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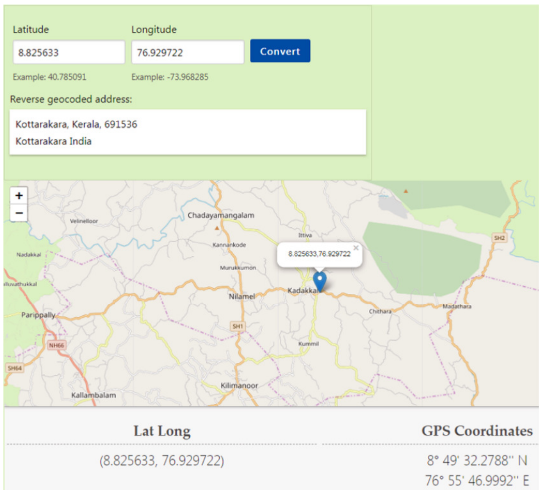


(https://www.electroschematics.com/wp-content/uploads/2019/04/5-Reverse-Geocoded-Address.png?fit=800%2C731)

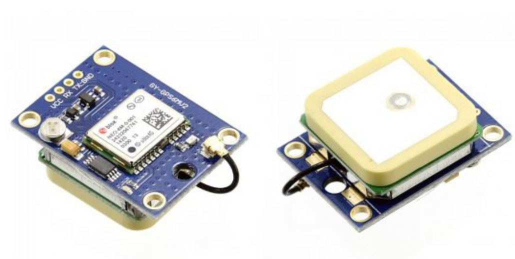
NEO-6M GPS Module — An Introduction

T.K. HAREENDRAN (HTTPS://WWW.ELECTROSCHEMATICS.COM/AUTHOR/HAREENDRAN/)

Arduino (/tag/arduino) battery (/tag/battery) GPS (/tag/gps) NEO-6M (/tag/neo-6m) voltage (/tag/voltage)

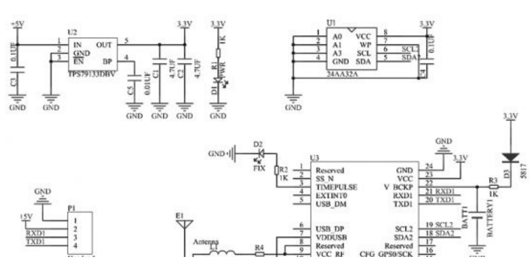
This article demonstrates how to play with the u-blox NEO-6M global positioning system (GPS) module, a very popular, cost-effective, high-performance GPS module with a ceramic patch antenna, an on-board memory chip, and a backup battery that can be conveniently integrated with a broad range of microcontrollers. Nowadays, two NEO-6M GPS modules are extremely popular — the GY-GPS6MV2 and the GY-GPSV3-NEO.

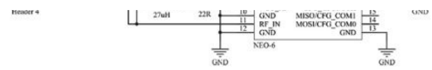
u-blox NEO-6M GPS module



(/wp-content/uploads/2019/04/1-Ublox-NEO-6M-Module.jpg)

The u-blox NEO-6M GPS engine on these modules is quite a good one, and it also has high sensitivity for indoor applications. Furthermore, there's one MS621FE-compatible rechargeable battery for backup and EEPROM for storing configuration settings. The module works well with a DC input in the 3.3- to 5-V range (thanks to its built-in voltage regulator). The original circuit diagram of the module, borrowed from the web, is shown below:





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(/wp-content/uploads/2019/04/2-Ublox-NEO-6M-GPS-Module-Schematic.jpg)

As indicated, the GPS modules are based on the u-blox NEO-6M GPS engine. The type number of the NEO-6M is NEO-6M-0-001, and its ROM/FLASH version is ROM 7.0.3 (PCN reference UBX-TN-11047-1). The NEO-6M module includes one configurable UART interface for serial communication, but the default UART (TTL) baud rate here is 9,600. Because the GPS signal is right-hand circular-polarized (RHCP), the style of the GPS antenna will be different from the common whip antennas used for linear polarized signals. The most popular antenna type is the patch antenna. Patch antennas are flat, generally have a ceramic and metal body, and are mounted on a metal base plate. They are often cast in a housing. For more information about u-blox reference designs, see their website (http://www.u-blox.com/). Remember, the position of the antenna mounting is very crucial for optimal performance of the GPS receiver. When using the patch antenna, it should be oriented parallel to the geographic horizon. The antenna must have full view of the sky, ensuring a direct line of sight with as many visible satellites as possible.

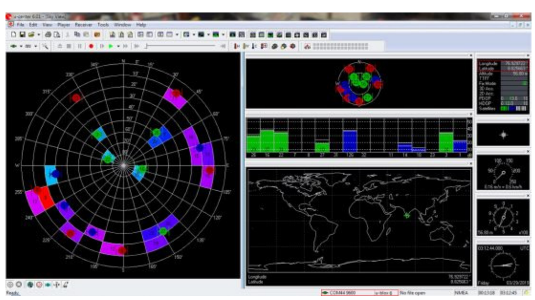
Initial test setup

For a quick test using your Windows computer, you just need to establish a serial communication with the GPS module using one USB-UART adapter like the PL2303 USB-to-Serial Converter module. The hardware setup is pretty simple:

NEO-6M GPS Module	USB-to-Serial Converter
TX	RX
RX	TX
GND	GND
VCC	5 V

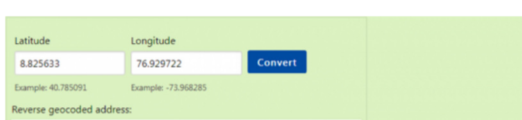
(/wp-content/uploads/2019/04/3-Workbench-Snaps.jpg)

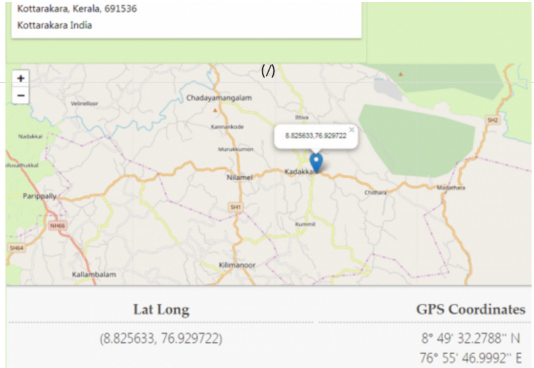
Next, download and install the Windows PC debug/evaluation tool "u-center (http://wiki.sunfounder.cc/images/b/b5/U-center.zip)". After successful installation, run the software (and the hardware) setup to transfer positioning data collected by the NEO-6M GPS module to the u-center software so that it can clearly display GPS data/information on the screen (see the below screen capture).



(/wp-content/uploads/2019/04/4-uCenter-Live.jpg)

Note that when the GPS module works, the green indicator on the GPS module will blink (the red one is for power-on indication), and the figures regarding the time, latitude, longitude, etc., will be displayed in the u-center software window. Finally, you should compare the figures shown by the software with the data collected by another trusty GPS device to ensure that your NEO-6M GPS module is perfect (and precise) in all respects. An alternative trick that I'd figured out to complete the quick evaluation process is the "Reverse Geocoded Address" method (see next image), as it'll help to eliminate the requirement of a commercial GPS device. It's worth a try!

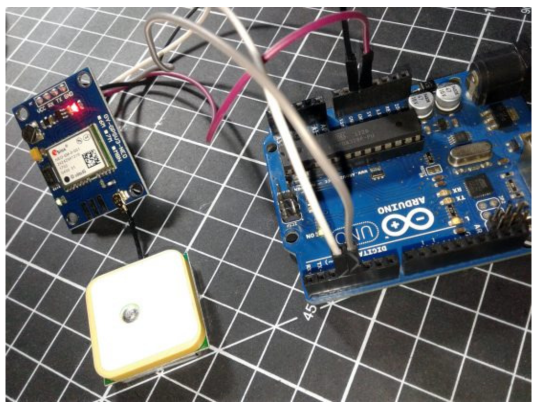




(/wp-content/uploads/2019/04/5-Reverse-Geocoded-Address.png)

Arduino experiment

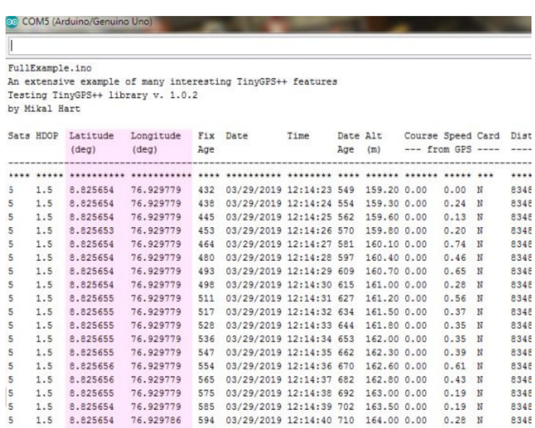
For a good start with Arduino, you just need to download and install the "TinyGPS++ (https://github.com/mikalhart/TinyGPSPlus/archive/master.zip)" library, which is a very cool Arduino library for parsing NMEA data streams provided by GPS modules. Thereafter, wire the NEO-6M GPS module to your Arduino as shown in the below table.



(/wp-content/uploads/2019/04/6-Arduino-Setup.jpg)

NEO-6M GPS Module	Arduino Uno
TX	D4
RX	D3
GND	GND
VCC	5 V

Next, open one TinyGPS++ library example — the "Full Example" code, for instance — and upload it to the Arduino board. Example sketches in Arduino GPS libraries usually listen to the GPS serial port, and when data is received from the module, it's sent out to the serial monitor in a readable, easy-to-understand, and useful format (see next image).



```
COM5 (Arduino/Genuino Uno)

FullExample.ino
An extensive example of many interesting TinyGPS++ features
Testing TinyGPS++ library v. 1.0.2
by Mikal Hart

Sats HDOP Latitude   Longitude   Fix  Date       Time     Date Alt    Course Speed Card  Dist
          (deg)      (deg)       Age                      Age  (m)    --- from GPS ----  ----
---------------------------------------------------------------------------------------------
**** ***** ********** *********** **** ********** ******** **** ****** ****** ***** ***   ****
5    1.5  8.825654   76.929779   432  03/29/2019 12:14:23 549  159.20 0.00   0.00  N     8348
5    1.5  8.825654   76.929779   438  03/29/2019 12:14:24 554  159.30 0.00   0.24  N     8348
5    1.5  8.825654   76.929779   445  03/29/2019 12:14:25 562  159.60 0.00   0.13  N     8348
5    1.5  8.825653   76.929779   453  03/29/2019 12:14:26 570  159.80 0.00   0.20  N     8348
5    1.5  8.825654   76.929779   464  03/29/2019 12:14:27 581  160.10 0.00   0.74  N     8348
5    1.5  8.825654   76.929779   480  03/29/2019 12:14:28 597  160.40 0.00   0.46  N     8348
5    1.5  8.825654   76.929779   493  03/29/2019 12:14:29 609  160.70 0.00   0.65  N     8348
5    1.5  8.825654   76.929779   498  03/29/2019 12:14:30 615  161.00 0.00   0.28  N     8348
5    1.5  8.825655   76.929779   511  03/29/2019 12:14:31 627  161.20 0.00   0.56  N     8348
5    1.5  8.825655   76.929779   517  03/29/2019 12:14:32 634  161.50 0.00   0.37  N     8348
5    1.5  8.825655   76.929779   528  03/29/2019 12:14:33 644  161.80 0.00   0.35  N     8348
5    1.5  8.825655   76.929779   536  03/29/2019 12:14:34 653  162.00 0.00   0.35  N     8348
5    1.5  8.825655   76.929779   547  03/29/2019 12:14:35 662  162.30 0.00   0.39  N     8348
5    1.5  8.825656   76.929779   554  03/29/2019 12:14:36 670  162.60 0.00   0.61  N     8348
5    1.5  8.825656   76.929779   565  03/29/2019 12:14:37 682  162.80 0.00   0.43  N     8348
5    1.5  8.825655   76.929779   575  03/29/2019 12:14:38 692  163.00 0.00   0.19  N     8348
5    1.5  8.825654   76.929779   585  03/29/2019 12:14:39 702  163.50 0.00   0.19  N     8348
5    1.5  8.825654   76.929786   594  03/29/2019 12:14:40 710  164.00 0.00   0.28  N     8348
5    1.5  8.825653   76.929786   606  03/29/2019 12:14:41 723  164.20 0.00   0.09  N     8348
```

(/wp-content/uploads/2019/04/7-Arduino-Serial-Monitor.jpg)

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Note that the examples provided in the TinyGPS++ library presume a baud rate of 4,800 for the GPS module, but here, you need to change that to 9,600 for the NEO-6M module. The data delivered by the NEO-6 GPS module follows the standard 0183 from the National Marine Electronics Association (NMEA), which supports one-way serial data transmission from a single talker to one or more listeners. Even though there are many sources of ample information on the NMEA 0183 standard, I'd like to suggest this **especially useful one (http://www.gpsinformation.org/dale/nmea.htm)**. Finally, if you're searching for a compendium of information related to GPS and Arduino projects, **this article (http://esalvage.blogspot.com/2017/04/gps-and-arduino.html)** will quench your thirst.

Mixed thoughts and notes

- A close inspection later revealed that the part numbers of some components in my NEO-6M module (GY-GPSV3-NEO) differ from what's specified in the original schematic. For example, the part number of the 3.3-V regulator is ME6211C33M5G (S2QJ), while the memory chip is ST432RK. Then again, most GPS modules today have an output called Pulse Per Second (PPS), which is a digital output signal that changes value on the 1-second boundary for universal coordinated (UTC) time. Sadly, my module missed a header pin for that time pulse, coming (presumably) from Pin 3 of NEO-6. Furthermore, I think the addition of an on-board logic-level converter will help us to connect the GPS module to 5-V devices as well as 3.3-V devices.
- It's worth remembering that a GPS receiver must be locked onto the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude, and altitude). Once the user's position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time, and more.
- Needless to say, you can play with the raw data from a GPS module, or you can convert the NMEA messages into a readable and useful format. NMEA sentences start with the $ character, each data field is separated by a comma, and the type of message is indicated by the characters before the first comma. For example, $GPGGA denotes the basic GPS NMEA message that provides 3D location and accuracy data, while $GPGLL announces the geographic latitude and longitude (see next image).

(/wp-content/uploads/2019/04/8-GPS-Raw-Data-Arduino.jpg)

To get the raw GPS data through Arduino's serial monitor (as above), you can try this simple sketch:

```
#include <SoftwareSerial.h>

SoftwareSerial ss(4, 3); // GPS Module's TX to D4 & RX to D3

void setup(){

Serial.begin(9600);

ss.begin(9600);

}


void loop(){

while (ss.available() > 0){

byte gpsData = ss.read();

Serial.write(gpsData);

}

}
```

I hope that you've found this article to be useful. I intend to build a portable geolocation tracker device primarily based on the NEO-6M GPS module, so stay tuned!

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