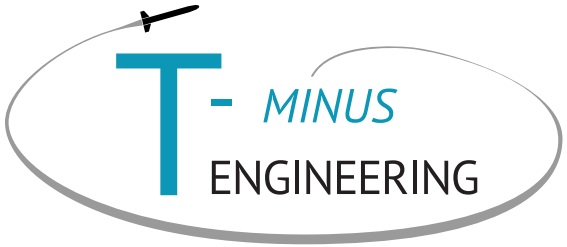


The steps towards a basic CanSat

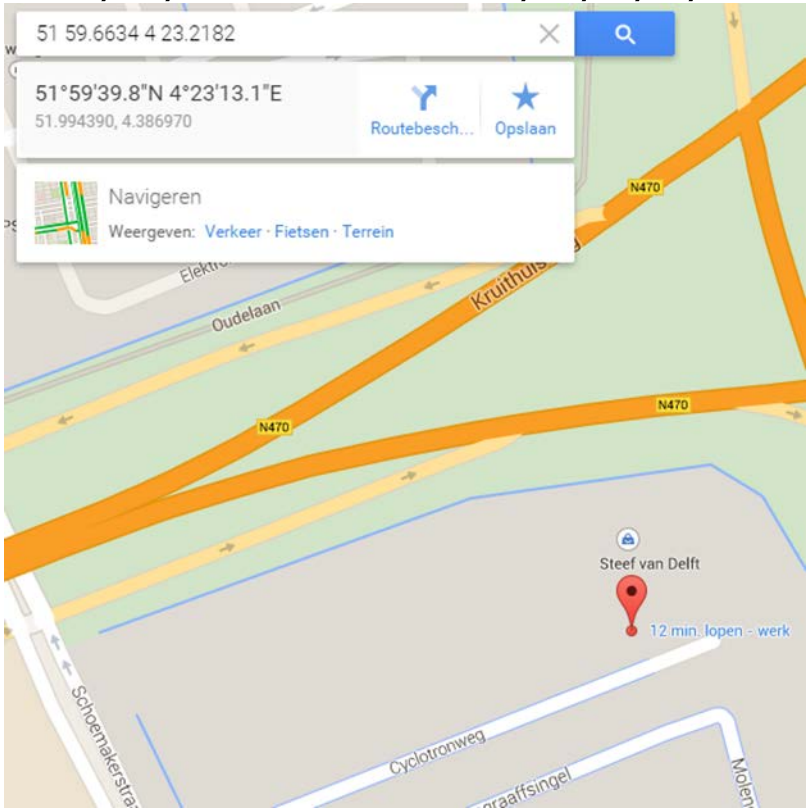
Going through all this is necessary.

Three examples of an advanced Cansat

- GPS
- Accelerometer
- SD-Card read-out

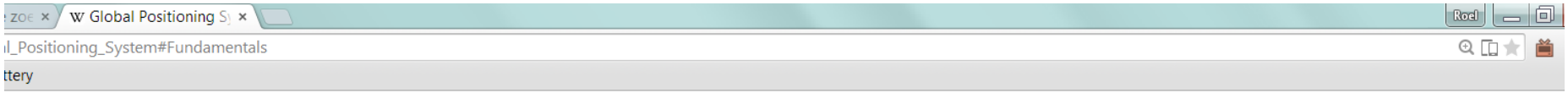
How to know your location?

$GPGGA,111958.000,5159.6634,N,00423.2182,E,1,3,9.69,102.2,M,47.1,M,,*5C



Where to start?

- Wikipedia



Fundamentals [edit]

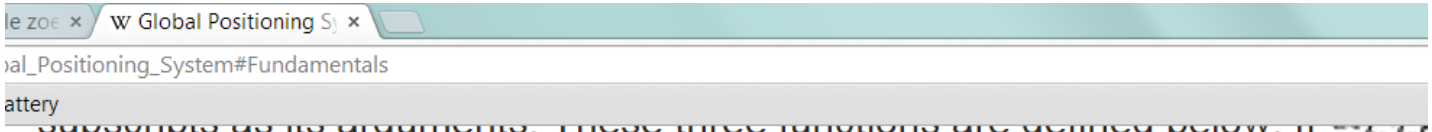
The GPS system concept is based on *time*. The satellites carry atomic clocks which are synchronized and very stable; any drift from true time maintained on the ground is corrected daily. Likewise, the satellite locations are monitored precisely. User receivers have clocks as well. However, they are not synchronized with true time, and are less stable. GPS satellites transmit data continuously which contains their current time and position. A GPS receiver listens to multiple satellites and solves equations to determine the exact position of the receiver and its deviation from true time. At a minimum, four satellites must be in view of the receiver in order to compute four unknown quantities (three position coordinates and clock deviation from satellite time).

GPS

- Position
- Time

- Clear field of view
- Time to fix
- Hot/cold start

But don't get lost



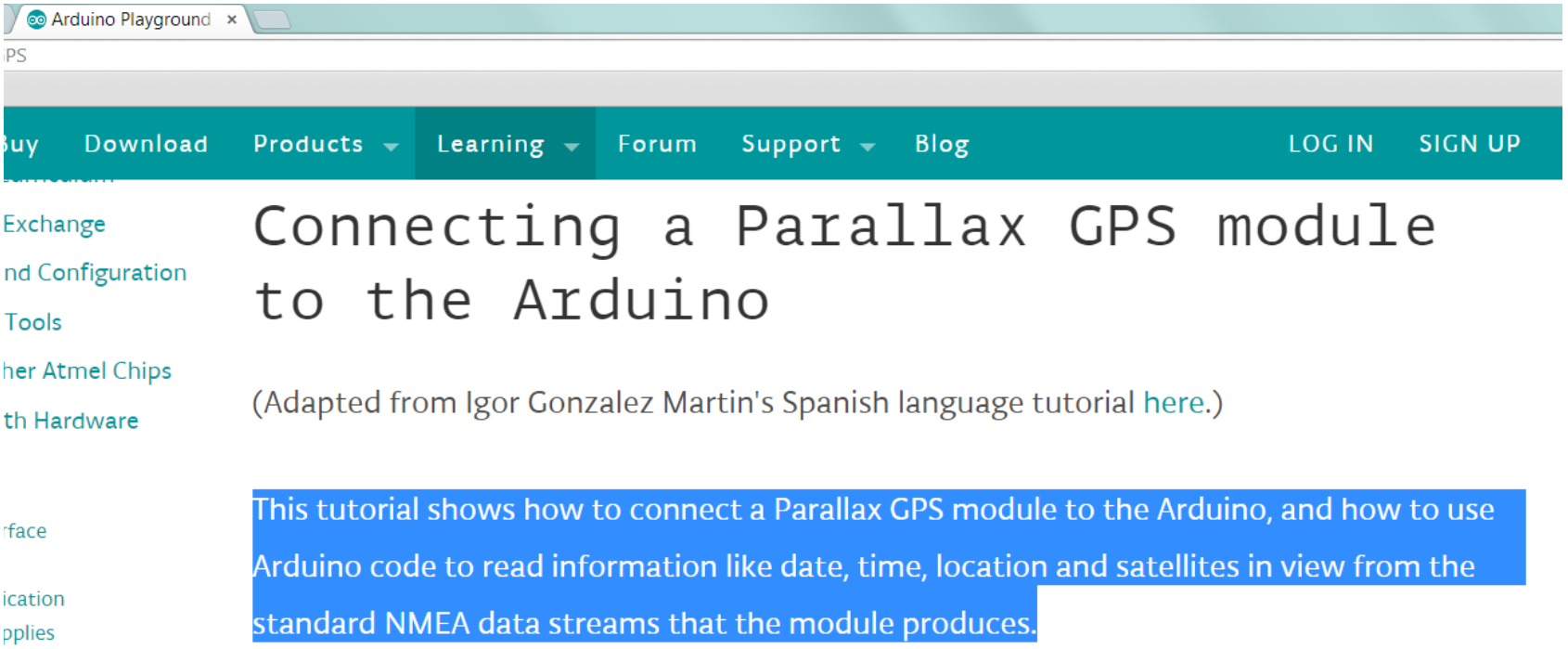
arguments, *i, j,* and *k* then it is a valid argument for the functions, $:\Delta^r, \Delta^s, \Delta$

$$\Delta^r(\alpha_{i,j,k}) = \alpha_{i+1,j,k} - \alpha_{i,j,k},$$
$$\Delta^s(\alpha_{i,j,k}) = \alpha_{i,j+1,k} - \alpha_{i,j,k}, \text{ and}$$
$$\Delta^t(\alpha_{i,j,k}) = \alpha_{i,j,k+1} - \alpha_{i,j,k}.$$

Also if $\alpha_{i,j,k}$ *and* $\beta_{l,m,n}$ are valid arguments for the three functions and *a* $(a\ \alpha_{i,j,k} + b\ \beta_{l,m,n})$ is a valid argument with values defined as

$$\Delta^r(a\ \alpha_{i,j,k} + b\ \beta_{l,m,n}) = a\ \Delta^r(\alpha_{i,j,k}) + b\ \Delta^r(\beta_{l,m,n}),$$
$$\Delta^s(a\ \alpha_{i,j,k} + b\ \beta_{l,m,n}) = a\ \Delta^s(\alpha_{i,j,k}) + b\ \Delta^s(\beta_{l,m,n}), \text{ and}$$
$$\Delta^t(a\ \alpha_{i,j,k} + b\ \beta_{l,m,n}) = a\ \Delta^t(\alpha_{i,j,k}) + b\ \Delta^t(\beta_{l,m,n}).$$

Standing on the shoulders of giants



What language does it speak?

Protocols:
Serial (UART , I2C)
Parallel (SPI)

high altitude
ease of use,

Key Specifications

- Power requirements: 3.3 V – 5 V, 55 mA max (typically 35 mA)
- Communication: TTL Asynchronous Serial (UART), Optional I^2C
- Operating temperature range: -40 to +185 °F (-40° to +85° C)
- Dimensions: 1.0 x 1.5 x 0.5 in (25.4 x 38.1 x 12.7 mm)

Application Ideas

But does it fits your needs?

- Specifications of the mission
- Get the datasheet of the sensor!

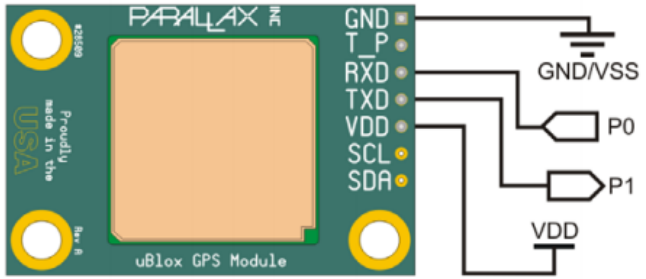
- Examples

Pin Definitions and Ratings

Pin	Name	Function
1	GND	Ground Reference (VSS) -> 0 V
2	T_P	Time Pulse
3	RXD	Device UART Receive
4	TXD	Device UART Transmit
5	VDD	Voltage Input (3.3 V – 5.0 V)
6	SCL	Optional I^2C Serial Clock
7	SDA	Optional I^2C Serial Data

Symbol	Quantity	Minimum	Typical	Maximum	Units
VDD	Supply Voltage	3.0	3.3	5.2	V
GND	Ground reference connection		0		V
I_{DD}(Ave)	Average active supply current		35		mA
I_{DD}(Pk)	Peak instantaneous current			55	mA
VOH	Signal high transmit (TXD, T_P)	VDD × 0.9	VDD	VDD + 0.5	V
VOL	Signal low transmit (TXD, T_P)	GND - 0.3	GND	VDD × 0.15	V
VIH	Signal high receive (RXD)	1.5	VDD	40	V
VIL	Signal low receive (RXD)	- 0.3	GND	0.7	V
V_{SCL}	I^2C Clock Signal	0		3.3	V
V_{SDA}	I^2C Data Signal	0		3.3	V

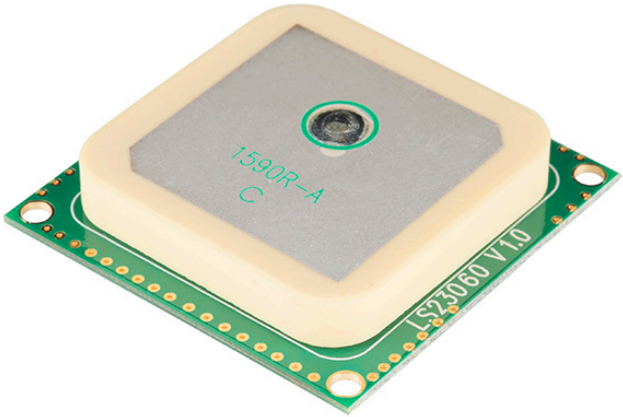
Quick Start Circuit

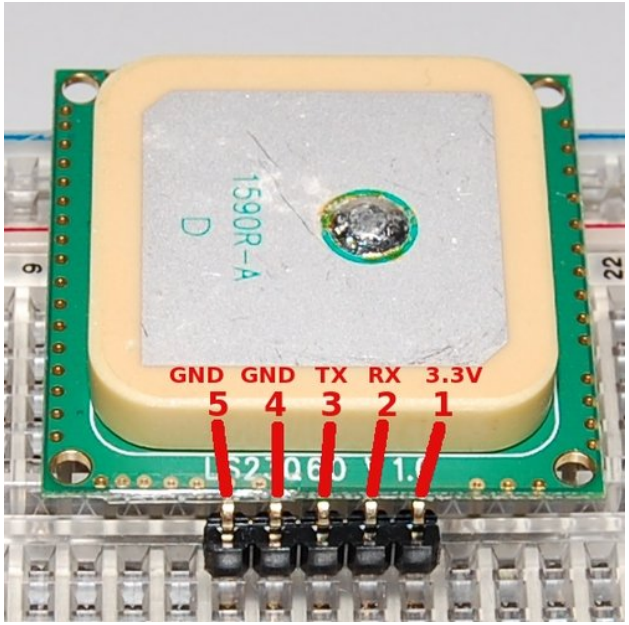


The PAM-7Q GPS Module can be interfaced with many common microcontrollers or computers, including the Propeller, BASIC Stamp, Arduino, PIC, Raspberry Pi, Beaglebone, and more. At minimum, you can

GPS sensor

- 5Hz
- 3.3 V
- Internal memory and battery





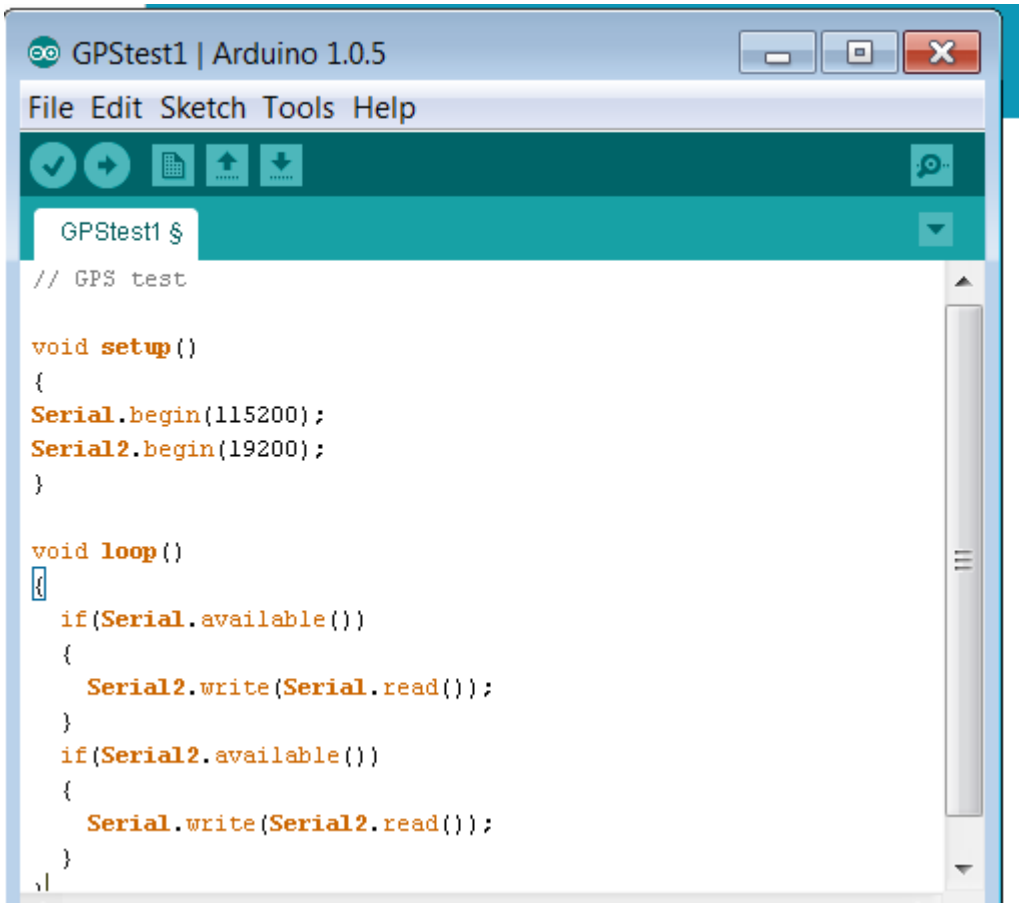
Adaptation

- The Arduino Code

```
/*
Example code for connecting a Parallax GPS module to the Arduino
Igor Gonzalez Martin. 05-04-2007
igor.gonzalez.martin@gmail.com
English translation by djmatic 19-05-2007
Listen for the $GPRMC string and extract the GPS location data from this.
Display the result in the Arduino's serial monitor.
*/
#include <string.h>
#include <ctype.h>
int ledPin = 13;                // LED test pin
int rxPin = 0;                  // RX PIN
int txPin = 1;                  // TX TX
```

Diagrams, Diagrams and Diagrams.

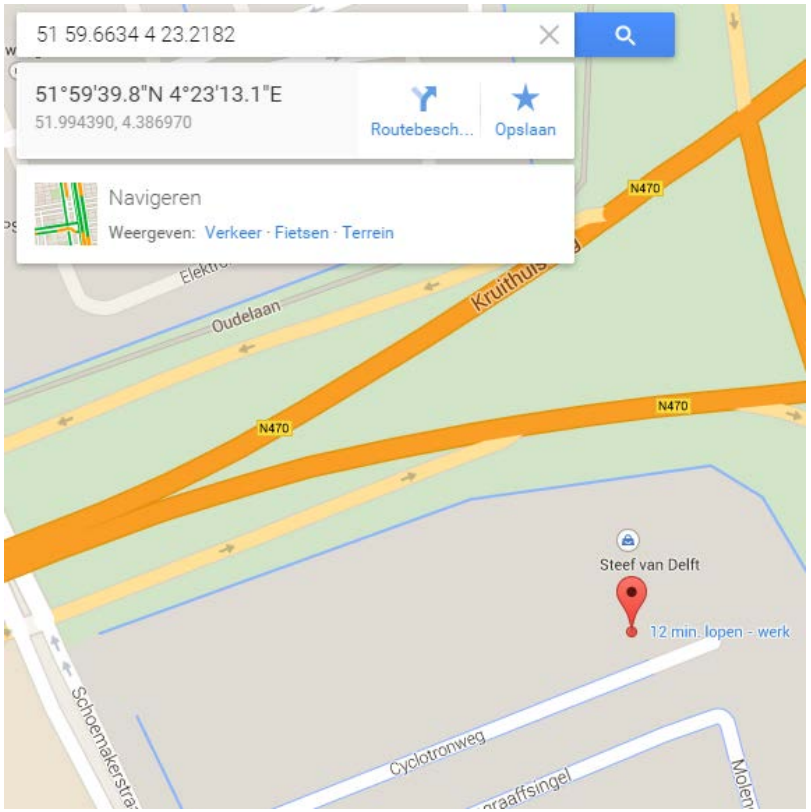
Arduino Software



Output

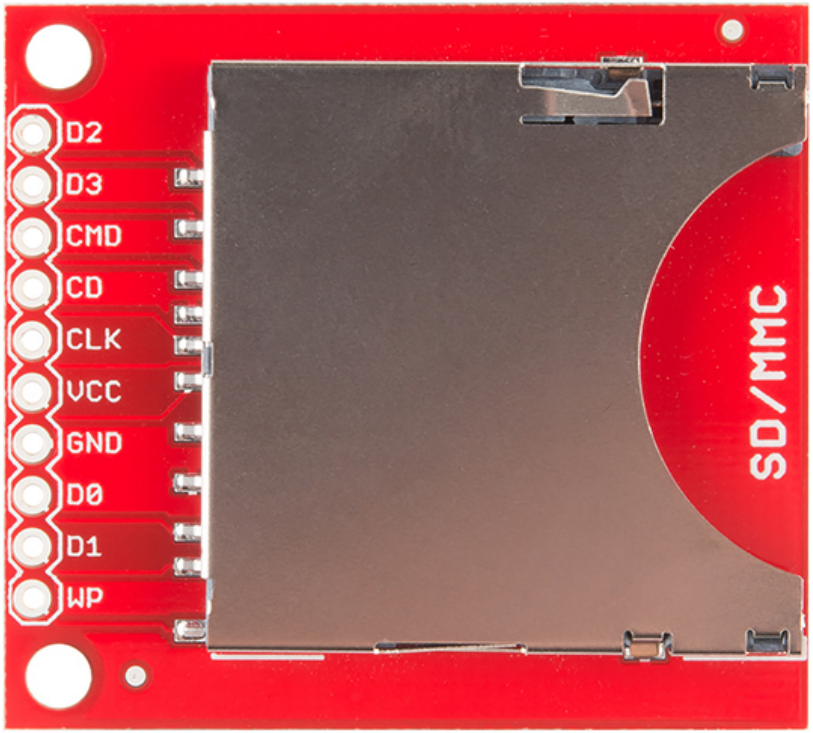
$GPGGA,111958.000,5159.6634,N,00423.2182,E,1,3,9.69,102.2,M,47.1,M,,*5C

Output in degrees and decimal minutes



SDCard

- Store data for recovery
- More information
- Backup vs Radio



SDCard alternatives

- Fixed memory
- Micro SD

Testing

- Validate correct working
- Create problems
- Always run under max performance

3 axis accelerometer

- XYZ Acceleration
- Integration over time
- Detect launch
- Determine orientation

9DOF

- 3x acceleration (accelerometers)
- 3x rotations (gyroscope)
- 3x Magnetic field measurements