# ES 4 Final project proposal

For your final project, you will work with a team of 4 to design and implement a complex digital system on your FPGA. The first step is to submit a 1-2 page proposal of what you plan to create, so we have clear plan of what you're working on, and so the teaching staff can give you advice to make your project a success. Read on for the details!

At the highest level, the only requirement for your project is that it should take some kind of input, do "something interesting", and produce some type of output. We've got lots of fun hardware you can use for input and output:

- NES gamepads
- NES "Zoomer" racing wheels
- Duck Hunt zappers
- PS/2 computer keyboards
- Guitar Hero controllers (one hacked for just buttons, and one Wii)
- Wii Nunchucks
- Rotary encoders
- MIDI keyboard
- Arcade joysticks
- Arcade pushbuttons
- Speakers
- Audio driver chips
- Analog-to-digital converters (ADCs) (for reading analog signals)
- SPI flash memory (for storing extra data)
- SD cards (for storing lots of extra data)
- LED billboard panels
- VGA adapters for driving a display

And of course, the buttons, switches, LEDs, and 7-segment displays in your lab kit. We can also acquire other items if you get in touch right away.

Many of the arcade games and early video games which were cutting edge 40-plus years ago are completely doable on your FPGA. Past teams have built 2D racing games, Space Invaders, 4-player PONG, and more. See the examples and resources on the course website for inspiration: https://www.ece.tufts.edu/es/4/project.html.

Your project proposal should be a brief document (1-2 pages) which explains the main idea of the project, clearly defines the its scope, and sketches out the path forward. It should have three sections:

1. **Project description**: One or two paragraphs describing your project: the basic idea, what the input device(s) will be, what the output device(s) will be, and how people will interact with it. If you plan to build an arcade game, include sketches or simulated screenshots to demonstrate what kind of graphics you're planning to create.

2. **Current unknowns & point people**: A list of the technical parts of the project which you do not currently know how to accomplish. For example:

   - How to display an image on a VGA monitor
   - How to read the buttons from a Guitar Hero controller
   - How to make a scrolling background
   - How to make sounds that aren't just square waves of different frequencies

For each of the unknowns, you must identify one person who will be responsible for figuring out the answer.

3. **Hardware needed**: A list of any hardware components you will need for the project beyond the items we already have (listed above).