



STANDARD OPERATING PROCEDURE

VeinFinder

Semrah Odobasic | Donggi Lee
Jin Jeong | Logan Allen

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The Project

This project is a vein finder which assists people in finding veins using IR. Blood carries hemoglobin which absorbs IR light. When you apply IR light to the arm and take an image you can see the veins. Because we can see the veins we want to segment them. This is because the future goal is to use the onboard projector to project the veins back onto the arm. To do this we will use a machine learning model. Specifically the U-Net designed by Rich Baird. This allows us to use lower quality hardware to get an image we can use.

Hardware

Included

- Raspberry Pi 2
- NoIR PiCam 2
- IR Emitter Array
- Projector
- IR Pass Filter
- Voltage Regulator
- Custom 3D Printed Hardware

Required for Operation

- Keyboard
- Mouse
- Monitor
- HDMI Cable

Software

Dependencies

- Picamera 2 Python Library
- OpenCV
- Numpy

The Software

The script “cameratesting.py” is the main file that you will use. It takes an image, runs it through our U-Net, and outputs it on the screen. Overall it is very simple. It fixes the exposure, gain, contrast, auto white balance, and auto exposure to be fixed. They are currently set to the values that gave us the best results. There is also a file which has our first segmentation model. This model only uses OpenCV and doesn’t use any machine learning. It works to an extent but the machine learning segmentation model works better.

cameratesting.py

segmentationmodel.py

Operation

The operation of the camera is very simple. First, a keyboard and mouse should be connected to the raspberry pi. You also want to connect a monitor to the pi using an HDMI cable. Ideally you want to have a non IR reflective background so that the arm is clearly visible. You then want to turn on the projector. It powers everything from its internal battery so ensure that it is on. When the Pi powers up you want to run the “cameratesting.py” file which will run the script that uses the U-Net.

Key Notes

The IR light has a switch on the bottom if you don't see any output check to make sure the switch is on. To confirm the IR is enabled you can open your camera app on your phone and look at the IR. It should look like it emits a purple light.

The vertical distance from the camera is important. Move your hand up and down to ensure you get the best possible image.

Results vary. Some people can get great images while others struggle to get any veins to show up.