LAB 1 - MEC830 (Individual Lab)
LEDs and Processing Units

1. Purpose

The purpose of this lab is to interface LEDs and Vision Processing Units (VPU)s with Arduino. You will learn how to use such systems for various applications.

2. Scope

In this lab, you will learn about

- Interfacing LEDs with Arduino.
- Communicating with Arduino via Python scripts through serial communication.

3. Documents

The following documents will help you through the Lab:

- ELEGOO/Arduino programming examples
- OpenVINO documentation/Examples

4. Requirements

Make sure the following software requirements are met:

- Operating System: Windows 10
- Python >= 3.5
- OpenVINO Toolkit[1]
- ***Venv*** Virtual environment on your system using the instructions provided on the next page.

5. Procedure

Familiarize yourself with:

- Demo examples from ELEGOO Kit/Arduino about LEDs and serial communication.
- Basic navigation commands for the PowerShell or Command Prompt (CMD.exe). You may use this tutorial[2].

[1] https://docs.openvino.ai/latest/openvino_docs_install_guides_installing_openvino_windows.html#doxid-openvino-docs-install-guides-installing-openvino-windows

[2] https://riptutorial.com/cmd/example/8646/navigating-in-cmd

- Object detection using OpenVINO. Use this link[3] for the demo examples.
- Use this link for Venv tutorials[4].

No.	Item	Qty.
1	Intel Neural Compute Stick 2	1
2	Arduino Board	1
3	LEDs of different colour	2
4	Resistors	2
5	Jumper wires	4-5

Table 1: Bill of Materials (item# 1 will be provided. The rest of the items are included in your kit)

Table 1 shows the list of the components used in this lab. Additionally, you need to write two scripts described in Part A and Part B below.

PART A: Python script:
(a) In part, you will use OpenVINO toolkit to detect objects. You will use the provided AlexNet neural network model. There is no need to have an in-depth knowledge of the model or neural networks. A sample script for object detection using AlexNet is provided inside the Lab1 folder. To use the script, follow the steps below:

1. **Create a virtual environment**. In PowerShell use the following commands:
i) Navigate to the Lab1 folder.
ii) Create a Venv using this command: `python -m venv vino`
iii) Activate the Venv using this command: `vino\Scripts\activate`
iv) Install the required libraries: `pip install -r requirements.txt`

2. **Classification example:** Connect the VPU to the PC. In the PowerShell, follow these steps:
i) Set up variables by running the following command (required for openVINO):
`C:\Program Files (x86)\Intel\openvino_2022\setupvars.bat`
ii) Navigate to the Lab1 folder: `cd ($address of the folder)\classification_alexnet\`
iii) Run the classification script using:
`python lab1_vpu.py -m public/alexnet/FP32/alexnet.xml -d MYRIAD`
(note: use this command for troubleshooting, if needed
`python lab1_vpu.py -m public/alexnet/FP32/alexnet.xml -d CPU)`

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[3] https://docs.openvino.ai/nightly/openvino_inference_engine_ie_bridges_python_sample_hello_classification_README.html#doxid-openvino-inference-engine-ie-bridges-python-sample-hello-classification-r-e-a-d-m-e

[4] https://realpython.com/python-virtual-environments-a-primer/

(b) The script should take the image name as a continuous input[5] from the user.
(c) If the network detects pizza, then the program should write a message on the serial port to which the Arduino is connected.

PART B: Arduino scripts:
(a) Connect a yellow and a red LED to the Arduino.
(b) The Arduino should be programmed to read messages on the Serial Port. You will write a script for this from scratch,
(c) If your python script detects a pizza, then the yellow LED should glow.
(d) If some other object is detected, then the red LED should glow.
(e) If no messages are received on the Serial Port, then none of the LEDs should glow.

Once it is working properly, demonstrate it to your TAs and ask them to sign off. These tasks should be finished during lab hours. Pre-coding might be needed.

Notes:

- LEDs are diodes, so current only goes one way. Make sure the long leg is on the positive end. The current to the LED must also be limited through resistors to avoid damaging them. See ELEGOO example lesson 2.1 and apply the same circuit to the LEDs.
- Follow the openVINO's object detection tutorial provided above to understand the working of openVINO toolkit. You can simply modify this sample code to create Python scripts for this experiment.
- You will use Pyserial library in your python script to publish messages on the serial port.

[5] https://tutorial.eyehunts.com/python/how-to-take-continuous-input-in-python-example-code/#:~:text=Use%20While%20loop%20with%20True,if%20statement%20and%20break%20statement.

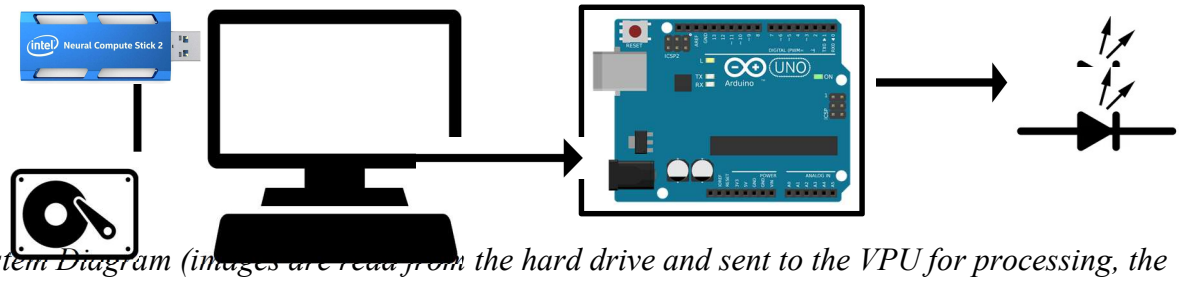

Figure 1: System Diagram (images are read from the hard drive and sent to the VPU for processing, the results are sent to the Arduino)

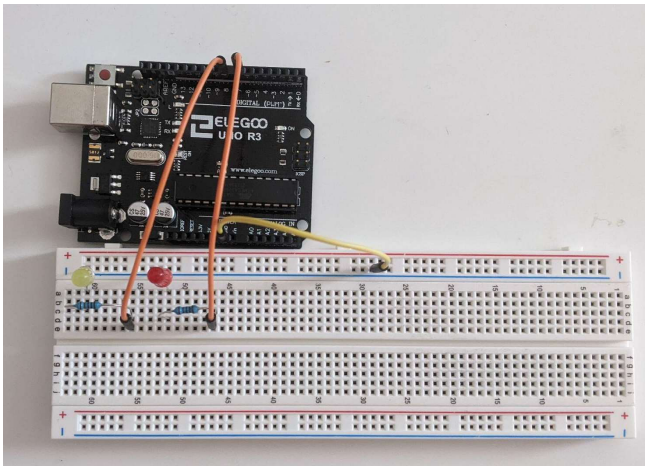

Figure 2:Circuit Connection

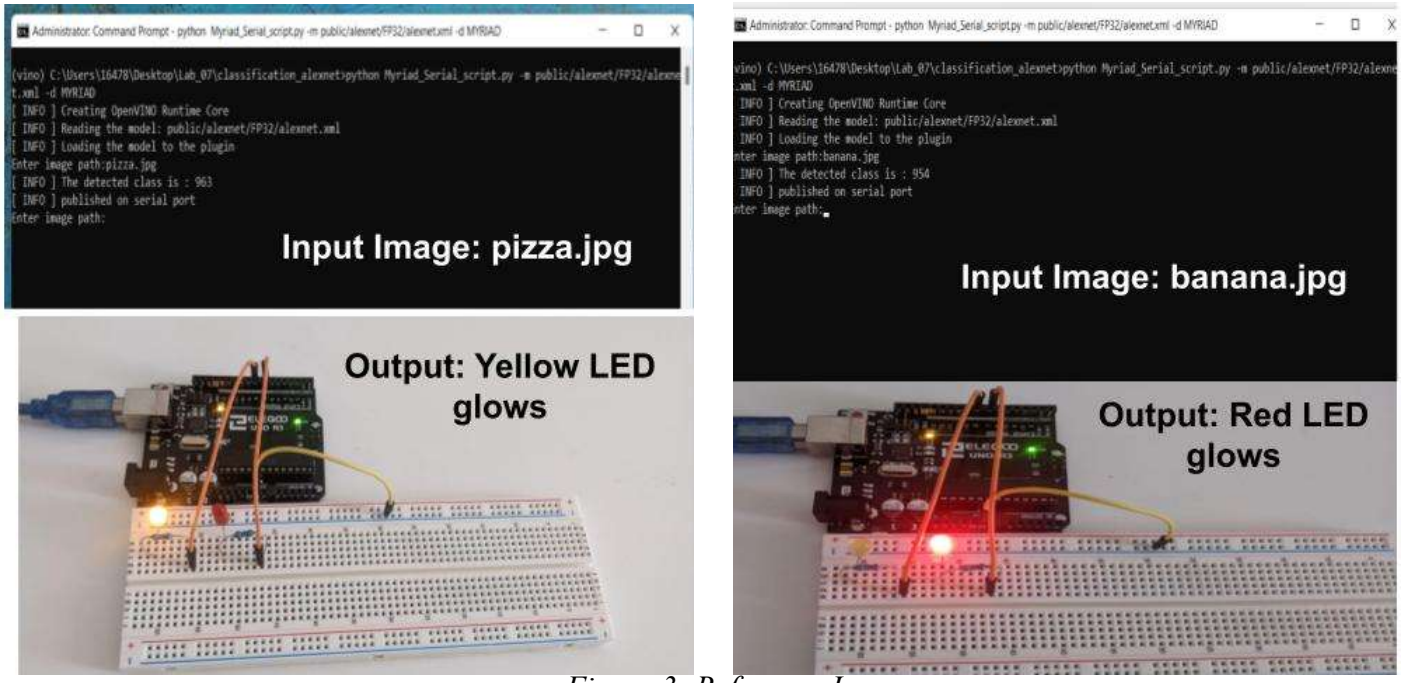

Figure 3: Reference Images

6. Report

Your lab report should include:

- Signed lab report cover page *(make sure you put your lab group number on the front if it applies)*
- Abstract
- Introduction
- Experimental Equipment (ie. what was used)
- Description of the Hardware, Program with Flowchart
- Conclusions & Recommendations
- Appendix: Program Listing
- Report file name convention:
- Report_Section#_Student-ID_ Last-Name_First-Name_LAB1.pdf, e.g. Report_09_00099887766_Smith_John_LAB1.pdf
- Your code also should be submitted in a zip file, if more than one file needs to be submitted. Otherwise, submit the code unzipped.
- Code file name convention: Code_Section#_Student-ID_Last-Name_First-Name_LAB1.pdf, e.g. Code_09_00099887766_Smith_John_LAB1.[c, zip]

- Lab reports are due 1 week since your lab session starts.
- Submit to D2L→ Assessment → Assignment → Lab1
- Late submissions will be penalized at a rate of 10% per day, where weekends count as two days, and a fraction of a day is considered a full day.
- Each student should submit their own individual report. This is not group work.
- Lab attendance is mandatory. If you submit a report without attending the lab, you will get zero marks.
- Weight:
  - 50%: TA confirms that you did the lab during the lab hour
  - 50%: Lab report and the code