ISPEED Syllabus

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**Useful Links:**

1. <https://forums.raspberrypi.com//viewtopic.php?f=43&t=210605&p=1673444#p1673444>
2. <https://forums.raspberrypi.com/viewtopic.php?t=276084>

**Objective:**

To provide students with an interactive and hands-on opportunity to build their own microscope using the Raspberry Pi (RPi) platform and image histological, bacterial, and natural specimens. In doing so, students will learn more about optics and microscopy when acquiring images and basics of computer programming as they write code to analyze their images.

**Session 1 (07/06/2023):**

*Focus: Build the RPi microscope and setup the software environment*

75 minutes:

1. Nick/Ji Yi gives a 15-minute overview of microscopy to the students.
2. Students build their own foldscope (design studio).

105 minutes:

1. Teams of 5 students get their own RPi microscope kits.
2. Hardware:
   1. Setup connections between camera, power supply and display screen.
   2. Arrange RPi v3 camera and smartphone macro lens configuration.
   3. <INSERT IMAGE OF MSCOPE DESIGN>
3. Software:
   1. Install Raspian OS onto the RPi system.
   2. Perform initial setup of the OS
      1. Mantej will pre-install the OS on SD Cards so that the students should just plug in the SD card for the install process to begin.
   3. Interface the camera controls using Python’s [PiCamera Library](https://picamera.readthedocs.io/en/release-1.13/)
      1. Involves writing a Python script in an IDE to connect to the camera and read the image data coming from the camera.
      2. At the end of the session, students should be able to open a live preview of their microscope and acquire a single image.

**Session 2 (07/13/2023):**

*Focus: Program and image acquisition and analysis pipeline*

*180 minutes:*

1. Continue working on the PiCamera coding pipeline to ensure that clear images are being acquired.
2. Proceed to acquire images from the provided brain cell slides and tweak imaging parameters as needed (light intensity, exposure, etc).
3. Students can only bring their own specimens of interest to this session to image.
4. Depending on interests, students can try 2 different tracks:
   1. Track 1: Mechanical/Electrical Engineering
      1. Students use motors and their RPi to build a motorized stage to help them move their samples around. These controls would be manipulated using Python on the RPi board.
   2. Track 2: Computer Science
      1. Students explore image filters such as Frangi, Otsu, Edge detection, etc. and incorporate them into their software to further explore image analysis.

**Bill of Materials:**

**Github Instructions:**