



模块 4

简介：使用 **MSP432** 进行软件设计



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教学目标：

回顾 C 语言编程

理解 C 语言中的条件表达式和循环

开发 逻辑和四则运算函数

学习 如何调试 C 语言程序

设计、构建和测试软件模块

机器人在探索周围世界时，必须做出许多决策。在本模块的实验环节中，您将编写程序来从三个距离传感器中获取输入，并判断下面八种情况之一是否发生，请见图 1。在实验 15 中您将使用真正的传感器，但在本实验中您将先编写后面将要用到的机器人程序。

需要预先学习的模块（模块 1）

- 使用 CCS 在 LaunchPad 上运行代码（模块 1）

推荐阅读材料：

- Volume 1 Chapter 1, Sections 2.8, 5.1, 5.2, 5.3, 5.6, and 5.8
Embedded Systems: Introduction to the MSP432 Microcontroller
ISBN: 978-1512185676, Jonathan Valvano, copyright (c) 2017

或

- Volume 2 Sections 1.4, 1.5, 3.1, 3.2, 3.3, and 3.4
Embedded Systems: Real-Time Interfacing to the MSP432 Microcontroller, ISBN: 978-1514676585, Jonathan Valvano, copyright (c) 2017

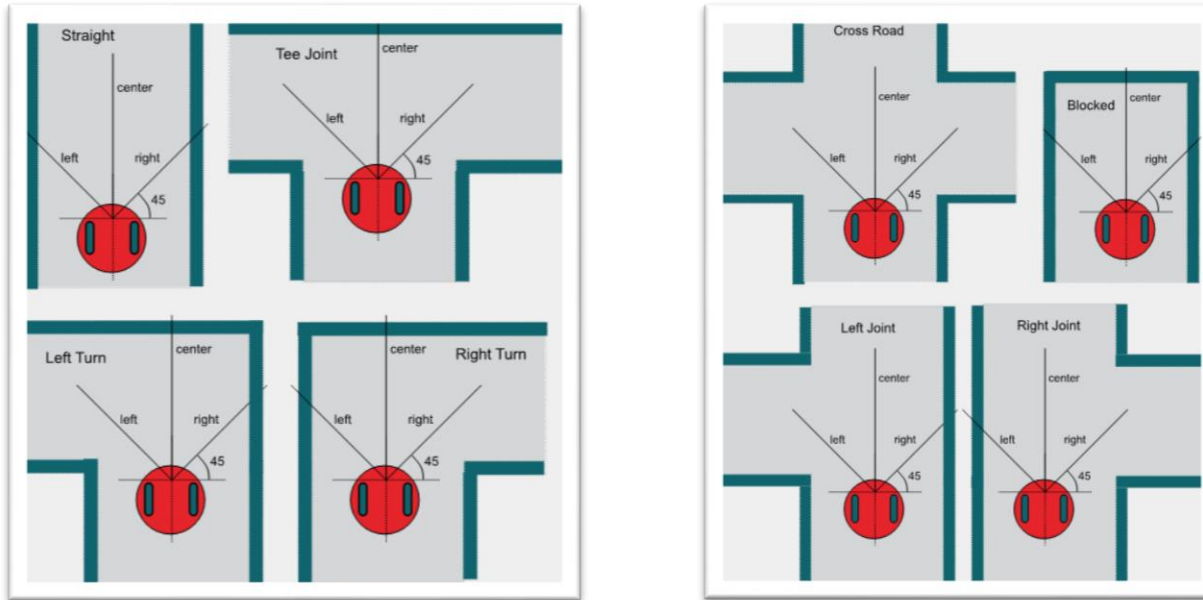


图 1. 机器人探索迷宫时可能出现的八种情况。当机器人接近路口时，它首先判断有哪些可供选择的路径存在，然后选择将要走哪一条路



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本模块将会对 C 语言进行简单介绍。C 语言是由 Dennis Ritchie 在 1969 至 1973 年间在 AT&T 贝尔实验室工作时发明的。1999 年，一个 C 语言的专业标准版本被建立起来，这个标准叫做 C99。本课程中我们将使用 C99 标准语言来编写我们的软件，因为这个标准在业界是被广泛使用的。

编译器是用来将人类可以读懂的高级语言转化成机器可以识别的目标代码的系统软件。编译器生成的代码运行速度很快，但如果要更改软件，我们必须编辑源代码并重新进行编译。

CCS 中的 Project Explorer 可以显示一个工程中的多种软件组件。**链接器**通过链接这些组件生成一个单个的软件系统。在 CCS 中，**build** 命令会同时执行编译和链接这两个过程。

在嵌入式系统中，**加载器 (loader)** 负责将目标代码烧写到 flash ROM 里面。我们将代码放在 ROM 中是因为 ROM 中的信息在掉电之后仍会保持。在 CCS 中，**debug** 命令会完成加载操作并打开调试器。

调试器 (debugger) 是一组硬件和软件工具的集合，可以用来验证系统是否正常运行。一个优秀的调试器应具备控制和观察两个功能。

在开始编写代码之前，我们必须先制定一个计划。软件开发是一个迭代的过程。尽管在下面我们按照 1、2、3、4 的顺序列出了开发的过程，但在现实中我们会在这几个步骤中不断循环往复。我喜欢先从第 4 步开始，甚至在决定程序是做什么的之前就先决定如何对它进行测试。

- 1) 我们从列出程序的输入和输出开始。这通常将决定整个系统是做什么的。我们确定输入输出的范围和重要程度。
- 2) 接下来，我们列出所需要的数据。我们必须决定数据的结构、含义，以及数据是如何被收集和改变的。
- 3) 下一步我们开发软件算法，算法指的是我们想要一定次序去执行的指令。有多种方法可以描述算法。有经验的程序员可以直接用 C 语言开发算法。但大多数人需要先利用一种抽象方法来记录所需的操作顺序。流程图和伪代码是两种最常用的描述方式。伪代码没有格式限制，它只是快速记录要做什么以及什么时候去做。我们可以将伪代码放在我们程序的注释里。接下来我们将编写代码来执行流程图或伪代码所描述的算法。
- 4) 最后一步是调试。学会调试技巧将极大地提高您的代码质量和开发效率。

在本模块相关实验中，您将编写和测试一些后面需要用到的迷宫机器人程序。具体来说，第一个程序会把从传感器获得的 ADC 测量结果转化为机器人和墙壁之间的距离，而第二个程序则将获取三个距离数据并通过结果将目前情况与最合适的情景进行匹配。

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