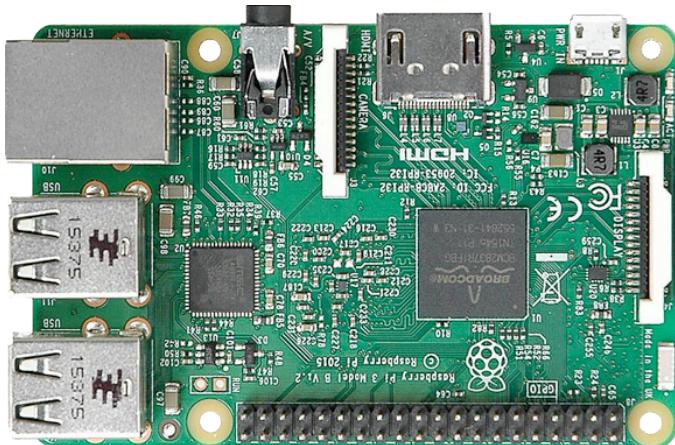


last update September 4th, 2018

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:



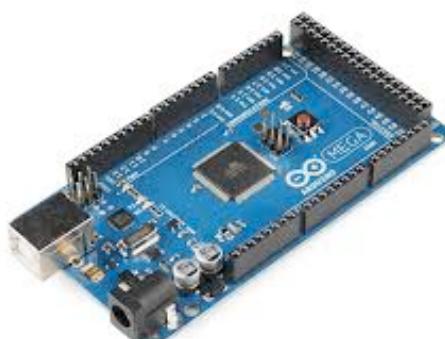
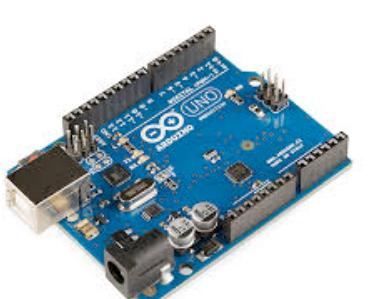
WiFi: TP-LINK
TL-WL725N



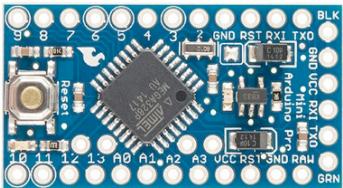
Bluetooth 4.0: CSR
dongle or Konig dongle

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



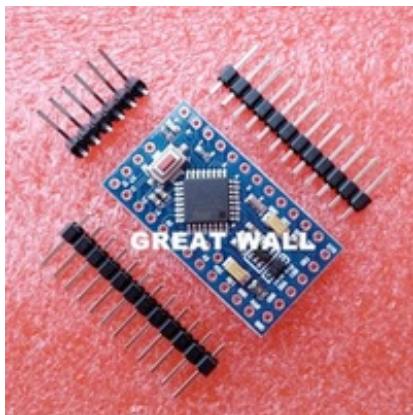
3.3v and 8MHz version

Can be bought as low as 1.5€ from Chinese manufacturers

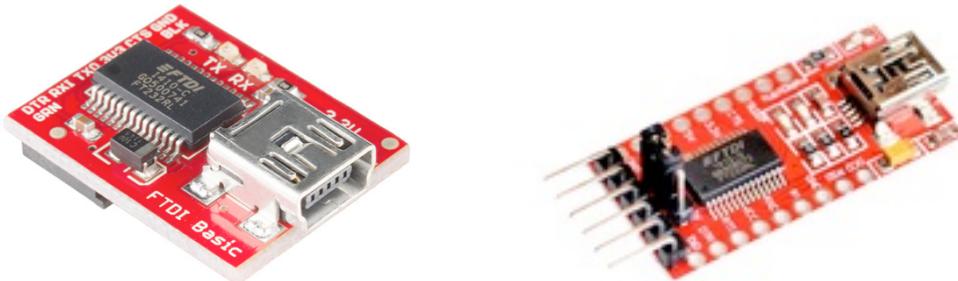
<http://www.aliexpress.com/popular/arduino-pro-mini-328.html>

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

- You can 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>

The screenshot shows the product page for the "Wireless SX1276 LoRa Module, 868MHz and 915MHz, 3.3V, SMA Connector". The price is listed as USD15.95. A red arrow points to the "Description" section of the page, which contains detailed technical information about the module's features, performance, and compatibility with other products like the inAir9 antenna.

Description

We will soon be releasing two new versions of the inAir9 module with integrated (soldered) antenna versions.

The inAir9 is a 868 and 915MHz wireless module. It is one of our most popular modules. The frequency bands used are the 863-870MHz and 902-928MHz ISM bands. This module is nearly identical to the inAir8 module, except where the inAir9 has a maximum of +20dBm, while the inAir8 has a maximum of +14dBm. This modules requires less supply current than the inAir9, even when configured for the same output power (+14dBm or less). Choose this module if power consumption has to be kept to a minimum, and no more than +14dBm is required.

The SX1276 is a revolutionary new chip enabling wireless communications at distances up to 15km, using Semtech's LoRa (Long 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

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

USD15.95

Header Type: 6.0mm Pin Header (+USD1.00)

No Pin Header: inAir9

Avalability: 9.3 items(s)

Quantity: 1

Loose 3, 4 or 6.0mm Pin Header (\$0 Extra - FREE): Two loose (unsoldered) 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.

3, 4 & 6mm Pin Header: Add to wish list

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

Press-Fit Header: One with an UFL connector, and one with an SMA connector. Both 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.

PAYPAL EXPRESS CHECKOUT

To pay via PayPal Express Checkout, go to Cart! Paying via this method is very fast, no sign in or registration is required. Your payment information is used.

SEE ALSO

- 1 Relay Module, 5V, 10A, Opto isolated USD4.95
- I2C Wire Interface Module with I2C bus, 3.0V-5.5V, Pluggable TB USD0.95
- 1x16 Pin Header, 4.0mm Pins USD0.58
- 1x18 Pin Header, 4.0mm Pins USD0.60
- 1x20 Pin Header, 4.0mm Pins USD0.30

- The RFM95 LoRa module from HopeRF is also a very popular module that you can buy from many Chinese manufacturers. It however require sa breakout board as it is very small. Its advantage is to be easily integrated on a PCB board



HopeRF RFM95W

- 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 (SMA male connector):

<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 (SMA male connector):

<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 use a sleeve dipole antenna, you will also need a cable antenna. Take an RG58 cable, SMA male to SMA female



<https://fr.aliexpress.com/item/SMA-Male-to-SMA-Female-Plug-Rightangle-Connector-Extension-Cable-RG58-2M/32543987605.html?spm=a2g0s.13010208.9999999.258.14bb3c002VqZWY>

You can select 2m or 5m, avoid more than 5m

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



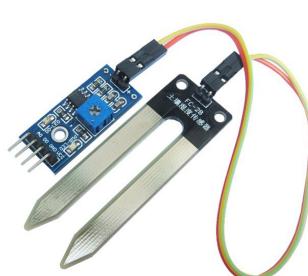
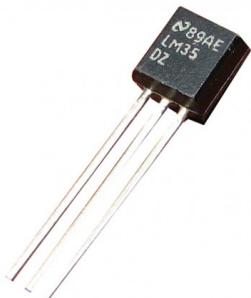
SMA Male

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



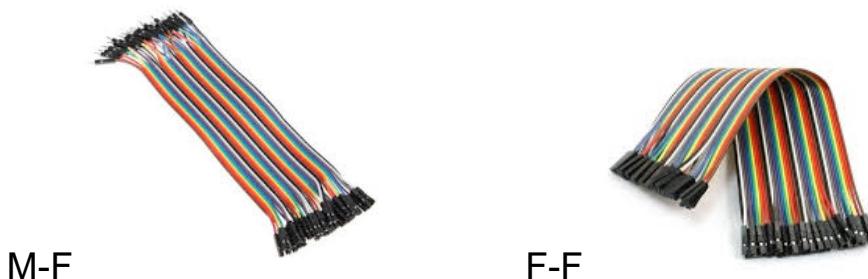
SIMPLE PHYSICAL SENSOR FOR TEST AND DEMONSTRATION

- 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



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

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

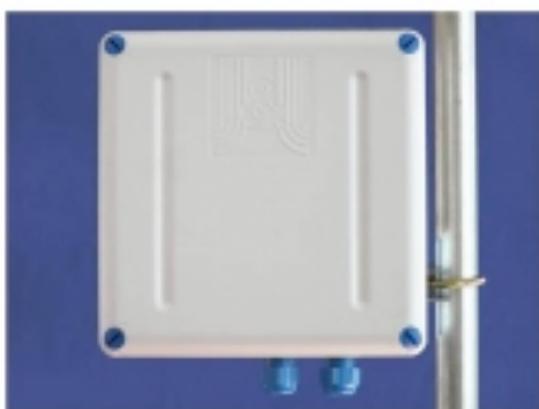


<http://www.lextronic.fr/P34821-botier-tanche-avec-3-presses-toupes.html>

<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, but other box would do



<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



(search on AliExpress)

- Some standoffs/spacer and associated screws for the gateway



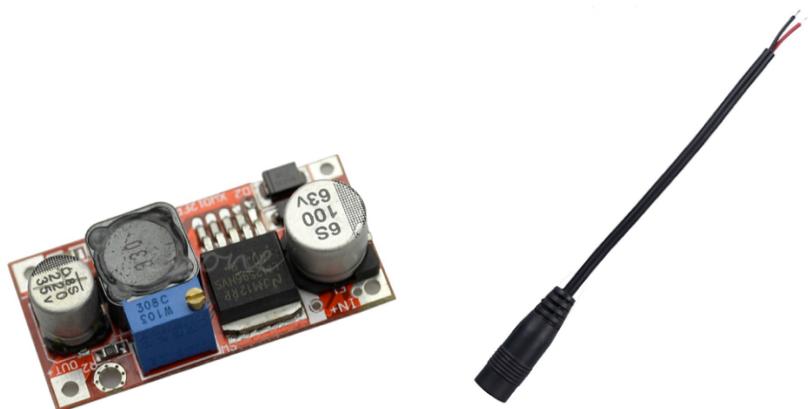
take 10mm to 20mm maximum

- PoE gland & injector



(search on AliExpress)

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



(search on AliExpress)

- 4-AA battery couplers for the IoT device



(see on AliExpress)

- Simple waterproof switch



or



(search on AliExpress)

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

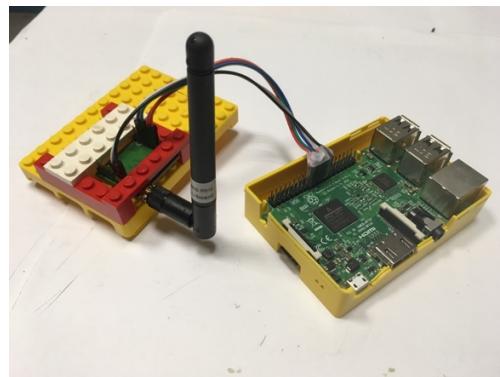
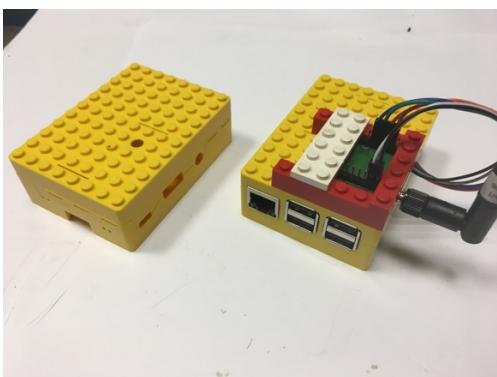
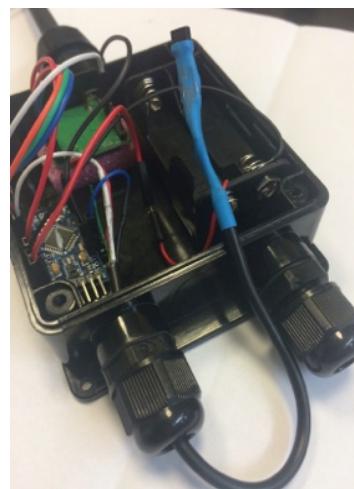
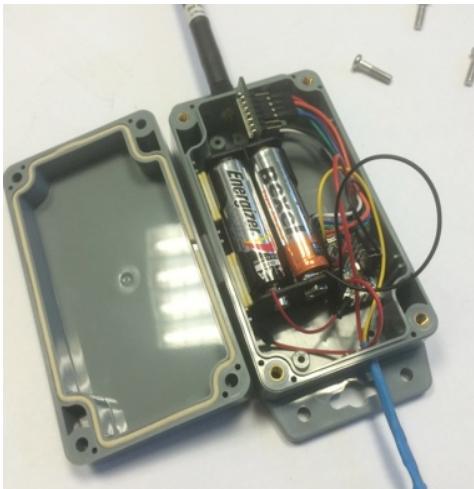
- A simple soldering iron (or station if you want to invest) with thin solder wire



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



RESULTS:



Enjoy!

C. Pham, University of Pau, France

(*) provided web links to some vendors are only given as example.
You can search from other vendor to optimize item cost and shipping cost