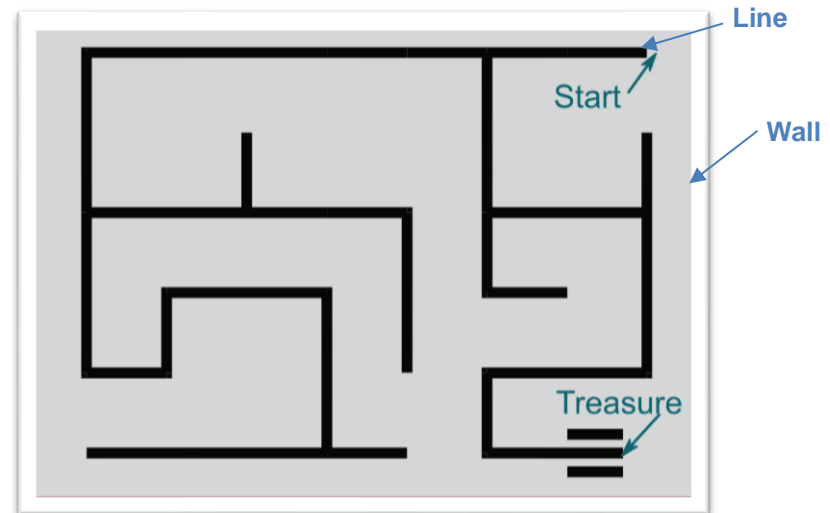


图 1.（来自实验 6）在本实验之后，您可以使用线传感器和碰撞传感器创建一个能够从迷宫中找到出路的机器人探险器。同样，您可以创建一个循线的机器人探险器。

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