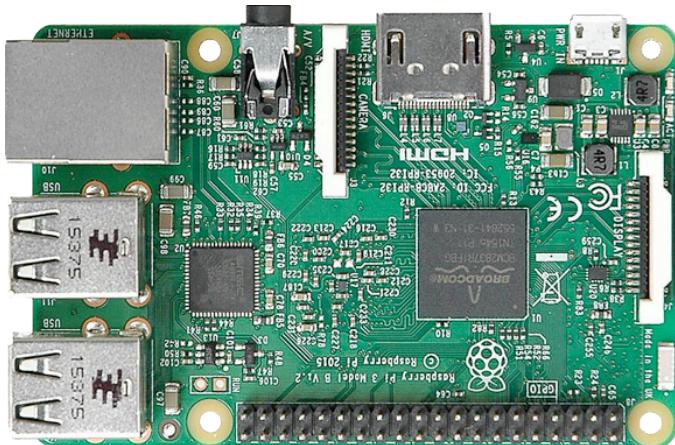


last update July 28th, 2018

TO BUILD THE GATEWAY

- Raspberry: we recommend a RPI3 model B



You also need an 8GB SD card **class 10**

RPI3 has built-in WiFi and Bluetooth 4.0,

if you get or already have the RPI2 and want WiFi and Bluetooth, get dongles, but it is not mandatory. Dongles that have been tested successfully are:



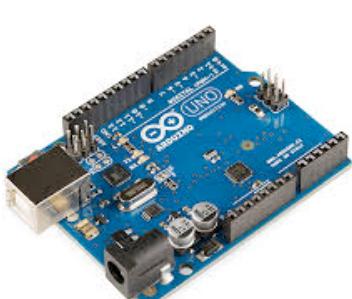
WiFi: TP-LINK
TL-WL725N



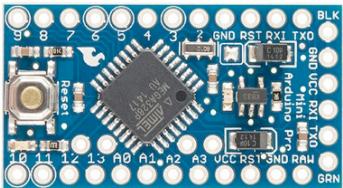
Bluetooth 4.0: CSR
dongle or Konig dongle

TO BUILD THE IOT DEVICE

- For prototyping and development tests Arduino Uno/MEGA2560



- For integration phase: Arduino Pro Mini (take the 3.3v, 8MHz version). Original version is from Sparkfun



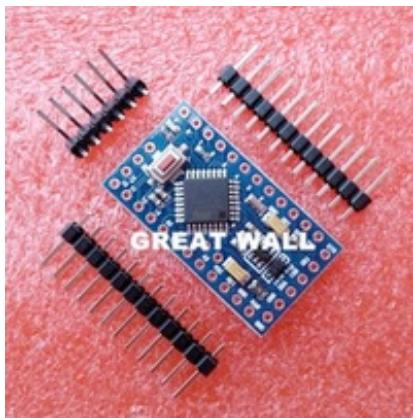
3.3v and 8MHz version

Can be bought as low as 1.5€ from Chinese manufacturers

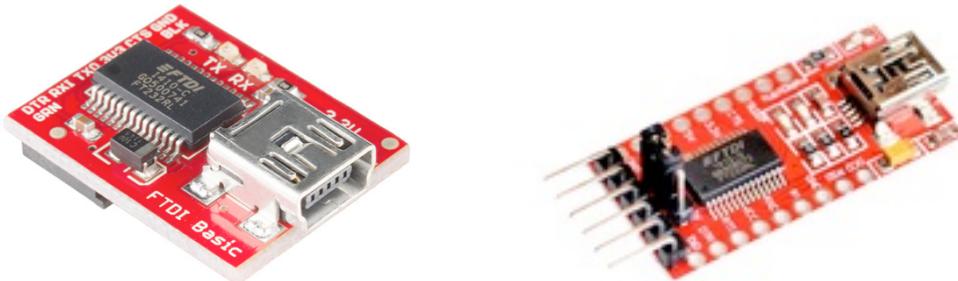
<http://www.aliexpress.com/popular/arduino-pro-mini-328.html>

We tested this one:

https://fr.aliexpress.com/store/product/Free-Shipping-1pcs-pro-mini-atmega328-Pro-Mini-328-Mini-ATMEGA328-3-3V-8MHz-for-Arduino/731260_32340942669.html?spm=2114.12010608.0.0.4LfFx2



You will also need the FTDI breakout (3.3v version) to program the board. You need only one to program all your boards. Original product from Sparkfun is here: <https://www.sparkfun.com/products/9873>



We tested a Chinese one (on the right) that can be set either at 5v or 3.3v. Much cheaper!

https://fr.aliexpress.com/store/product/Free-shipping-FT232RL-FT232-FTDI-USB-3-3V-5-5V-to-TTL-Serial-Adapter-Module-Mini/1735233_32648254875.html?spm=2114.12010608.0.0.PizHXM

LORA RADIO MODULES

- take the Modtronix inAir9 with 6mm pin header already soldered (see the available option on the modtronix web page); and the 868MHz whip antenna



<http://modtronix.com/inair9.html>

<http://modtronix.com/ant-f105-868.html>

Wireless SX1276 LoRa Module, 868MHz and 915MHz, 3.3V, SMA Connector

USD15.95

Header Type:

No Pin Header: inAir9
No headers are assembled: 9.95 Item(s)

Quantity:

Loose 3, 4 or 6.0mm Pin Header (\$0 Extra - FREE):
Two loose(unassembled) pin headers with 3.0, 4.0 or 6.0mm long pins are included FOR FREE. Select option below(with fee) if headers should be soldered.
USD14.46 USD12.96 USD11.95

3, 4 & 6mm Pin Header: Add to wish list
Pins headers with 3.0, 4.0 and 6.0mm long pins are assembled.
Select 3.0mm if module is going to be soldered into place.
Select 6.0mm if module is going to be plugged into standard 8.5mm high Female Socket, or 4.0mm for low profile 3.7mm Female Sockets.

Round Swiss Pin Header: Add to wish list
Pins headers with Round (Swiss) style pins are assembled. Select to plug module into female Round (Swiss) Socket.

Press-Fit Header: Add to wish list
One with an UFL connector, and one with an Press-Fit pin headers are assembled. Select if module is going to be pressed into pads with 1.0mm pitch (solderless), with a standard SMA connector (for antenna). It is configurable in software, and will typically be used for the 863-870MHz or 902-928MHz ISM bands. This module is not yet certified for these frequencies, so it is not yet available for sale. We will soon be releasing two new versions of this module with UFL and SMA connectors.

We will soon be releasing two new versions of this module with UFL and SMA connectors.

The inAir9 is a 868 and 915MHz wireless module. It is our most popular module. The frequency is configured in software, and will typically be used for the 863-870MHz or 902-928MHz ISM bands. This module is not yet certified for these frequencies, so it is not yet available for sale. We will soon be releasing two new versions of this module with UFL and SMA connectors.

The SX1276 is a revolutionary new chip enabling wireless communications at distances up to 15km, using Semtech's LoRa(LoRa Range) technology. This chip also supports high performance (G)FSK modes for systems including WMBus, IEEE802.15.4g.

This module can be used for **868** and **915MHz** communication. It is based on the Semtech SX1276RF1KAS and SX1276RF11AS reference designs, which also use identical components for 868 and 915MHz. We have also confirmed with Semtech engineers that

- other radio modules are possible but require more soldering work on breakout boards



HopeRF RFM95W

LoRa1276
NiceRF LoRa1276

- Antenna for gateway

Ground plane, $\frac{1}{2}$ wave dipole (e.g. sleeve dipole, center-fed), or fiberglass antennas are best choice for the gateway if you need a cable extension to put the antenna outdoor.

https://fr.aliexpress.com/store/product/868mhz-antenna-3dBi-omni-fiberglass-antenna-best-price-factory-outlet-antenna-basestation-antenna/2201026_32801738509.html?spm=2114.12010612%2Fitm2home-1.8148356.17.3b56c2deuuEg0k



<https://www.lextronic.fr/antennes/507-antenne-868-mhz-ground-plane-pour-base.html>



Sleeve dipole such as this one:

<https://fr.aliexpress.com/item/ALLISHOP-868Mhz-5dbi-Gain-OMNI-Antenna-SMA-Male-19cm-Rotatable-Omni-Wireless-Wifi-Antenna-SMA-Male/32771698006.html?spm=a2g0s.9042311.0.0.62876c37iHwvko>



You can also use a cheap, general purpose antenna such as this type of omni-directional antenna, but performance is far from optimal. We tested this one:

<https://fr.aliexpress.com/item/868MHZ-915MHZ-GSM-3G-antenna-small-sucker-7dbi-aerial-3meters-SMA-male-2/32512220307.html?spm=a2g0s.9042311.0.0.27426c37eBDSMw>

If you want to build your own antenna or adjust the length of the antenna cable, then you will need the following items.

- SMA connectors (for cable model RG58) for custom antenna cable



SMA Female



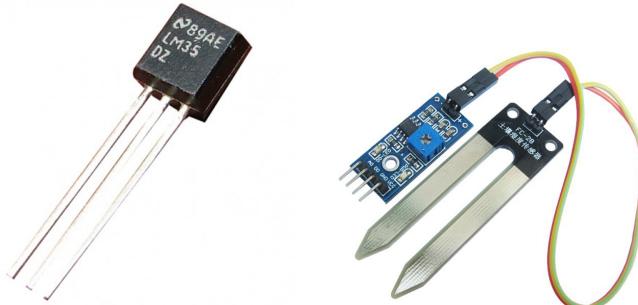
SMA Male

- Coax crimping tool (with RG58 format) and RG58 coax cable



SIMPLE PHYSICAL SENSOR FOR TEST AND DEMONSTRATION

- Simple temperature sensor: take a simple LM35DZ (from local electronic stores)
- Simple Soil humidity sensor: take a low-cost one from AliExpress



WIRES, CASING, AND VARIOUS ADDITIONAL PARTS

- Breadboard cables: need both M-F and F-F



M-F



F-F

take those that are about 10cm to 20cm maximum.

- Water-proof cases: electric out-door cases for instance



<http://www.lextronic.fr/P34821-botier-tanche-avec-3-presses-toupes.html>

<http://www.lextronic.fr/P22453-botier-tanche-115-x-65-x-40mm.html>

or any water-proof casing you can find suitable from your local hardware/electric stores

For the gateway, we are using this waterproof box



<http://www.mhzshop.com/shop/Accessoires-MHz/Boites-etanches/Boite-etanche-avec-fixation-mat-203x203x65mm-GentleBOX-JE-200.html>

You may need your own cable gland to have a real customized case



(see on AliExpress)

- Some standoffs/spacer and associated screws for the gateway



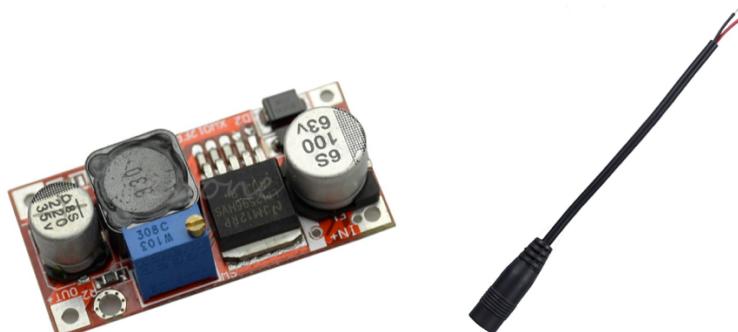
take 10mm to 20mm maximum

- PoE gland & injector



(see on AliExpress)

- LM2596 DC-DC down stepper & DC 5.5x2.1mm female power jack



(see on AliExpress)

- 4-AA battery couplers for the IoT device



(see on AliExpress)

- Simple waterproof switch



or



(see on AliExpress)

SOLDERING MATERIALS THAT ARE NOT MANDATORY BUT ARE ALWAYS GOOD TO HAVE!

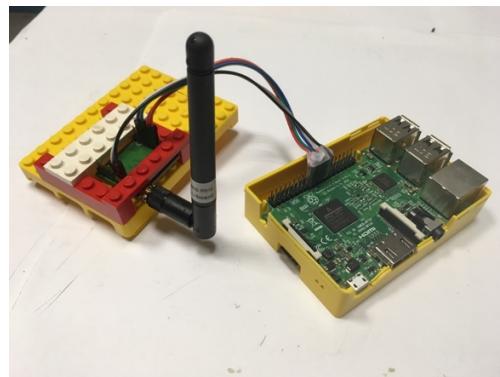
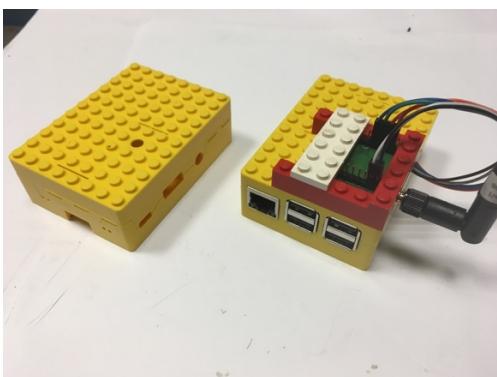
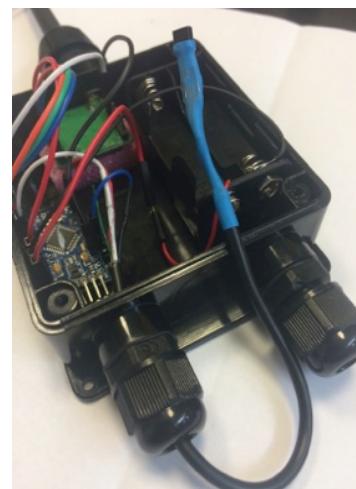
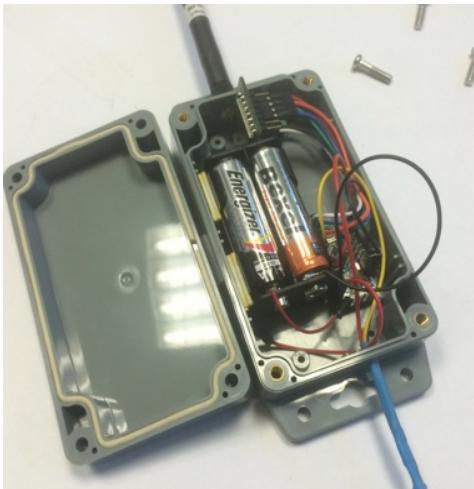
- A simple soldering iron (or station if you want to invest) with thin solder wire



- A set of heat-shrink tubes to isolate wires / silicon for joints



RESULTS:



Enjoy!

C. Pham, University of Pau, France