CanSat in Europe 2014

Carmen Sylva 1

2014 european competition · carmen sylva I team

Team:

- Bâcă Adrian,
- Coea Robert,
- Coea Vlad,
- Gherasim Nicoleta,
- Iordache Lucian,
- Rusnaciuc Andreea,
- Vasile Liviu
- Dincă Andrei

Teacher:

- Şerbu Florin

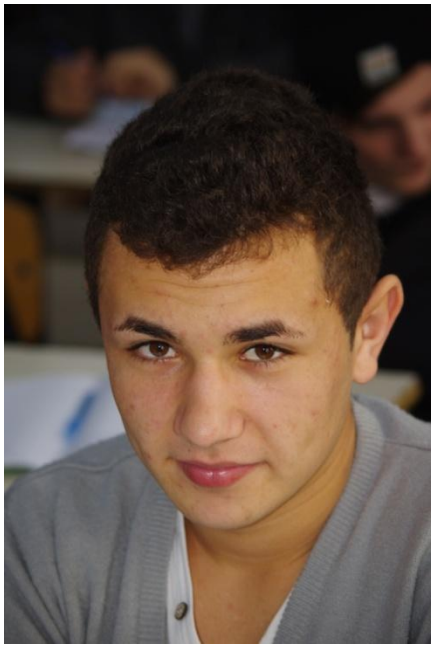
Project Manager

- Coordinates the team. He is responsible for integrating all the components, team management, time management and tracking error.

Liviu

Mechanical Engineer

- They are responsible for mechanical structure and for design of our CanSat. They also build and test the paragliding system



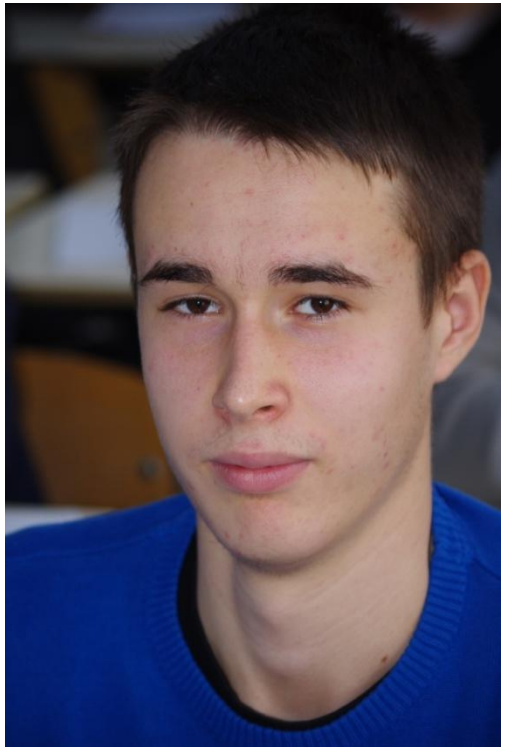
Vlad

Robert

Hardware Engineer

- They are responsible with the design and build of the electronical modules. They also tests all the components

Andreea



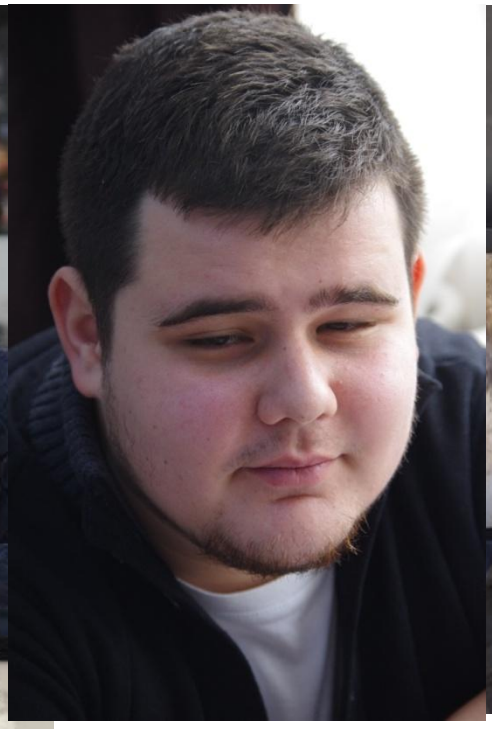
Adrian

Nicoleta

Software Engineer and Data analysis responsible

- They are responsible for programming and testing the Arduino board to collect and send data to the ground base
- They are responsible for creating data display program

Liviu



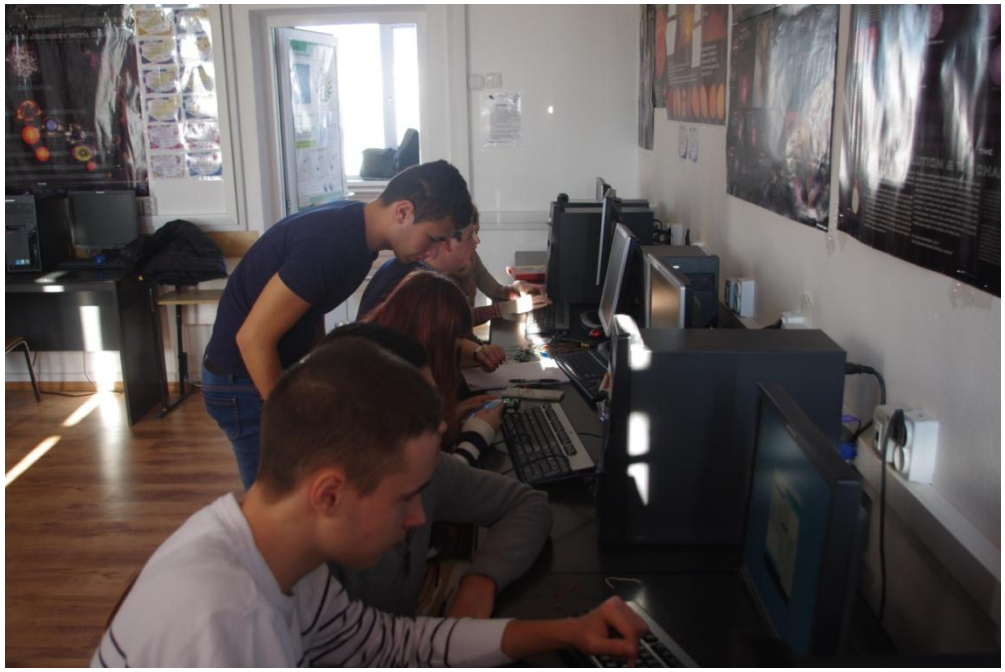
Lucian

Andrei

Adrian

Nicoleta

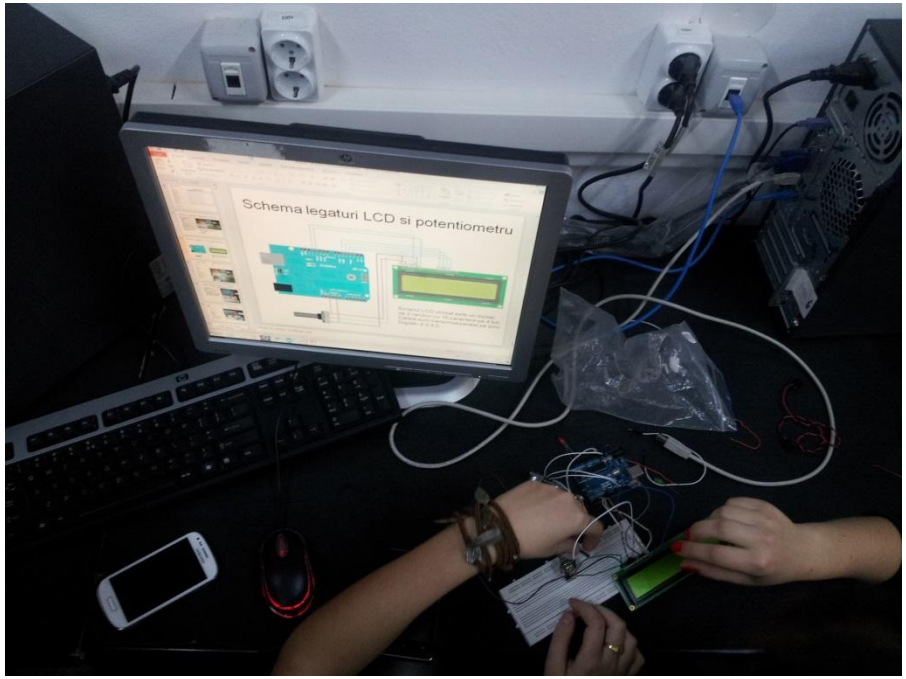
Liviu

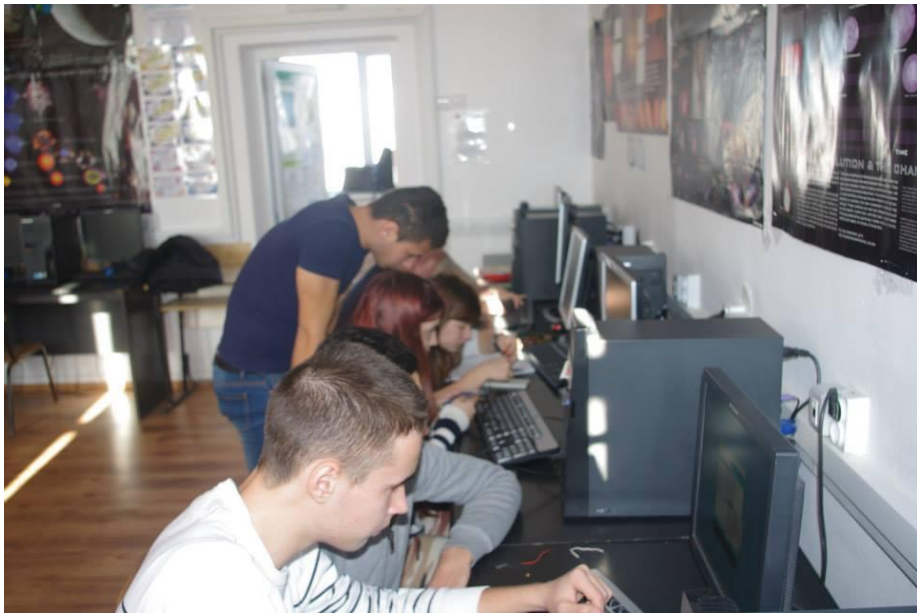


Outreach, media and public relation

- They are responsible for the publicity and dissemination of the project, before, during and after the launch campaign. They also organizes a found raising campaign in order to purchase hardware and to support the travel expenses of team members.

Working in school





Working in school

Mission overview

Design and build a CanSat to be launched and deployed from a rocket at an altitude of 1000 m. CanSat will descend with a speed of 8-10 m/s. During the descend we will measure:

- Atmospheric parameters : air temperature, air pressure, air humidity, UV radiation, air quality;
- CanSat position and velocity using the GPS sensor;
- 3 axes acceleration, 3 axes angular velocity and 3 axes magnetic field;
- Current intensity absorbed by our CanSat.
- All parameter measure will be stored on a SD card and transmitted twice a second to the ground station.

Primary Mission

Building and programming the CanSat that after the launch and during the descent to measure the temperature and air pressure, following the data to be send through telemetry to the ground

Characteristics	Figure
Height of the CanSat	115mm
Mass of the CanSat	300g
Diameter of the CanSat	66mm
Length of the recovery system	30mm
Flight time scheduled	100-120s
Calculated descent rate	8-10 m/s
Radio frequency used	434,65MHz
Power consumption	
Total cost	369 Euro

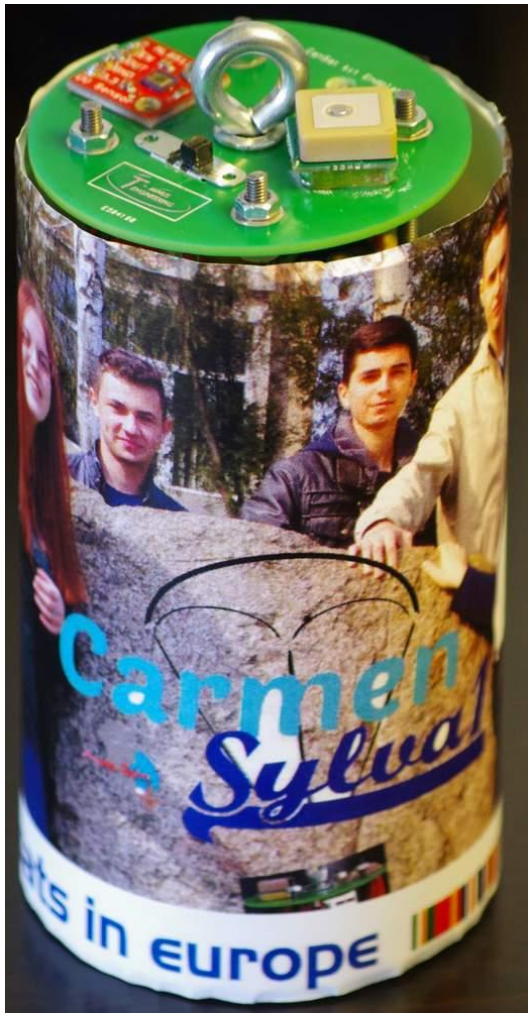
Secondary mission

- We will monitor atmospheric parameters during its ascent and descent, using some sensors. The atmospheric parameters will include temperature, pressure (Primary mission) humidity, air quality, UV radiation, presence of some gases in the air.
- We will measure the location (longitude, latitude and altitude) during the flight.
- We will also monitor the acceleration, angular velocity and magnetic field
- Will be to determine, using the sensors on the board, the principal moment of the flight (launch, ejection, and landing)
- The technical objective of our mission will be to acquire accurate data, to store the data on board and send it to the ground station 2 times per second.

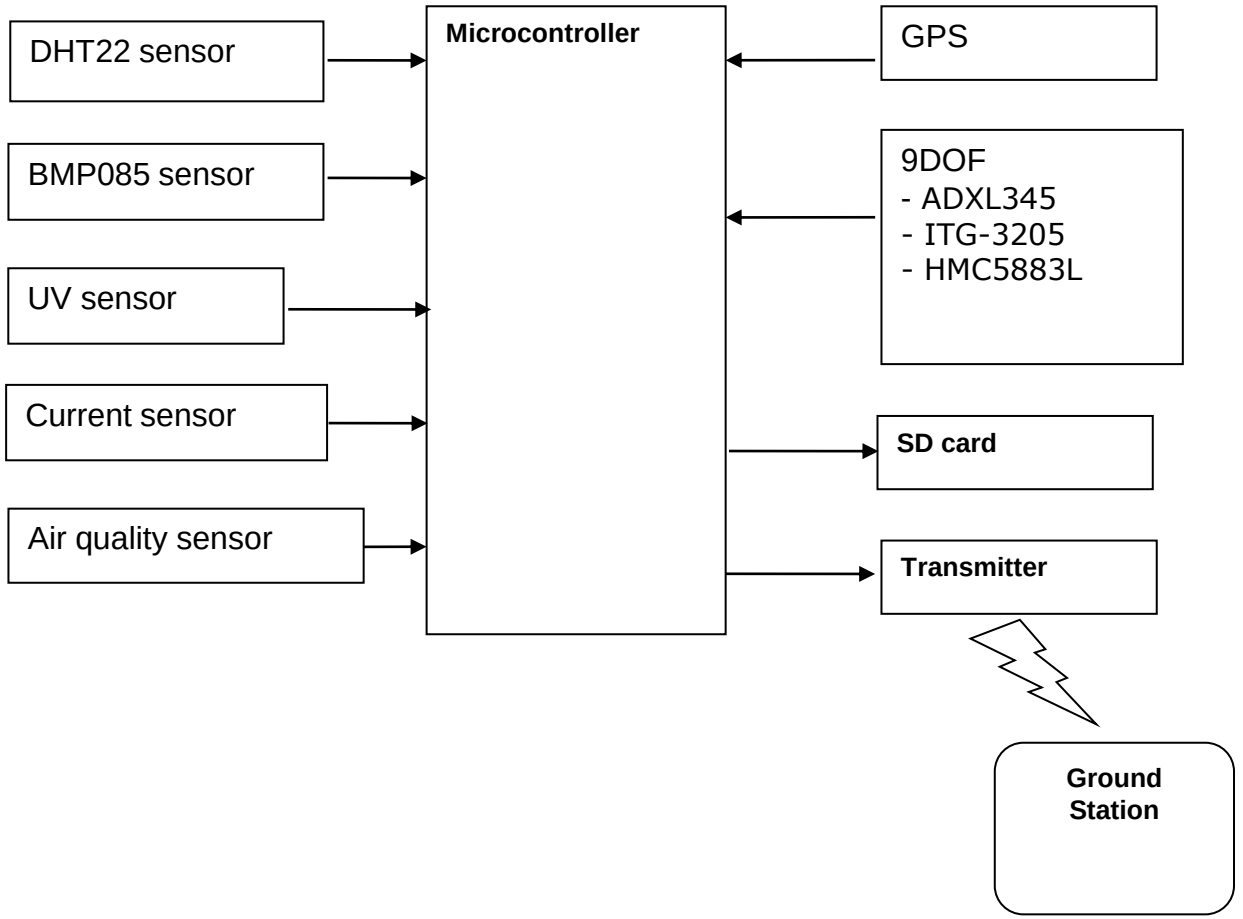
Secondary mission

We will measure:

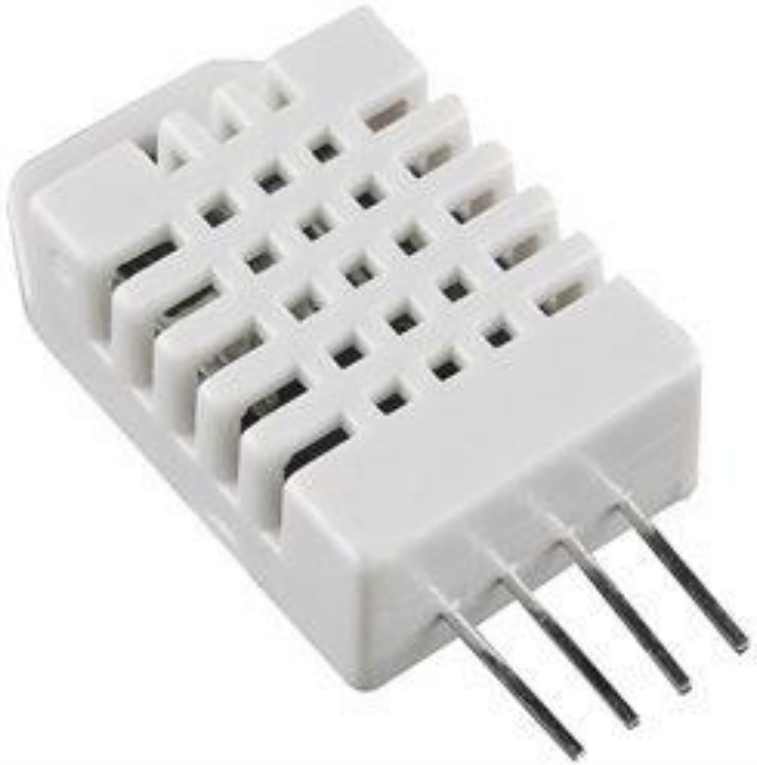
- Air temperature and air humidity using DHT22 sensor. From the data collected by this sensor we will also calculate the Dew Point.
- Air Pressure using Bosch BMP085. Using air pressure we will calculate the altitude of CanSat.
- Current Intensity absorbed by our CanSat, using ACS 712 sensor.
- UV radiation using the ML8511 UV sensor.
- Air quality using the Air Quality sensor.
- GPS data (UTC time, latitude, longitude, medium sea level altitude, number of satellites tracked). We will be able to compare the altitude calculated from air pressure data with the altitude determinate by the GPS system.
- 3 axes acceleration, 3 axes angular velocity and 3 axes magnetic field using the 9DOF sensor breakout board with 9 degrees of freedom (MinIMU-9 Pololu sensor). It includes the ADXL345 accelerometer, HMC5883L magnetometer, and the ITG-3205 gyro. This board has an I2C interface.



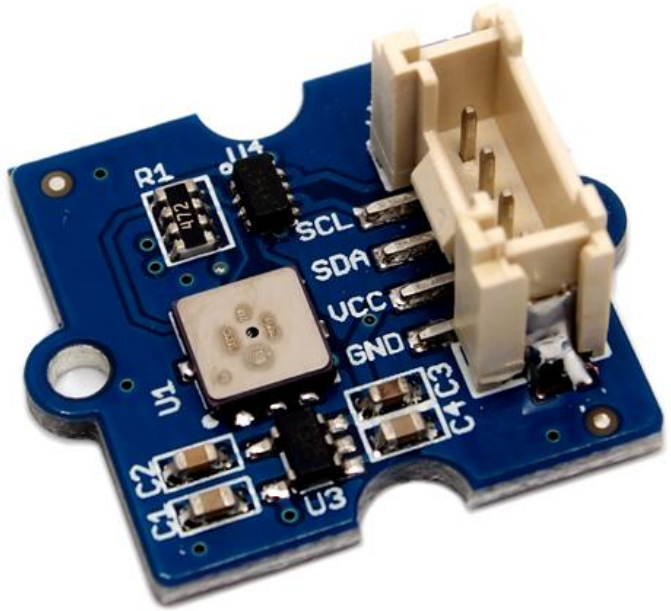
CanSat block diagram



Carmen Sylva 1 sensors



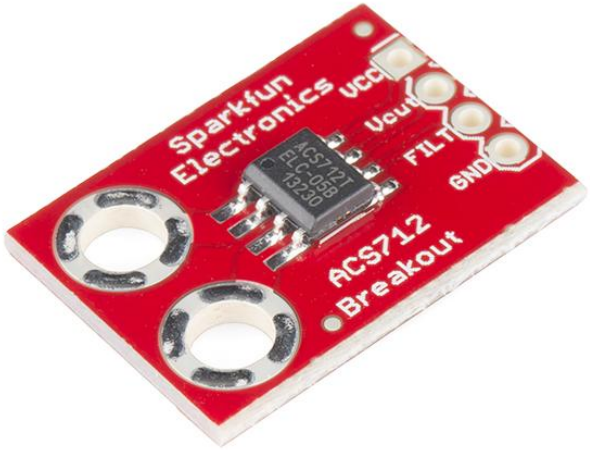
Temperature and Humidity sensor - DHT22 (RHT03)



Grove-Barometer Sensor uses a Bosch BMP085

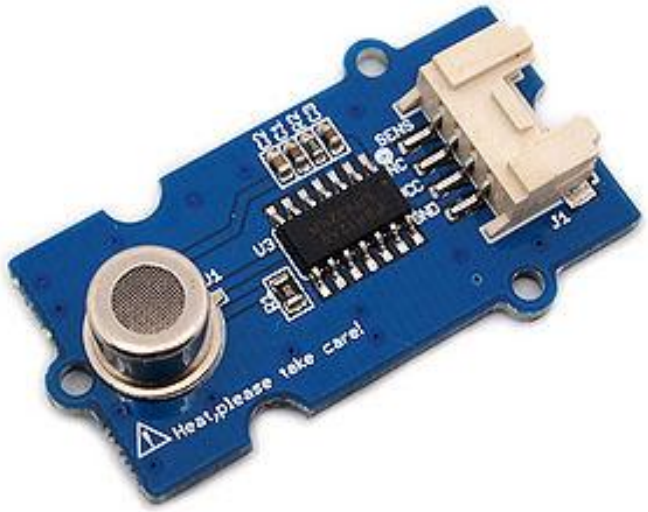
Carmen Sylva 1 sensors

Spark Fan MP8511 UV Sensor

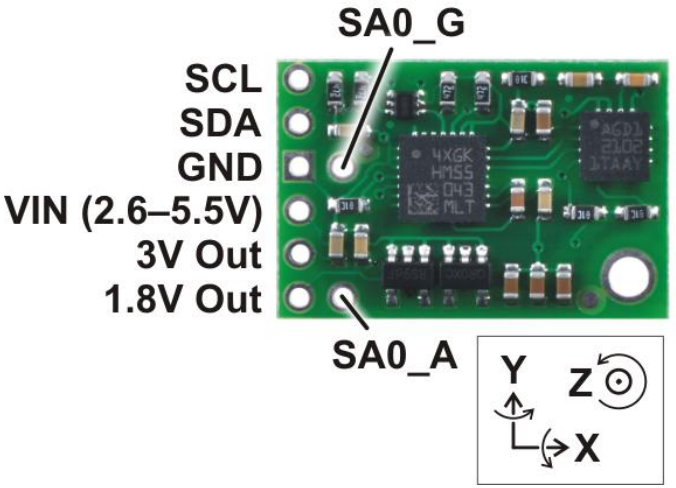


SparkFan ACS712 current sensor

Carmen Sylva 1 sensors



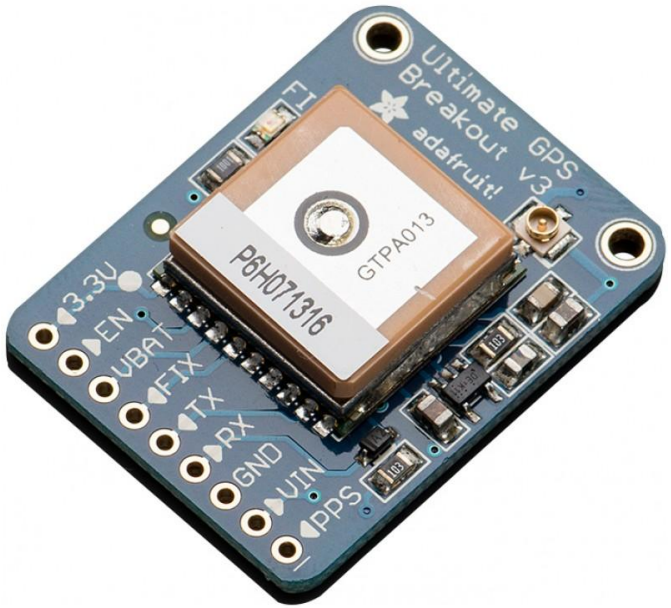
Grove Air Quality sensor



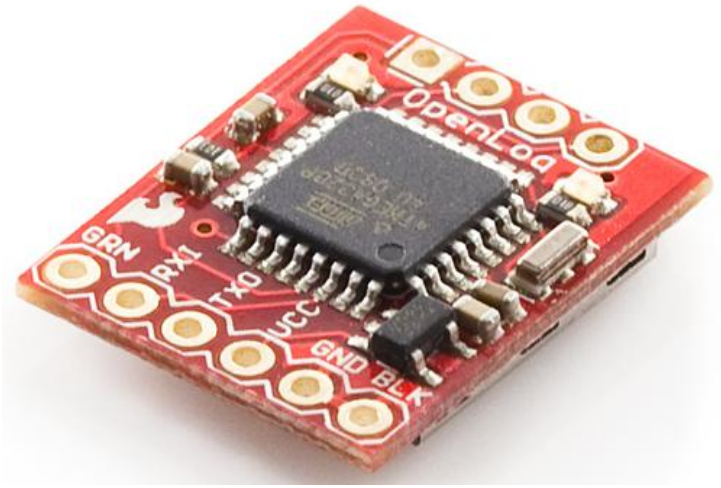
Pololu MinIMU-9 - inertial measurement unit (IMU)

- L3G4200D 3-axis gyro and
- LSM303DLH 3-axis accelerometer and 3 axes magnetometer

Carmen Sylva 1 sensors



Adafruit Ultimate GPS breakout
with the MTK3339 chipset



SparkFan OpenLog
based on ATmega328

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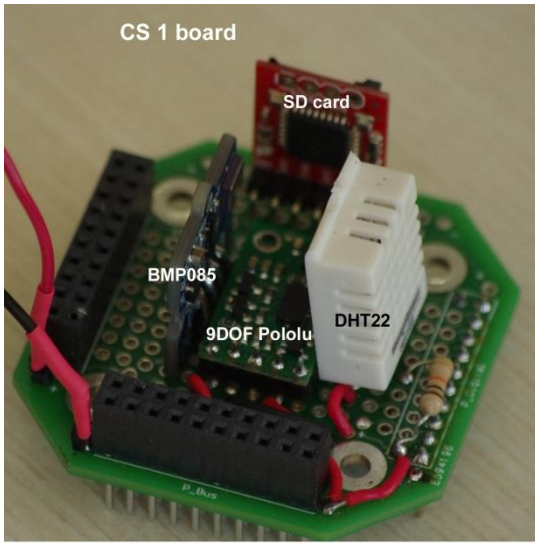
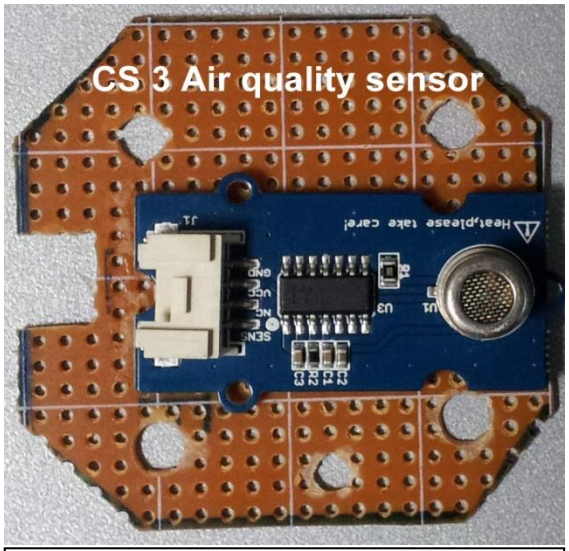
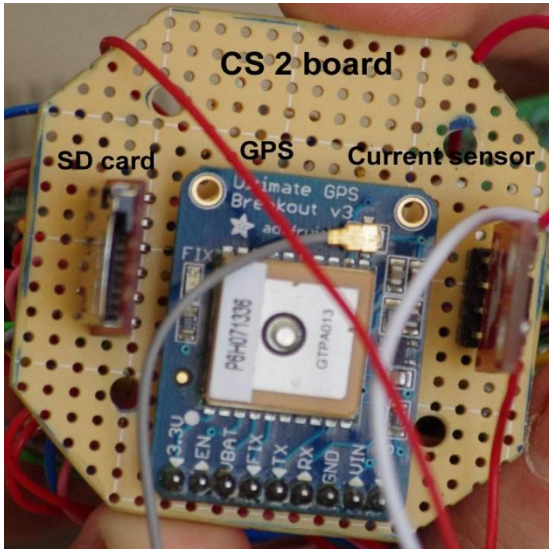


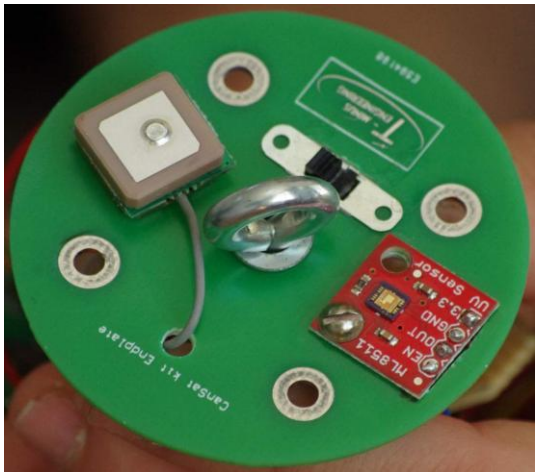
CS 1 board



CS 3 board



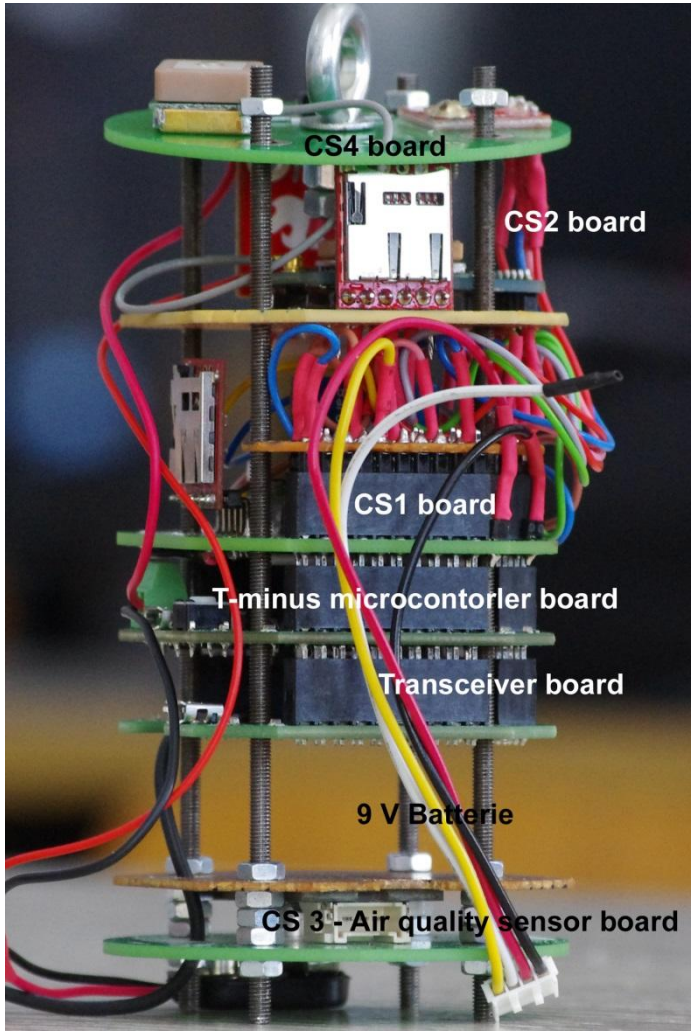
CS 2 board



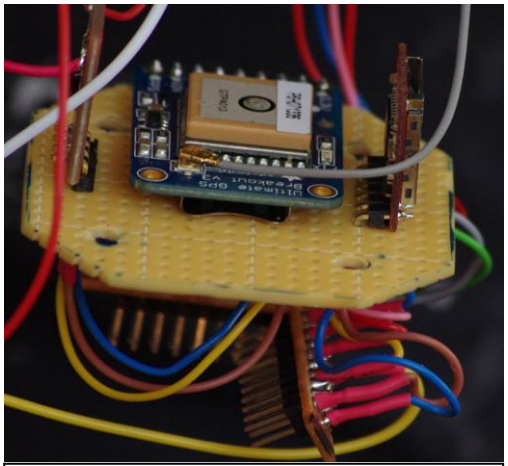
CS 4 board

Mecanichal structure

- CS 3 board – Air quality board.
- The 9 V lithium battery.
- T-minus transceiver.
- T-minus microcontroller.
- CS1 board, integrating DHT22 sensor(temperature and humidity), BMP085 (air pressure, temperature), MinIMU-9 sensor (L3G4200D 3-axis gyro and an LSM303DLH 3-axis accelerometer and 3-axis magnetometer), and OpenLog SD card board.
- CS 2 board, integrating Adafruit Ultimate GPS, ACS712 current sensor and OpenLog SD card.
- CS 4 board integrate ML8511 sensor UV radiation sensor), power switch, and a GPS external antenna

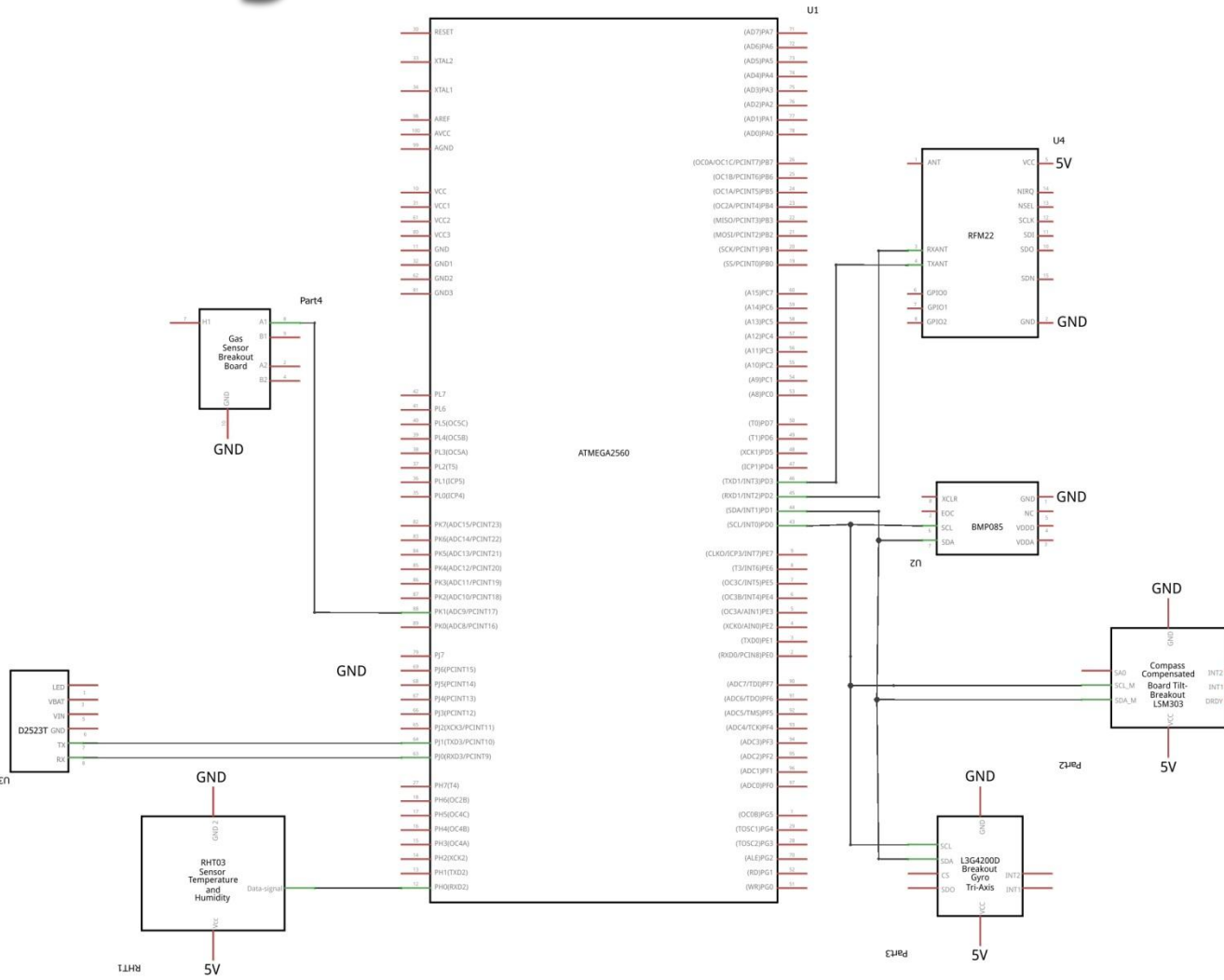


Electrical design



CS 2 board

Nr	Sensor	I(mA)
1	BMP085	0.13
2	DHT22	1.5
3	UV radiation sensor	0.31
4	Air quality sensor	50
5	GPS	20
6	MinIMU-9	10
7	Card MicroSD	6
8	ACS712	20
	Total	**107.94**



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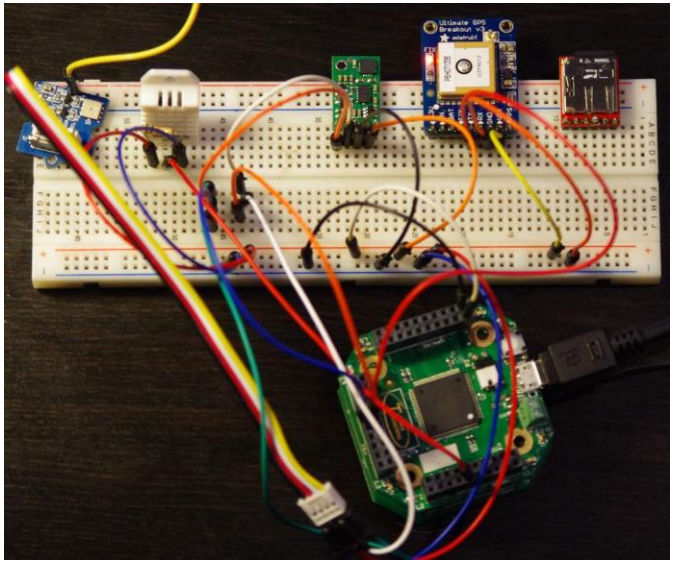
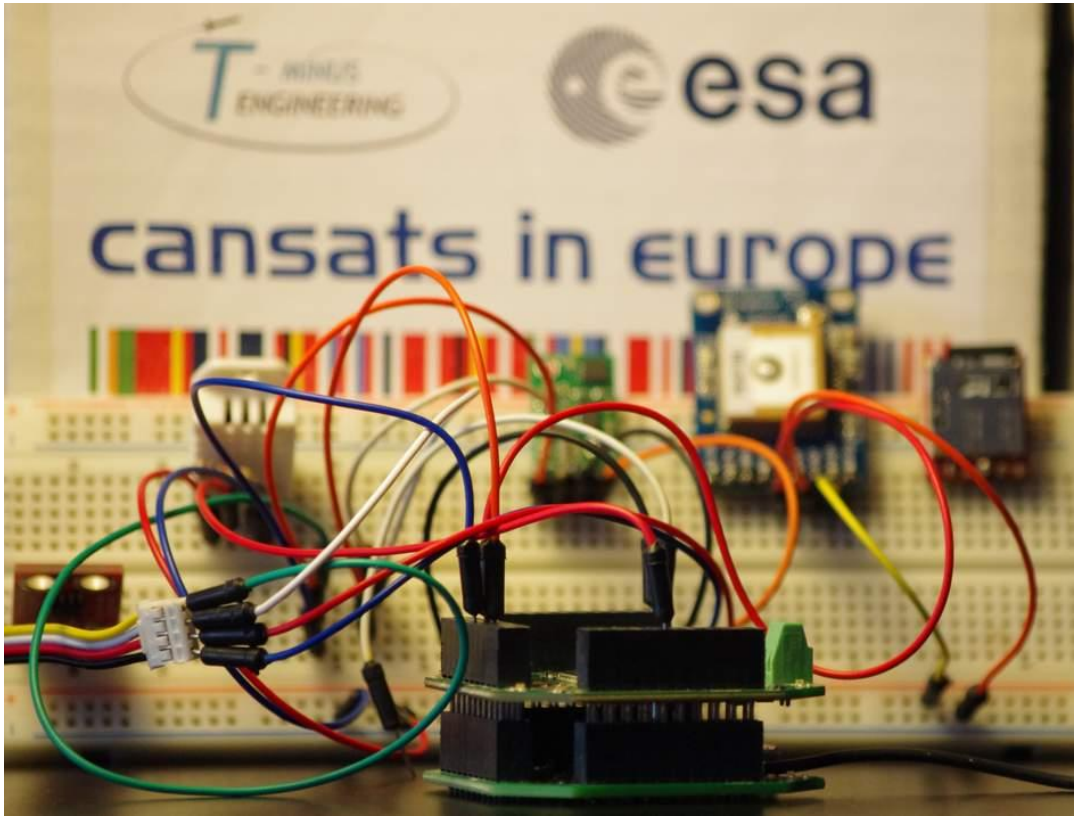
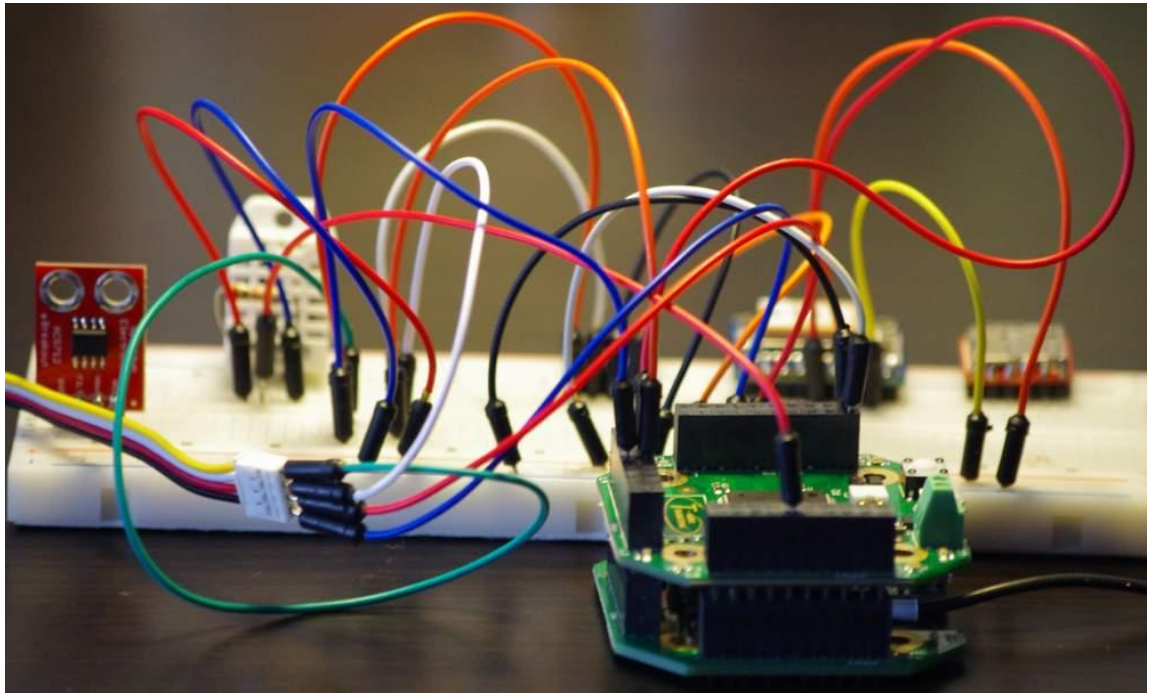
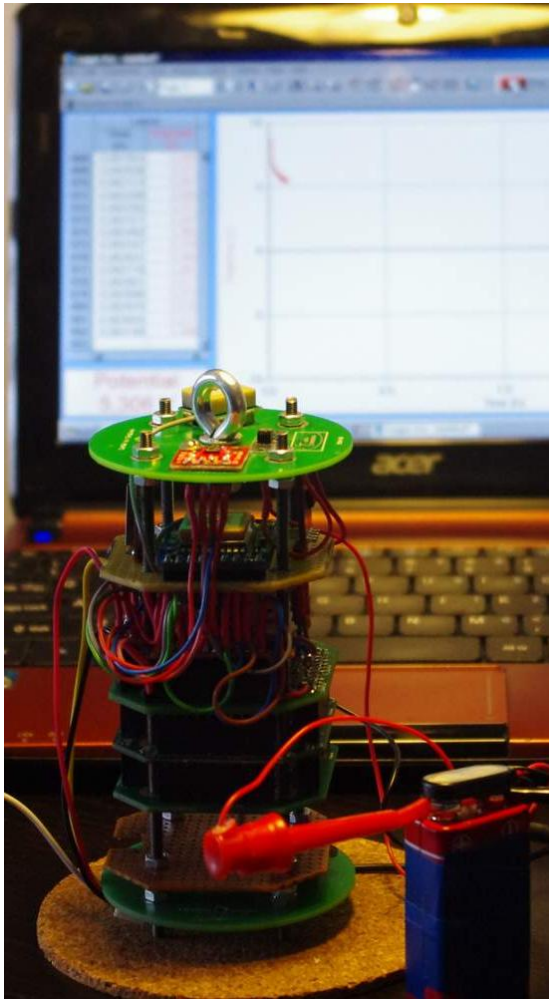




Batteries tests

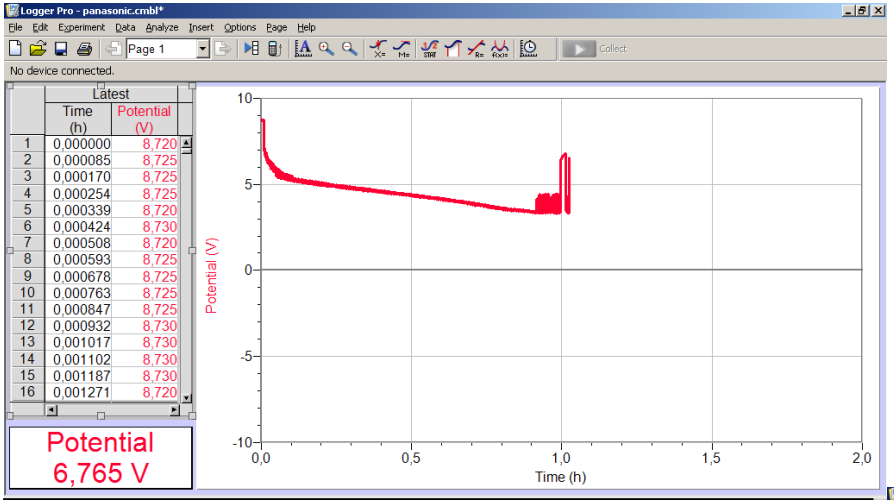
Because we want to have a more exact estimation, we decided to introduce a current sensor in our CanSat. We will monitor the current use by our CanSat during field tests and we will choose the batteries.



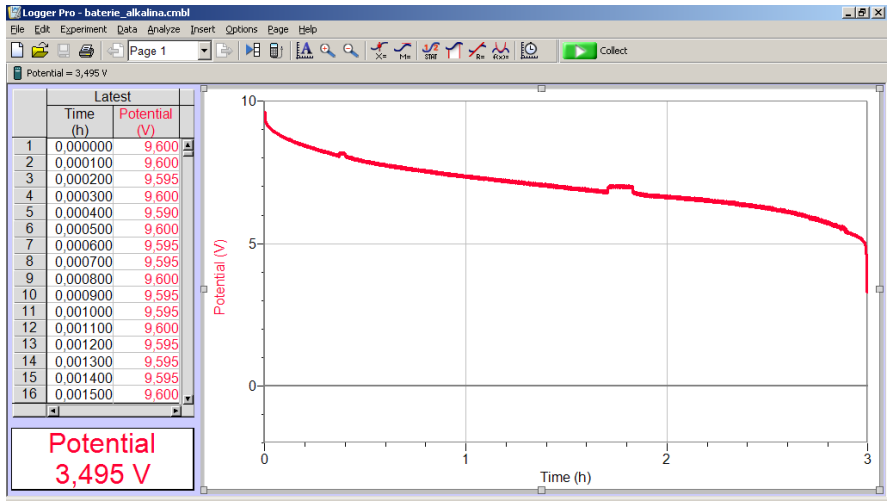


Lifetime batteries cycle measurement, using Vernier Logger Pro software

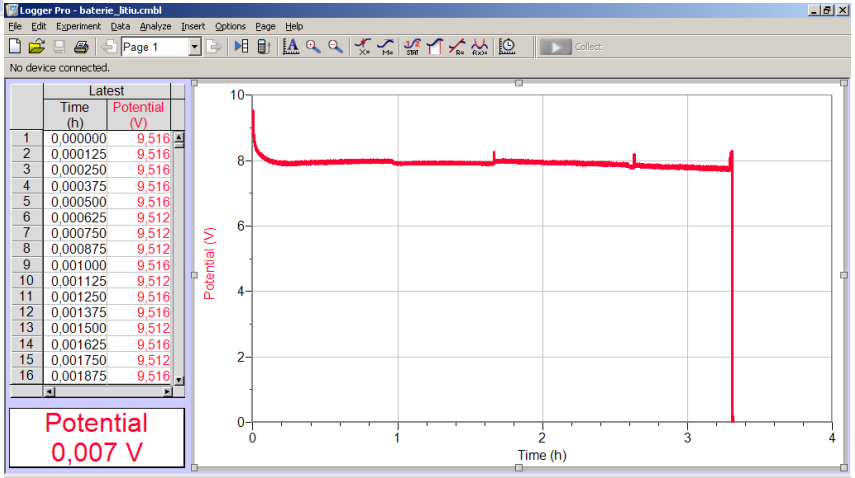
Batteries tests



Panasonic Zinc Chloride battery, 1hour (120mAh)



Auchan Alkaline battery, 3hours (360mAh)



Ultra Life Lithium Battery, 1200mAh, 9

After the flight

- Using temperature and relative humidity we will calculate the Dew Point.
- Using air pressure and temperature we will calculate the altitude.
- From GPS data, we will be able to calculate the velocity of the CanSat. We will calculate also the velocity components (vertical and horizontal). Horizontal speed is an indicator for the wind direction and wind speed at different altitude.
- Using the accelerometer and gyroscope data, we will calculate, position and velocity.
- We will compare the position data obtained using the GPS and the IMU system.
- We will calculate the module of the magnetic field, from the tree components.
- We will display (plot) all data to analyses the variation in time and with altitude
- Using data from GPS we will display in 3D the trajectory of the CanSat

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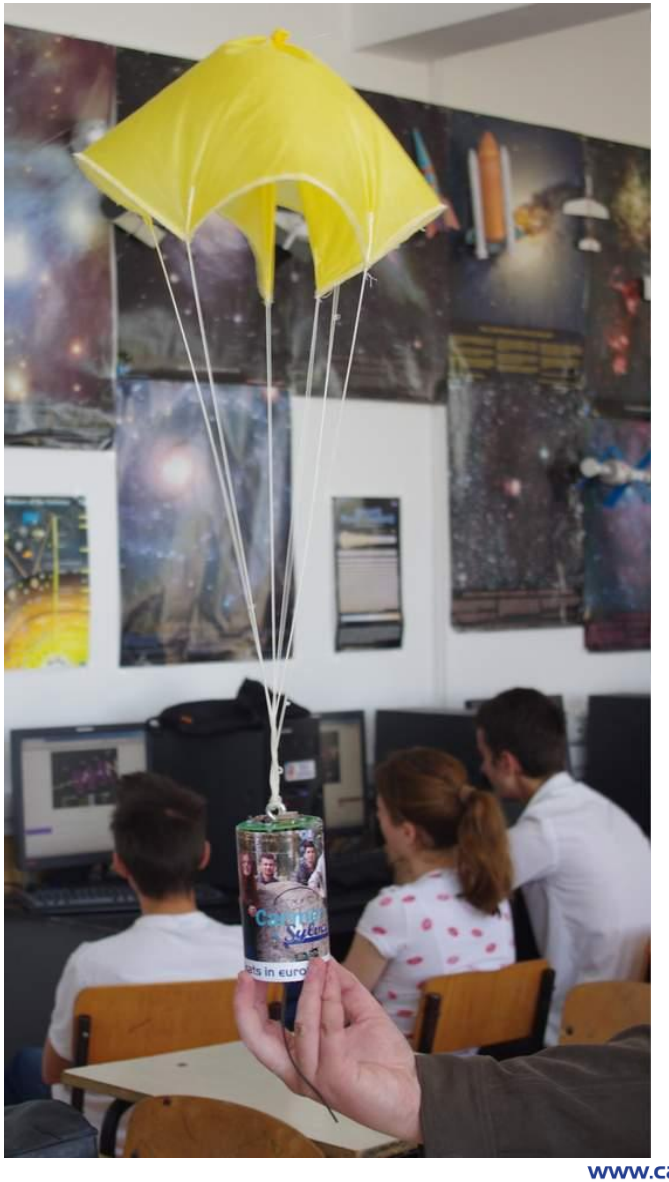
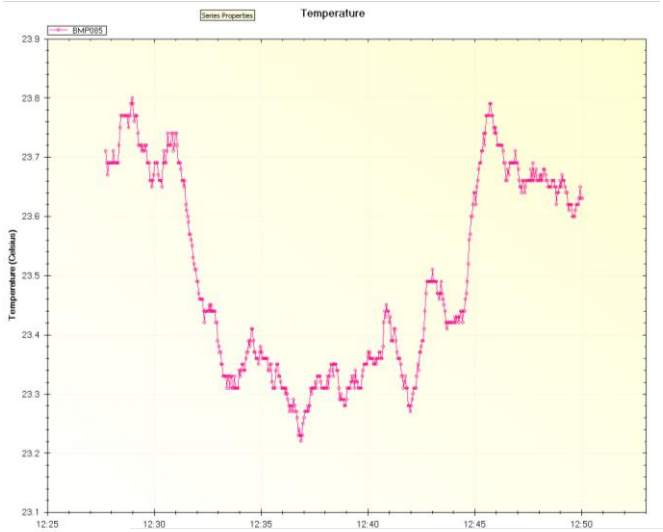
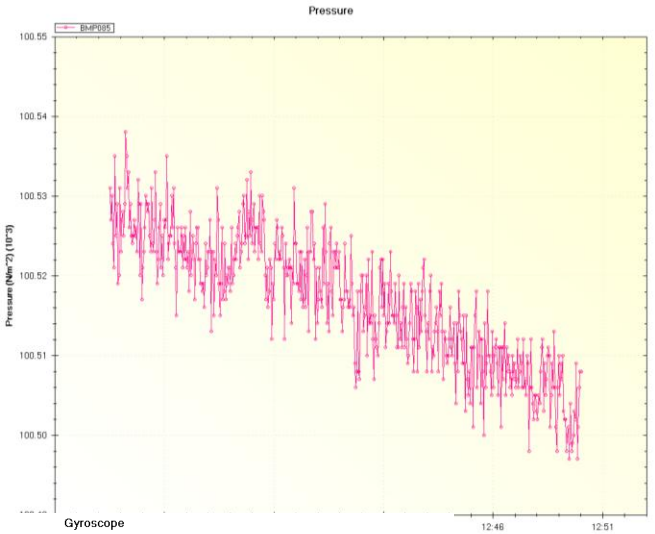
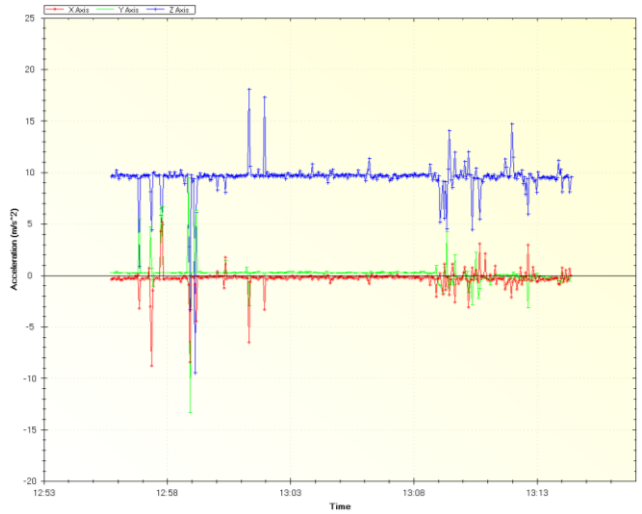


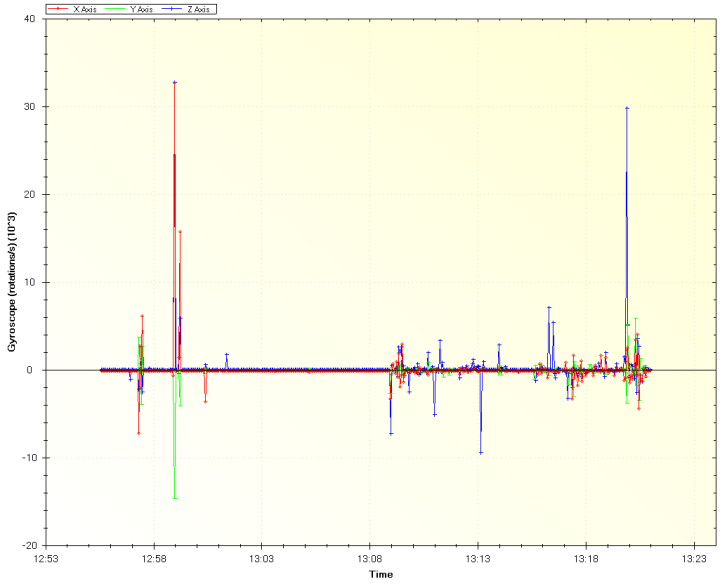
CanSat sensors tests

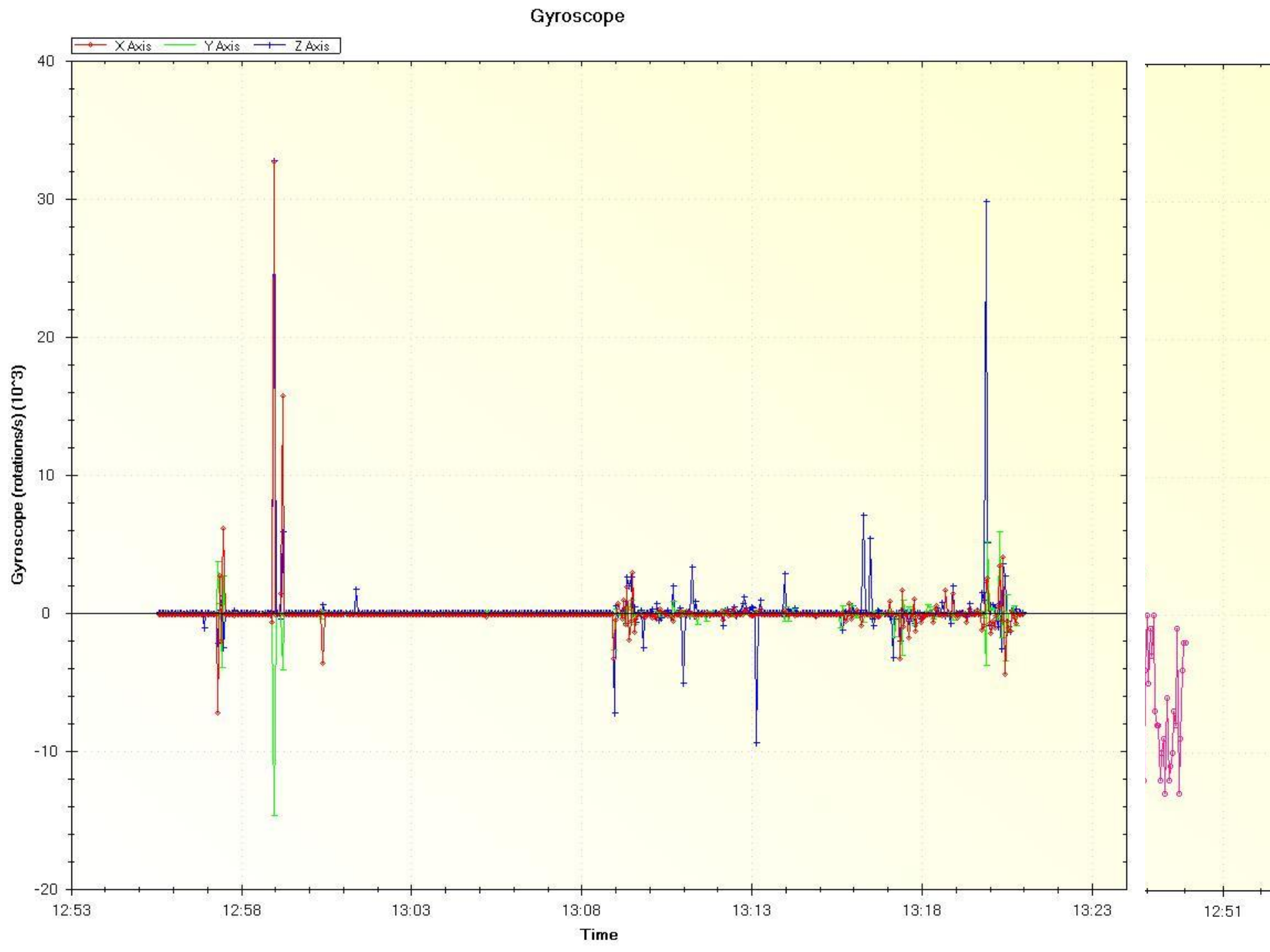
CanSat sensors tests










Gyroscope
X Axis
Y Axis
Z Axis
Gyroscope (rotations/s) (10^3)
40
30
20
10
0
-10
-20
12:53
12:58
13:03
13:08
13:13
13:18
13:23
12:51
Time

CanSat GPS tests

GPS test. The GPS data save on the SD card, are converted in a KML file and display in Google Earth. The image represent a tour around a residential area in Eforie Sud, Romania.

CanSat GPS tests

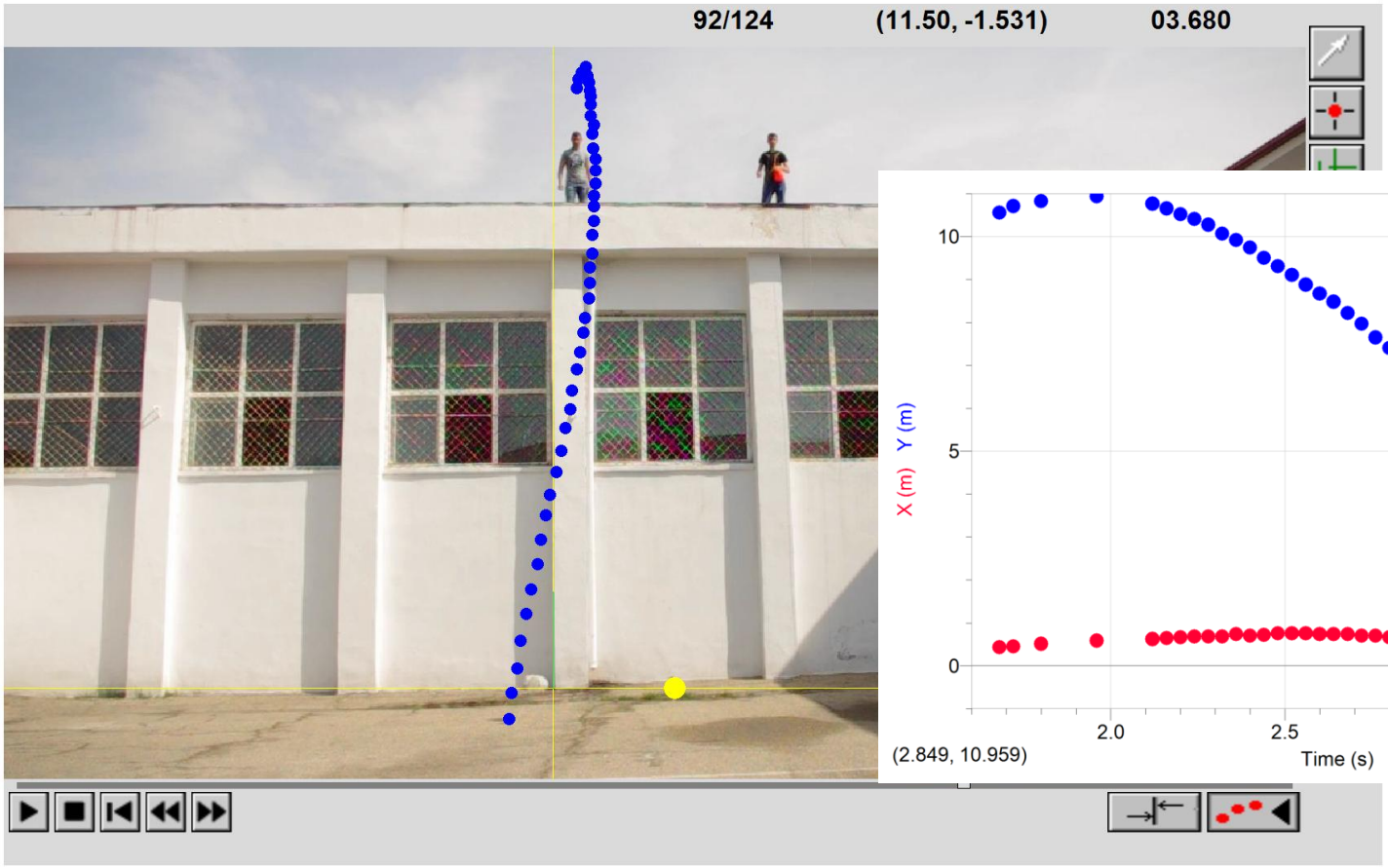
GPS test. The GPS real data for latitude and longitude and simulated data for altitude.
The image represent a tour around a residential area in Eforie Sud, Romania.

CanSat's flight tests

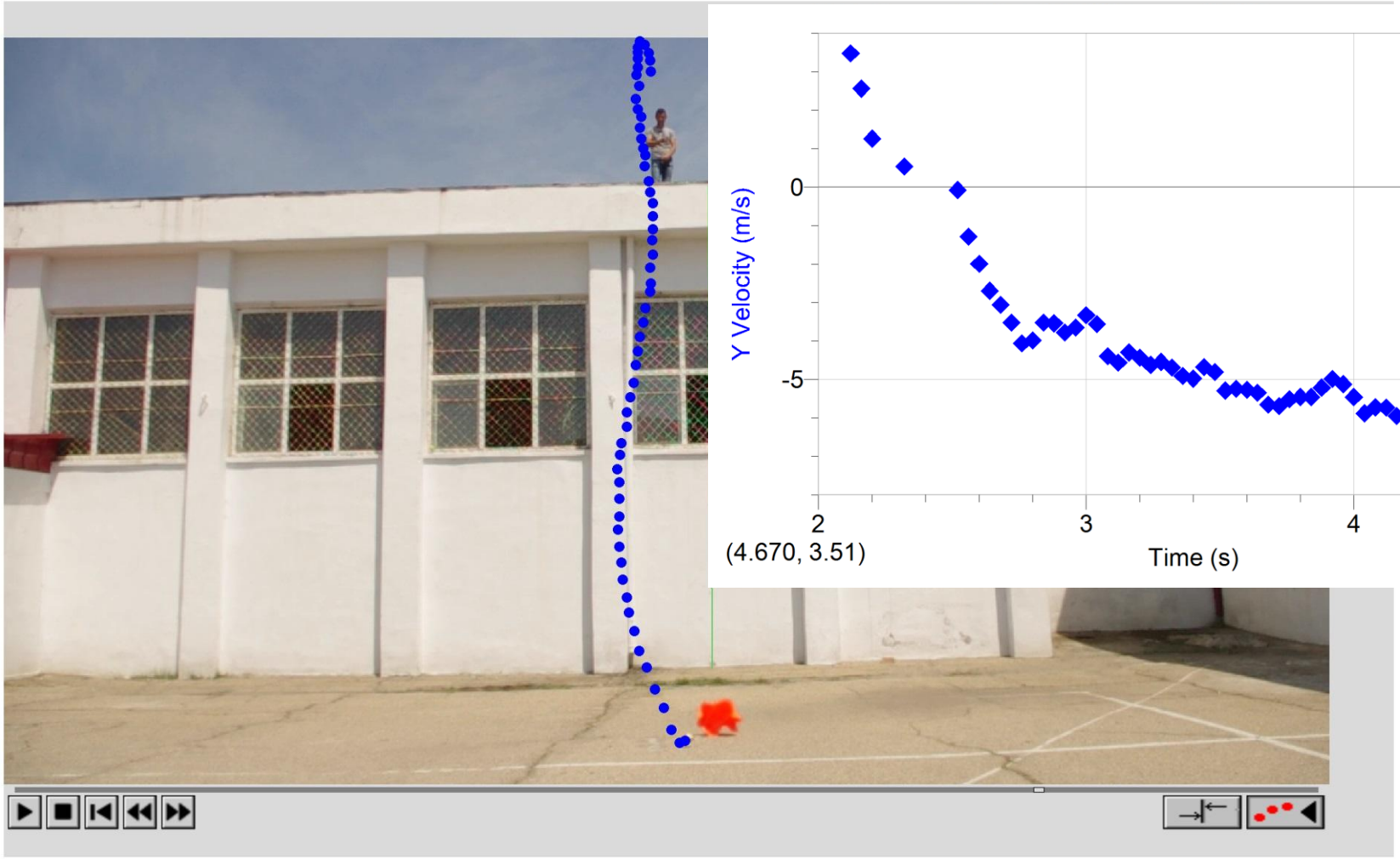
CanSat's flight tests

Can Sat flight tests

Can Sat flight tests



Can Sat flight tests



Radio modules tests

Outreach Program

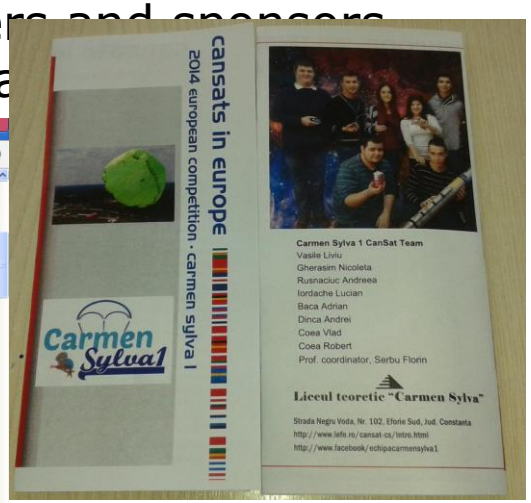
Before the completion we will develop a web page and a Facebook page, we will write article about CanSat project in the school newspaper, we will develop presentation for the local community stakeholders, trying to find sponsors to acquire hardware components

Outreach Program

During the CanSat completion we will register (photos and videos) the preparation of the team, the launch and the recovery of the CanSat. All materials will be available on the web and Facebook page as soon as possible.

After the CanSat completion, we will disseminate in local and national media the CanSat European Competition and other programs from the European Space Agency, trying to involve more schools and students in education ESA programs. We also try to find partners and sponsors to organize a National CanSat Competition In Romania year

Our team Logo



Our brochure

CULTURĂ-EDUCAŢIE 120 de vizite

Ştire online publicată Marţi, 17 Decembrie 2013. Autor : Simona ANGHEL

Ce performanţă au reuşit elevii de la Liceul „Carmen Sylva“

În perioada 1-5 iunie 2014, la Andoya Rocketrange în Andenes,

Credits

- Echim Claudiu, “Siscom Media Services”, sponsor our team with 500 €. He is a former student of our school.
- Cotae Costel, from “Web Net Solutions”, helps our students to design, build and solder circuit’s board. He is a former students of our school.
- Bulacu Cicerone, from “Siscom Media Services”, helps our students to design, build and solder circuit’s board.
- Echim Anca, from “Habitat for Humanity”, Romania, found raising specialist, former students of our school.
- Dr. Dan Argintaru, Physics department of Constanta Maritime University
- Dr. Cristian Panaiotu, Geophysics Deparment of Physics Faculty, Bucharest University.
- Dr. Dan Sporea, Center for Science Education and Training (CSET) Bucharest, representativ of the Hands on Science network in Romania