General Comments & Questions

Project Summary

- Our final project deliverables will be a resource bank for getting future students started on developing embedded systems with GPU.
    - Embedded systems/mini-PCs with GPU present significantly greater graphics processing power than Arduinos
    - A well-designed foundation will open the way for future senior capstone groups to collaborate across majors, such as with the chemistry department
- These deliverables will include a GitHub page (containing code samples and a startup guide), a research paper, and several technical demos
    - The code/tech demos are designed to get future students quickly started on the various applications of GPUs, particularly in image processing applications

TLDR: Version of Deliverables

- GitHub Page
- Research Paper (our research-implementation paper will likely be incorporated into our Github page)
- GPU-powered image-processing for the OSURC Mars Rover (concrete application showing what a GPU can do)
- Code demos (for other applications; we are still working out what these will entail)

General Comments

- This project started this term as our previous project fell through. This current project was formulated in the last two weeks. Please keep this in mind when reviewing the limited artifacts.
- If we have developed additional artifacts by the time of the meeting, we will bring these with us to review at the actual meeting.
- The finer details of the project are being finalized. You are welcome and encouraged to leave suggestions on the general direction of the project.
- **The most productive feedback at this stage in our project is for you to provide as many questions about literally anything.**

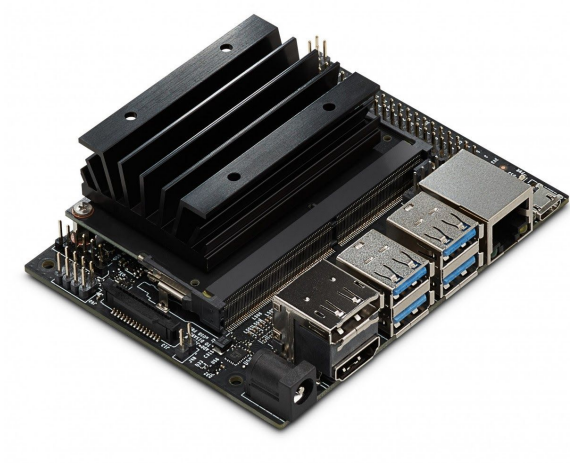
Specific Questions to Consider

1. Are there any resources you could recommend for our research?
2. What type of engineering resources do you prefer? (We would like to tailor our project to best suit the preferences of students)
    a. Think about what types of sources--visual, bullet points, video--help you learn best?
    b. Our current plan includes a code and written portions. What would be an ideal way to combine these into a single working document/webpage
3. If you have any practical experience working with the architecture of GPUs, please share your insights and suggestions.
4. Are the costs related to this project prohibitive? (GPU systems are expensive)

5. What other information would you need to know to begin using a computer in an embedded system?

Visual Guide

The following is an image of the Jetson Nano. The goal of the deliverables is to set new users up with something like the following:



It is used in a manner similar to Arduinos, but it has the processing power of a personal computer, and an Nvidia GPU many times more powerful than that of a standard computer. In addition, the device comes with an SDK to get you started are a variety of different software applications.

Outline of Resources

Quickstart Guide

- Setting up the Jetson TX2 using a host computer
- Accessing the existing SDKs
- Setting up ROS
- (working on the other sections)

GitHub

- For storing code related to demos and implementation

Paper

Abstract (200 word max)
Introduction (350 word max, generous)
Background Info (500 word max)

- Prerequisites
- Brief history of GPUs

Theory (~1000 words)

- Discuss GPU architecture and unique characteristics
- Single vs Multi GPU
- What's the most efficient way to use GPU together with a CPU?
- When are CPUs prefered over GPUs?
- How to interpret the output of a GPU?

Application (~1000 words)

- Situations where GPU usage is optimal
- Examples of GPU usage

Implementation (~3000)

- Hardware (~1500)
    - Types of GPUs on the market
    - Power requirements for common developer kits
    - Altering the hardware
    - GPU specs
    - Minimum requirements
- Software (~1500)
    - Nvidia GPU Cloud
    - Coding Options: OpenCL, CUDA, OpenACC, Numba
- Community Section
    - Nvidia GPU Cloud
    - Nvidia JetPack Software

Example Application: Implementation of GPU on the OSURC Mars Rover

- ZED Stereo Camera Introduction
- Architecture of the OSURC Mars Rover
- Linking up everything with ROS
- Accessing the GPU on the Jetson TX2