

Mechatronics Systems Design Laboratory ECE 491

Igor Paprotny

Upcoming Checkout

- This week: - soldering lab (lab 1)
- Next week: FRDM-KL25Z lab 2 (GPIO and ADC)
- Safety write-up on BB
- Project proposal due next Friday (project proposal guidelines on BB soon)



Igor Paprotny

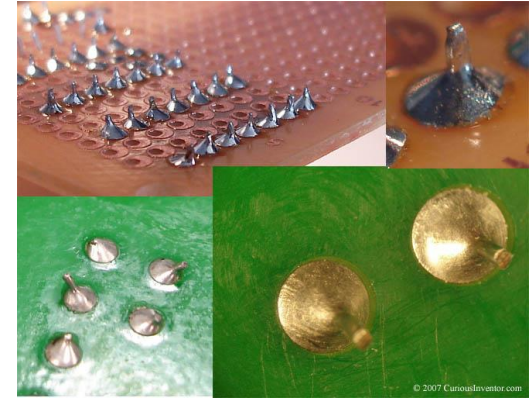
Interests: EE, Robotics, MEMS

What I want to get out of ECE 491: Have an awesome time teaching it !

webpage: <http://www1.ece.uic.edu/~paprotny/>

Soldering Basics

- Clean area
- Pre-tin wires and tip
- Clamp your work
- Apply heat to the wire and the pad
- Add solder to the part not the iron
- Apply for ~ 5 sec.
 - Should wet part and pad clearly
- Clear the flux residue



Good !



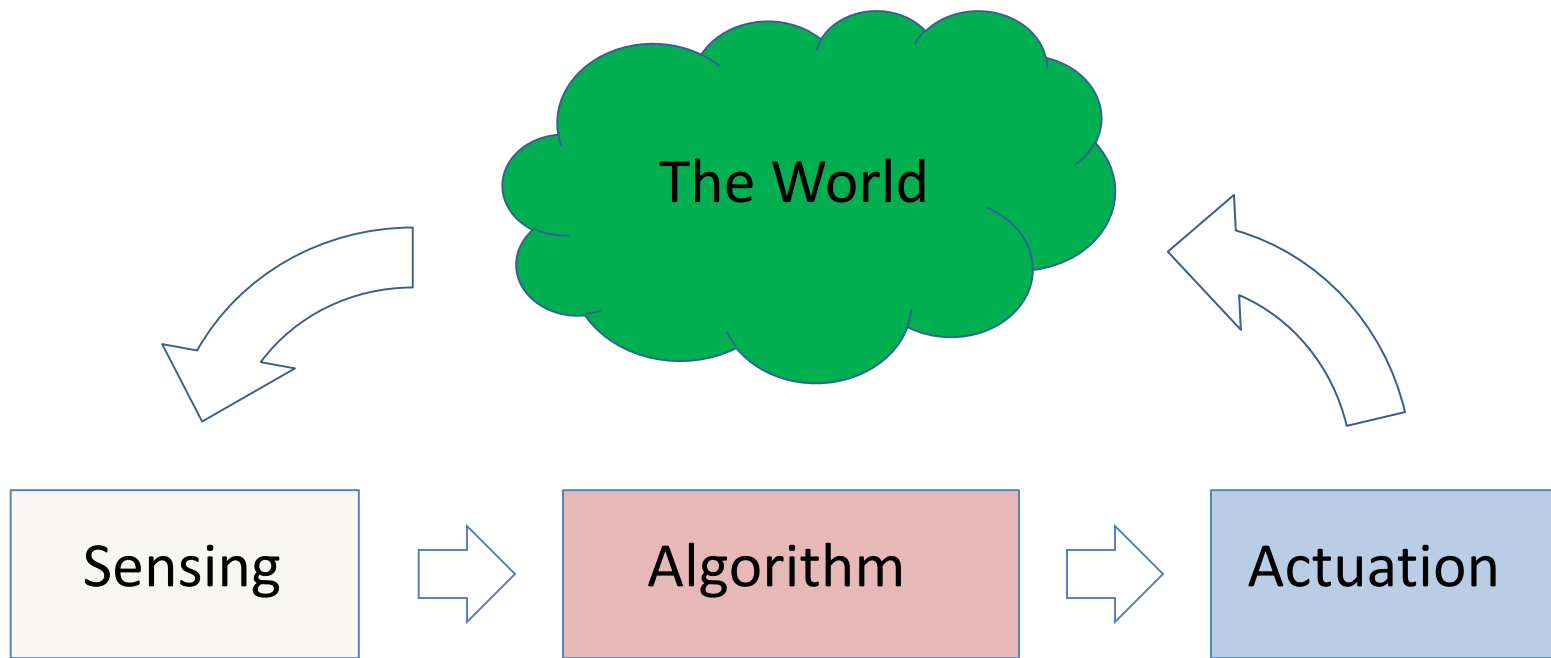
BAD !

Review this:

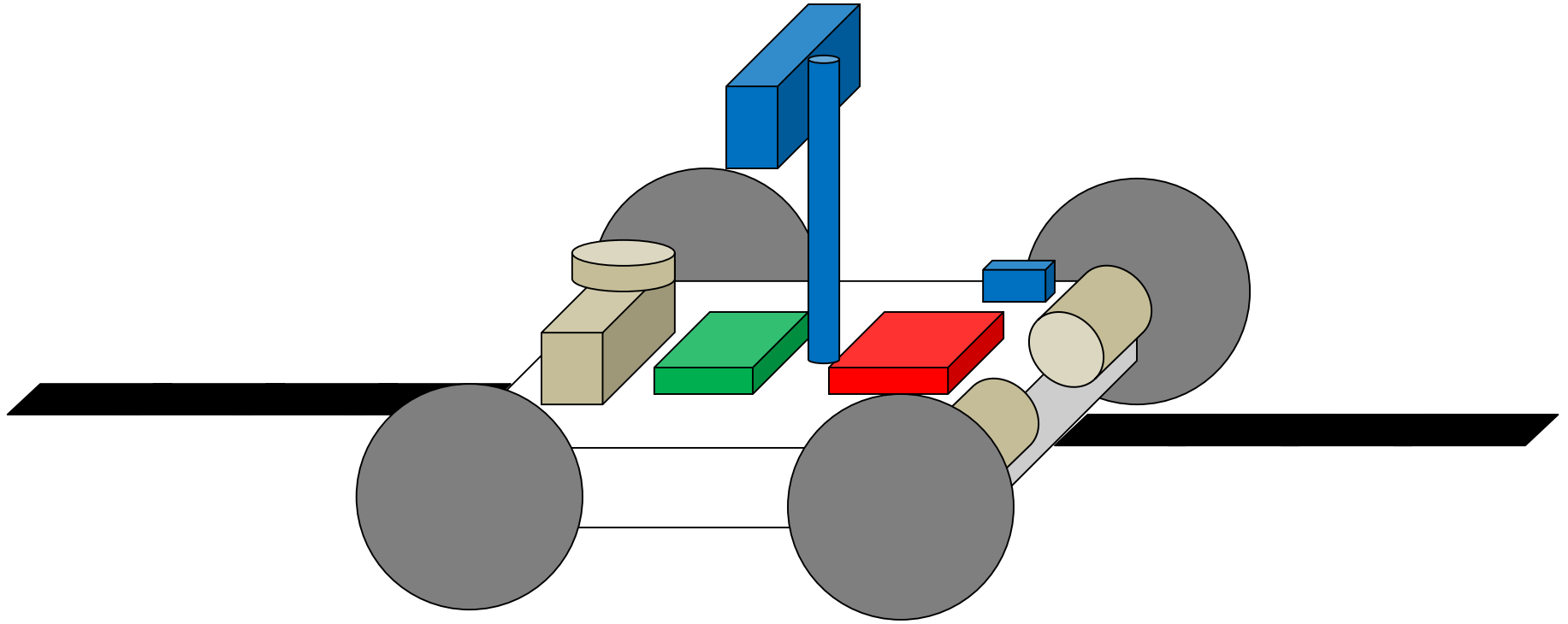


http://store.curiousinventor.com/guides/how_to_solder/

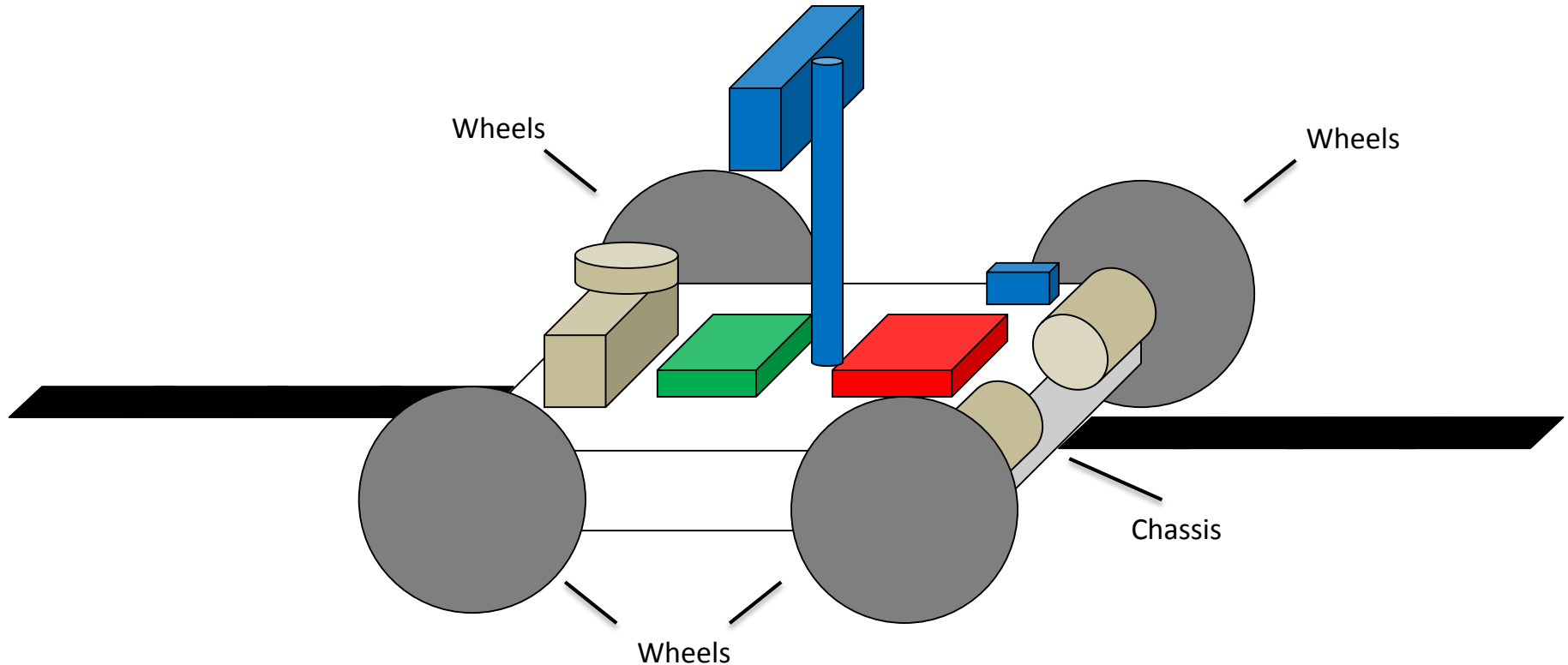
Introduction of Mechatronic Systems Design



Autonomous Car: A Complex Mechatronic System



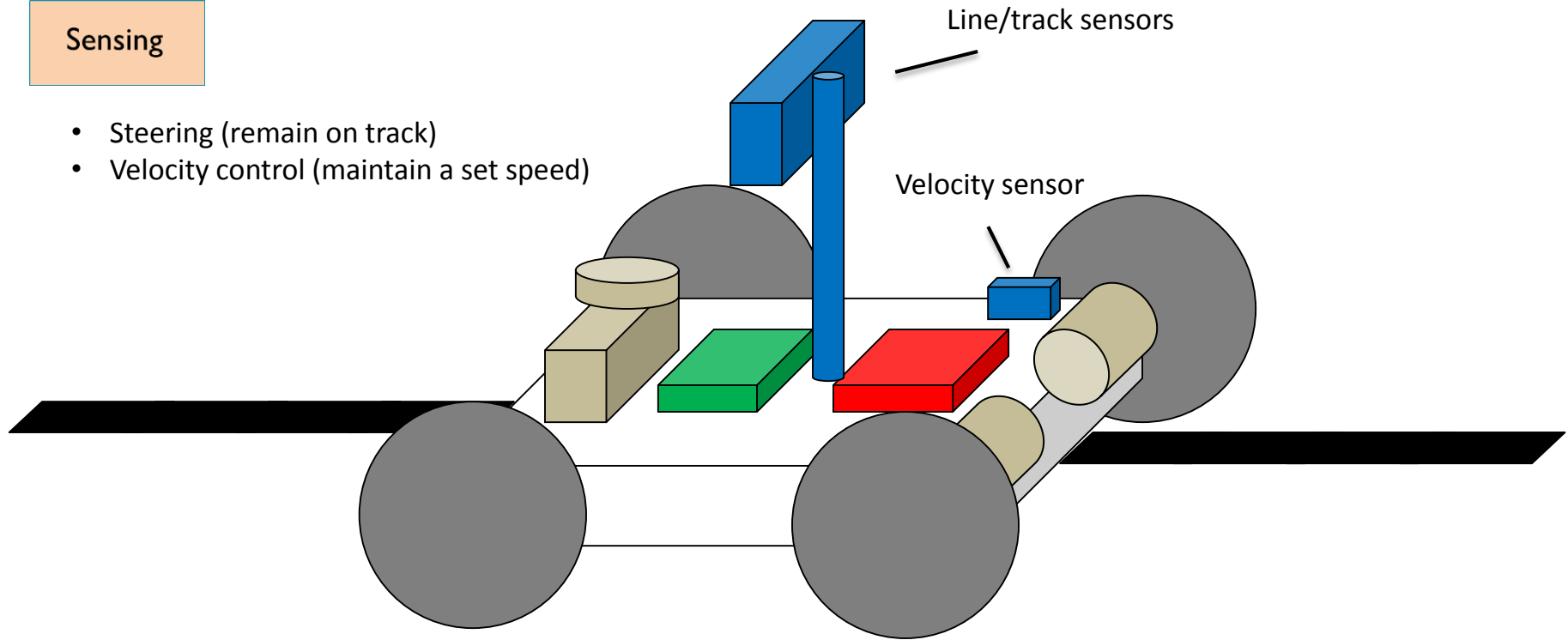
Autonomous Car: A Complex Mechatronic System



Autonomous Car: A Complex Mechatronic System

Sensing

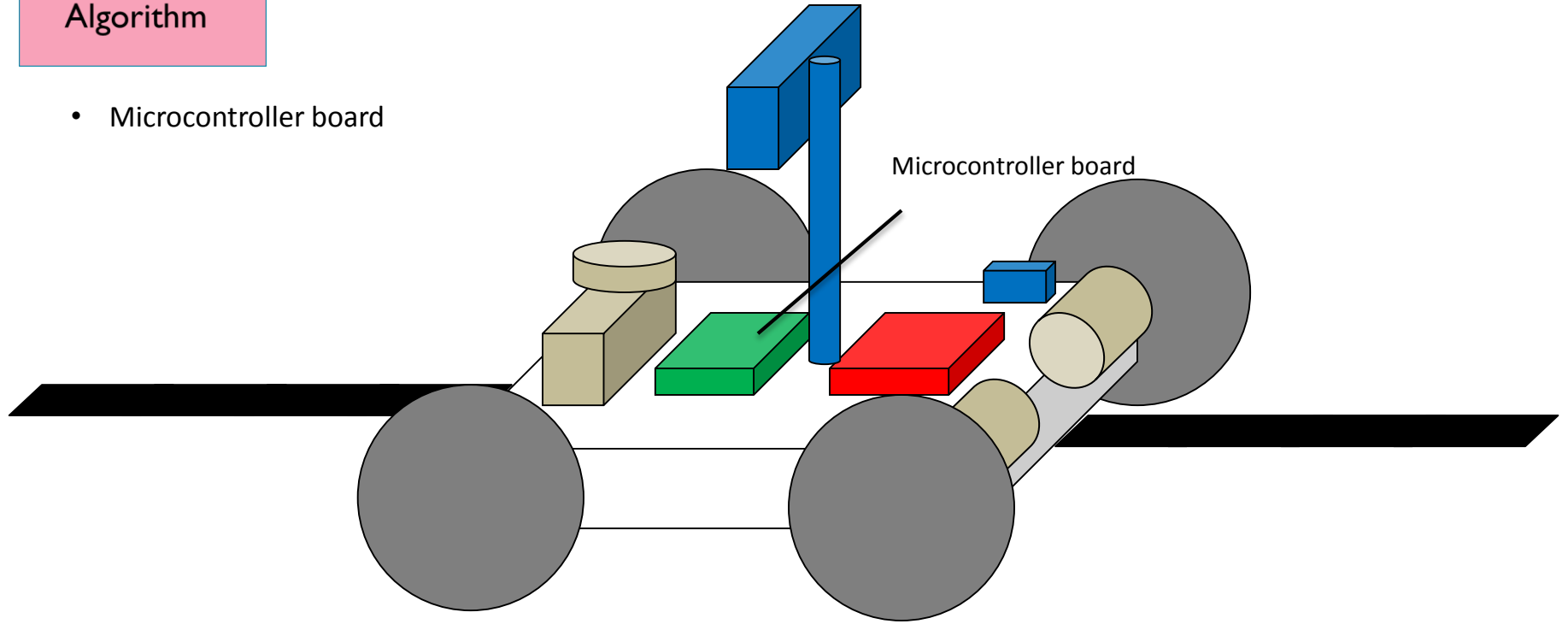
- Steering (remain on track)
- Velocity control (maintain a set speed)



Autonomous Car: A Complex Mechatronic System

Algorithm

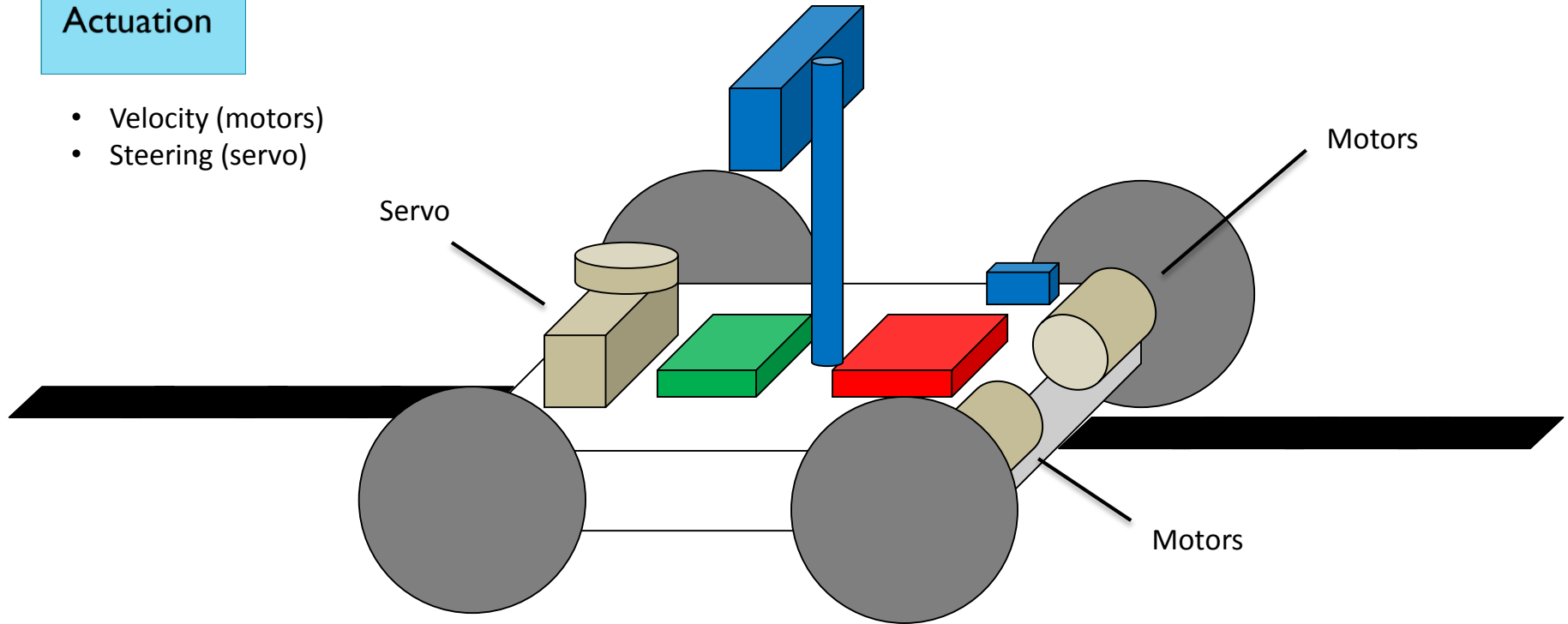
- Microcontroller board



Autonomous Car: A Complex Mechatronic System

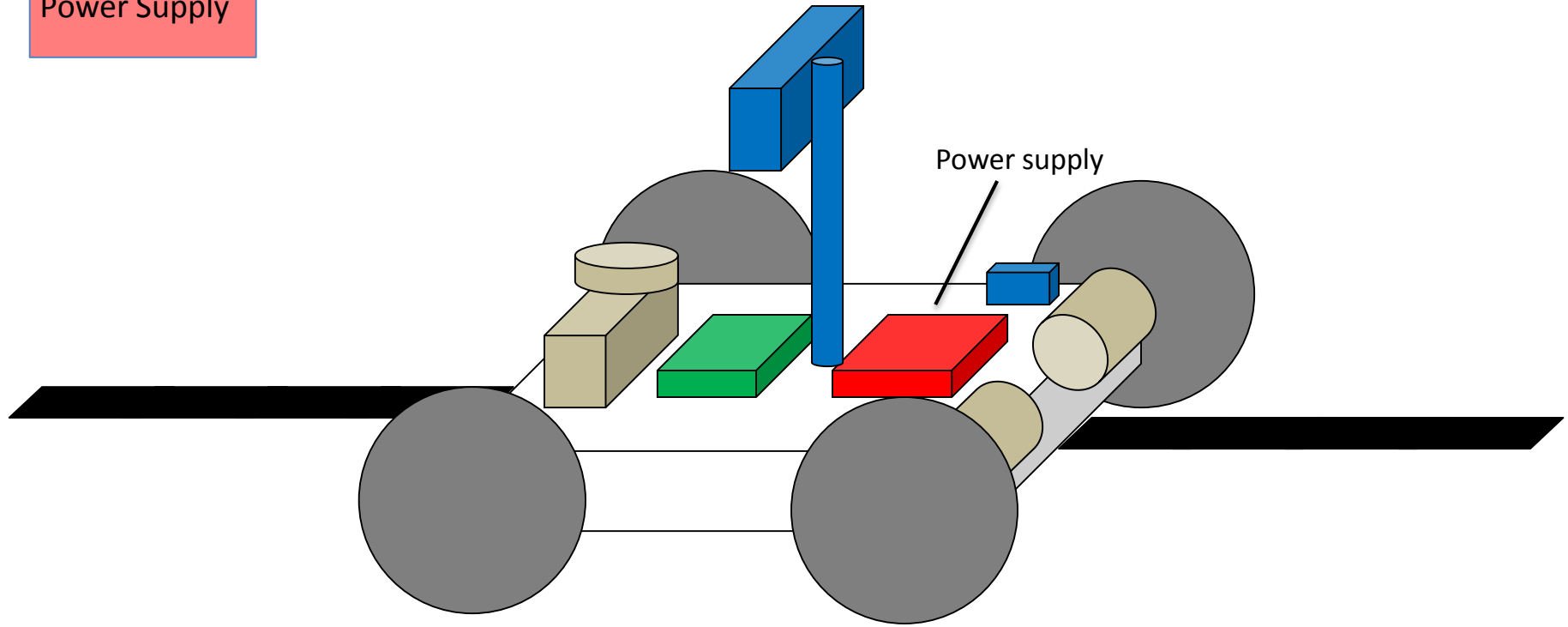
Actuation

- Velocity (motors)
- Steering (servo)



Autonomous Car: A Complex Mechatronic System

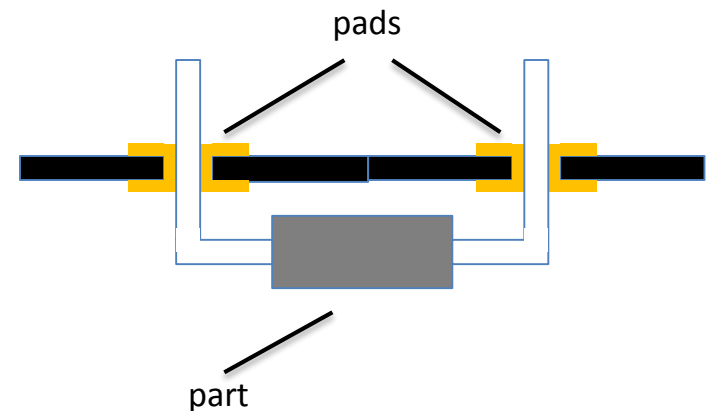
Power Supply



Review of Preliminaries - Soldering

Steps necessary for good soldering:

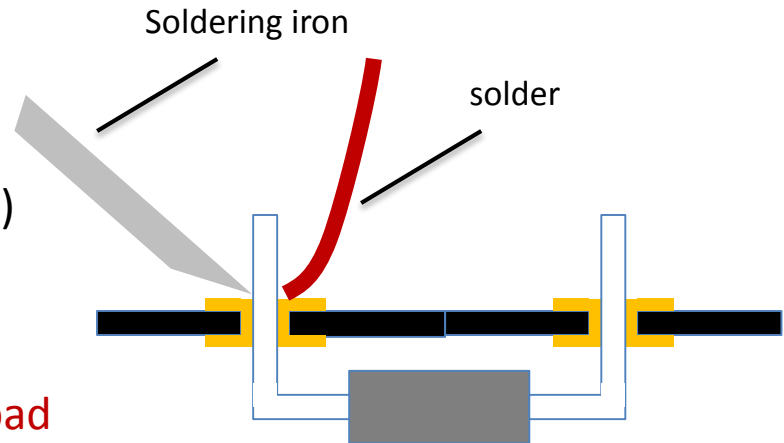
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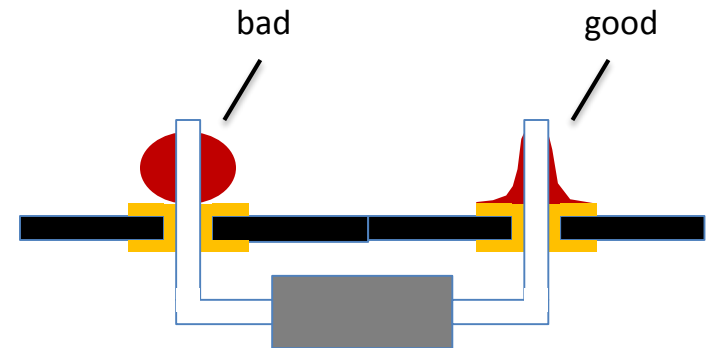
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FRDM-KL25Z Manual

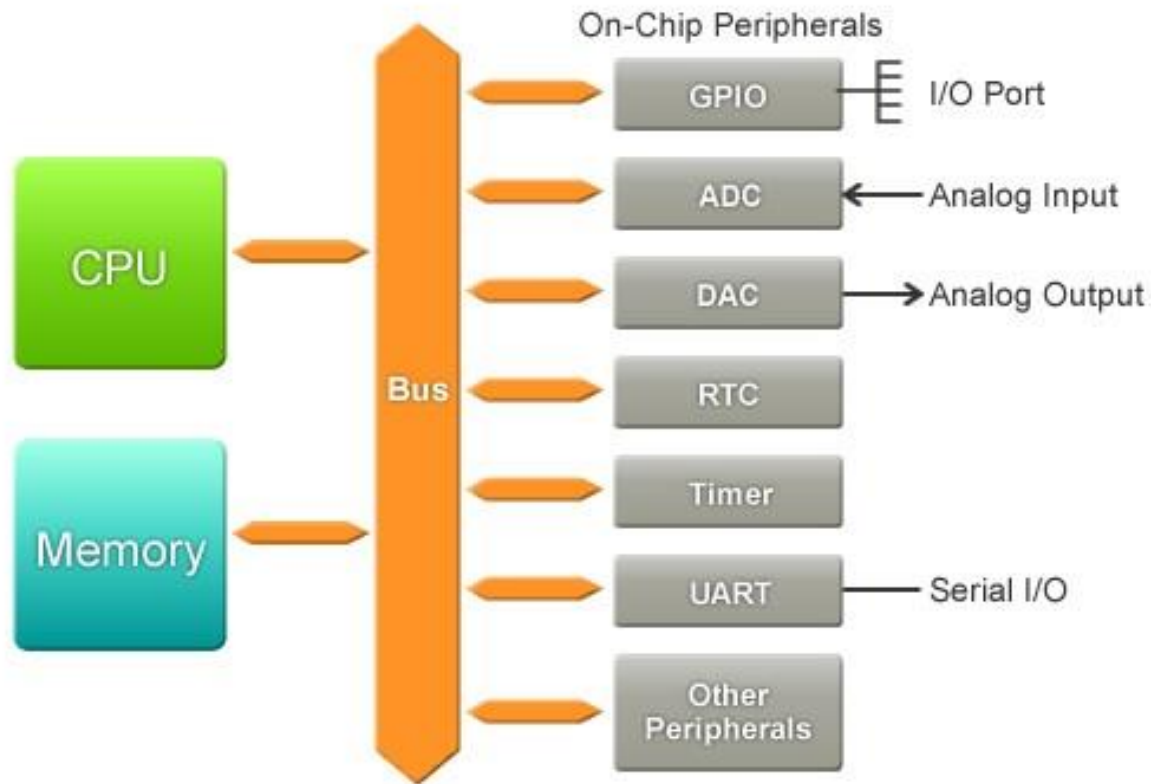


MCU – I/O structure

GPIOs and ADCs

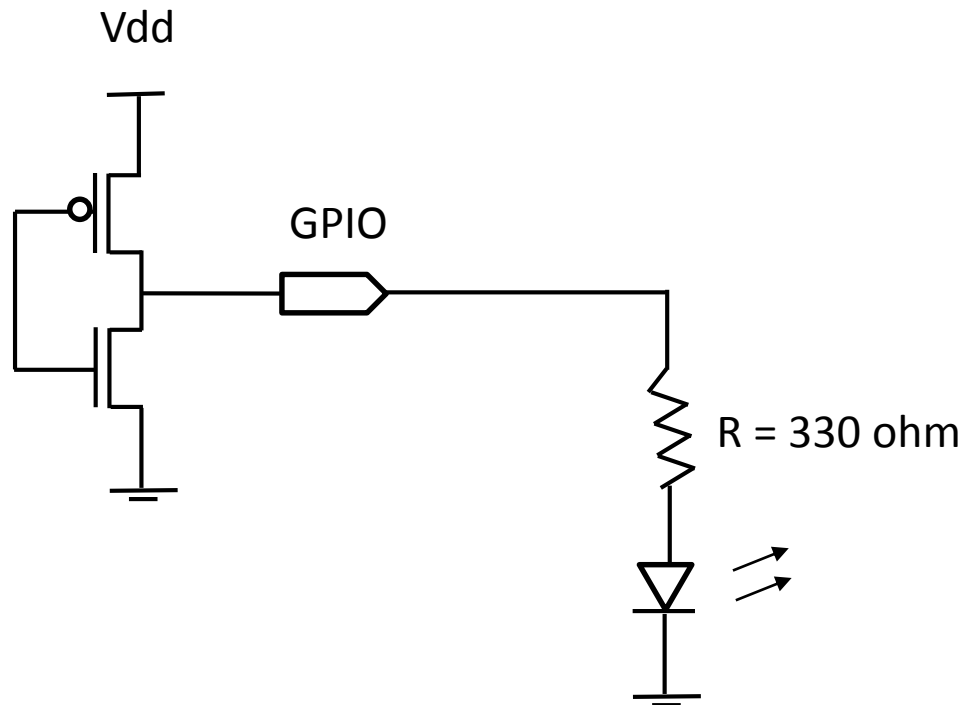
MCU I/Os

Figure 1: MCU's Internal Configuration (Conceptual)



General Purpose I/O's (GPIO)

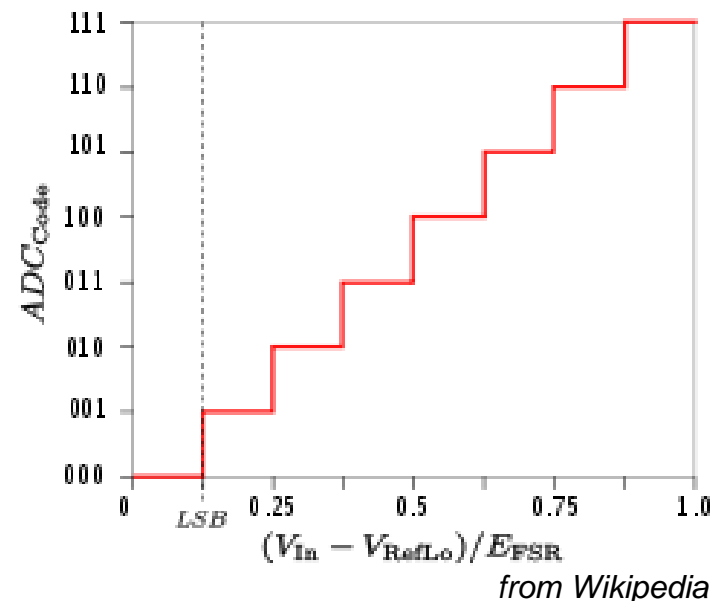
- General Purpose Input Outputs (GPIO)
 - reconfigurable Input/Output
 - digital (1 (high) or 0 (low))
 - need to be configured in software (lab 2)



Analog to Digital Converters (ADCs)

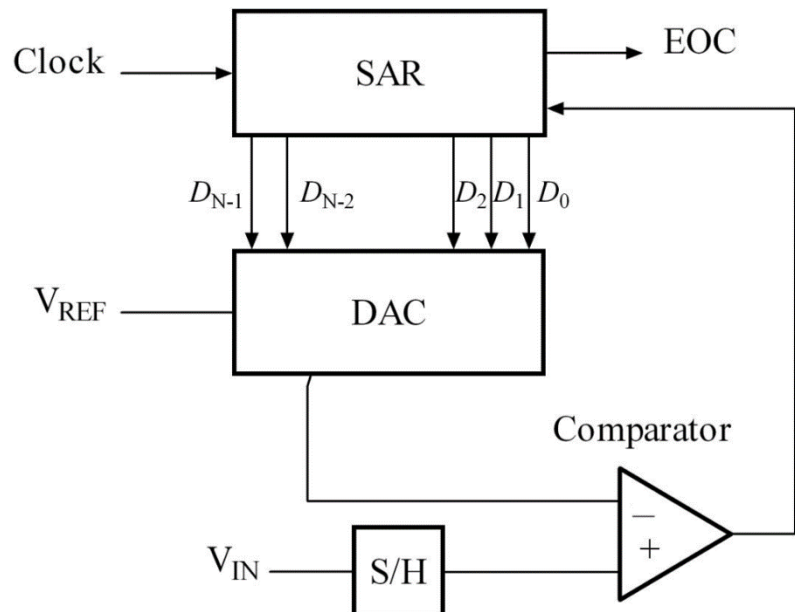
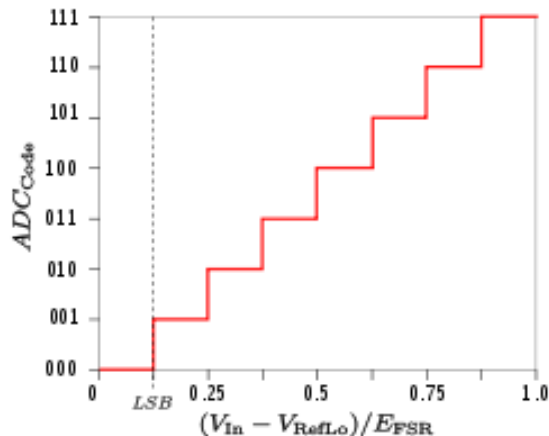
- Analog to Digital Converter
 - Can read in the analog value
 - Input pins need to be configured
- FDM board uses:
 - 16-bit Successive Approximation (SARC) ADC
 - 12-bit DAC

Use processor Expert



ADCs

- Successive Approximation ADC
 - Allow the Microcontroller to sample an analog waveform
 - Common type of ADCs
 - S/N: Sample and hold register
 - SAR: Successive Approximation Register
 - DAC: Digital to Analog Converter
 - EOC: end of conversion



from Wikipedia

Timers and Interrupts

- Interrupts:
 - Allow code execution on an event.
 - External interrupts or software interrupts (timers)
- Timers:
 - Allows code to be triggered after some elapsed time
 - Can be used to trigger PWM
 - Sleep timer (low power mode)

Set in processor Expert

Demo

Processor Expert