



Configurable indoor air quality monitoring system



Student

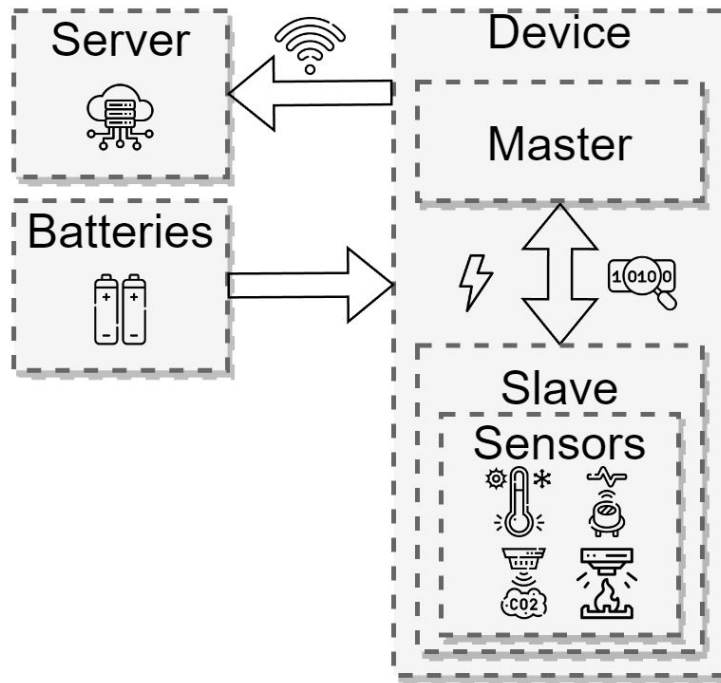
Andrei-George-Lucian ENESCU



Introduction

→ architecture (1/1)

- Indoor data acquiring system
- Design a device
 - 2 components
 - Slave board
 - Arduino Nano
 - Multiple sensors
 - Master board
 - ESP32
 - Power management
 - WiFi
 - Serial communication
 - Battery powered

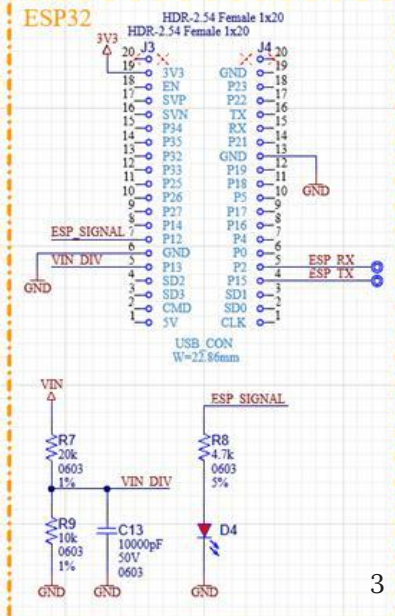
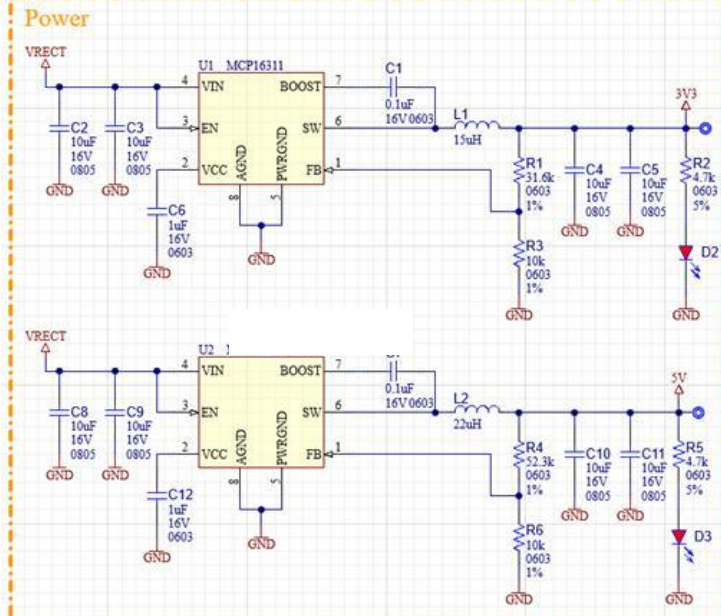
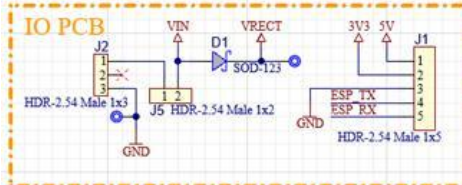


○ Website



Master board → schematic (1/2)

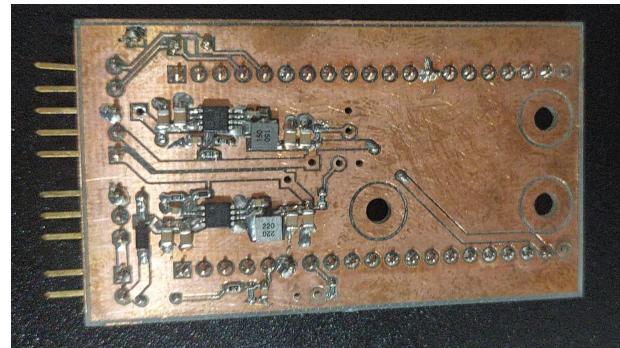
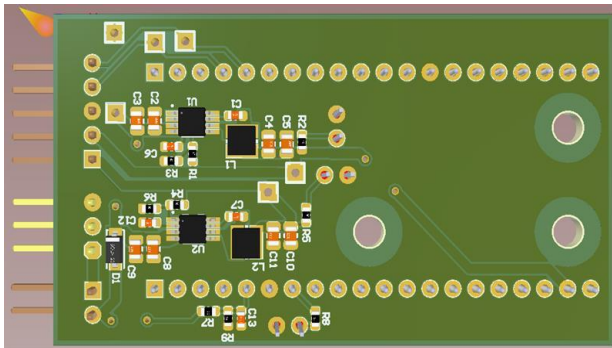
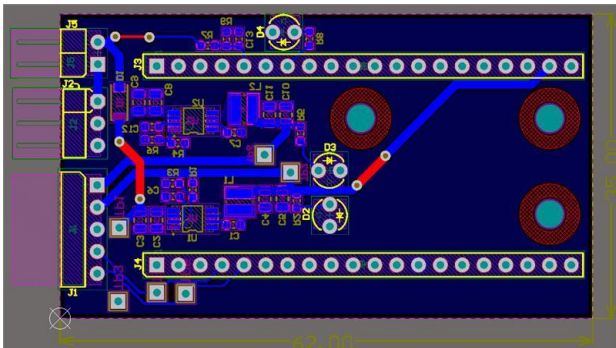
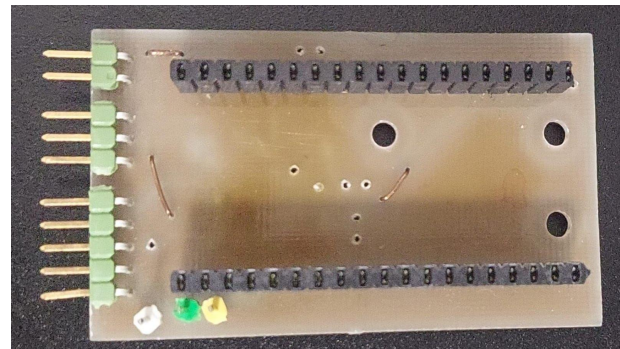
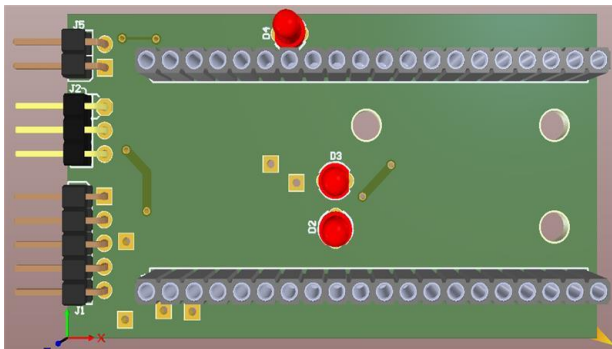
- Shield ESP32
- Battery powered
 - 2x 18650 in series
 - 7.4V
 - Reverse polarity protection
- Voltage level 5V, 3V3
 - 2x MCP16311
 - Sync buck
 - PWM+PFM
- Input voltage divider





Master board ↪ layout (2/2)

- Optimization
 - Single sided
 - Board size
- debugging LEDs
- M3 screws
- CNC

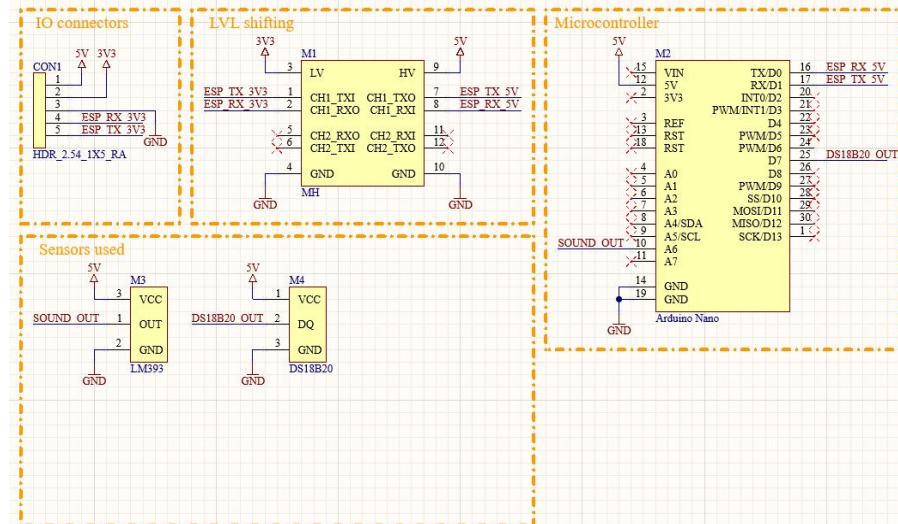
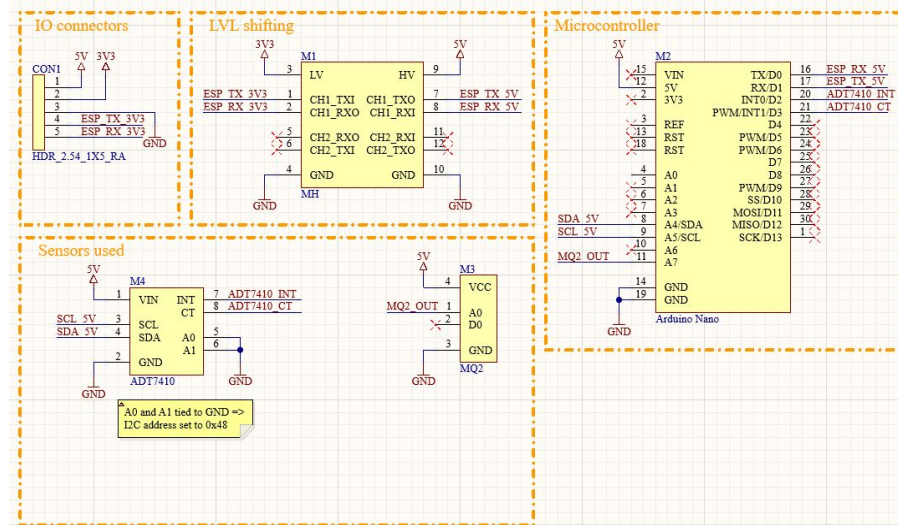




Slave boards

→ slave schematics (1/2)

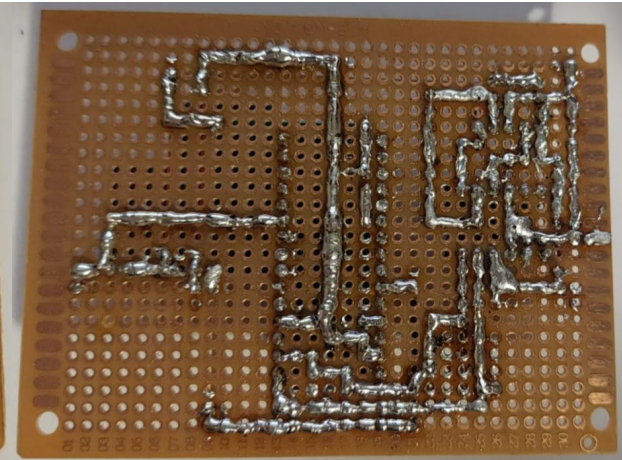
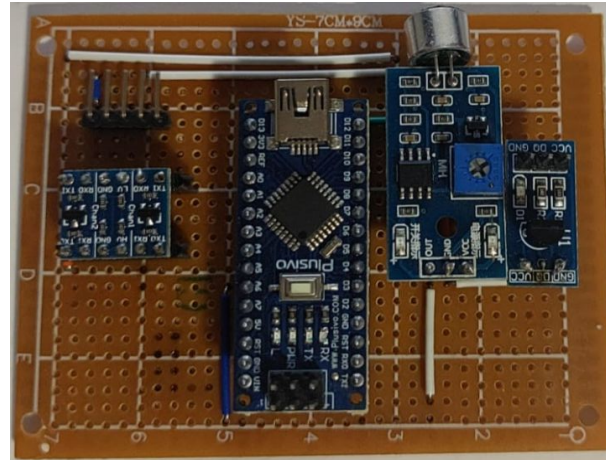
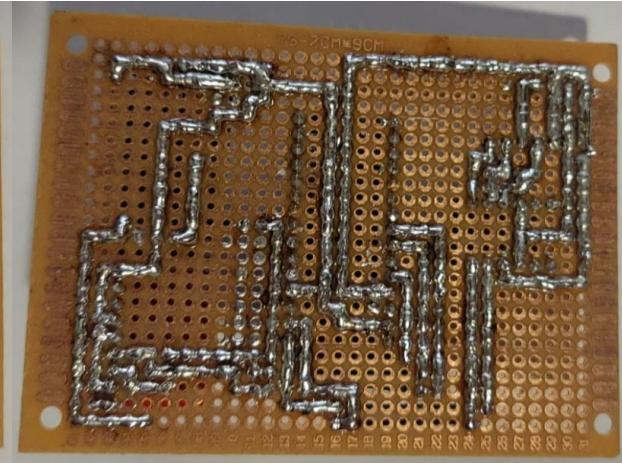
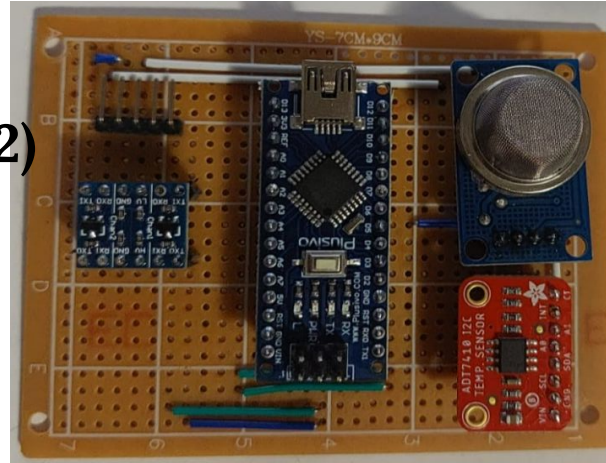
- Shield Arduino Nano
- Level shifter
 - 3V3 ESP32 ↔ 5V ATMEGA328P
- Sensors
 - ADT7410 temp
 - I2C, interrupts
 - Address 0x48
 - MQ2 gas
 - Analog voltage
 - DS18B20 temp
 - 1-Wire
 - Sound sensor
 - Analog voltage





Slave boards → soldered (2/2)

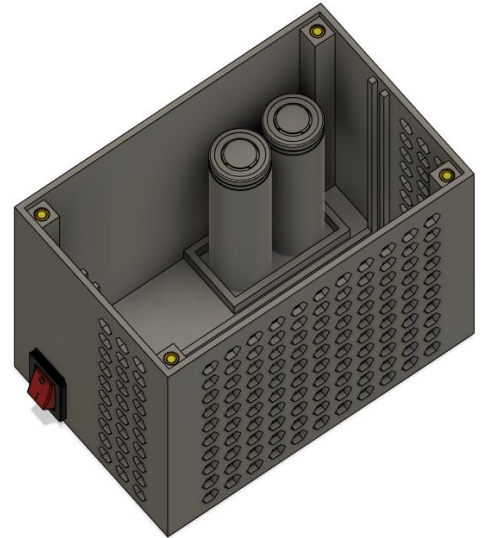
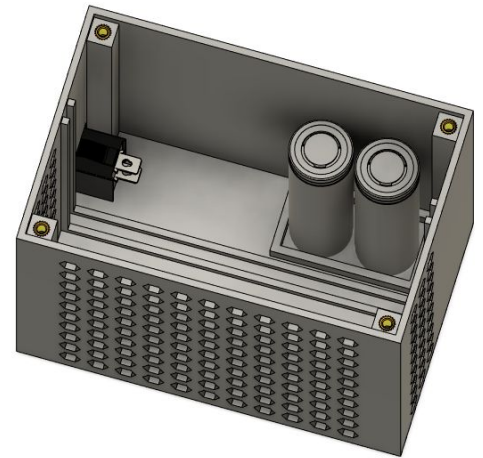
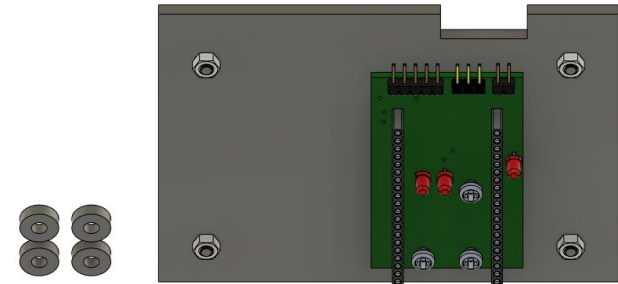
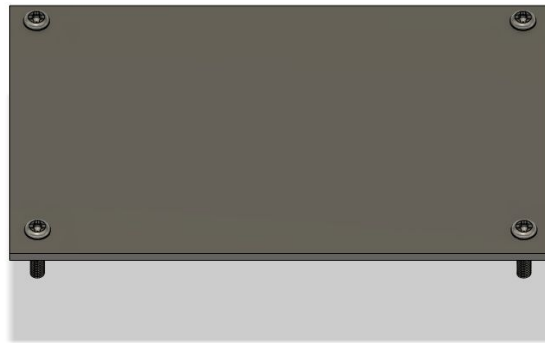
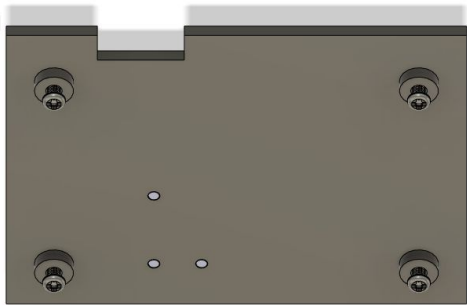
- Perforated circuit board





3D case

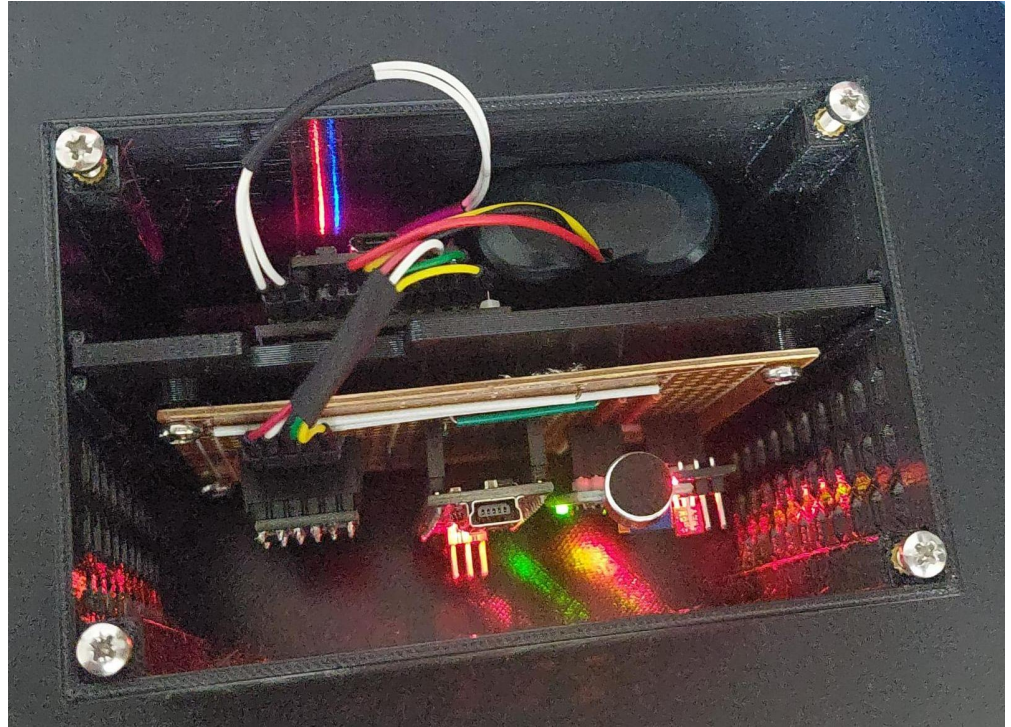
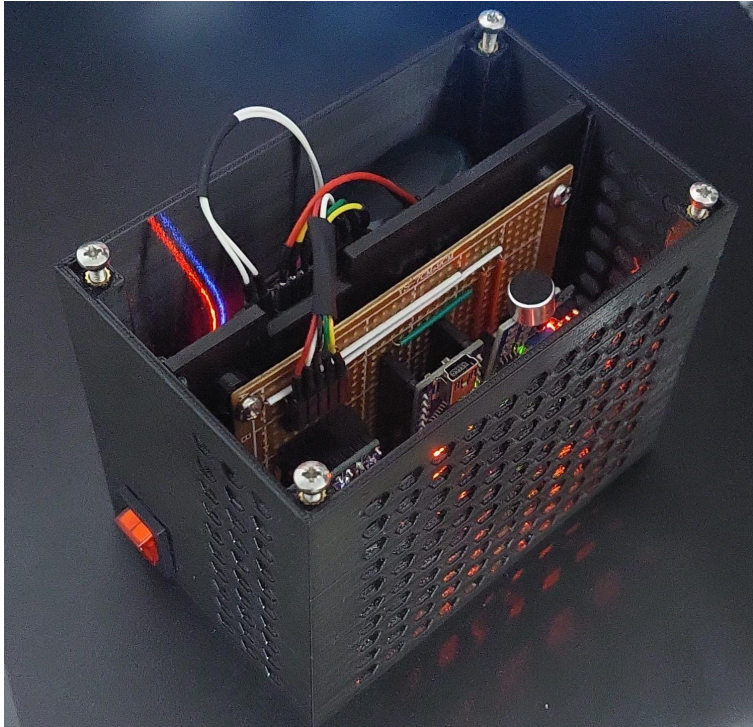
→ componenets (1/1)





Final product

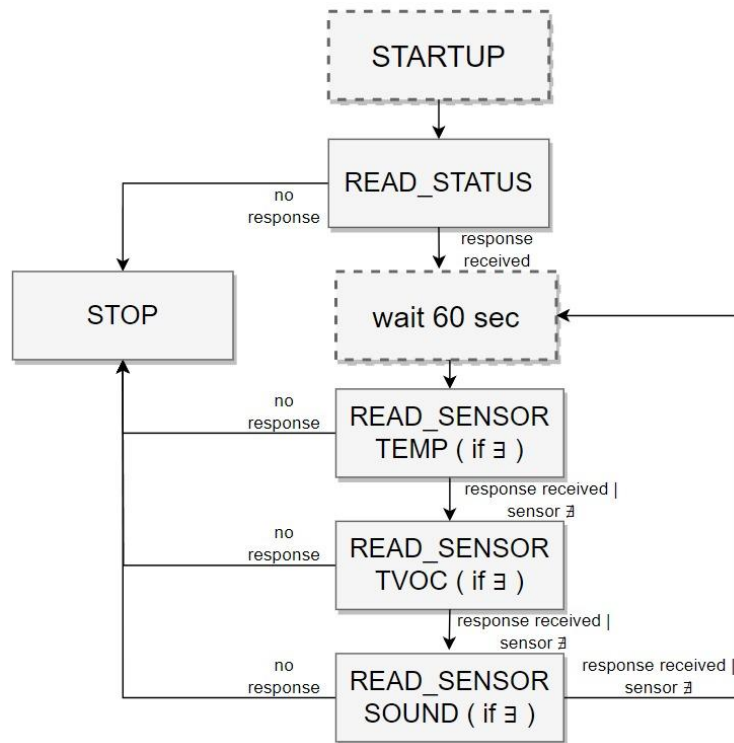
↪ complete assembly (1/1)





MCU code ↔ architecture (1/1)

- 2 commands
 - UART_CMD_READ_SENSORS_STATUS
 - Slave configuration
 - UART_CMD_READ_SENSORS_DATA
 - Read sensor data
- Timeout => stop

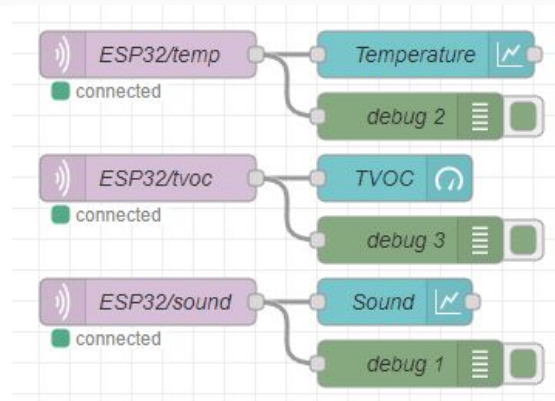
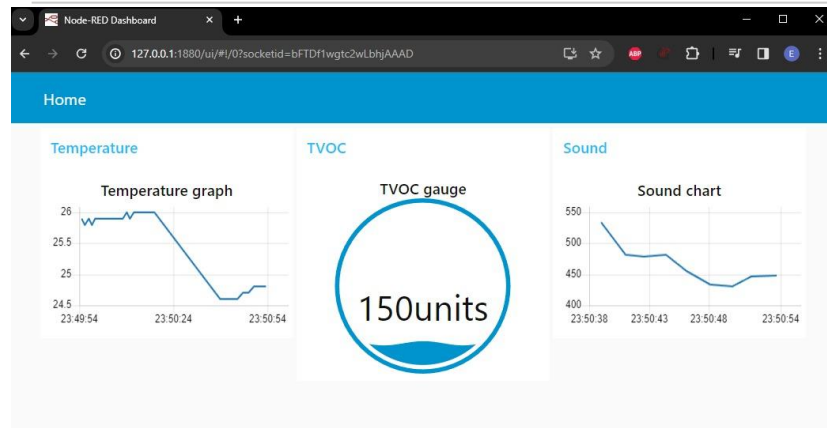
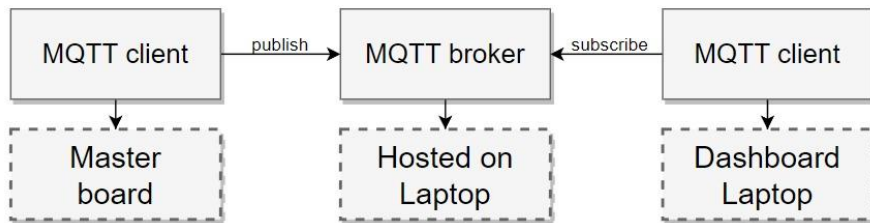




Dashboard

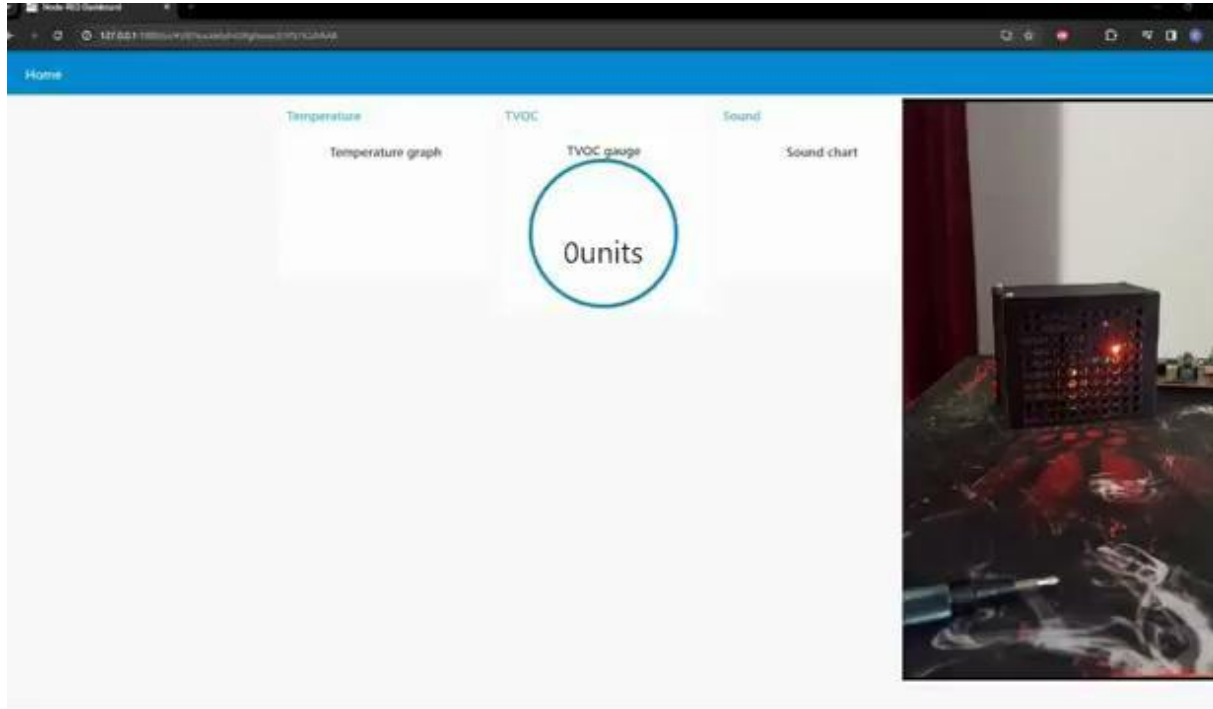
↔ Node-RED+MQTT (1/1)

- Node-RED
 - Browser-based editor
 - Flow
- MQTT network
 - 2 components
 - Broker
 - Clients
 - 3 topics





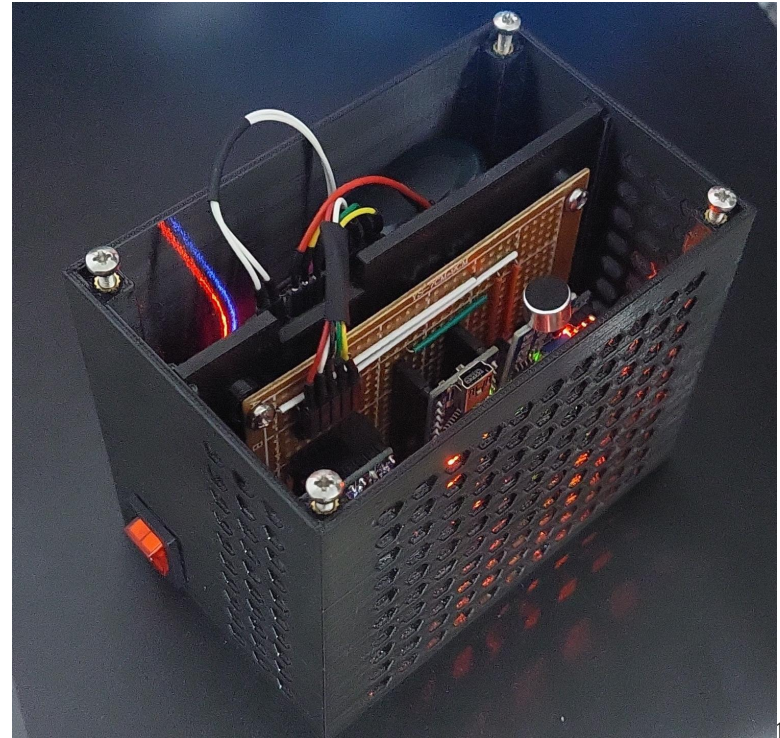
Demo





Conclusions

- Node-RED + MQTT
 - Multiple devices
- 2 components
 - Reconfigurable sensor architecture
- Easy to move





Resources

- ◉ https://www.espressif.com/sites/default/files/documentation/esp32-wroom-32_datasheet_en.pdf
- ◉ https://ww1.microchip.com/downloads/en/DeviceDoc/Atmel-7810-Automotive-Microcontrollers-ATmega328P_Datasheet.pdf
- ◉ <https://ww1.microchip.com/downloads/en/DeviceDoc/MCP16311-Family-Data-Sheet-DS20005255C.pdf>
- ◉ <https://www.analog.com/media/en/technical-documentation/data-sheets/adt7410.pdf>
- ◉ https://github.com/adafruit/Adafruit_ADT7410
- ◉ <https://www.analog.com/media/en/technical-documentation/data-sheets/ds18b20.pdf>
- ◉ <https://github.com/milesburton/Arduino-Temperature-Control-Library>
- ◉ <https://github.com/PaulStoffregen/OneWire>
- ◉ <https://nodered.org/docs/getting-started/>
- ◉ <https://microcontrollerslab.com/esp32-mqtt-publish-multiple-sensor-readings-node-red/>