UC Berkeley, EECS Department   Prof. B. E. Boser

EE 49   **LAB3: INA219**

Name	SID	Checkoff

Objectives: Deploy IoT techniques to automate lab work.

Attention!

The maximum voltage on any ESP32 pin is 3.3 V. Applying a higher voltage will damage the ESP32 (no smoke signal, the device will quietly die).

Before connecting anything to one fo the pins of the Huzzah32 board, verify (with a multimeter) that the voltage is no more than 3.3 V.

Parts and Tools

For this laboratory, you will need the software installation from the last lab, ESP32 microcontroller, solar cell, potentiometer, solderless breadboard, and a INA219 breakout board.

Prelab

To complete the prelab (and subsequent labs), you need a working and tested installation of the MicroPython programming framework introduced in the last lab. You may either use the departmental computers in 199 Cory Hall or your own computer.

- Read the description of the INA219 breakout board at https://www.adafruit.com/product/904.

- Write the code to configure the INA219 and read the measured voltage and current and print the voltage, current, power, and value of the load resistor once a second in an endless loop.

  Have this program ready either on the departmental computer's file system or on your own computer if you are planning you use it in the lab. Be sure to have it in the lab, you won't have time to retype the code.

- Write a `boot.py` script with the following features:

  a) Connect to the wifi network (EECS-PSK) and print the IP address. Make sure the program does not block (e.g. in an endless loop) if the WiFi network is not available.

  b) Advertise its hostname on the network via mDNS.

  c) Fetch and print internet time.

- In the space provided below, draw the circuit diagram of the IoT app for measuring the voltage and current from the solar cell. Your circuit should include the solar cell, INA219, ESP32, and potentiometer.

Use Piazza, office hours, and discussions to get help and your questions answered so that you will come completely prepared for building your first IoT app in the lab!

Lab

INA219 Header

Solder the six pin header to the INA219 breakout board. Optionally you may also solder the two pin screw terminal block.

Wire the IoT Circuit

Wire the IoT circuit using the circuit diagram prepared in the prelab.

Test Voltage/Current Reading with the INA219

Use the program prepared in the prelab to print out current and voltage measurements from the INA219. Check the readings for different illuminations of the solar cell and settings of the load resistor (potentiometer). Verify the accuracy with the DMM. When everything is verified, ask the instructor to checkoff your setup.   Checkoff: ☐

Connect the Huzzah32 to the Internet

Test the `boot.py` script prepared in the prelab with a serial (USB) connection using the `run` command in `shell49`. Verify that it prints the correct time and date fetched from the Internet and note the IP address. When it's working, copy the script to `/flash/boot.py` on the ESP32.

Reboot the ESP32 (press the reset button) and verify internet connectivity with the ping command.

Note: unless your computer is connected to the same net, it will not see the address broadcast by mDNS. This often is the case if your computer is connected to the Internet with a cable (e.g. the computers in the lab), while the ESP32 is connected wirelessly. In that case connect with the IP address. Checkoff: ☐

Write and Test the IoT App

Write and test the IoT app for collecting solar cell power measurements with the INA219 and plotting the results via MQTT.   Checkoff: ☐