

# Week 3

**ECE2883 HP**

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# “Projects”



- “Project” can mean many things
- Most of you will work professionally with projects
  - New highway interchange
  - Web site deployment
  - iPhone 10
  - Updated corporate accounting system
  - Planes, trains, automobiles, etc.
- Requires different roles, skills, and good communication/organization/management

# Multidisciplinary design



- A strength of this class roster is its variety of SMEs
  - 3 BMED
  - 1 CM
  - 1 CS
  - 6 CMPE
  - 6 EE
  - 2 ENVE
  - 1 IE
  - 3 ME
  - 1 MGT
  - 1 NRE
  - 2 UEC
- Most of you will have a capstone design project, which can be multidisciplinary

# It's not always easy

- Diversity in expertise can foster creativity and innovation
- But there are hurdles
  - Buzzwords, acronyms
  - Culture
  - Assumptions, stereotypes
- “Non-SMEs” have probably already been sensing this...

# The design process



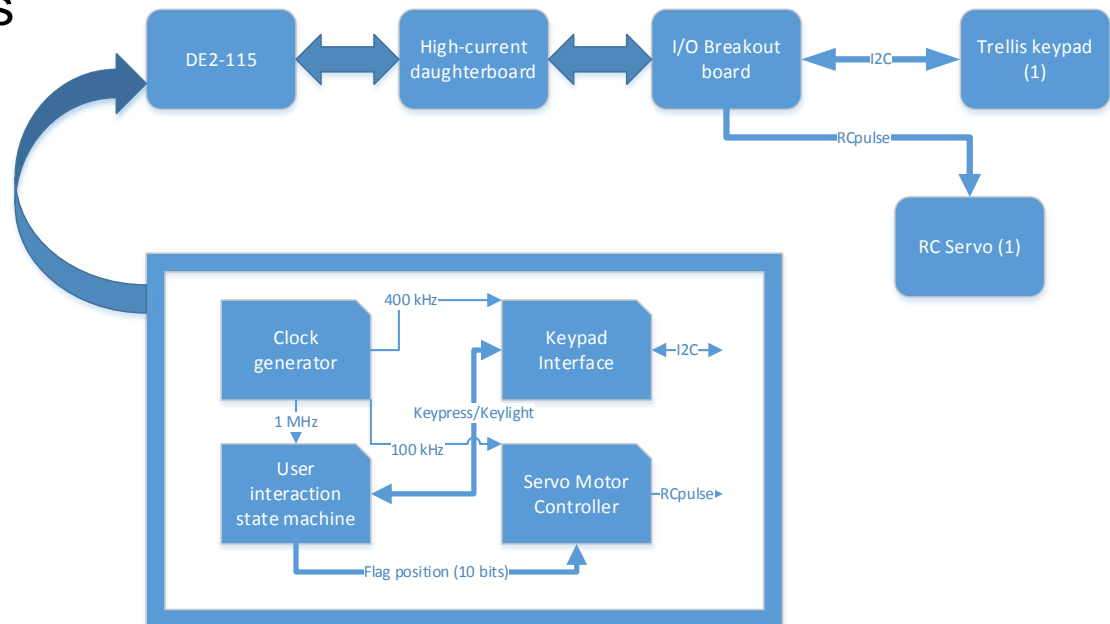
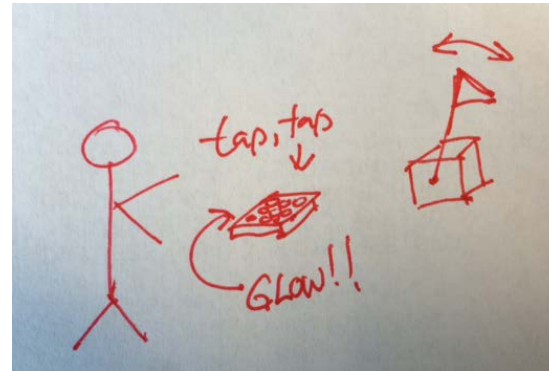
- Usually “top-down design” makes sense
  - Understand the system requirements (e.g., what neat project do we want to build this semester)
  - Break it down into major subsystems
  - Understand the interfaces between subsystems
  - Design and build subsystems
    - Perhaps repeating the top-down steps at this new level
- Some degree of “bottom-up” design also takes place in this course
  - We already know some of the components we should try to use

# Top-down helps multidisciplinary design

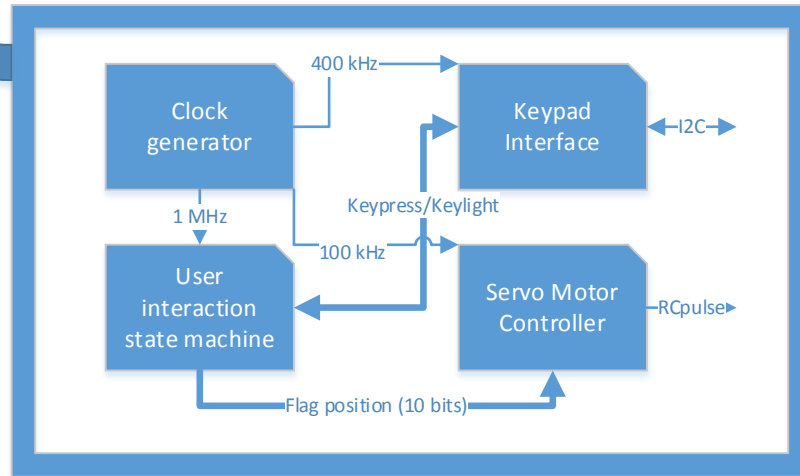
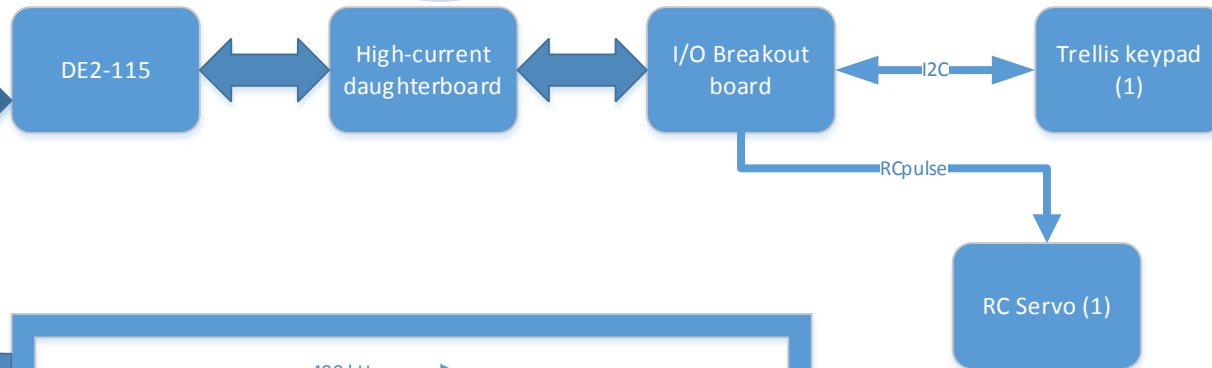
- Anyone can come up with a big idea
  - A team can break it up into subsystems
  - Specialists can work on the subsystems
  - The partitioning of the problem forces the team to define interfaces
- Let's build a flying car.
  - Need wings, wheels, engine, controls, pilot seat, efficient assembly, etc.
  - Assign to AE, ME, EE, ID, IE, etc.
  - Engine has to fit, wings have to mount, onboard computer has to drive certain solenoids, cabin has to be big enough, etc.

# How this applies to ECE2883

- You can conceptualize your project any way you like
  - Hand drawings
  - Mechanical CAD
  - Physical models
- But you MUST maintain at least two block diagrams
  - Top-level
  - Major FPGA devices



# Details of diagram

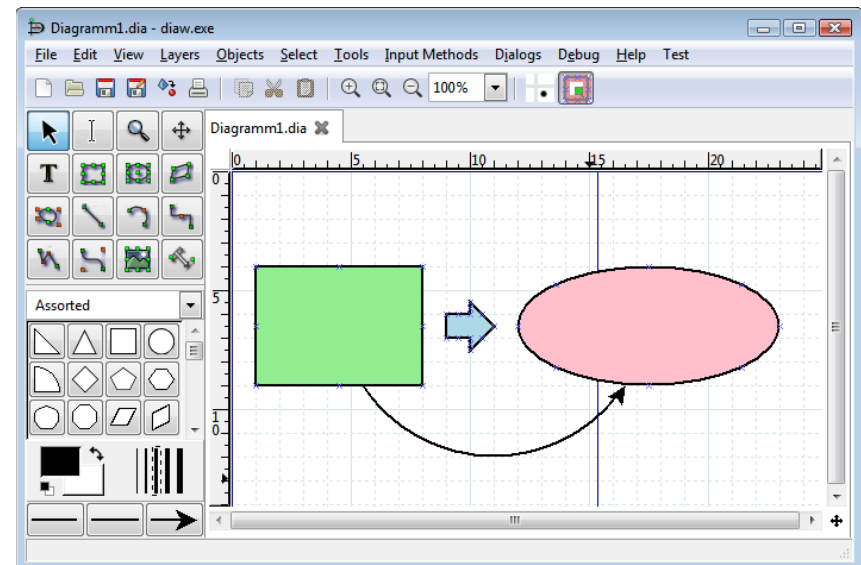
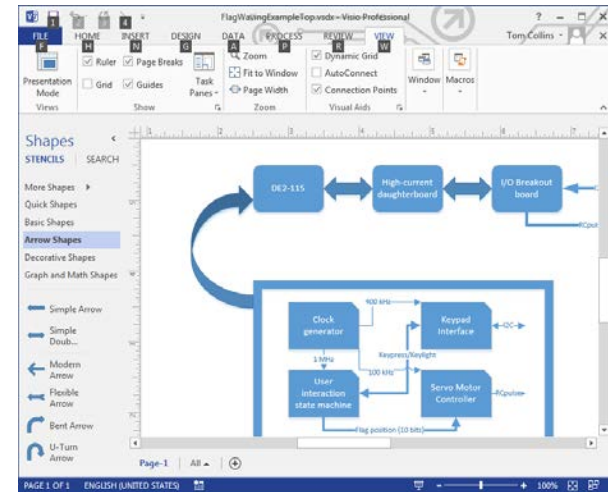


- Probably two separate diagrams
- You already know most of the top-level block choices
  - You can propose others
- Some of you have already seen an example of an FPGA block



# How to create block diagrams

- I often use *Visio*
  - Not currently in Office 365 student package
- *Dia* is open-source
  - <http://dia-installer.de/>
- You may use anything that works for you



# NOT covering Systems Engineering

- S.E. design methodology includes
  - Surveying customers / market
  - Formal requirements analysis
  - Functional analysis
  - Verification (test and evaluation)
- ME 2110 and many Sr. Design classes cover this
- We do not have the time, or really, the need



# We approximate S.E.

- Surveying customers / market – you are your own customer
- Formal requirements analysis – you decide roughly what your project can do
- Functional analysis – you break it down into pieces (the block diagrams)
- Verification – you decide if good enough to turn in as complete

A decorative header consisting of five circles in a row. From left to right: a solid light purple circle, an outlined light purple circle, a solid light purple circle, an outlined light purple circle, and a solid light purple circle.

Let's look at project ideas

- Go to links from students....

# Motion

- Immersive mirrors
- Wooden mirrors
- Strandbeest (and mini 3D ones)

# Music



- **Emphasis on input**

- [MIDI controller](#)
- [Cardboard laser piano](#)
- [Playable poster](#)
- [Resistance-based sound](#)

- **Emphasis on output**

- [Tesla coils](#)
- [Ruben's tube](#)
- [Solenoid-based player piano](#)

# Water, fluid



- [WET Superlights](#) (background [here](#))
- [Ferrofluids](#)
- [Painting machine](#)
- [Waterfall swing](#)

# Light

- [Sensory dome](#) (also fits music category)
- [Holographic water projection](#) (background [here](#))
- WET superlights (already mentioned)
- Various other projects involved lit keypads, other small LEDs



# Sculpture

- Electronic art sculpture



# Automation

- Garden watering
- Book scanning
- Security system
- Robotic weather plane
- Turtlebot sensors
- Remote garage door opener
- Safecracker