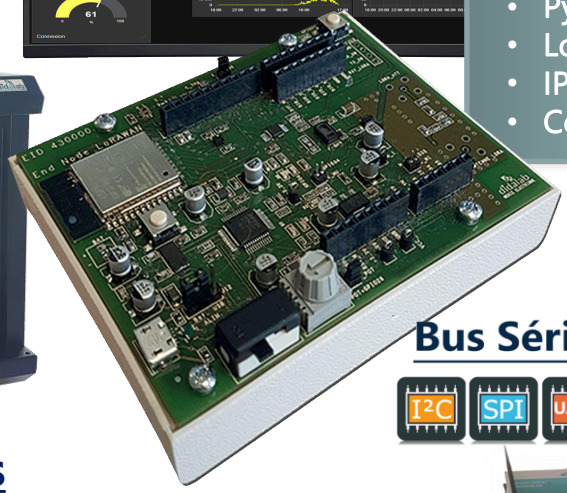
IoT, Smart City
LoRa LoRaWAN protocole

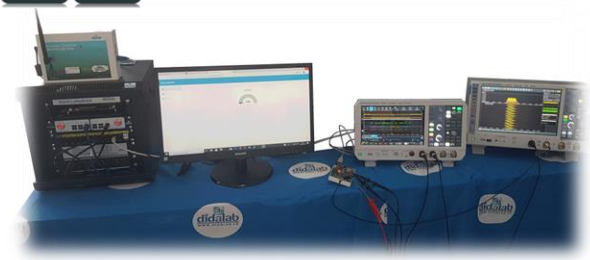


- Study of Sensors
- I2C SPI frames analysis
- Python programmation
- LoRa/LoRaWAN protocoles
- IP networks
- Compatible with Arduino sensors

Programmations

Bus Série

Protocoles



HIGH LIGHTS

Communicating objects are on the verge of revolutionizing the current use of telecommunication. The miniaturization and the multiple sensors we can propose allow us to envisage a significant growth of this activity in the coming years.
Among the different protocols proposed by the developers, we have chosen the Lora protocol, which presents the most effective technical features concerning the absolutely essential points for this technology and its expansion: **Very low consumption and long distance communication.**

The LoRaWAN network has a star topology. Each element is connected to a single concentrator for supervising and ordering several hundred sensors spread over an area of several kilometers of radius.

Didalab has developed, for the students' use, a set of sensors and concentrators for students to install and implement a complete IoT (Internet of Things) system from the sensor to the server through the Gateway.

PEDAGOGICAL PURPOSES

The proposed Practical Works are intended to familiarize the student with the use of different sensors and the diversity of possible applications. We also highlight the particular technology used by Lora WAN to drastically reduce electrical consumption, but ensure communication of several kilometers between the different elements.

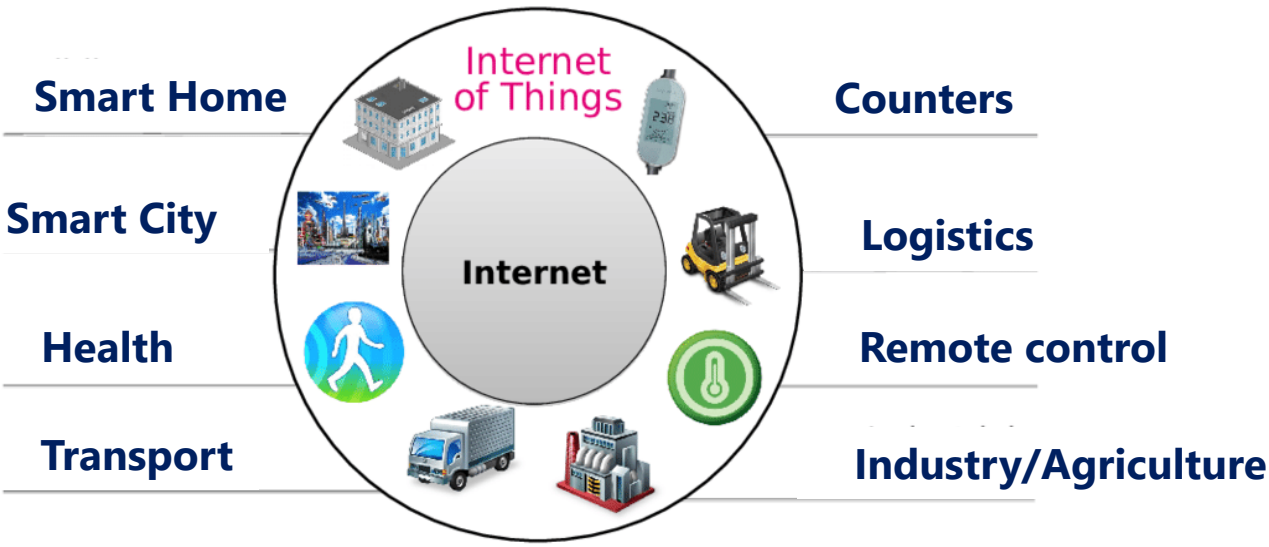
TARGETED TRAININGS

- Upper secondary education (General and Vocational)
- Post secondary non-tertiary education (General and Vocational)
- Short-cycle tertiary education
- Bachelor's or equivalent level

Why study IoT?

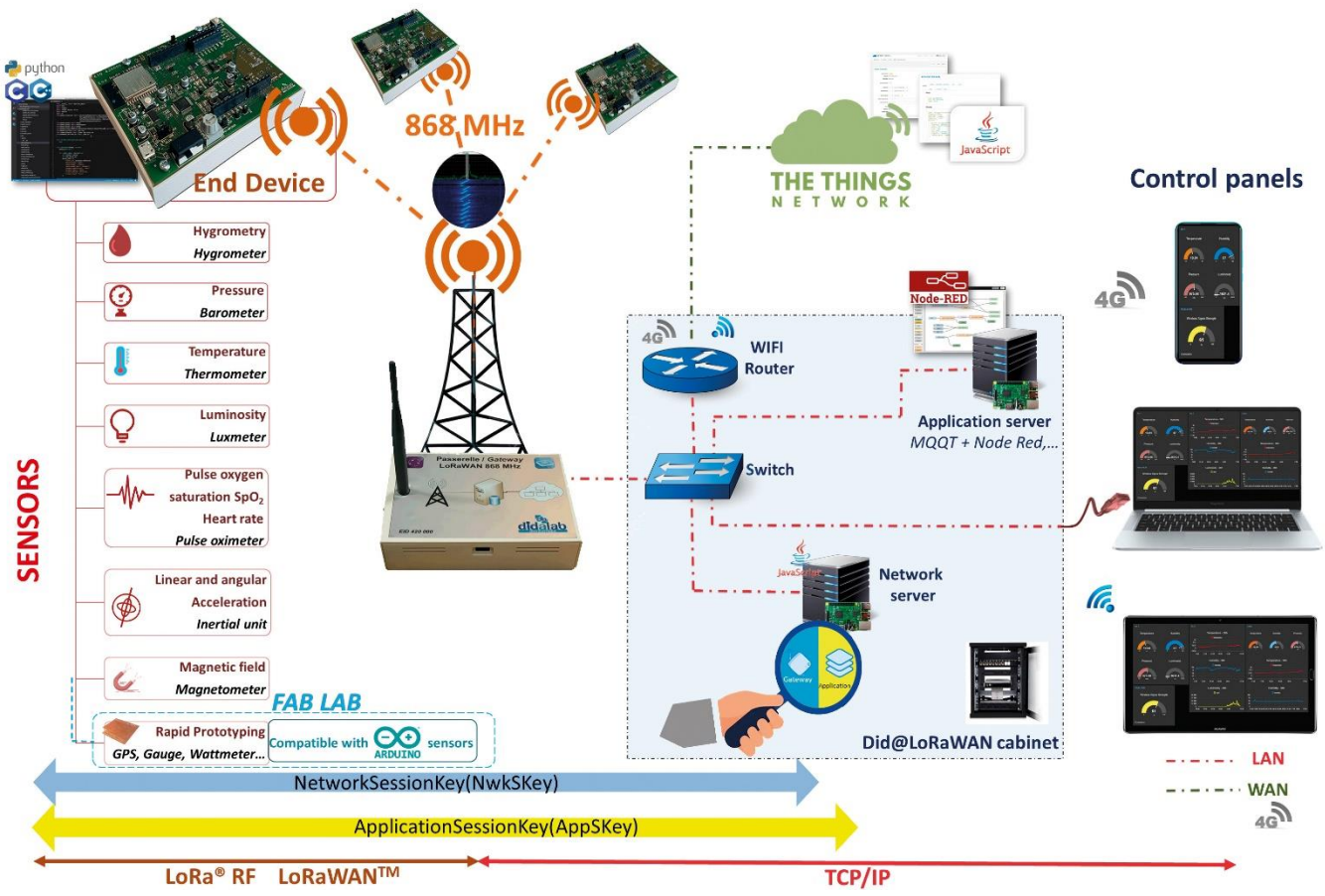
IoT are used everywhere:

At home, at school, in the companies, the universities, the hospitals, shopping centres, in the Administration and on public transport, …

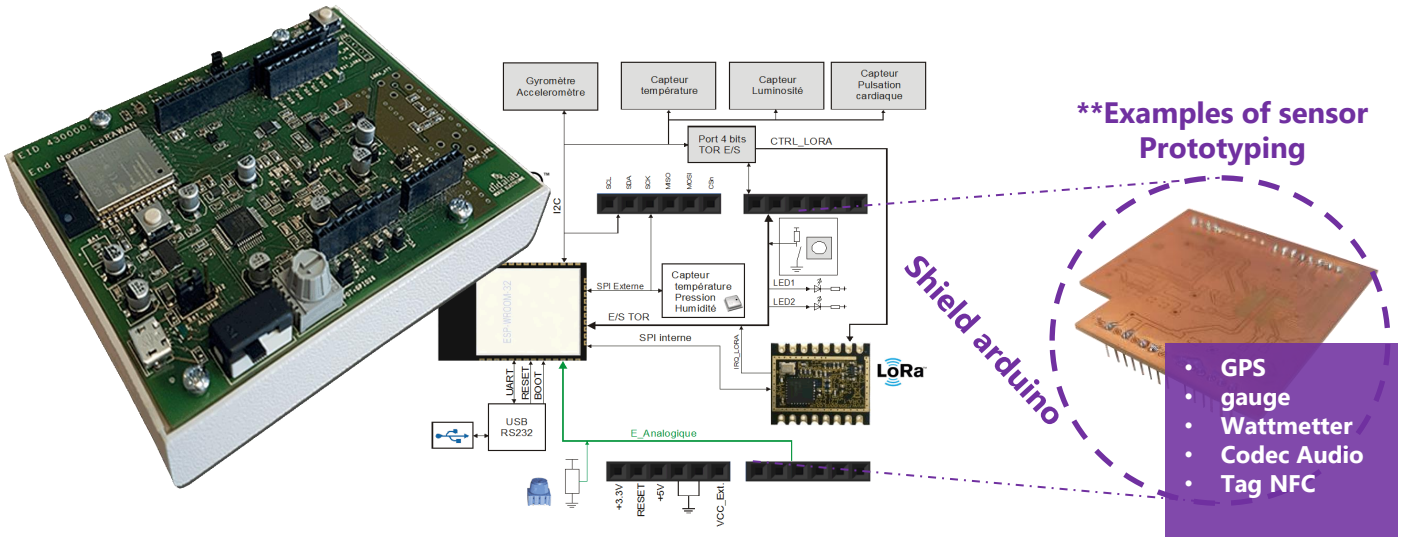


IoTs have grown so fast in recent years that their development into new applications is inevitable.

SCHEMATIC DIAGRAM

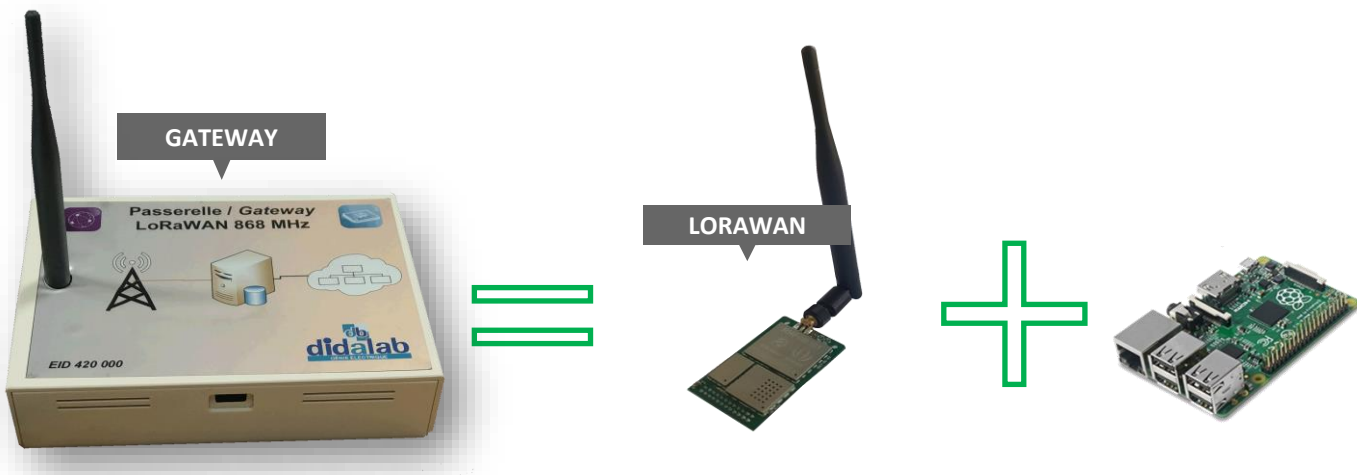


EID 430 000 : LoRa End Device module/ LoRaWAN 868 MHz



CPU	ESP32 Soc (XTENSA dual core 32 bits LX6 microprocessor à 240 MHz, 600 DMIPS), Bluetooth, WIFI
Memory	32 Mbit Flash
Serial Bus	UART, 2 SPI, I2C,USB, RS232
Port	6 ADC inputs, 2 DAC outputs, 1 potentiometer, 2 LEDs, 15 On/Off I/O USB debug and ESP programming
Measures	Current Consumption, Battery voltage, Serial bus I^2C, SPI
Modem SX1272	LoRa/ GFSK at 868 MHz with LoRaWAN stack (class A, B and C), measure of RSSI and SNB with 1 embedded antenna and 1 20 dB attenuator output.
Sensors	Temperature, pressure, humidity, luminosity, heart pulse rate, accelerometer, 3-axis gyroscope magnetometer
Power supply	5 V via USB or battery (embedded charge)
Support	Shield arduino with (1 power supply port, 1 analog port and 2 digital ports).

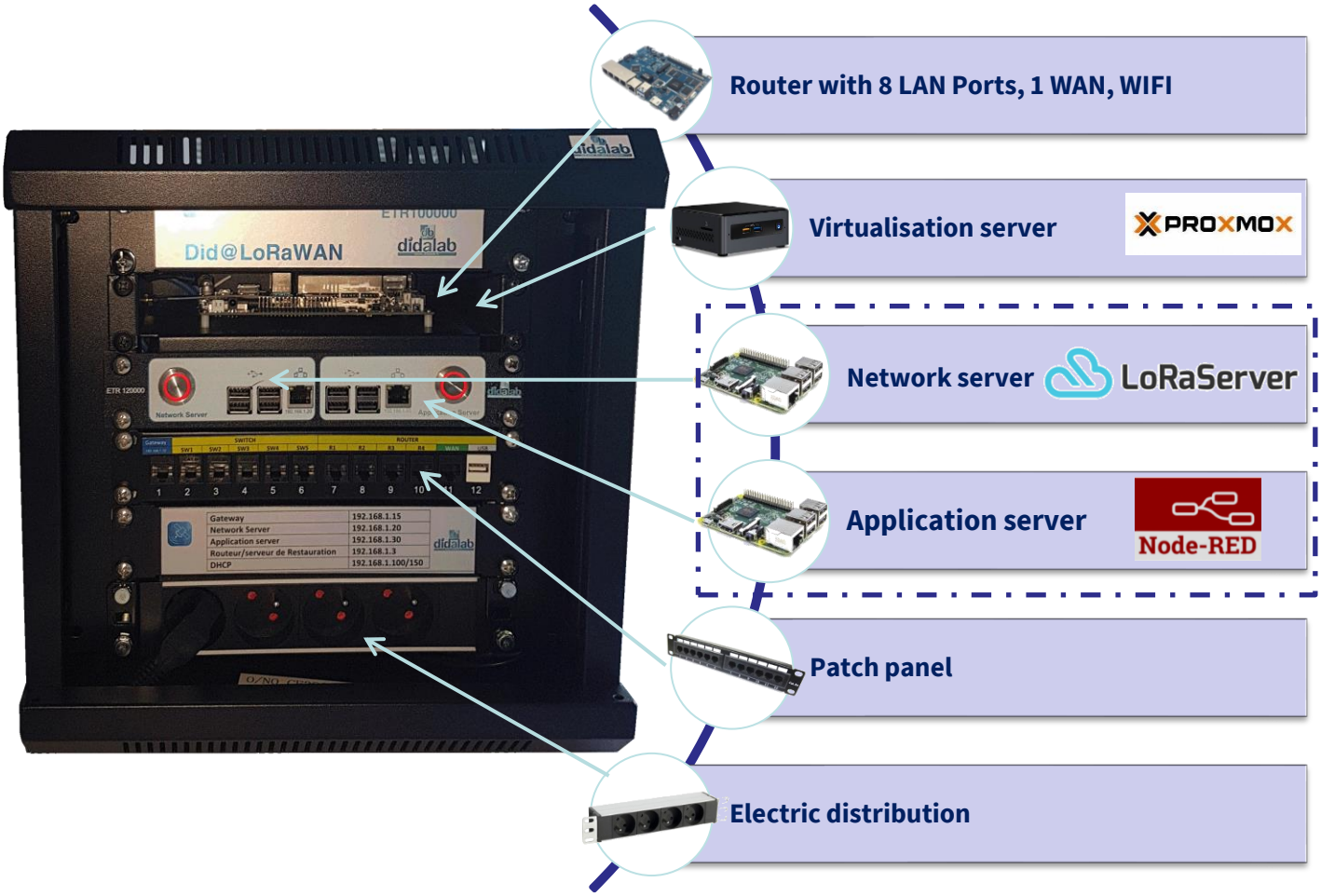
EID 420 000 LoRa/LoRaWAN Gateway 868 MHz



ETR 100 B : Did@LoRaWAN Cabinet

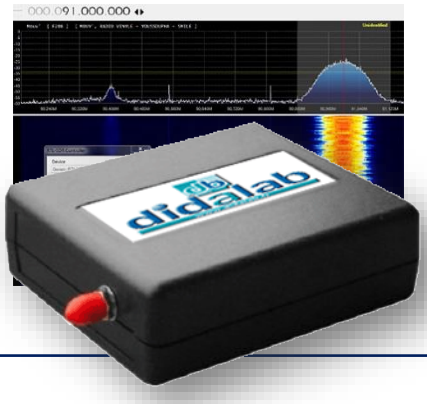
The ETR 100 B cabinet is autonomous, it is **totally isolated from the Internet network**, this feature has several advantages:

- Any misuse by students **will not cause any damage to the school network,**
- Server with 4 virtual machines
- The network cabling is done via a patch panel to **protect the active components**.



Several screen shots

EMD 430 000 : Radio Spectrum Processor / software define Radio (SDR)



- Continuous coverage from 1 kHz to 2 GHz
- Visible bandwidth of 10 MHz
- Power supply by USB cable with a simple type B socket
- Silicium technology: ADC 14 bits
- 11 integrated front preselection filters, high selectivity
- Software selectable AM/FM and DAB diffusion notch filters
- Software selectable multi-level low noise preamplifier
- Cross-platform driver and API support for Windows, Linux, Mac, Android and Raspberry Pi 3
- Documented API for the development of new applications
- Single SMA antenna socket covering the entire frequency range

Standard composition

ETR100C : IoT LoRa/LoRaWAN basic package, made of

Reference	Description	Qty
EID420000	LoRa/LoRaWAN gateway, 868 MHz with 2 TX & RX interfaces for the parallel demodulation on 8 frequencies. LoRa and GFSK demodulation. 1 external antenna, 868 MHz.	1
EID430000	LoRa / LoRaWAN End Device module, 868 MHz, including 1 ESP32 with 32 Mbit Flash,1 UART, 2 SPI, 2 I2C, 1 WIFI, 1 Bluetooth, 6 ADC inputs, 2 DAC outputs. Programmation and debug via USB interface. It includes 1 push button, 1 potentiometer, 2 LEDs, 1 temperature sensor, 1 humidity and pressure sensor, 1 luminosity sensor, 1 heart pulse sensor, 1 accelerometer and 3-axis gyroscope sensor, 1 battery charger, 1 current measure , and 1 shield arduino (with 1 port for power supply, 1 analogue port and 2 digital ports). 1 LoRA / GFSK Modem, 868 MHz (with LoRaWAN stack (Class A, B and C), measure of RSSI and SNR) with 1 embedded antenna and 1 20-dB attenuation output. Power supply: 5V via USB or batteries.	1 (*)
EMD430000	Radio spectrum processor ,14 bits, covering frequencies from 1 kHz to 2 GHz	1
ETR1000000	Computer cabinet, with:	1
	1 router with 8 LAN ports ,1 WIFI WAN port	
	1 patch panel composed of 11 RJ45 crossings	
	1 Virtualisation server	
ETR120000	Server rack made of	1
	1 Network server	
	1 Application server	
ETR340200	Set of 10 50-cm UTP cords	1

(*) : you can have up to 10 End-devices per laboratory (for 1 Computer cabinet / 1 Gateway)

Optional extra: Connected scale

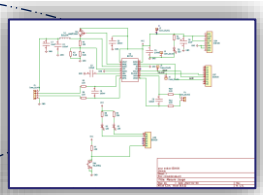
With the connected scale, extensios of our IoT pack, and a suitable electronic environment, the student will be able to tackle :

The production and maintenance of electronic products by designing, wiring and testing the "force cell daughter board" that will be plugged into the main End device board.

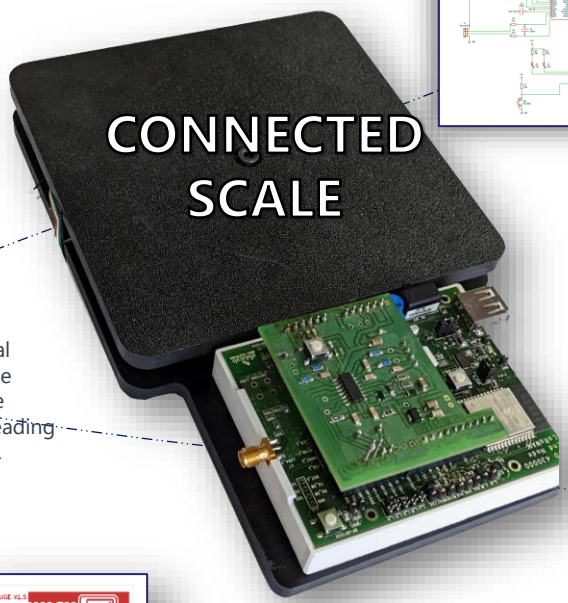
Analysis

In response to the problem of pollution caused by used batteries, Didalab is offering a connected scale solution using LoRaWAN protocol that provides real-time information on how full the used battery collector is.

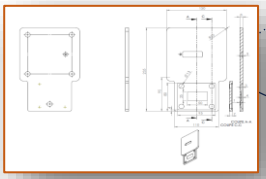
Schematics



Using KiCad software, students will be able to en the electronic diagram of t strain gauge

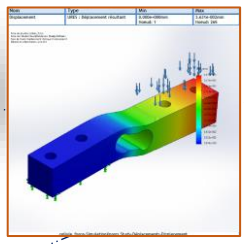


Schematic diagram reading



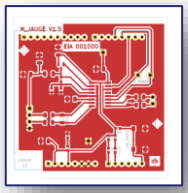
The mechanical drawings of the balance will be supplied for reading and validation.

Datasheet reading



The force cell datasheet will provided to validate the specifications.

Routing



Placement and routing of the electronic board

ETR100_BAL : IoT LoRa/LoRaWAN basic package, with Optional connected scale, made of:		
Reference	Description	Qty
ETR100C	IoT LoRa/LoRaWAN basic package	1
EIA010000	Hardware structure with 5 kg load cell, set of 3 x 1 kg weights and 4 x 500 g weights	1
EIA001000	Gauge « daughterboard »	1
CIM02829	PCB	25
EIA010000	Set of components	25
EMD018015	Oscilloscope	*optional*

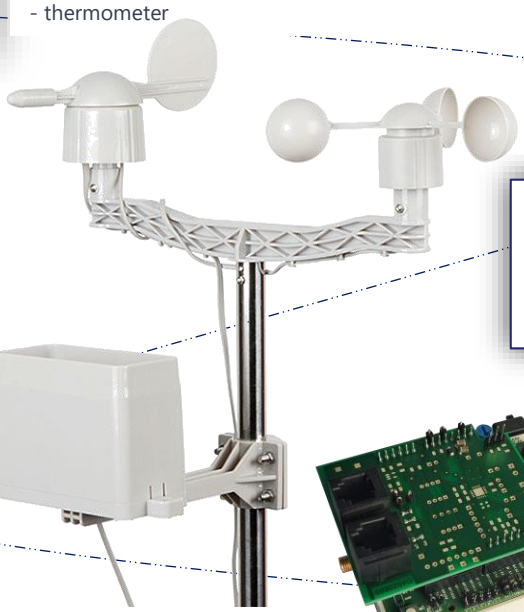
Optional extra: Weather station

With the weather station, another extension of our IoT pack and a suitable electronic environment, the student will be able to tackle :

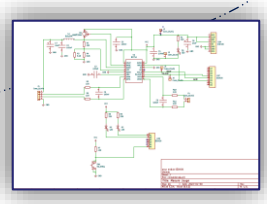
The production and maintenance of electronic products by designing, wiring and testing the "weather station daughter board", which will be plugged into the main End device board.

Analysis

An automatic weather station is an observation weather station, installed on a fixed or mobile site, whose sensors report a series of meteorological data at predefined intervals without human intervention:
- Anemometer
- wind vane
- rain gauge
- thermometer

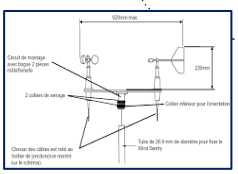


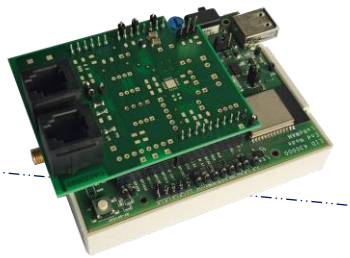
Schematics



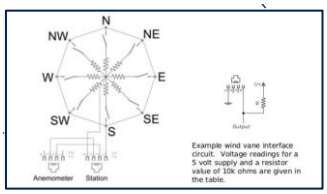
Via le logiciel KiCad, les élèves pourront saisir le schéma électronique de carte interface

Schematic diagram reading



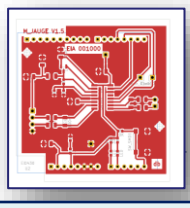


Datasheet reading



Routing

Placement and routing of the electronic board



The weather station datasheet be provided to validate the specifications.

ETR100_SM : IoT LoRa/LoRaWAN basic package, with Optional Weather station ; made of		
Reference	Description	Qty
ETR100C	IoT LoRa/LoRaWAN basic package,	1
EIA200000	Hardware for the weather station with its tripod and sensors (wind vane, rain gauge, PT100, PTC)	1
EIA020000	« Weather station« daughter board	1
CIM 03286	PCB	25
EIA020100	Set of components	25
ACC02679	Fan	*Optional*
EMD018015	Oscilloscope	*Optional*

Manufacturing and validation

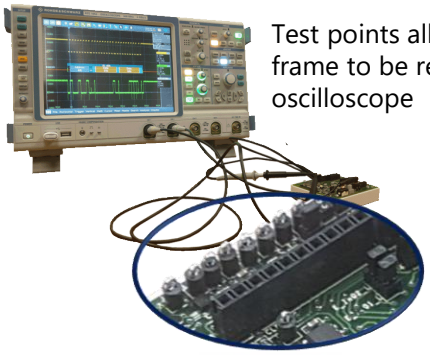
Production

Mechanical and electronic assembly of the connected scale or the weather station

Programme

Compilation / flash code in the ESP32 card

Control &Test



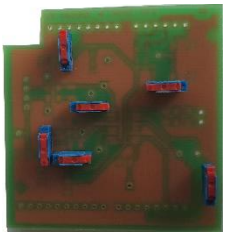
Test points allow the frame to be read via an oscilloscope

Validation

Product validation

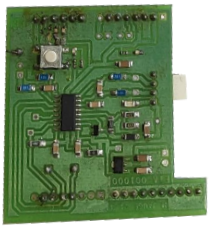
Maintenance and repair

Diagnostic



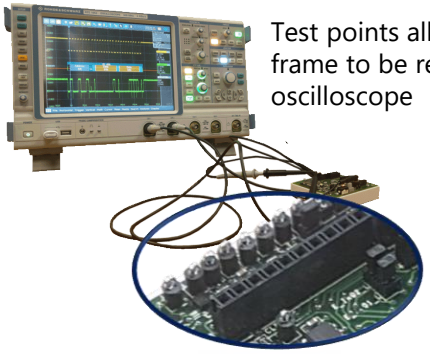
To meet the current need for maintenance and repair of electronic boards, we offer a daughter board with bottom straps for fault generation.

Repair



Once the fault has been diagnosed, an intervention will be carried out according to the procedure provided.

Control & Test



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Validation

Product validation