Systems Design Approach

- First reaction with new systems design - PANIC!!!
- No! Apply systematic design approach
  - Requirements
  - 68HC12 systems employed
  - Background theory
  - Hardware construction
  - Structure Chart and UML Activity Diagrams
  - Code
  - Testing
Design Case Study I - Wall-following Robot System

• Autonomous - self-contained
• Navigate through unknown maze
• Detect maze walls with IR emitter-detector pairs
• Avoid “land mines” (magnets) in maze floor
Wall-following Robot System
Required Robot Functions

- ATD conversion for IR sensors
- Turn decision algorithm
- Turn control function
- Hall Effect sensor processing
- Land mine avoidance algorithm
- LCD display
Background Theory
Hardware Interface
Software Interface

(a) Structure Chart

- main
  - LCD_init
  - LCD_print
  - init_ADC
  - delay_25
  - init_PWM
  - read_ADC
  - decision
    - put_command
    - put_character
    - pwm_motors

(b) UML activity diagram

- initialize LCD
- initialize ATD
- initialize PWM
- while(1)
  - yes
    - read ATD
    - decision operation
Design Case Study II - Laser Light Show

• Seven pre-coded patterns
• traced by laser
• LED illuminates on control panel to indicate selected pattern
• Control system traces selected pattern
Laser Light Show
68HC12 Systems Employed

- Debounded eight switch bank
- Eight position LED display
- Two-channel DAC
- Laser source
- Shutter and shutter controller
- Two galvanometer steered mirrors
Background Theory

- DAC
- Lasers
- Laser Safety
- Laser Control HW
  - mirrors
  - shutters
  - galvanometers
X-Y Scanning System
Hardware Interface
Software Design
Testing

- Use bottom-up implementation approach
- Test each subsystem separately and exhaustively
- Combine subsystems one at a time until system fully functional
- Test! Test! Test!