Module 4

Mini Project Intro

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Mini-Project Intro

- Do a project that is **meaningful** to you, not too complicated, not too simple, that you can **display**, that serves as a **vehicle for learning**, and that you will cherish later.

- The rules:
  - 4 current ECE 362 students per team.
    - You do not need to share a lab section.
  - Your project must use an STM32F091 and no other programmable computer (even for power).
    - Power with 5V supply (e.g. USB phone charger) if you need to.
  - Your project must use at least two external interface formats:
    - GPIO, PWM, analog, I2C, I2S, SPI, serial
  - Your project must use at least four internal peripheral subsystems:
    - GPIO, PWM, ADC, DAC, I 2C, I2S, SPI, UART, Timers, DMA
  - Your project must do simultaneous things

"I don't know what to make."

- Many students do not know what to do at this point. Don't worry.
- Myself and Rick are available to consult, suggest and recommend

Mini-Project Bonus Points

- Design of a custom PCB: up to 4%
  - It must have an STM32F0x LQFP64 soldered down to it for full credit
  - Less credit for a PCB that does not have an STM32F0x on it
  - **It must be purpose-designed for your project**
  - It must be demonstrated with your working project.
  - You **will** prototype your project **before** designing a PCB
  - Early completion and demonstration: up to 1%
    - Sliding scale over dead week. (Mon: 1%, Tue: 0.75%, Wed: 0.5%, …)

  - **Attendance** or **participation** at the Spark Challenge: 0.5%
    - – To participate in the Spark Challenge, we need to approve it

Disallowed project ideas

- Things that are:
  - Destructive (flying things, lasers, fire, high voltage)
    - Note that motors may count as "high voltage"
  - Not possible (USB, camera, audio analysis, etc.)
  - Not feasible (e.g., extensive physical construction)
  - Too Simple:
    - Easy enough to do without a microcontroller (e.g. thermostat)
    - Obvious combination of two or three lab experiments

Forming Teams

- Do you have a team?
    - Do you need a fourth member for a team of three?
- Are you looking for teammates?
    - Do you want to work with a team that already has an idea?
- How do you come up with ideas?

Maximize the team size

- You should create teams of **<u>four</u>** students
  - If you have a team of three students, I'll ask you to pick up a fourth member.
  - There are students on Piazza that are looking for teams. Communicate with them.
  - If you join a team as a "fourth member", you should work hard for your team.

Team Dynamics

- Let's try to avoid some things:
  - Team leaders. The best mini-project teams divide responsibilities by areas of expertise and manage by consensus.
  - Impostor syndrome. You may think you're not good enough to help a team. Everyone here is a student and everyone will learn a lot with the mini-project.
  - Outsider suspicion. Just because you only recently met someone does not mean they are incompetent.

Building your mini-projects

- Question: What kind of Op-Amp did I show?
  - LM324 Quad op-amp chip. 3V – 32V. You can use it with single-ended power supply. Not going to go rail-to-rail on the output.
- Question: Where can I solder things?
  - On bench in back of EE 069. (We need to clean it.)
    - Soldering iron, tools, solder, fume filter, etc.

Things you want to get

- Breadboards
  - Adafruit, Sparkfun, Newark: $5.95 each
  - MPJA.com: $4.95 each. Eh. OK.
  - Some places: $2.00. Do not buy these
- Hook-up wire. Solid-core, 22AWG, tinned copper, multi-color, PVC insulation.
  - Various: Remington Industries 22UL1007SLDKIT10COLOR: 25' of 10 colors: $39 shipped.
  - Adafruit: 25' of each of 10 colors: $29.95 + shipping.
  - Elexp.com: 25' of each of 6 colors: $18.95 + $15.95 shipping. Great quality, but buy something else if you're going to pay that much for shippin

Tools

- Safety goggles.
- Wire stripper
  - Mintcraft Multi-Function Wire Stripper. SKU #677-95323. (Von Tobel Hardware, $19. Lowe's, $20.)
- Diagonal pliers. 4-5" long. $5–$10
- Needle-nose pliers. Xcelite NN7776G. $25
- Flush cutter.
- DMM. Extech EX330: $60. <u>Continuity test</u>.

Buying parts

- Buy parts of electronics suppliers that specialize in selling quality parts to hobbyists
  - You can buy solderless breadboards elsewhere for $2.00. There's a reason electronics suppliers don't sell them that cheaply

Recommended Parts: Graphic Displays

- These are not as important now that there is a TFT LCD in your lab kit:
  - 128x64 monochrome LCD panel ($23.95):
    - www.sparkfun.com/products/710
  - 240x320 color LCD touchscreen ($29.95):
    - https://www.adafruit.com/product/1770
  - 7.0" 800x480 color LCD touchscreen ($47.50)
    - https://www.adafruit.com/product/2354
    - https://www.adafruit.com/product/2353 (w/o touchscreen ($37.50))
  - RA8875 driver board ($34.95):
    - https://www.adafruit.com/product/1590
  - LED Matrix panels ($40 – $80). e.g.:
    - https://www.adafruit.com/product/2278
  - It's good to ask about these before you buy them.

Graphic Displays: Challenges

- The documentation is always bad

- Interface protocols are new to you and sometimes strange
    - "Parallel" interfaces need lots of wires.
    - "Serial" interfaces are slow

- You'll find hundreds of examples on the web
    - ...for Arduinos.