

**NATIONAL PRACTICAL EXAMINATIONS FOR TSS
LEVEL 5,
SCHOOL YEAR 2022-2023**

**SECTOR: ICT AND MULTIMEDIA
TRADE: SOFTWARE PROGRAMMING AND EMBEDDED
SYSTEMS**

**INTEGRATED ASSESSMENT FOR EMBEDDED
SYSTEMS**

Modules combined:

1. SPEEH302 Embedded Systems Hardware Design
2. SPEES401 Embedded Systems Software Integration
2. SPEAE501 Advanced Embedded Systems

1. INTEGRATED SITUATION:

Weather Station

Human activity is influenced by weather conditions. Monitoring of weather conditions can help in controlling the activity. Without a weather station, people can't be alerted of the strong winds, heat waves or any other weather-related emergency.

Rwanda Coding Academy wants to monitor and study the pattern of weather in the surrounding in order to let people know about temperature and humidity. With adequate data it will be able to make weather forecasts and view the history of information as well.

TASK:

As an Engineer in Embedded Systems, develop the “**IoT Weather Station**” that is capable of:

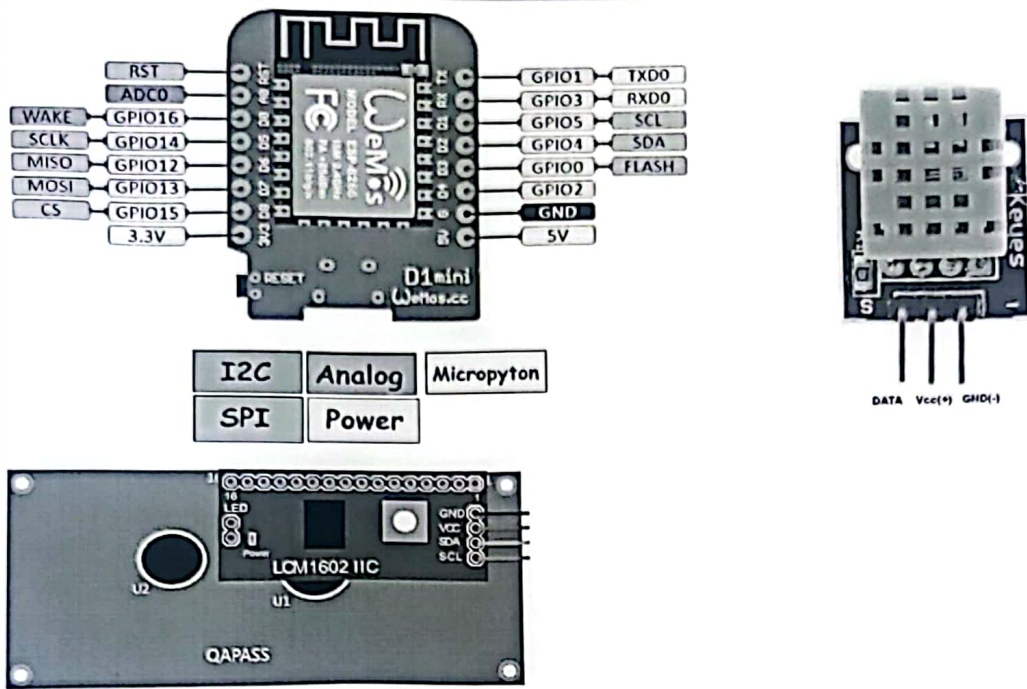
1. Collecting temperatures and humidity in the Rwanda Coding Academy surroundings.
2. Displaying on LCD Display the temperature reading.
3. Alerting students when it is time to wear or remove the pullovers.
4. Sending records to a web server.
5. Presenting data to interested people on a web page using a bar chart

Instructions:

- Arduino IDE should be installed and running.
- ESP8266 boards should be configured with the Arduino IDE.
- The library LiquidCrystal_I2C.h for the I²C Liquid Crystal Display (LCD) should be installed within the IDE.
- The board “ESP8266 WeMos D1 Mini” (referred to as the microcontroller) should be pinned into the breadboard using its male pins.
- The DHT11 sensor should be pinned into the breadboard using its THREE pins.
- The blue LED should be pinned into the breadboard as follows: its cathode pin should be connected to the ground pin (G) of the

microcontroller through a 220-ohm resistor while its anode pin is connected to the pin D0 of the microcontroller.

- The red LED should be pinned into the breadboard as follows: its cathode pin should be connected to the ground pin (G) of the microcontroller through a 220-ohm resistor while its anode pin is connected to the pin D5 of the microcontroller.
- The buzzer should be pinned into the breadboard as follows: its negative pin should be connected to the ground pin (G) of the microcontroller while its positive pin is connected to the pin D6 of the microcontroller.
- The I²C Liquid Crystal Display (LCD) should be connected as follows: The SCL pin is connected to the D1 pin of the microcontroller; The SDA pin is connected to the D2 pin of the microcontroller; VCC pin is connected to the 5V pin of the microcontroller; The GND pin is connected to the ground pin (G) of the microcontroller.
- The temperature and the humidity are measured every 10 seconds.
- if a temperature above or equal to 25 °C is measured, 1) the red LED should turn ON, 2) the blue LED should turn OFF, 3) the buzzer should beep 10 times where the interval between beeps is 100 milliseconds. Otherwise, as long as the temperature below 25 °C is measured, 1) the red LED should turn OFF, 2) the blue LED should turn ON, and 3) the buzzer should be OFF.
- Every time the temperature and the humidity are measured they should be uploaded to a web server's URL "<http://192.168.1.150/weather-station/backend.php>".
- Data uploaded to the web server should have THREE keys, "device", "temperature", and "humidity" where the device value is your INDEX NUMBER (like 340722SPE0992023) while the temperature and the humidity values are the measured values.
- Users can view data presented using bar chart on the web page with the URL <http://192.168.1.150/weather-station/>
- The values of the temperature and the humidity should be displayed on the LCD.
- **No component should get damaged.**
- Below is the pinout of the microcontroller, the DHT11 sensor, and the LCD for reference.



Timing: This task will take 4hours