Lab 2: Interface with Sensors

Objectives:

1. Interface with DHT22, light sensor, HC-SR04 and relay module.
2. Calibrate the sensor reading DHT22, light sensors and HC-SR04.
3. Display the sensor data in serial port terminal.

Materials:

1. ESP32-S3 devkit board.
2. Breadboard and Dupont wires.
3. A USB 2.0 cable (Standard-A to Micro-B).
4. DHT22 sensor, light sensor, HC-SR04 and relay module.
5. 10KΩ resistor x1, 1KΩ resistor x1, and a red LED diode.
6. Computer with your charging cable.

Prelab preparation: Refer to the lecture notes. Design circuit to connect the sensors and actuator to the ESP32-S3 devkit. Include your design schematics in your lab report.

Lab activities:

a. Build your circuit using the components and tools provided. In all the following steps, program your ESP32-S3 devkit to display the sensing results in the serial port terminal if needed.

b. Design circuit to connect the ESP32-S3 devkit to the humidity and temperature sensor DHT22.

c. Program your ESP32-S3 devkit to read the humidity and temperature from the DHT22. Check against the actual readings provided in the lab session. Modify your code to add calibration if needed.

d. Add circuit to connect the light sensor to ESP32-S3 devkit.

e. Insert your code to read light sensor data through ADC channels. You can choose any available ADC channel. Use your phone torch light as the most intensive light in this light sensing task and adjust your program accordingly. Obtain and calibrate the analogy and digital readings. Find the minimum time interval between two valid readings of your light sensor.

f. Add circuit to connect the ultrasound sensor HC-SR04 to ESP32-S3 devkit.

g. Insert your code to read from the ultrasound sensor to measure after putting a target 50-100cm in front it. Read the data and calculate the distance. Check against the actual distance and modify your code to calibrate it.

h. Write and insert your code to control the relay module to switch the red LED diode. The red LED should light up in the room light and turn off under your torch light.

i. With the DHT22, light sensor and the relay module connected in above steps, program your ESP32-S3 devkit to

- Update humidity and temperature data in the serial port terminal every 5 seconds;
- Turn the Red LED on/off when the room illumination condition changes;
- Display the temperature data on demand. The request is sent through the serial port.

Assessment: You should finish all the tasks above and show your results to the instructor before 11am. Submit your lab report which includes your results in above steps and your final code (with detailed documentation and indention) by 23:59 midnight today to Canvas submission folder.