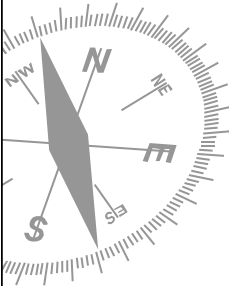




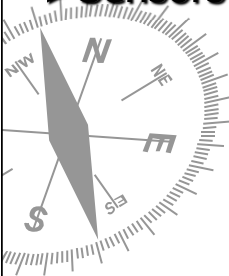
Robot Hardware Overview

A. A. Arroyo



Overview

- ▶ **Planning**
- ▶ **Embedded Boards**
 - **Build (Design) or Buy?**
- ▶ **Sensors**





Embedded Computers

▶ 8/16 Bit

- Architectures
 - ▶ 8051
 - ▶ Atmel AVR, Xmega
 - ▶ PIC
- Characterized by ease of use and lower learning curve
- Arduino (ATMega-based)

▶ 32 Bit

- Architectures
 - ▶ ARM7
 - ▶ ARM9
 - ▶ X86
- Steeper learning curve, Linux, pays off if more power req.
- Arduino Due (ARM-based)



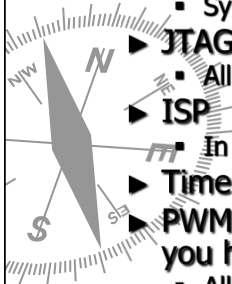
What to consider....

- ▶ First, a clear scope and task list must be defined.
- ▶ Pick a processor that has enough peripherals to support your tasks.
- ▶ Bigger, faster, and more complicated processors are not always better!



Peripherals

- ▶ **USART/UART (2 minimum)**
 - Provides serial communication interface
 - Typically RS232
- ▶ **Analog/Digital Channels (as many as you can)**
 - Many sensors are analog
 - 8 channels minimum
- ▶ **SPI/I2C/CAN interfaces**
 - Synchronous serial, very common interfaces
- ▶ **JTAG**
 - Allows in circuit debugging and programming
- ▶ **ISP**
 - In system programming, serial communication
- ▶ **Timers (The more the better)**
- ▶ **PWM / frequency generation modules (as many as you have actuators/motors)**
 - Allows hardware generation of motor driving signals



ATxMega 64/128

- ▶ **Atmel - Most popular**
- ▶ **Kitchen sink of peripherals**
 - 8 UARTS, 2 x 8 channel 12-bit A/D, multiple counters and PWM channels, SPI/I2C/CAN, ISP, and JTAG
- ▶ **RISC based 8Bit core**
- ▶ **32MIPS @ 32Mhz**
- ▶ **Development Software free from Atmel**
- ▶ **Large Hobbyist user base on the internet**





ARM7/9 LPC

- ▶ 32 Bit ARM7TDMI based core
- ▶ Computational advantage with a much steeper learning curve
- ▶ Massive amounts of peripherals
- ▶ Usually more expensive to develop with
- ▶ Recommended for beginners
- ▶ Linux-based inexpensive boards



Buy or Build?

- ▶ Building Your Own Board
 - Not as cost effective as you might think
 - Altium Designer (Protel)
 - Design flaws can kill your timetable
- ▶ Buy an Embedded Processor Board
 - May not fit your needs exactly
 - Documentation can help or hurt...





Where to buy your board?

- ▶ **Tim Martin's (martint2560@gmail.com) Company**
www.ootbrobotics.com
- ▶ **Olimex www.olimex.com**
 - Many types of development boards
 - Programmers
- ▶ **Spark Fun Electronics www.sparkfun.com**
 - Everything you need is here somewhere!
- ▶ **BD Micro www.bdmicro.com**
 - Mavric IIB ATmega 128 board



Sensors

- ▶ Distance
- ▶ Imaging / Cameras
- ▶ Bump
- ▶ Inertial/Magnetic
- ▶ Temperature
- ▶ Environmental

