模块 7

简介：有限状态机

简介:有限状态机

教学目标:

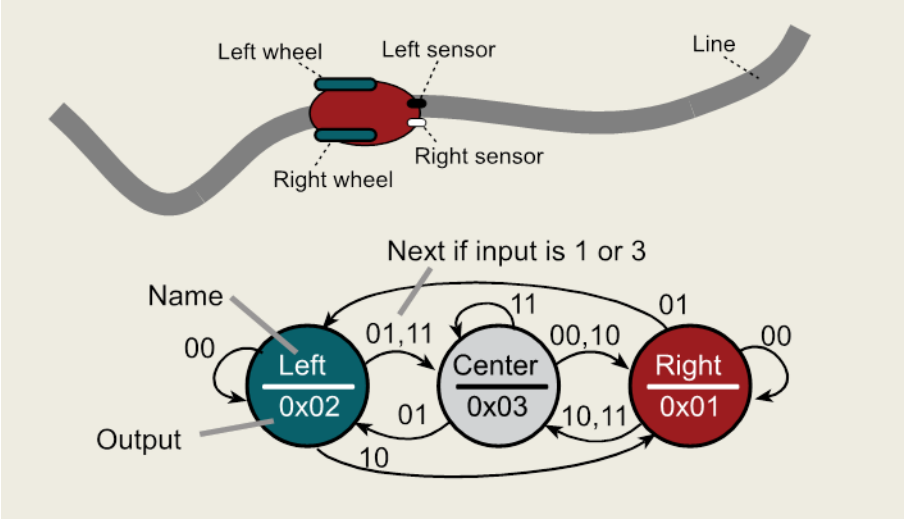
回顾 C 程序设计
理解 变量，数字，指针，结构体，数组
开发 调试技术
学习 如何解决有限状态机的问题
设计、构建和测试一个系统 控制循线机器人

需要预先学习的模块：模块 1，4 和 6

- 使用 CCS 在启动板上运行代码(模块 1)
- 基本的 C 语言程序 (模块 4)
- GPIO (模块 6)

推荐阅读材料：

- Volume 1 Sections 6.1, 6.2, 6.4 and 6.5
  Embedded Systems: Introduction to the MSP432 Microcontroller ISBN: 978-1512185676, Jonathan Valvano, copyright (c) 2017
- Volume 2 Section 3.5
  Embedded Systems: Real-Time Interfacing to the MSP432 Microcontroller, ISBN: 978-1514676585, Jonathan Valvano, copyright (c) 2017



软件抽象允许我们用一套基本抽象原则定义复杂问题。然后，我们可以使用这些抽象构建块构建系统解决方案。使用抽象可使我们更好地理解问题及其解决方案。这是因为我们可以将系统所做的事情（策略）与系统工作方式（机制）的细节分开。这种分离首先是通过描述系统的功能简化了设计过程，然后我们可以将描述转换为实现该描述的系统。抽象提供了正确的函数证明，并简化了扩展和定制。本节介绍的抽象是有限状态机（FSM）。 FSM 开发的抽象原则是输入，输出，状态和状态转换。 FSM 状态转换图（STG）定义了其输入和输出之间的时间依赖关系。如果我们可以解决复杂问题并将其映射到 FSM 模型，那么我们可以使用简单的 FSM 软件工具来解决它。我们的 FSM 软件实现将易于理解，调试和修改。

该问题被映射到一个定义良好的模型，该模型具有一组抽象但功能强大的规则。然后，软件解决方案是实现模型规则的关键。 在我们的例子中，一旦我们证明我们的软件正确地解决了一个 FSM，那么我们就可以对状态转换图进行更改，并确信我们的软件解决方案正确地实现了新的 FSM。

嵌入式系统通常部署在安全关键系统中。 在这些情况下，我们必须证明解决方案完全符合预期。 像有限状态机（FSM）这样的抽象方法允许我们将它的作用与它的工作原理分开。 FSM 的复杂性在状态转换图中，而控制器应该是非常简单的。一旦我们认证低级控制器正常运行，我们就可以在高级或抽象级别中验证系统。在与该模块相关的实验室中，我们将使用有限状态机为一个简单的循线机器创建控制器。 输入将来自两个开关（模拟两个线路传感器），输出将转到两个 LED（在一个差动驱动机器人上模拟两个电机）。控制器的目标是遵循直线。 本实验的目的是提供另一个 C 编程实验，并作为机器人控制的简介。 在之前的模块 **6（GPIO）**中，您连接了一个实际的线传感器。 其它实验室将为机器人控制器提供额外的传感器。 在 **10（调试）**中，您将添加防撞开关。 在 **15（ADC）**中，您将添加红外距离传感器。 在 **17（转速计）**中，您将添加转速计来测量车轮速度。 这些传感器测量值可用作 FSM 控制器的输入。 在 **12（直流电机）**和 **13（定时器）**中，您将连接机器人电机，这将是真正的 FSM 控制器的输出。

系统开发的基本方法是创建组件，然后将组件拼凑在一起以创建系统。 在本单元中，您将学习如何将 FSM 用作系统的中央控制器。

IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ('TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products http://www.ti.com/sc/docs/stdterms.htm), evaluation modules, and samples (http://www.ti.com/sc/docs/sampterms.htm).

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