

BUILDING COST-EFFECTIVE, WIRELESS SENSORS PLATFORMS FOR AGROECOLOGY MONITORING



C. Pham, UPPA



Research & innovActive Development International Offices
networking for upscaling research capacities and
encouragement of multidisciplinary studies

Technology developed in Capacity-building with

Deployed in

FRANCE PROGRAMME DE RECHERCHE AGROECOLOGIE ET NUMERIQUE

Building cost-effective, wireless sensors platforms for agroecology monitoring

Technology developed in Capacity-building with Deployed & Exploited in

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UNIVERSITE PAU DE FRANCE Wireless Sensors Made Simple for agroecology & sustainable agriculture
Powered by technologies developed in

BUILDING AN ECOSYSTEM OF SENSORS

Agriculture
Agroecology
Wildlife
Biodiversity
Environment
Surveillance

DESIGNING A CUSTOM PCB

We use EasyEDA, a free software to design electronic PCB

ORDERING THE PCB

EasyEDA generates so-called Gerber files used to produce the PCB. We provide the Gerber files as free resources for research

https://github.com/CongducPham/PEPR_AgriFutur Here we order from JLCPCB manufacturer

DO-IT-YOURSELF APPROACH - RAW PCB

RFM95W (868MHz)
RFM95W (433MHz)
SMA male
PCB mount for 1.6mm PCB SMA female
Length is 13.56mm
Arduino ProMini 3.3V 8MHz

ORDER THE FULLY ASSEMBLED VERSION

By providing the Bill of Materials (BOM) file, the manufacturer can produce the fully assembled version

The full assembled version comes with the solar charging circuit on the back side of the PCB

Connect for SOLAR with NiMH
Connect for alkaline batteries

CASING AND INTEGRATION

For SOLAR
For 2xAA alkaline batteries
For SOLAR with NiMH battery
SMA male

ADDING PHYSICAL SENSORS. EX:

Add a 10kOhms resistor for raw PCB.

Add a 4.7kOhms resistor for raw PCB.

ADD THE MICROCONTROLLER

We use an Arduino Pro Mini at 3.3V and 8MHz (ATmega328P)

We develop and provide the code (Arduino) for the microcontroller

FINAL RESULTS

DEPLOYMENT & PILOTING

ENERGY EFFICIENCY

Measured below 5uA in deep sleep, between 2 active periods with transmissions

Expected autonomy with 1 transmission / hour is over 2 years with 2 AA batteries

DATA TRANSMISSION TO GATEWAY

LoRa LONG RANGE RADIO, 3-10KM

Limited LoRaWAN SF12BW125 868.1MHz ABP mode Dev addr is 26011DAA 1msg/60mins 1 sensor XLPP data

ADVANCED SENSING SYSTEMS

Many applications need visual information → Image Sensing IoT

2012 → 2016 → 2024

XIAO ESP32S3 32-bit, dual-core, up to 240 MHz

PROOF-OF-CONCEPT: LORACAM-AI

UPDATED VERSION IN 2025 FOR THE PEPR AGRIFUTUR PROJECT

INTELLIGENCE AT THE EDGE

EMBEDDED WEB APPLICATION

TinyML, TensorFlow Lite, CMSIS-NN, Edge Impulse, etc