DESN2000 (Computer Engineering)

Introduction to STM32 ARM and GPIO

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What are embedded systems?

• A system composed of computer processor, computer memory, and input/output peripheral devices
• Embedded as part of a complete device often including electrical or electronic hardware and mechanical parts
• Dedicated function within a larger mechanical or electronic system
• e.g.: calculators, printers, Microwave ovens, treadmills ...
Microprocessors vs Microcontrollers

General Purpose Microprocessor System

CPU
RAM
ROM
I/O Port
Timer
Serial Port

Address Bus
Data bus

CPU
RAM
ROM
I/O
ADC
Timer
Serial Port

Microcontroller
Different Microcontrollers

• Microchip PIC
• Atmel AVR (Now under Microchip)
• Espressif Systems (ESP8266 and ESP32)

• ARM-based microcontrollers
  • STMicroelectronics STM32
  • NXP Freescale
  • Texas Instruments LM4F, TM4C ...
  • ....
STM32F303RE

• We will focus on STM32F303RE, which is the microcontroller found in the NUCLEO-F303RE Board
STM32F303RE Specification

- ARM Cortex-M4 32-bit CPU
- 64 Kbytes of SRAM
- Operating voltage - 2.0 V to 3.6 V
- Peripherals such as
  - Digital I/O
  - Analogue to Digital Converters (ADC)
  - Timers
  - Serial communication interfaces
- More info:
- Datasheet:
General Purpose I/O Pins

- Limited pins on a microcontroller
- GIPO pins can be configured by software to do different functions like
  - Digital I/O
  - Analogue I/O
  - Communication, interrupts, timer capture etc.
coaST board components

Board components:
https://webcms3.cse.unsw.edu.au/DESN2000/24T2/resources/99720

Board pin connection:
https://webcms3.cse.unsw.edu.au/DESN2000/24T2/resources/100378
STM32 cubeIDE

- STM’s integrated development environment (IDE)
  - Code Editor
  - Compiler
  - Drivers
  - Debugger
  - Flasher/programmer

- Getting started with cubeIDE
Let us move on to the whiteboard and some live coding

- Getting started with STM cubeIDE
- Digital I/O
  - Output: direct LEDs
  - Input: direct buttons
Reading Material

- Zhu, Yifeng, Embedded systems with ARM Cortex-M microcontrollers in assembly language and C
  - Chapter on GPIO (Chapter 15 in 4th edition)