# H2S-Dev board

## LoRaWAN Helium network sensor development board

## V1.1

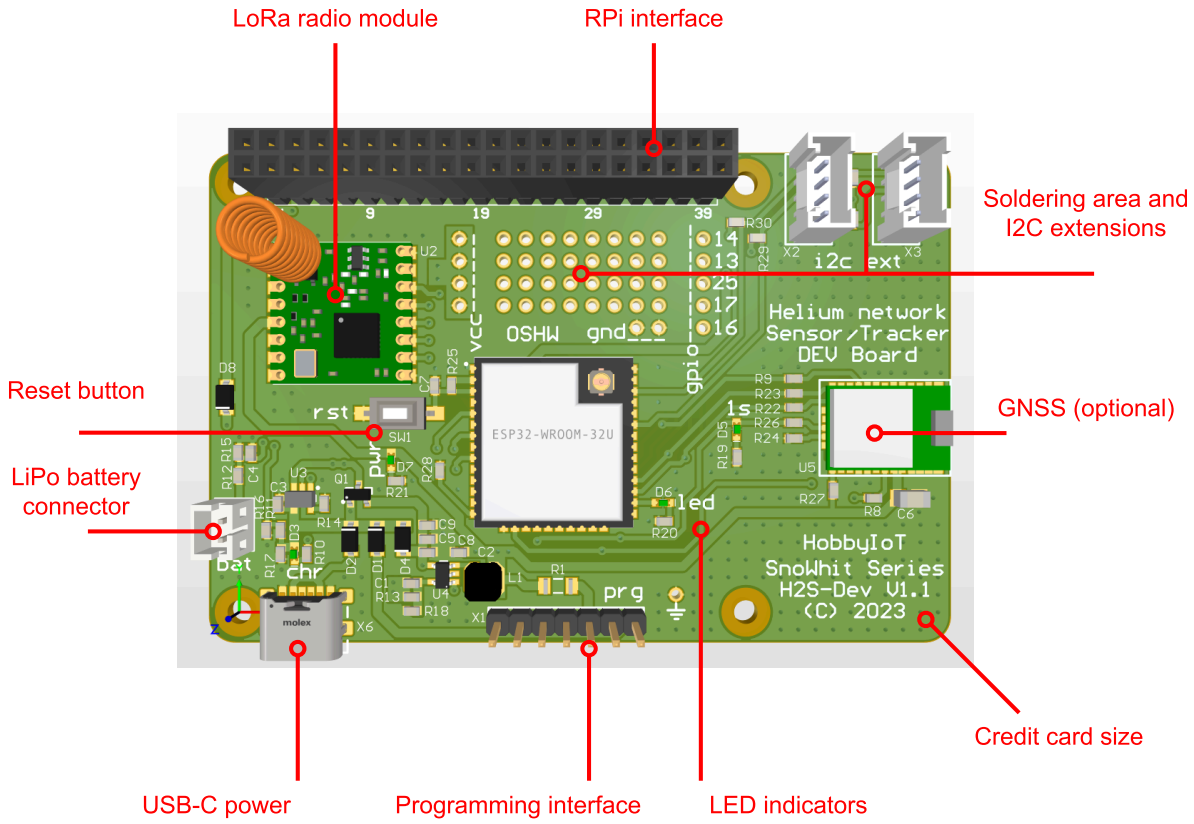
## Hardware description and features

### Introduction

H2S-Dev board is a ready-to-use, Open source hardware, Arduino compatible, LoRaWAN Helium network sensor development board. It is capable of implementing a number of sensor and positioning applications.

H2S-Dev board key features include ESP32 and SX1276 LoRa modules as well as optional GNSS. A practical powering circuitry is implemented that is capable of powering the board from the programming interface, USB-C and RPi compatible connector. The LiPo battery controller also charges the battery connected. The soldering area and I2C extensions allow placing of sensors and connecting devices via I2C interfaces.

H2S-Dev board is following the Raspberry Pi form factor (credit card size) with mounting holes and 40-pin connector including power and I2C traces for further development.



**Hardware description**

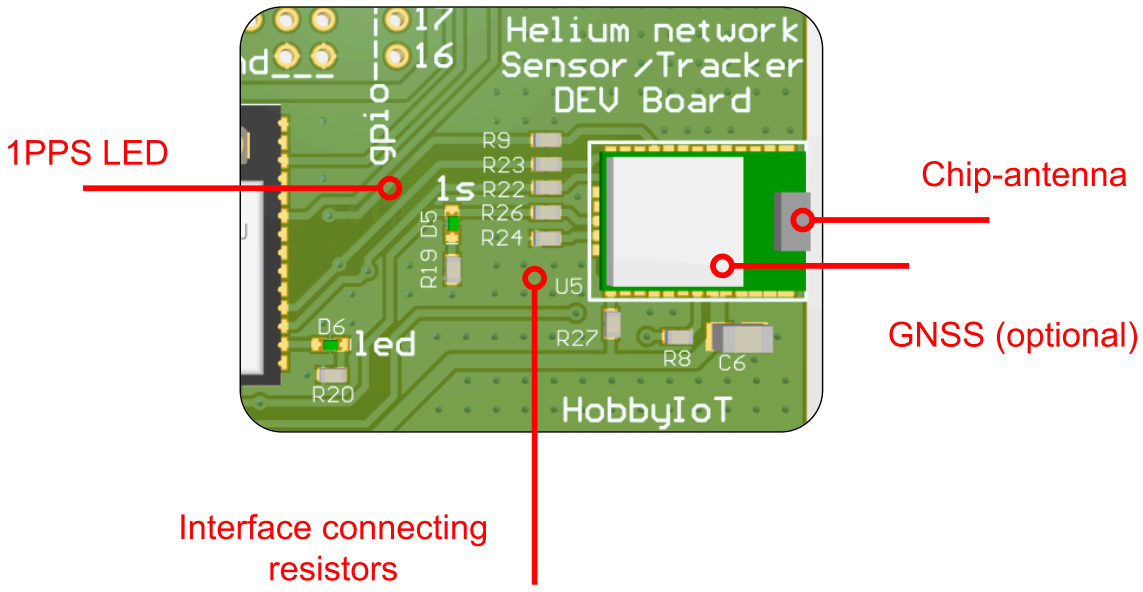
H2S-Dev board current version is V1.1. It contains ESP32, LoRa radio, optional GNSS, powering options and interfaces resulting in a rich set of features. That open source hardware platform is ready for one to quickly set up an application, connect sensors and test IoT data transfer over the Helium LoRaWAN network.

Main hardware parts are described below.

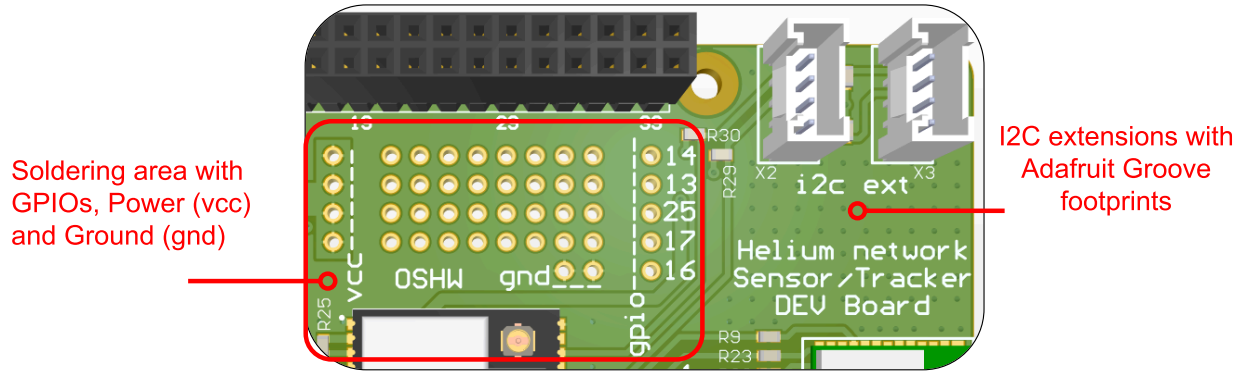
**ESP32 WROOM MCU** runs the device application software. It controls the LoRa radio module via SPI interface and I/O signals required. MCU also connects to the optional GNSS module via UART interface and control lines. When GNSS is not used, a number of GPIO lines are free for connecting additional sensors. These lines are routed close to the development area of the board. WiFi and Bluetooth are available with an external antenna.

**The LoRa Radio module** establishes the connection to the Helium LoRaWAN network. It is built around SX1276 IC and connects to the MCU via SPI interface as described. Radio module requires an antenna to operate and the antenna should be in place before powering on the module to prevent radio amplifier damage. Size and type of the antenna depends on the gain required and the specific frequency band for the region.

**GNSS module (optional)** - when assembled, the GNSS module connects to the MCU via UART interface. Once locked to satellites it provides date/time and positioning information to the system and the 1PPS LED will flash every one second. The dev board PCB topology is designed according to the GNSS module recommendations to ensure proper signal reception by the onboard chip-antenna.



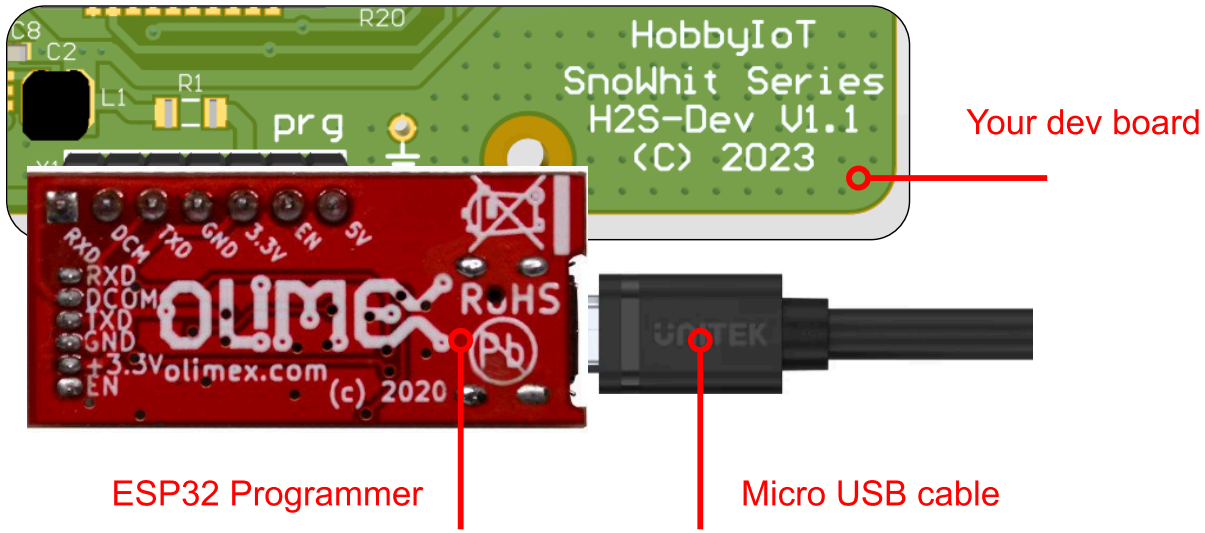
**Soldering area and I2C extensions** - That area is especially dedicated to developers. It contains 4 rows by 8 columns of THT mounting holes with 2.54 mm (100 mil) spacing as well as I2C extensions.



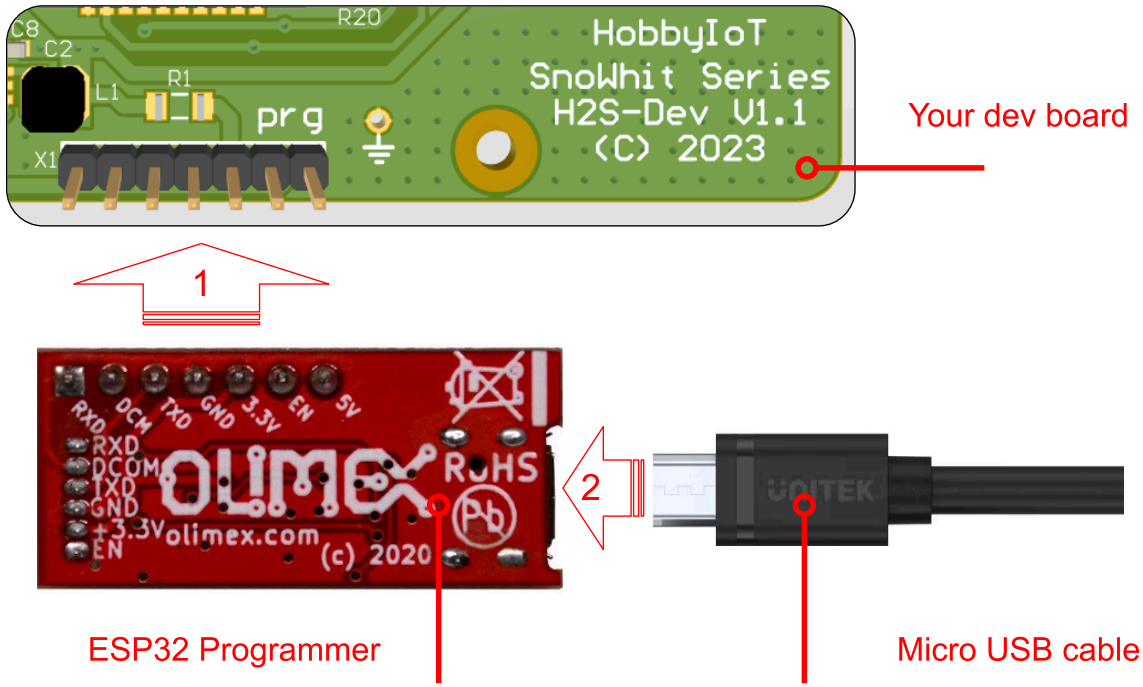

One can solder connection headers, small sensors and any other external devices into that area. Close to that pattern a 3.3V power (vcc) and Ground (gnd) connection points are available. Also, several MCU I/O signals are routed around that area for easy interfacing with the MCU.

I2C extensions (i2c ext) provide an I2C interface together with 3.3V and GND. Footprint and pinout are compatible with Adafruit Groove specifications. 4.7 k pull up resistors are populated on the dev board.

**Programming interface** - these pins are used to program and debug the software into the dev board. Pinout is compatible with the Olimex ESP32 programmer board as shown below. Using such a programmer the ESP32 is entering programing mode automatically when the upload attempt is initiated from the programming environment.

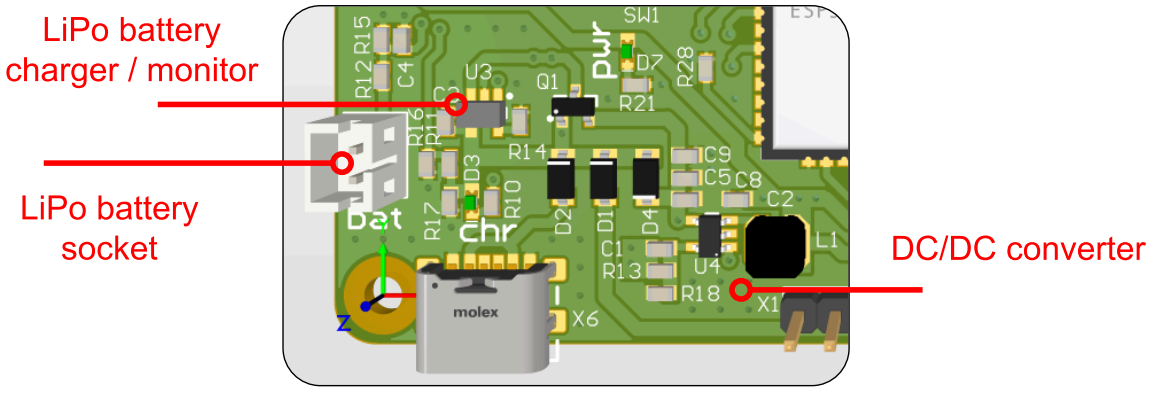


**Important notice!** When connecting the programmer, first connect it to the dev board and after that connect the micro usb cable as shown in the picture below.




**LiPo battery connector** JST type, 2-pole socket is used to connect a LiPo battery to independently power the dev board. The circuitry behind is built around the LiPo battery controller BL4054B and DC/DC converter SY8088AAC and will automatically switch to battery power when other sources are down. Connected battery will also be charged if any of the other power sources are connected. Battery voltage can be read by the user software at GPIO35 and the external voltage presence trigger level is available at GPIO39 via resistor dividers.

**USB-C power** - 5V DC power only input using USB-C standard cable.



**RPi interface** - As a future use the dev board could be connected and powered as a Raspberry Pi HAT. I2C, power and GND lines are routed to that connector.

**Reset button** - Used to perform hardware reset of the board.

**Credit card size** - The dev board dimensions are 85 mm x 56 mm and carries 4 mounting holes compatible with Raspberry Pi.

**Technical parameters**

| Item | Model | Parameters |
|---|---|---|
| MCU | ESP32 WROOM Series | ESP32, WiFi, Bluetooth |
| Radio | SX1276 with spring antenna | Worldwide bands |
| GNSS (option) | L96-M33 | GPS, GLONASS, Galileo and QZSS |
| Power | USB-C/Programmer | 5V DC |
| Battery | LiPo, Rechargable | Charging/sensing circuitry |
| Indicators | LED indicators | Power, Charge, 1PPS, user LED |
| Programming | External programmer | 7 pin 2.54 (100 mil) header |
| Interfaces | 2x I2C; GPIOs | I2C PU; GPIOs 13, 14, 16, 17, 25 |
| Dimensions | Credit card size | 85 mm x 56 mm |
| Certificates (pending) | CE; OSHWA | Safety, Radio, RoHS |
| Licensing | Open source hardware | MIT license |

**More information**

Github: https://github.com/hobbyiot/HELIUM-SENSORS

X/Twitter: https://x.com/HobbyIoT

Patreon: https://www.patreon.com/HobbyIoT

Web: https://www.hobbyiot.net