Video on different ways to power Arduino
https://www.youtube.com/watch?v=ewZY9oNbcds

- 9V battery through power jack or Vin – Arduino will step it down to 5V
    - Must be between 7-12V for mega
- When you plug a USB in, no step down required bc already at 5V
- If both plugged in, power only drawn from power jack
    - Only the power line of USB disconnected, can still have serial communication
- Powering 5V pin directly can be useful if you already have other stuff being powered by 5V
- Need to make sure you don't exceed the current limit of the Arduino or the power source
    - Estimate current consumption of the peripherals
- For Mega… 5V output current = 0.8 A, 3.3V output current = 0.05 A
- Check what the current limit is on the USB port on your computer
- What if the project needs > 0.8 A of current?
    - Use a higher voltage power supply and the Vin pin of the Arduino
    - Mega voltage regulator takes 7-12V
    - Ex. supply 12V to rails of breadboard (PCB in our case)
    - Connect Vin pin to power rail
    - Vin doesn't have polarity protection

Options	Pros	Cons
USB	• Already at 5V • Convenient if you also are communicating with a computer/uploading code	• Needs to be connected to a computer or a wall outlet (less portable) • Older USB has lower current limits
Power jack	• Portable for our design • Built-in step-down converter to 5V	• 9V battery would drain quickly & would need frequent replacement
Vin pin	• Useful if you want to use the 7-12V for peripherals • Built-in step-down converter to 5V	• Still needs to be powered by a battery with the same power concerns as the power jack
5V pin	• With a step-up converter, could use a longer-lasting battery	• Needs to be precisely regulated at 5V, no built-in regulation

- The FPGA will be powered through a wall socket. We would like to not have to power multiple components this way and would like this product to be standalone without a computer, so USB powered through a computer/wall outlet would not be ideal. So, battery-powered would be best.
- We want our product to be low-maintenance for use in museums and classrooms, so a longer lasting battery life would be ideal
- The device should be able to last for 8 hours a day and the batteries could be recharged overnight

Possible solutions

- 9V battery plugged into the power jack
    - Lower efficiency since it needs to be stepped down to 5V
- LiPo/LiIon battery with the Adafruit PowerBoost 500 Charger
    - Long battery life
    - Higher capacity than AA
    - Need a specific LiPo charger
    - Charging LiPo can be dangerous and is a fire hazard
- Three alkaline AAA batteries with the Adafruit PowerBoost 500 Basic
    - More easily accessible/affordable batteries
    - Would generate a lot of waste
    - Lower capacity/shorter battery life than LiPo
    - Higher capacity than 9V
- Three rechargeable NiMH AAA batteries with the Adafruit PowerBoost 500 Basic
    - More easily accessible/affordable batteries
    - Requires a specific NiMH charger, but these are accessible
    - Lower capacity/shorter battery life than LiPo
    - Higher capacity than 9V
    - Steadier discharge than alkaline batteries

Adafruit PowerBoost

- DC/DC boost converter that takes 1.8V or higher batteries up to 5.2V
- Includes a USB port that can then be plugged into Arduino
- Charger version comes with LiPo battery charger
- Light indicator for low battery
- 90% operating efficiency in most cases
- 750mA+ from 2 NiMH or Alkaline batteries, and at least 1000mA from a 3.7V LiPoly/LiIon battery or 3 NiMH/Alkalines

Proposed Solution: 3 NiMH AAA batteries with the Adafruit PowerBoost 500 Basic

- Better battery life than the 9V battery
- Less waste and less recurring maintenance/cost from the alkaline batteries
    - As well as steadier discharge
- Safer than the LiPo – although LiPo has a higher capacity, it would be risky to let the LiPo charge even with the PowerBoost's overcharge detection

    - For use in museums/schools, charging would have to occur overnight
    - Fire hazard risk is important, especially if the product is surrounded by historical artifacts or is in an important building like a school
    - Also less available for maintenance – AAA batteries could be bought at a nearby store
- To integrate into the PCB, we should make a small battery compartment underneath the PCB that can house the AAA batteries and the PowerBoost
    - When not in use, the USB cable should be unplugged from the Arduino

Ways to charge Arduino with lithium battery