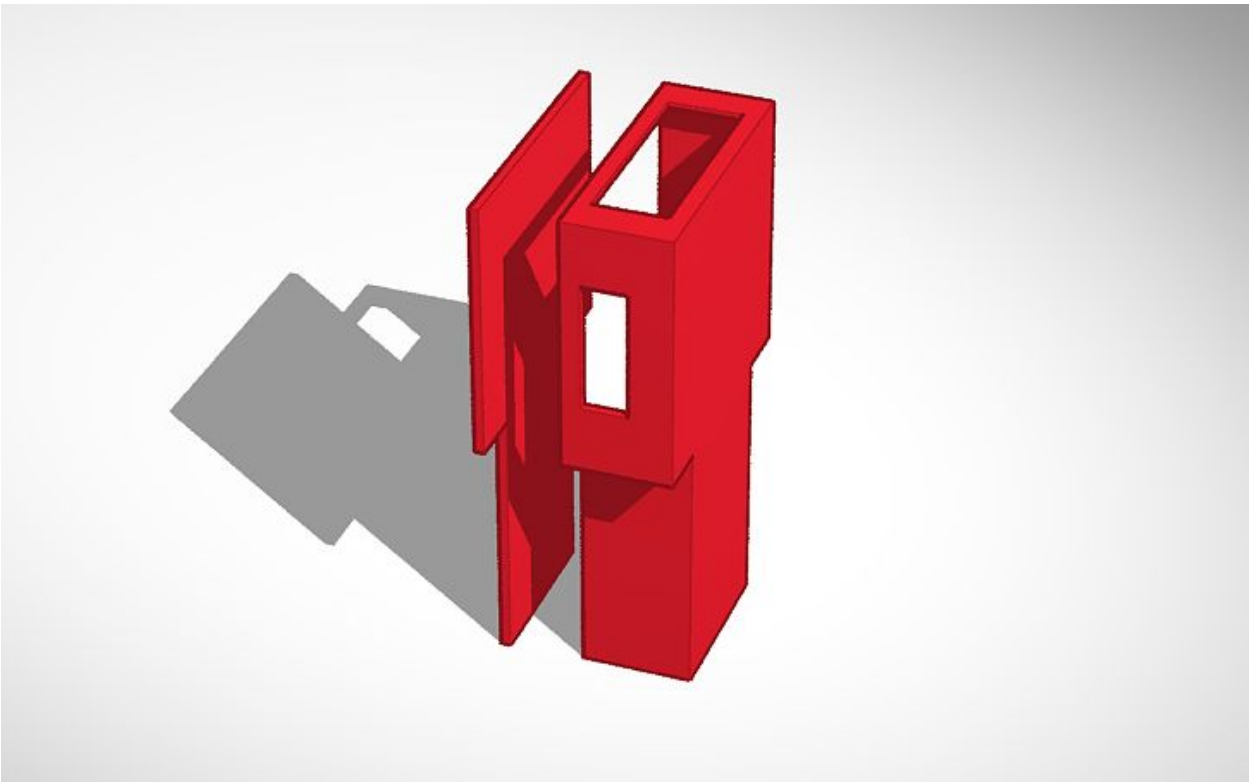
How To
F.L.O.A.T.



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Introduction

F.L.O.A.T. is a self contained and waterproof river mapper. The unit's purpose is to be sent down a river on a floating platform to collect data. The data collected consists of temperature readings, accelerometer measurements for rapid size, and GPS collected latitude/longitude for positional data and speed of current.

Quick Start

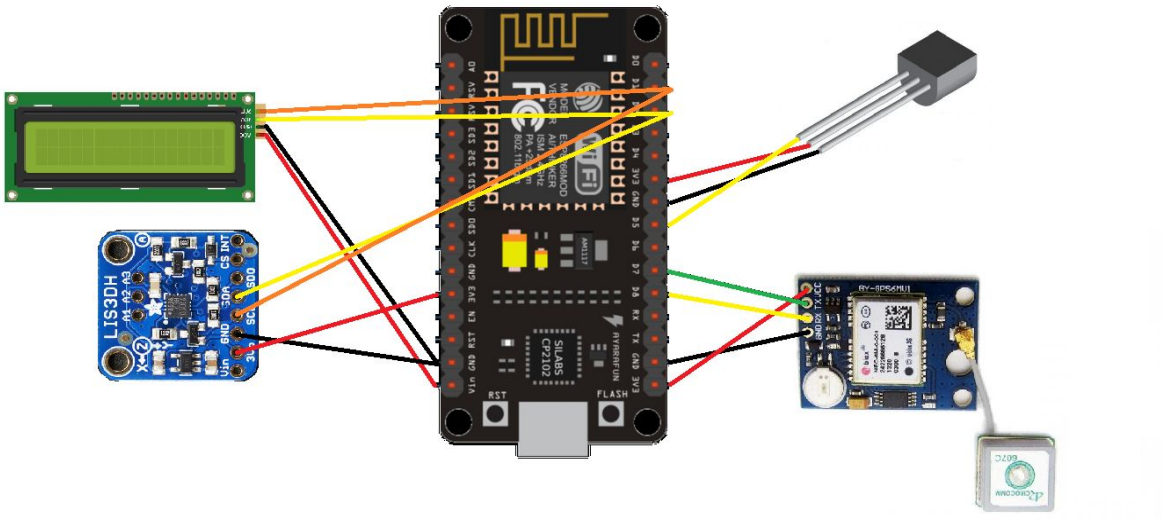
Follow our quick start guide on how to F.L.O.A.T.

1. Find a long pointed device to insert into the hole on the side of the F.L.O.A.T. housing, hold for 2 seconds.
2. Press the black toggle switch on the side of the F.L.O.A.T. housing.
3. F.L.O.A.T. will now initialize and shortly show a list of readings on the LCD on the top of the device. Measurements are as follows from upper left to bottom right. Temperature, Accelerometer, Latitude, Longitude.
4. Socket your F.L.O.A.T. device into your own RC Titanic.
    a. WARNING - The housing itself will not float!
5. Send down a river.

6. After the float, collecting your device and ask Will Cook to turn on his cell phone's WIFI hotspot, as the device is programmed to connect to that internet source only.
7. The LCD will now display an IP address that can be used to see the web interface that represents the collected river data.

Wiring Diagram

LCD - I2C connection, 5v power supplied through VIN
Accelerometer - I2C connection
GPS - Serial communication through secondary serial ports
Temperature Sensor - UART communication

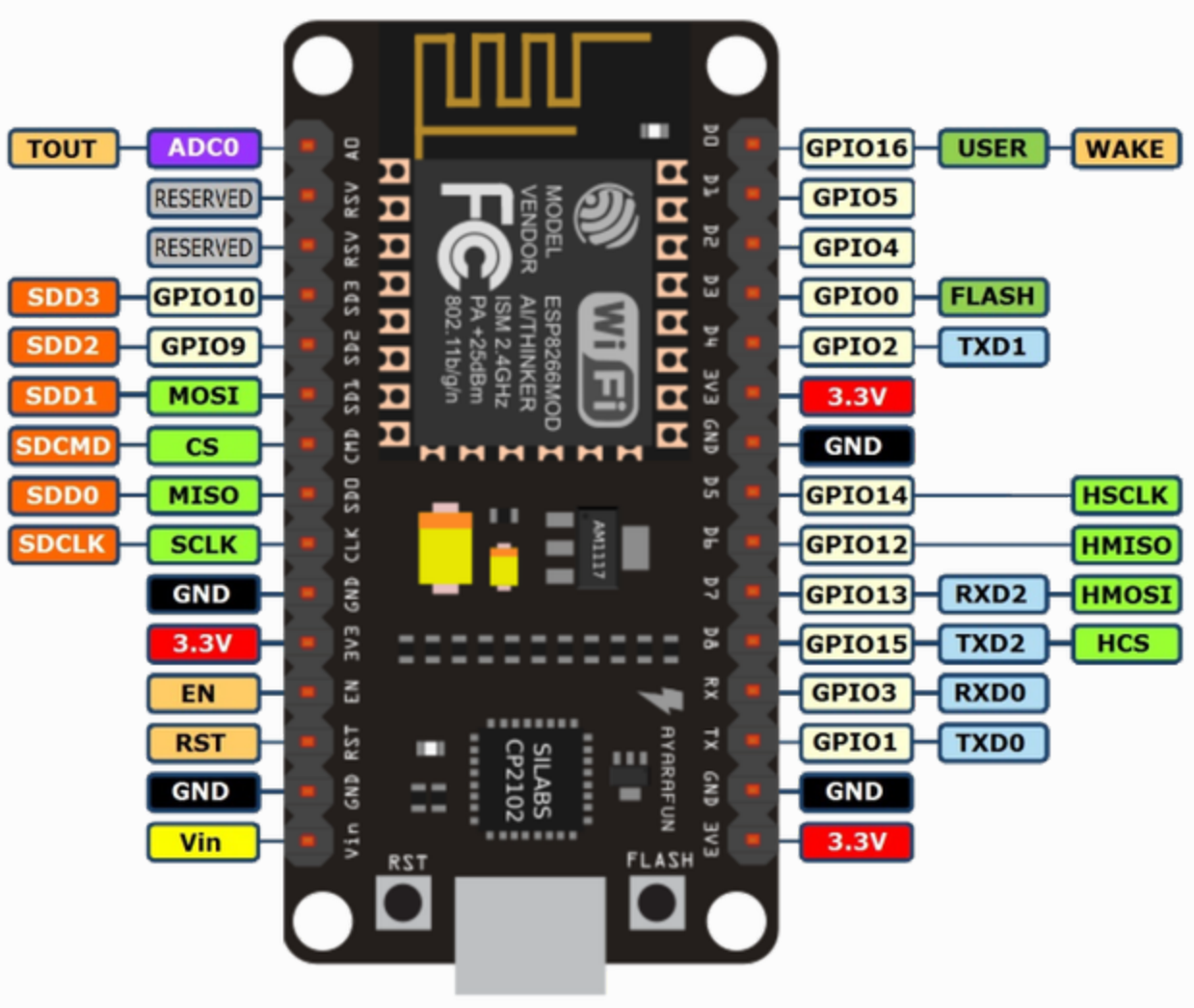


Source Code

https://github.com/ywingdriver/gitFLOAT

Parts List

ESP8266 Nodemcu 1.0 -
NodeMCU is an eLua based firmware for the ESP8266 WiFi SOC from Espressif. The NodeMCU *firmware* is a companion project to the popular NodeMCU dev kits, ready-made open source development boards with ESP8266-12E chips.(https://nodemcu.readthedocs.io/en/master/)



Reasons for choosing - Excellent documentation, price, and quick and easy accessibility from Amazon Prime shipping.

LIS3DH - TRIPLE-AXIS ACCELEROMETER (+-2G/4G/8G/16G) W/ 12C/SPI -
The sensor has three axes of measurements, X Y Z, and pins that can be used either as I2C or SPI digital interfacing. You can set the sensitivity level to either +-2g, +-4g, +-8g or +-16g. The lower range gives more resolution for slow movements, the higher range is good for high speed tracking. The VCC takes up to 5V in and regulates it to 3.3V with an output pin. (https://www.adafruit.com/product/1231)

Reason for choosing - Adafruit has great documentation including wiring diagrams and code examples, has 4 sensitivity levels, triple axis, and price.
Method of Communication - I2C, D1 and D2 (NodeMCU 1.0), (Address - 0x18).

Vktech DS18b20 Waterproof Temperature Sensors Temperature Transmitter -
Power supply range: 3.0V-5.5V
Operating temperature range: -55°C - +125°C (-67°F - +257°F)
Storage temperature range: -55°C to - 125°C (-67°F - +257°F)
Accuracy over the range of -10°C to +85°C: ±0.5°C
(Sourced from amazon.com)

Reason for choosing - Already owned! Sensor meets the needs required for F.L.O.A.T.
Method of Communication - GPIO, D5 (NodeMCU 1.0).

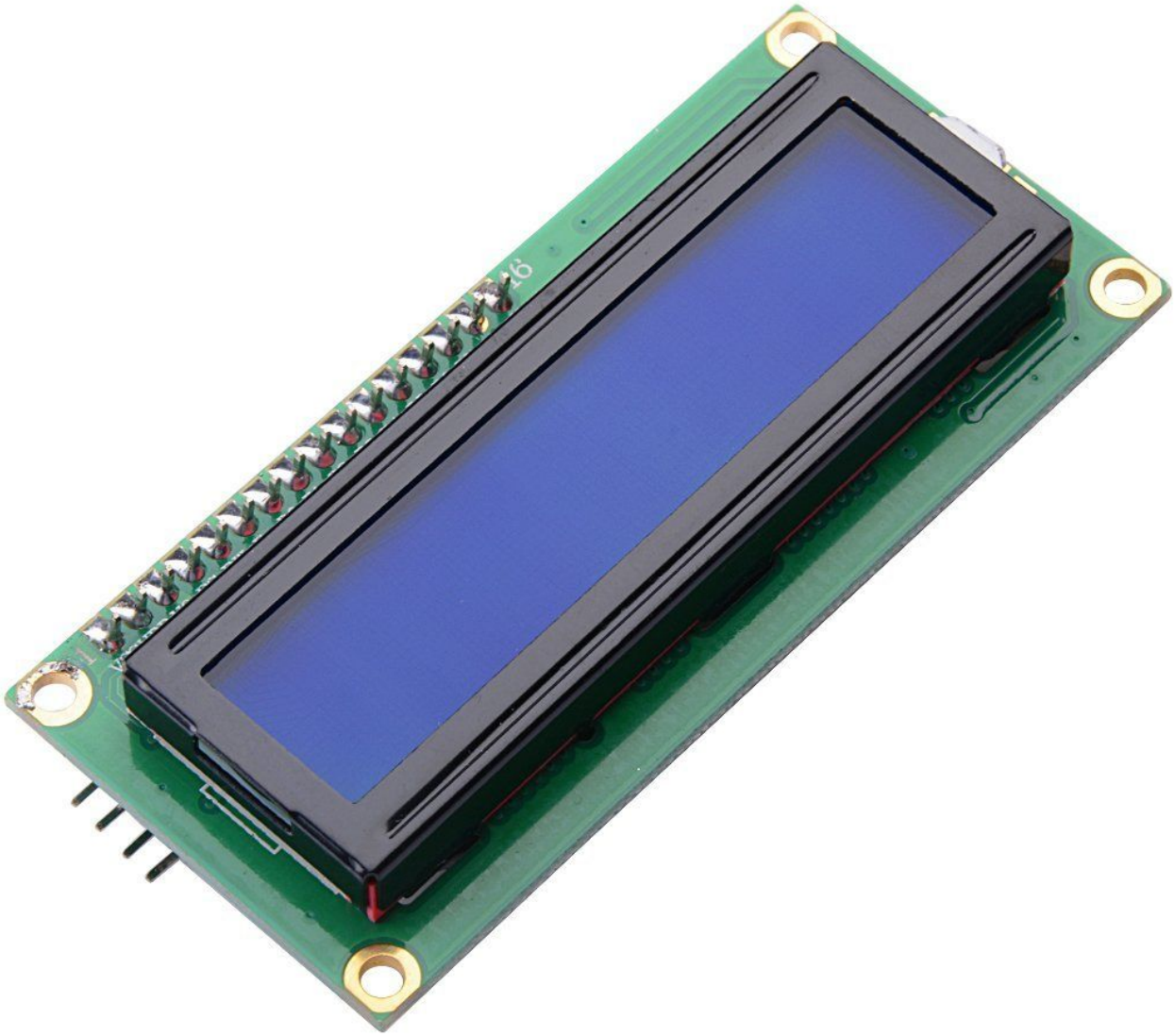
J-Deal Ublox NEO-6M GPS Module Aircraft Flight Controller with Active Antenna -

The NEO-6 module series brings the high performance of the u-blox6 position engine to the miniature NEO form factor. U-blox6 has been designed with low power consumption and low costs in mind. Intelligent power management is a breakthrough for low-power applications. These receivers combine a high level of integration capability with flexible connectivity options in a small package. This makes them perfectly suited for mass-market end products with strict size and cost requirements. (Sourced from datasheet: https://www.u-blox.com/en/product/neo-6-series)

Reason for Choosing - Low cost GPS with good documentation.
Method of Communication - UART, TX 2/RX 2, D7 and D8 (NodeMCU 1.0).

Qunqi IIC/I2C/TWI 1602 Serial Blue Backlight LCD Module -

- 5v power
- 16x2 display



Reason for choosing - Cheap I2C display device.
Method of Communication - I2C, D1 and D2 (NodeMCU 1.0), (Address - 0x3F).

Miscellaneous -

- 3D printed case
- Breadboard
- Toggle switch
- Butyle
- USB phone battery with 1 amp power
- RC Titanic
- Development environment (PlatformIO)

Sensor Function

GPS -
The GPS satellites broadcast radio signals containing their position and time, which your GPS receiver picks up. The receiver knows exactly where in the sky the satellite is, it just doesn't know exactly where on earth it is, until it determines the distance from the satellite.
It does this by calculating the time it took for the signal to reach it. It knows that the radio waves should travel at the speed of light, and it thinks it knows the elapsed time since the signal set off. It calculates its distances from 4 or more satellites and checks whether the spheres intersect at one point. If they do not it assumes its clock in inaccurate (satellites have atomic clocks, receivers quartz clocks) and adjusts the clock to find the exact location.

Hazard: Not reliable indoors.

(http://www.sensorland.com/HowPage025.html)

Temperature Sensor -
Our temperature sensor is a thermometer type device. As the temperature around the thermometer's bulb heats up, the liquid rises in the glass tube. The glass tube is mounted on a backboard that is marked in units called

degrees. When it is hot, the liquid inside the thermometer will expand and rise in the tube. The opposite happens when it is cold.

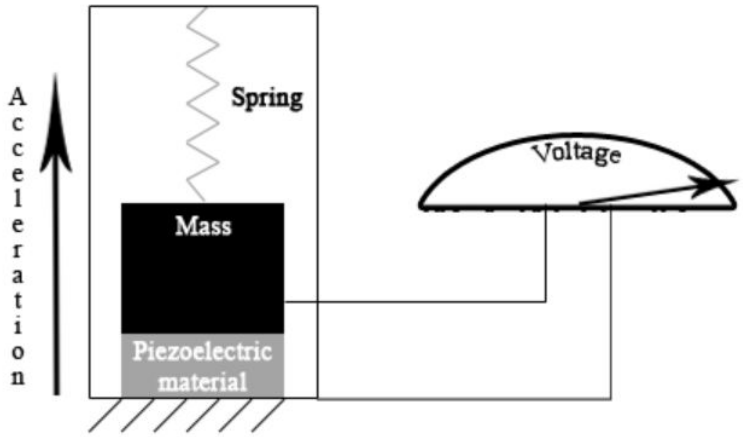
The DS18B20 Digital Thermometer provides 9 to 12-bit (configurable) temperature readings which indicate the temperature of the device. It communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition it can derive power directly from the data line (“parasite power”), eliminating the need for an external power supply.

The core functionality of the DS18B20 is its direct-to-digital temperature sensor. The resolution of the temperature sensor is user-configurable to 9, 10, 11, or 12 bits, corresponding to increments of 0.5°C, 0.25°C, 0.125°C, and 0.0625°C, respectively. The default resolution at power-up is 12-bit.

Hazard: Possible damage can occur -55°C - +125°C (-67°F - +257°F).

(https://www.quora.com/What-is-the-working-principle-of-DS18B20-one-wire-digital-temperature-sensor, https://www.edhelper.com/ReadingComprehension_37_177.html)

Accelerometer -
The LIS3DH, like most accelerometers, takes measurements in meters per second squared or G forces (9.8 meters per second squared) and is measuring both static and dynamic forces. Static force examples include gravity while dynamic can be measurements of vibration or movement. As a triple axis accelerometer, the LIS3DH can measure these movements in three directions. The inner workings of an accelerometer are outlined in the diagram below.



As the device is positioned differently during movement, the mass at the end of the spring will press on the piezoelectric material, which are tiny crystal structures, generating a voltage. This is the scenario represented in the diagram with the pressure producing a higher voltage. This voltage is then converted into a numerical representation of the voltage intensity. With a triple-axis accelerometer, this functionality is duplicated for each axis: X, Y, and Z.
(https://learn.sparkfun.com/tutorials/accelerometer-basics)