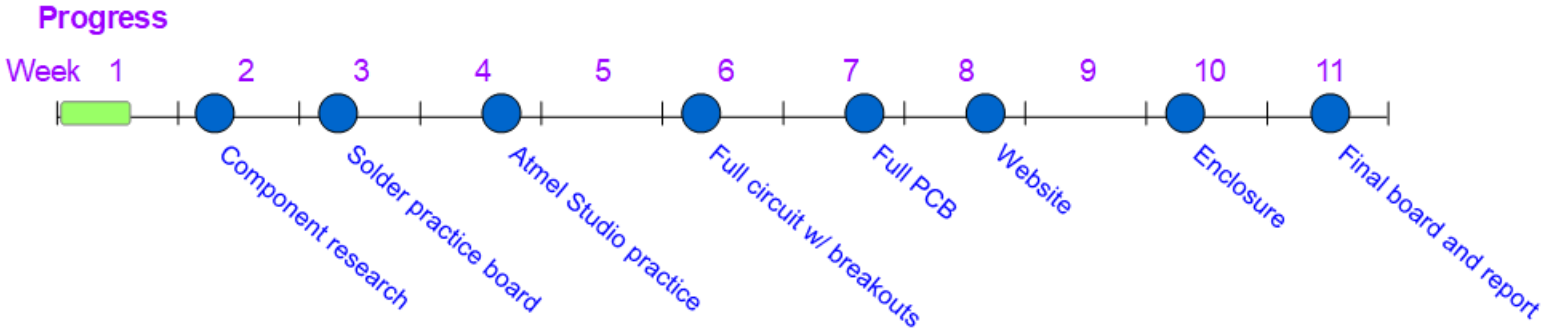
EECS 395/495: Engineering System Design 1

Task 1: Component Research

Due: Jan 16, 2018



Please complete this assignment individually and submit your work on Canvas.

1. Find your group mate(s). When you have your team ready, please enter your names here: https://goo.gl/forms/s0g9TdFkTBrQ9Afc2
2. Install the following software:
   - Atmel Studio
     - http://www.microchip.com/avr-support/atmel-studio-7
   - J-Link Software and Documentation Pack
     - https://www.segger.com/downloads/jlink#J-LinkSoftwareAndDocumentationPack
   - Eagle PCB
     - https://www.autodesk.com/education/free-software/eagle
3. For each of the three main components (SAM4S8B, AM136, OV2640), look in their datasheets and find their recommended operating voltage limits. Write these down. Are they compatible?
4. Based on the datasheet for the MCU, find an appropriate 12MHz crystal oscillator.
5. Our system will get power from a 5V power supply. Based on the datasheets, how many voltage regulators will we need? (*Hint: look at the Atmel-42155-SAM-AT03463-SAM4S_schematic_checklist_Application-Notes document.*)
6. Based on the datasheets (i.e. power requirements of all the components), find suitable voltage regulators and write down the relevant specs (i.e. voltage supplied, how much current can it source?). *Hint: find specifications for the worst case.*
7. Based on just these 5 components (from problems 3, 4, and 6):
   (a) What would the system cost if you were to produce 1 unit?
   (b) What would a single unit cost if you were to produce 5000 units?
8. Suppose you have a 500 mAh battery. For these calculations, ignore everything but the 3 main components.
   (a) If the system were constantly awake, taking photos, and acting as a server (and constantly transmitting data), how many hours would the battery last?
   (b) If the system were in the lowest power sleep mode, how many hours would the battery last?
   (c) If the system were in the lowest power sleep mode, but woke up to full power for 5 seconds every minute, how many hours would the battery last?

FAQ

Q. Atmel Studio is only supported for Windows platforms. What should I do if I don't have Windows? Is there an alternative?

A. Atmel Studio is more than just an IDE for C. It also includes the ASF (Atmel Software Framework), which is essential for our projects. For now, we suggest using a virtual machine. It will be sufficient for a single team member to have it, as you will be working on the code together. Additionally, the computers in CG50 have Atmel Studio installed.

Q. I have an older version of Atmel Studio / J-Link / Eagle, which version should I use?

A. Update to the newest version of the software. Updating ensures compatibility between your computer and the computers in the lab.

Q. Can I use other sources than Digikey?

A. Yes. For each component, list where you sourced it from, as well.

Q. What parameters are important for an appropriate 12MHz crystal oscillator?

A. There is potentially too much (and confusing) information in the datasheet about the crystal oscillator. For this assignment, assume you want a load capacitance of 18pF, and don't worry about the other parameters.

Q. What is the difference between oscillators and crystals? Which should I use?

A. A crystal is a passive (i.e. no power inputs), 2-lead device that needs other circuitry to get it to vibrate at its resonant frequency, thus creating a clock signal. An oscillator is an active (i.e. has power and ground as inputs), 4-lead device that creates a clock signal on its own and outputs a square wave. Most MCUs can take either one, but crystals are preferred because they are typically cheaper and smaller. For this homework, use crystals since the other circuitry will be provided by our MCU.

Q. Does the voltage regulator's sourced current need to be precise?

A. No, the regulators chosen must provide at least the required current but can provide more.