

A MINI SZATELLITTŐL A SUMO-ROBOTIG

Az atomoktól a csillagokig

2018. nov. 29.

Pető Mária

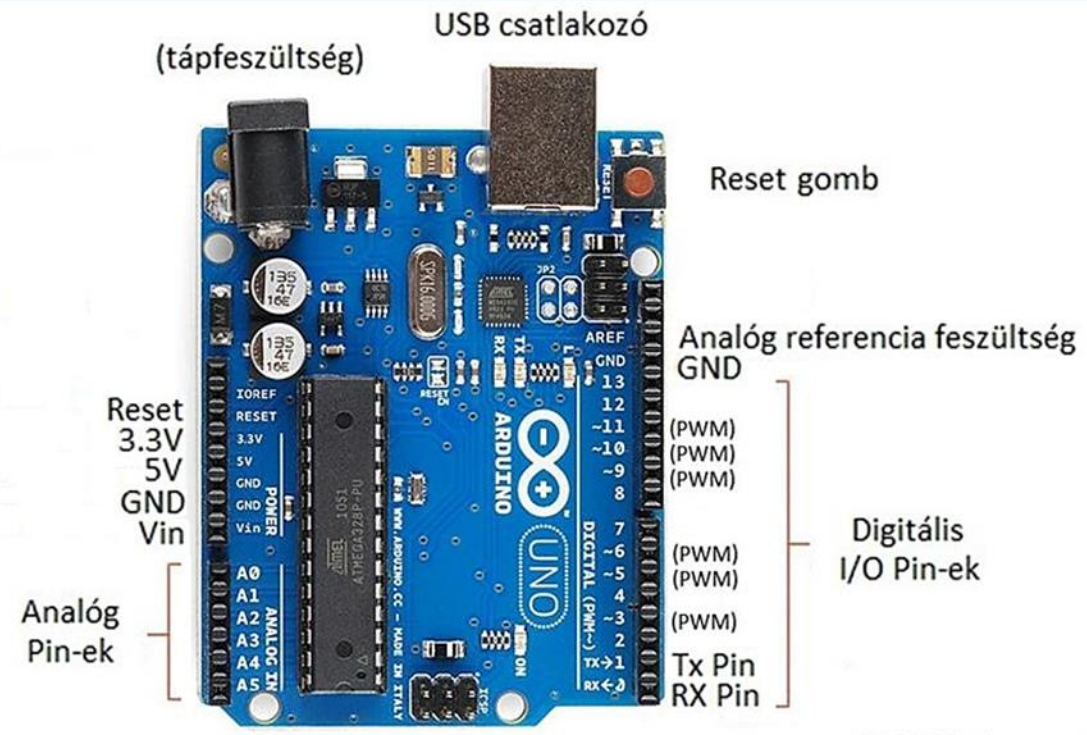
Székely Mikó Kollégium, Sepsiszentgyörgy
MTA-ELTE Fizika Tanítása Kutatócsoport



Témáink:

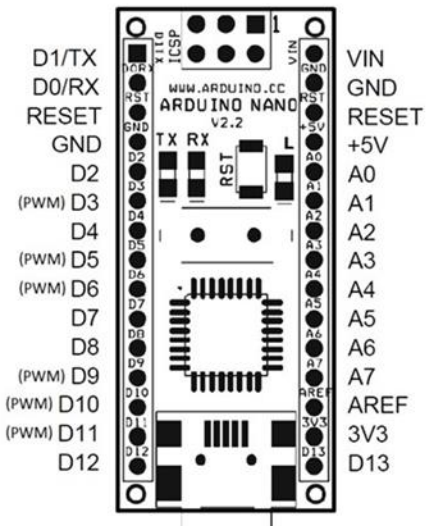
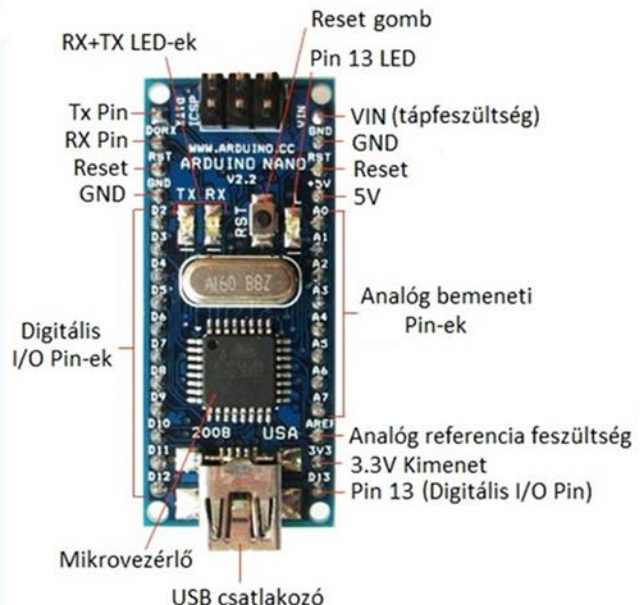
- Arduino - röviden
- CanSat- mini szatellit
- Elektromágneses hullámok
sebességének meghatározása méréssel
- Sumo robot
- Lego-robotok
- Versenyek - RoboChallenge; WRO;
RoboTec

Arduino UNO mikrokontroller

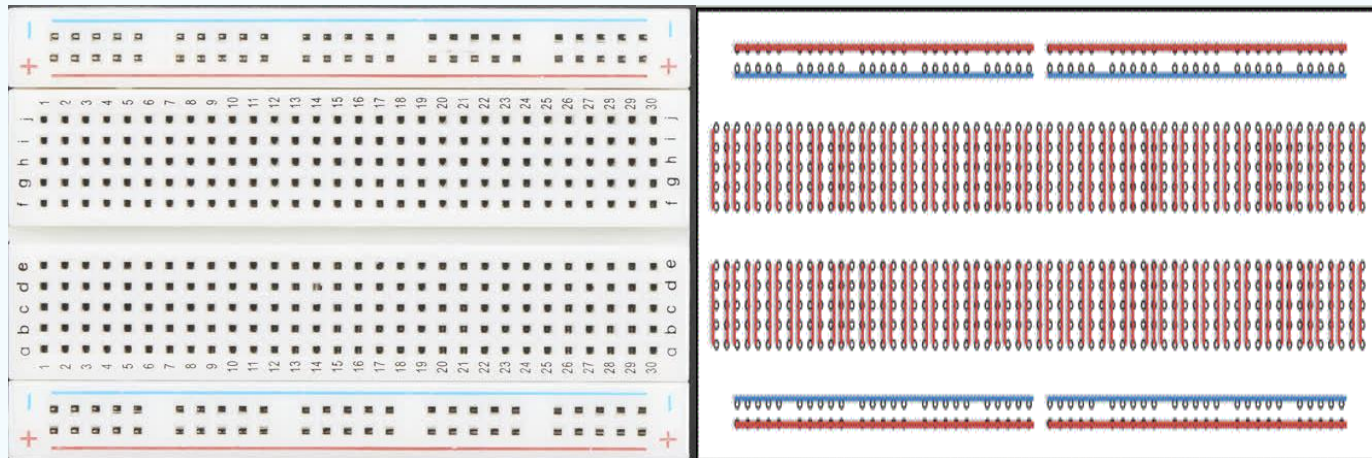


- Szabadforrású fejlesztői környezet;
- Atmel ATMEGA 328 mikrovezérlővel;
- C++ alapú programozási nyelv, saját könyvtár;

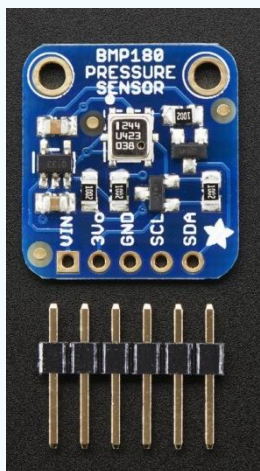
<http://arduino.cc/en/Main/Software>



Csatolható szenzorok, áramköri elemek



Áramköri tűzőlap, dugaszolós próbapanel



BMP180



DHT22



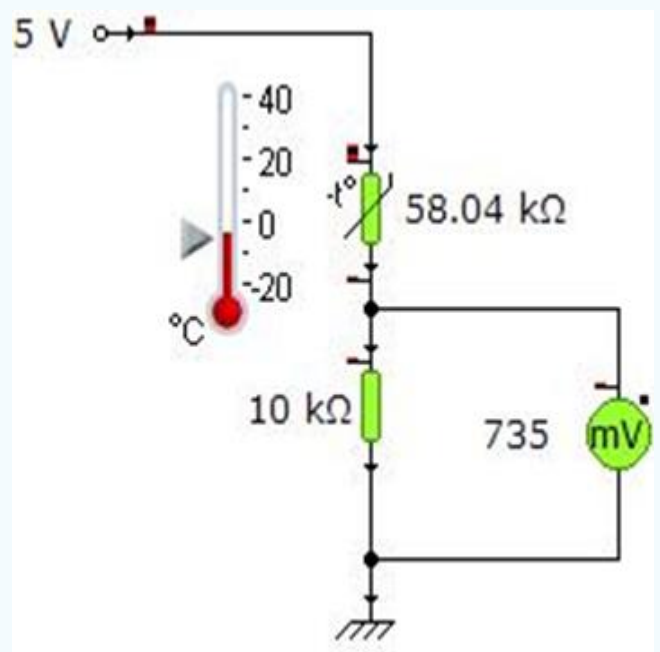
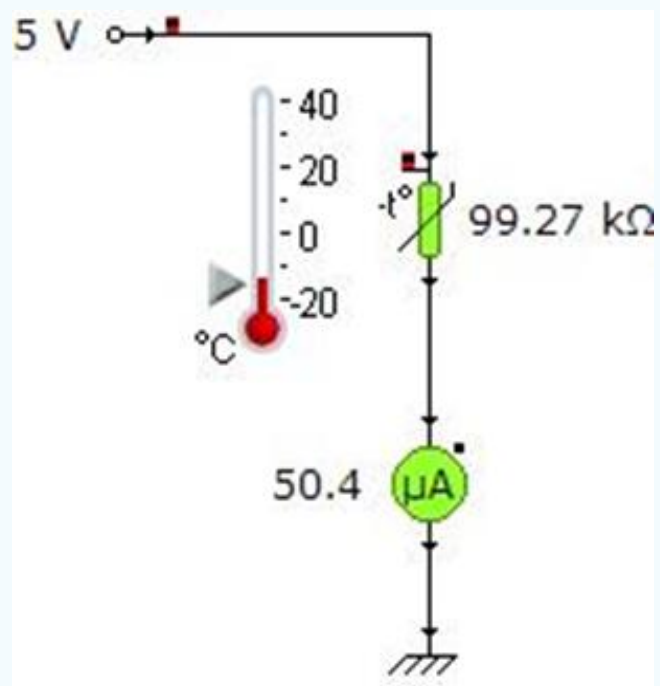
GPS_GP735



Motor

A hőmérsékletmérés elve:

- Ohm törvénye: $U = R * I$
- Az ellenállást a ampermérő adataiból kapjuk: $R = \frac{U}{I}$
- 1000Ω $t = 0^{\circ}C$
- 680Ω $t = -80^{\circ}C$
- Az ellenállást a voltmérő adataiból kapjuk meg:



Csatolható áramköri egységek

Shield- olyan elektronikus áramkörök, amelyek az Arduino egységekhez egyszerűen illeszthetők; ezekkel bővíthető a mikrokontroller feladatcsomagja. Pld.



WiFi Shield



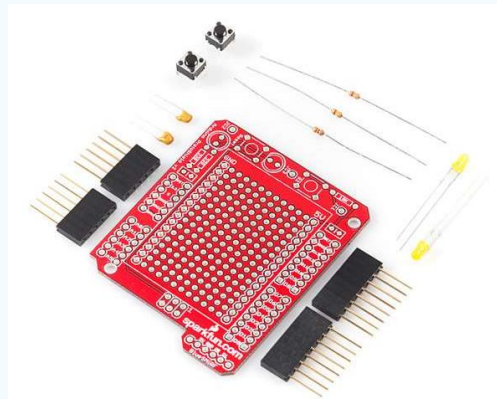
Ethernet Shield



LCD Shield



GSM-GPS Shield



Proto Shield



Motor driver

Az Arduino programozása

Arduino IDE egy kereszt-platformos Java nyelven írt fejlesztőkörnyezet;

"Wiring" nevezetű C/C++

programkönyvtárral,

-programok: C/C++ nyelven, amelyek

USB porton keresztül tölthetők fel a

kontrollerre;

A fejlesztői környezetbe beépített

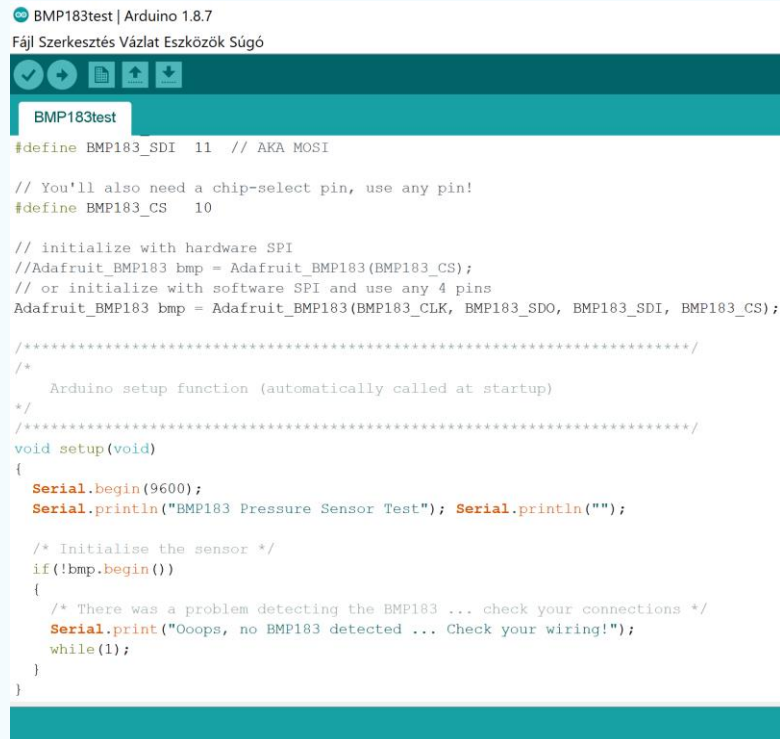
funkciók:

void setup (): a használt pin-ek, portok

és könyvtárak megadása; egyszeri;

void loop (): többször fut, kimeneti és

bemeneti változók a feladat szerint;



```
BMP183test | Arduino 1.8.7
Fájl Szerkesztés Vázlat Eszközök Súgó

BMP183test

#define BMP183_SDI 11 // AKA MOSI

// You'll also need a chip-select pin, use any pin!
#define BMP183_CS 10

// initialize with hardware SPI
//Adafruit_BMP183 bmp = Adafruit_BMP183(BMP183_CS);
// or initialize with software SPI and use any 4 pins
Adafruit_BMP183 bmp = Adafruit_BMP183(BMP183_CLK, BMP183_SDO, BMP183_SDI, BMP183_CS);

/*****
 */
/* Arduino setup function (automatically called at startup)
 */
/*****
void setup(void)
{
  Serial.begin(9600);
  Serial.println("BMP183 Pressure Sensor Test"); Serial.println("");

  /* Initialise the sensor */
  if(!bmp.begin())
  {
    /* There was a problem detecting the BMP183 ... check your connections */
    Serial.print("Oops, no BMP183 detected ... Check your wiring!");
    while(1);
  }
}
```

Kézikönyv_segédlet:

https://www.peschka.hu/userfiles/7/files/tavir_arduino_notebook.pdf

Mi a CanSat?



Egy 330ml –es üdítős dobozba zárt autonóm mérőegység, amely tudományos feladatok végrehajtására alkalmas.



Egy diákok által tervezett és megépített eszköz, amely modellezi a valódi műholdak mozgását, működését.



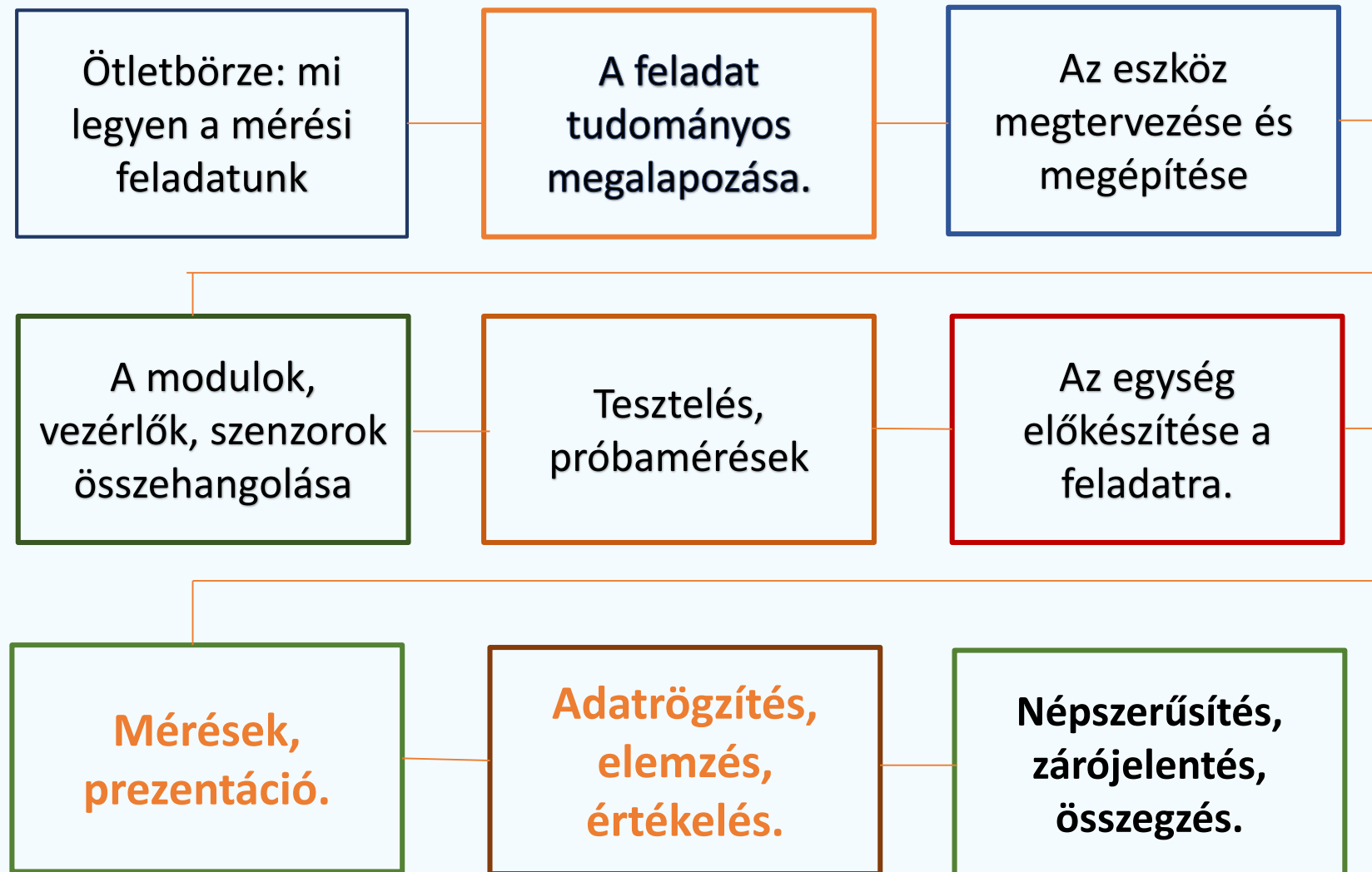
ESA



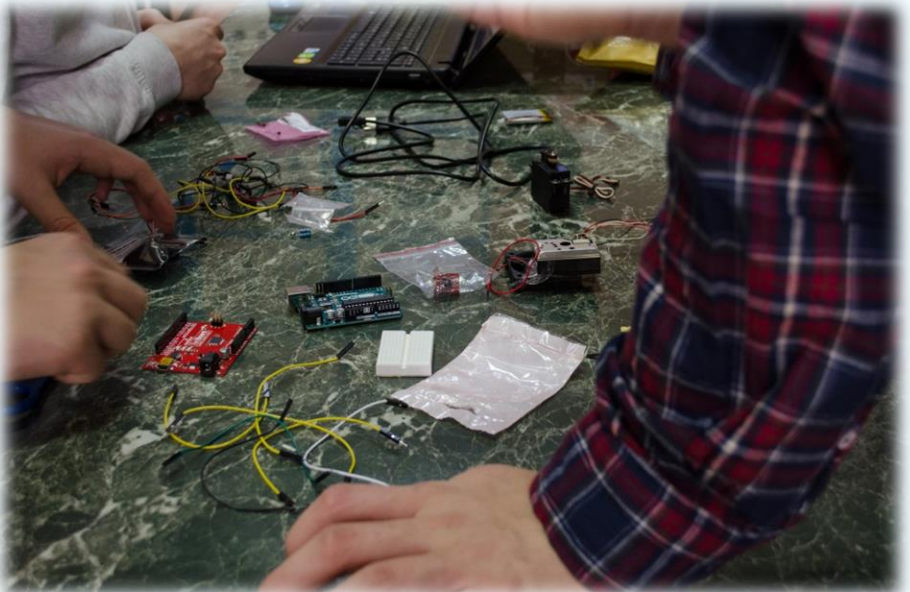
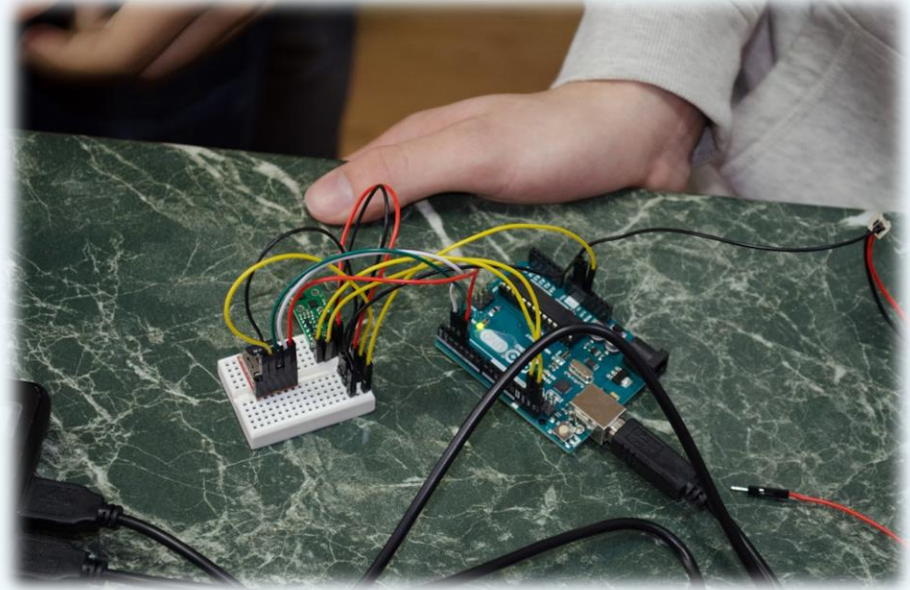
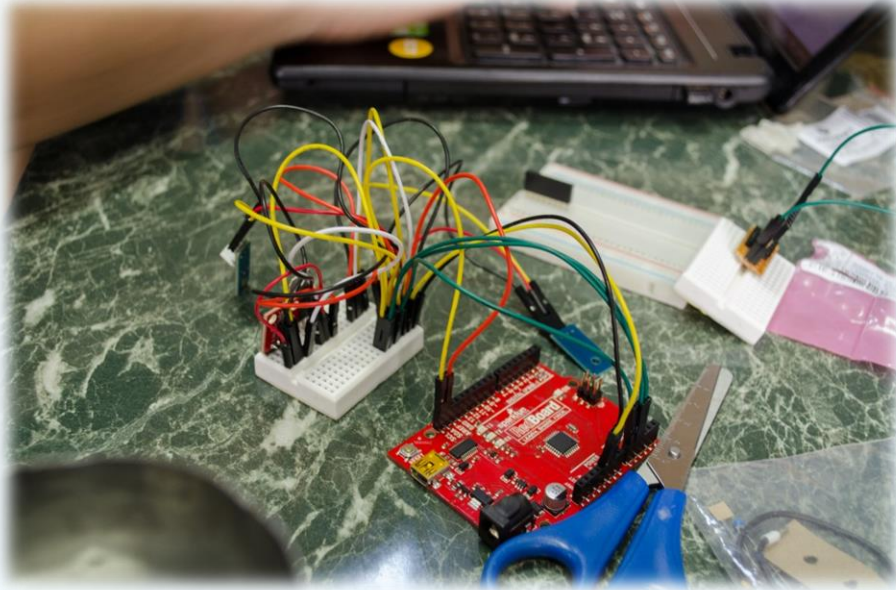
Kreatív, innovatív tanulási lehetőség. Érdekes, csapatépítő, ötletes műhelymunka.

A CanSat program célja:

- a CanSat műholdegység megépítése
- a mérőegység tervszerinti működése a fellövés alatt és kilövés után is (áramforrás, a szenzorok bekapcsolnak, adatátvitel megkezdődik)
- az ejtőernyő hatékony nyílása, működése
- esési sebesség (8-8,1)m/s
- valós légköri adatok rögzítése a különböző magasságokban (elvárt és mért adatok között ne legyen nagy különbség)
- sikeres földet érés, az egység működik landolás után is;
- hatékony rádiókommunikáció és adatátvitel
- a mért adatok rögzítése, feldolgozása, értékelése;



Ötletbörze



Felépítés

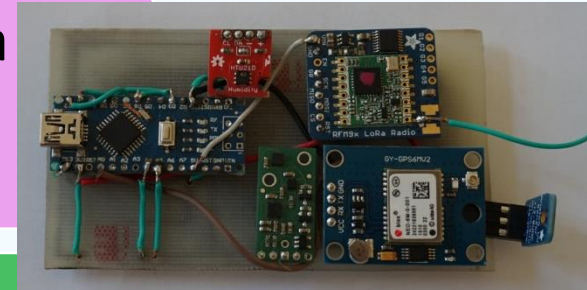
- Külső burkolat;
- Ejtőernyő;
- Tartószerkezeti elemek,



Mechanika

- Szenzorok;
- Áramforrás;
- Kapcsolók;
- Adó;
- Adatgyűjtés,

Elektronika

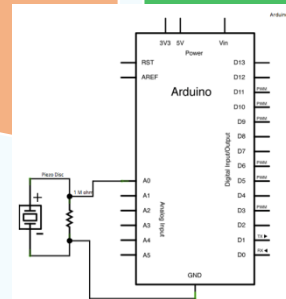


- Antenna
- Földi vevőegység
- Adatátvitel, adattárolás, feldolgozás

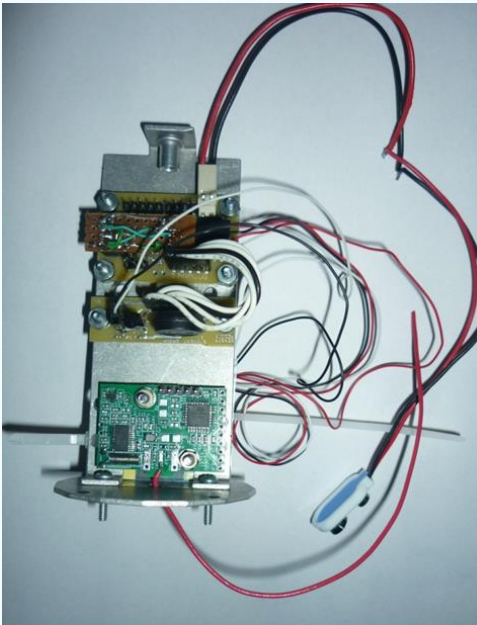
Kommunikáció

Vezérlés

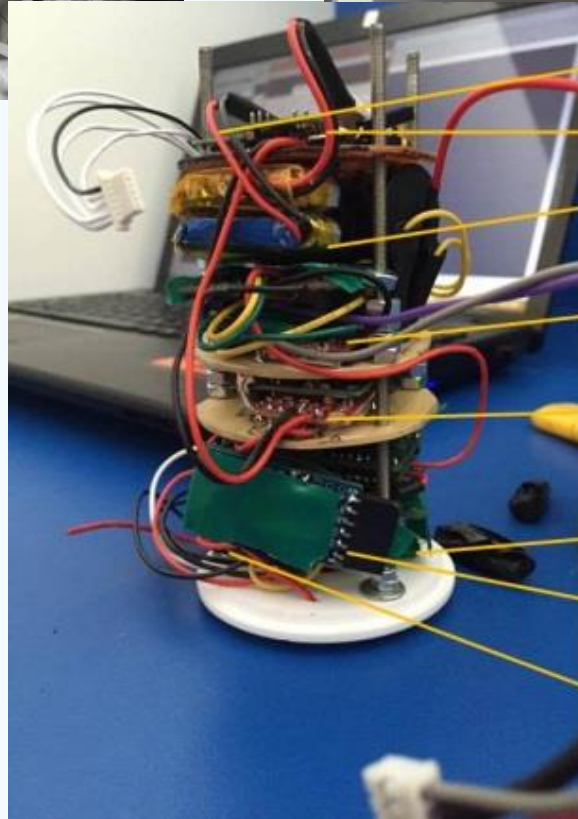
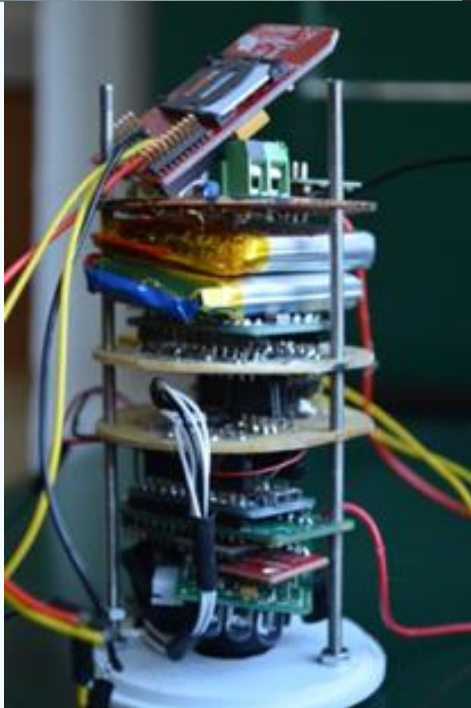
- Mikrontroller (Arduino)
- Vezérlőprogramok;
- Adatfeldolgozás,



2012



2016



UV szenzor

GPS GP735T egység;
RFM69H adóegység

GSM egység és LIPO akku

OPENlog, Reduino Core mikrovezérlő

ALTIMU10V4 szenzor; órajel
egység DS1307

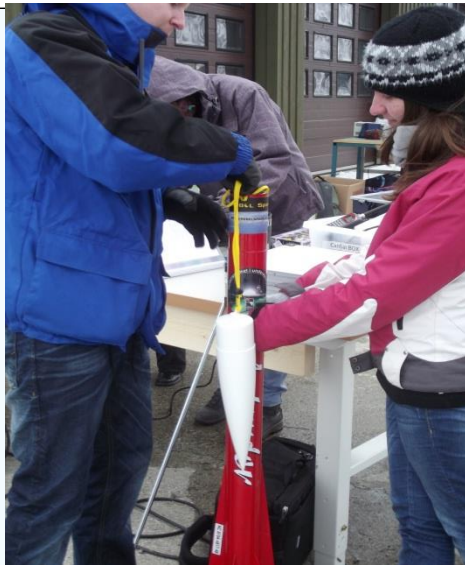
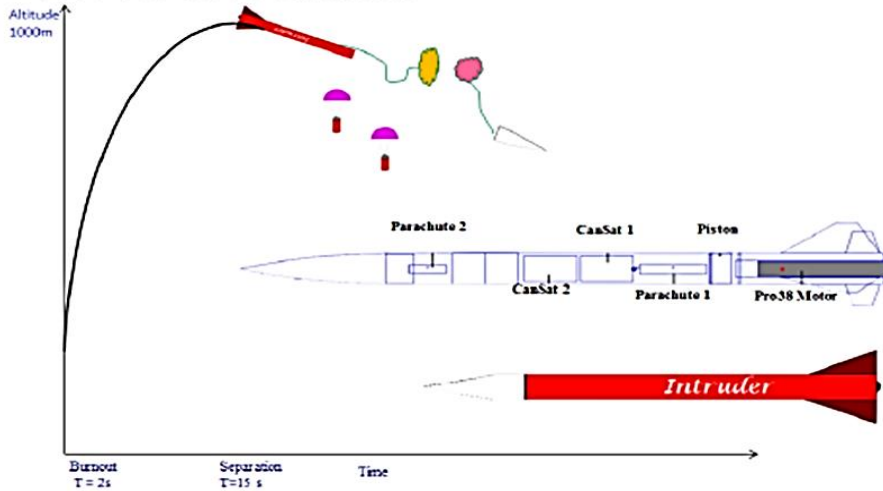
CMOS Kamera

HTU21D hőmérséklet,
páratartalom szenzor

Piezo - ütés szenzor

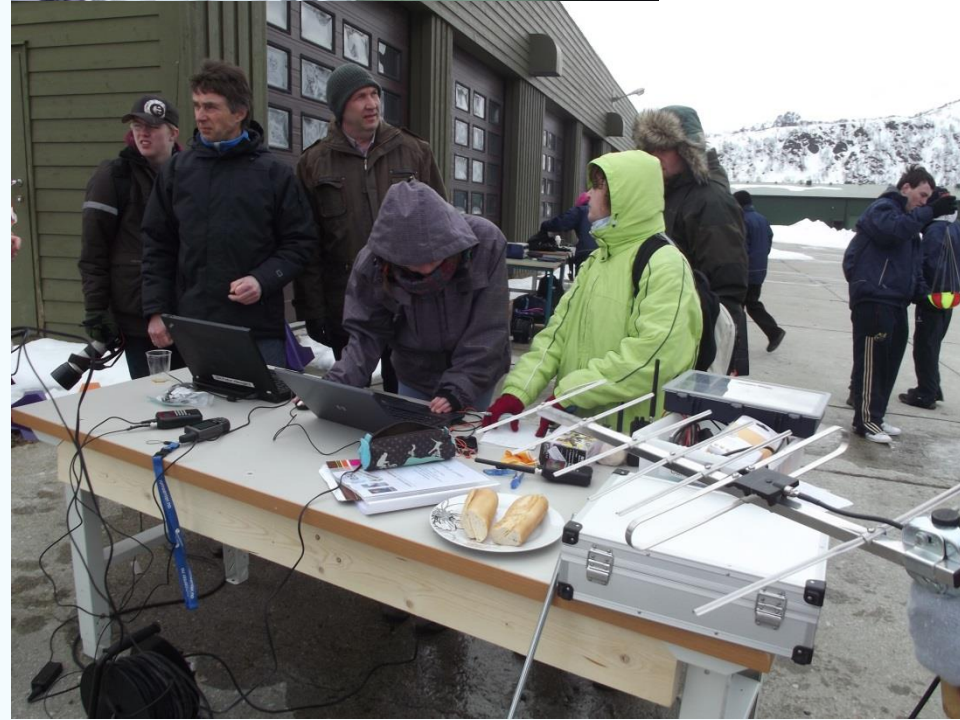
Az **INTRUDER** rakéta adatai (ez emeli 1km magasra a mérőegységet): gyorsulás 11g, sebesség: 550km/h, tömeg 3kg, hosszúság: 1,5m, kilökési nyomás 40atm.

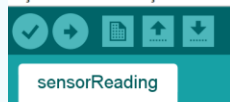
The Rocket Launch



2012 Andoya
Rocket Range,
Norvégia

2o12 Andoya Rocket Range, a „Bolyai” csapat





sensorReading

```

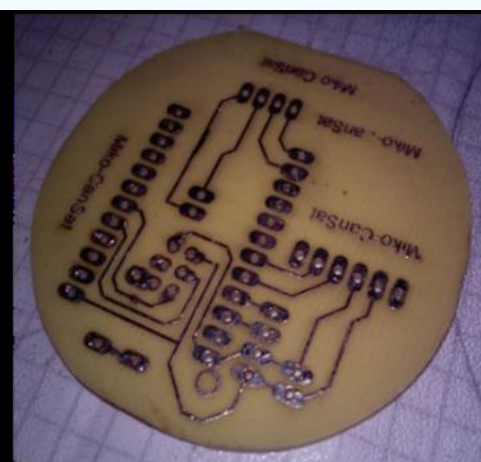
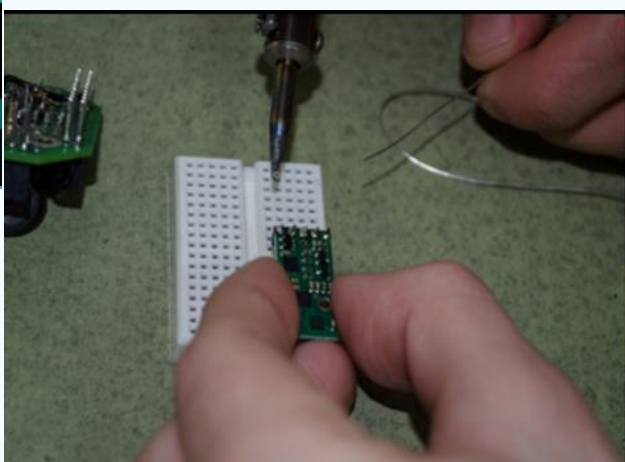
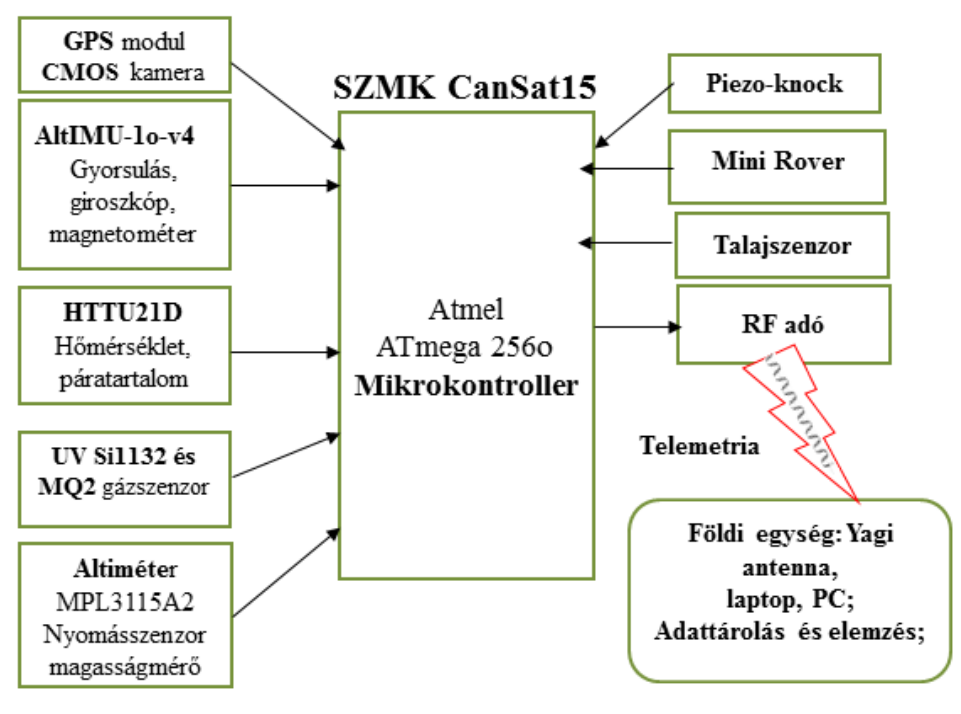
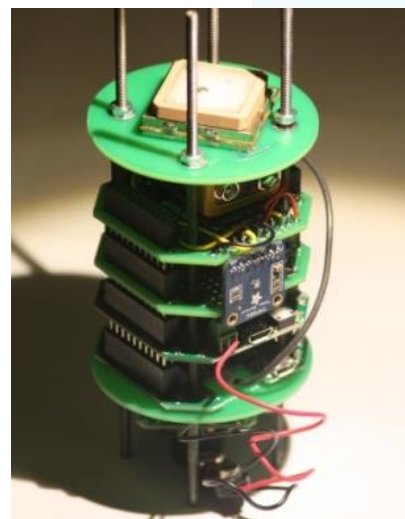
void loop() {

  // Serial.print(analogRead(A4));
  float pressure=readPressure();
  float LM35temp = readTempLM35();
  float NTCtemp=readTempNTC();

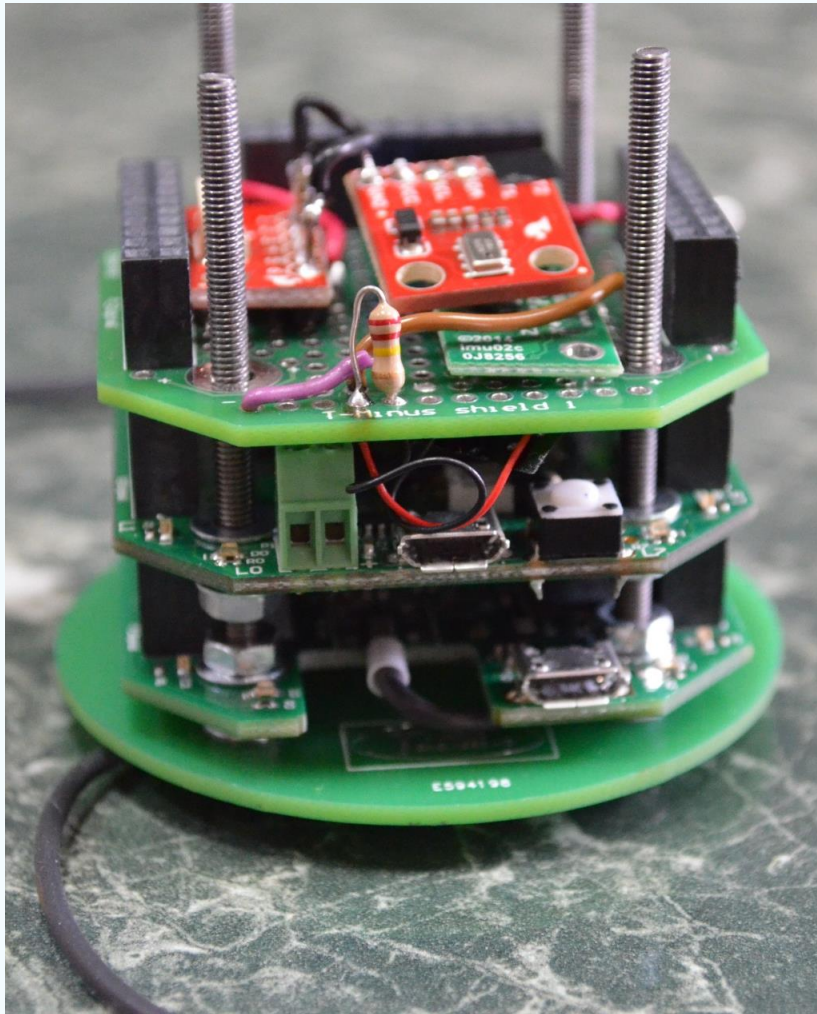
  Serial.print(pkId);
  Serial.print(", ");
  Serial.print(pressure);
  Serial.print(", ");
  Serial.print(LM35temp);
  Serial.print(", ");
  Serial.print(NTCtemp);
  Serial.println();

  Serial1.print("iovanalex, ");
  Serial1.print(pkId);
  Serial1.print(", ");
  Serial1.print(pressure);
  Serial1.print(", ");
  Serial1.print(LM35temp);
  Serial1.print(", ");
  Serial1.print(NTCtemp);
  Serial1.println();
}

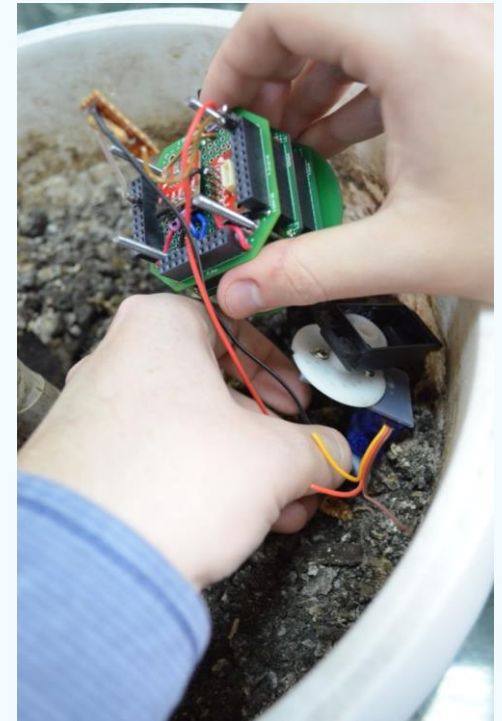
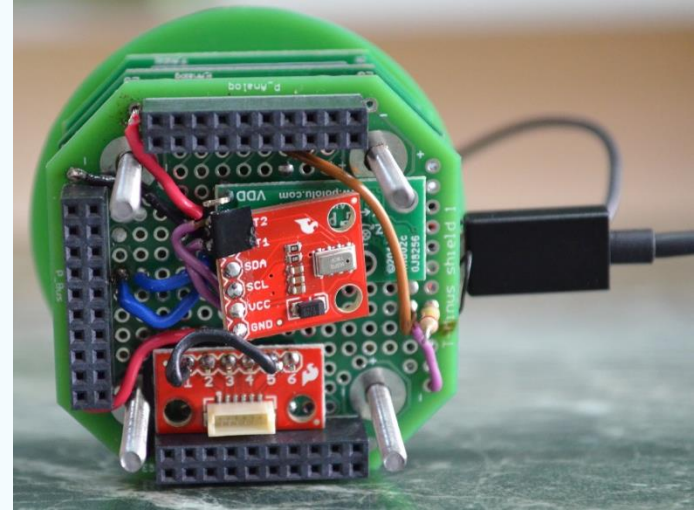
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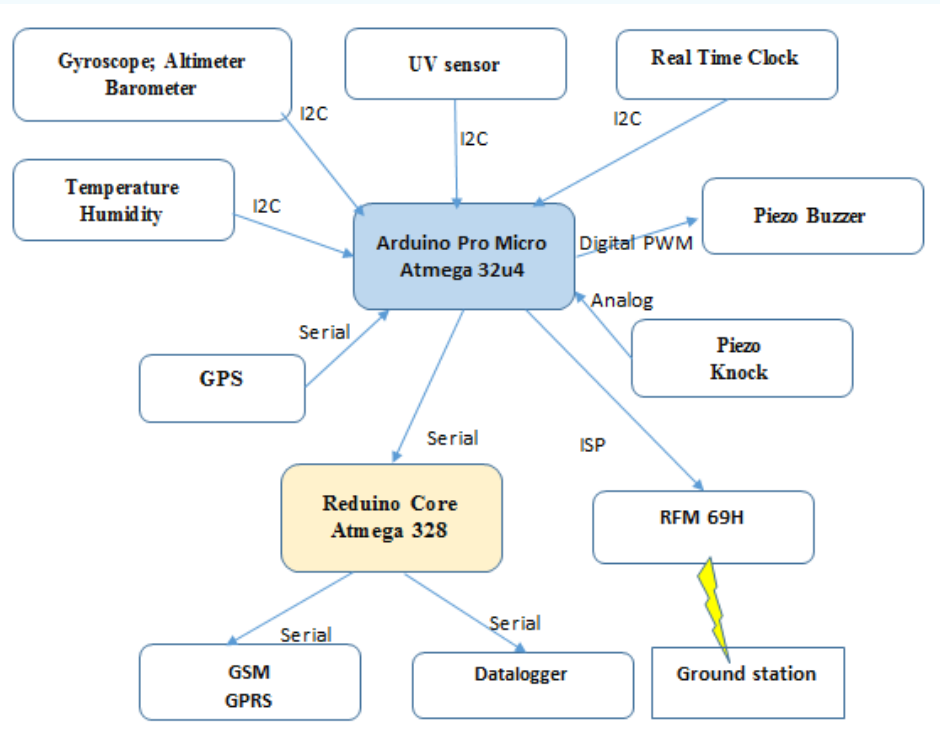


CanSat15

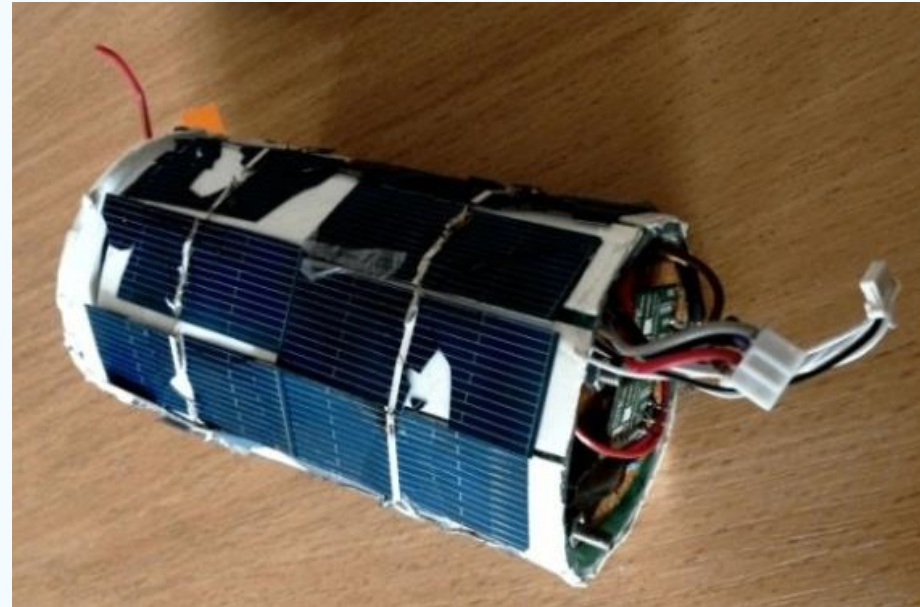
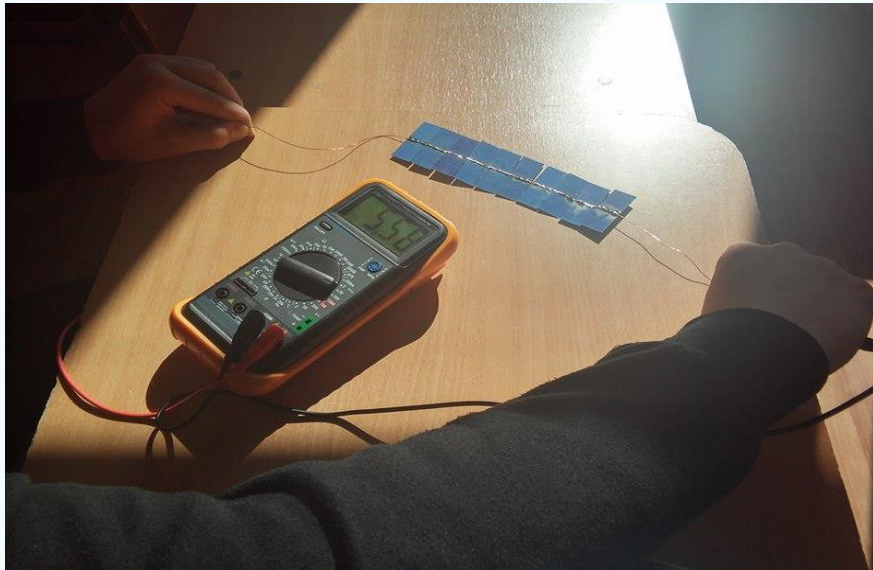
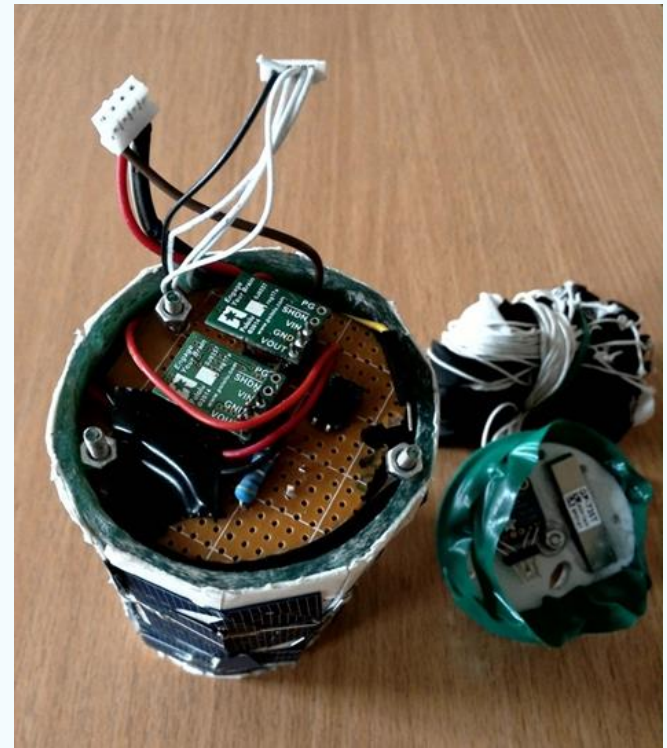


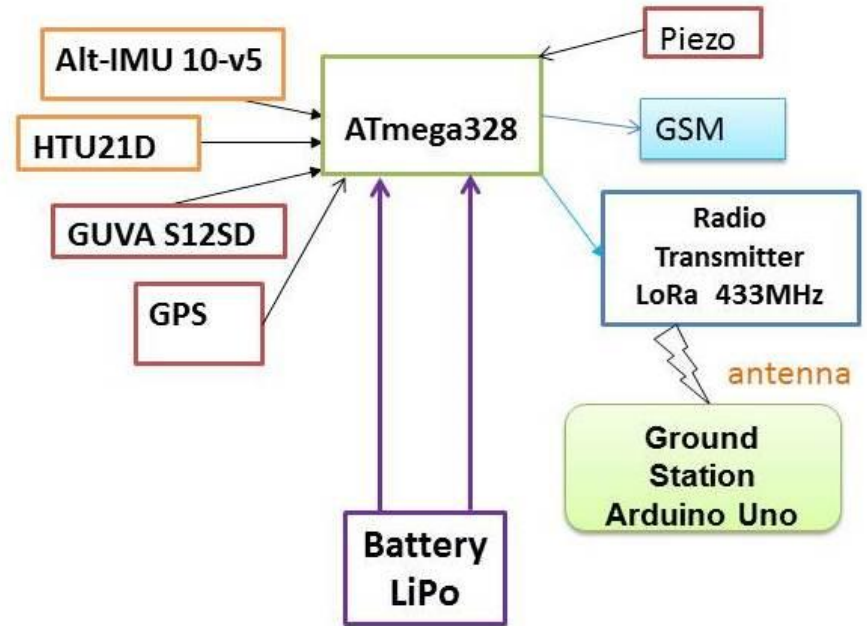
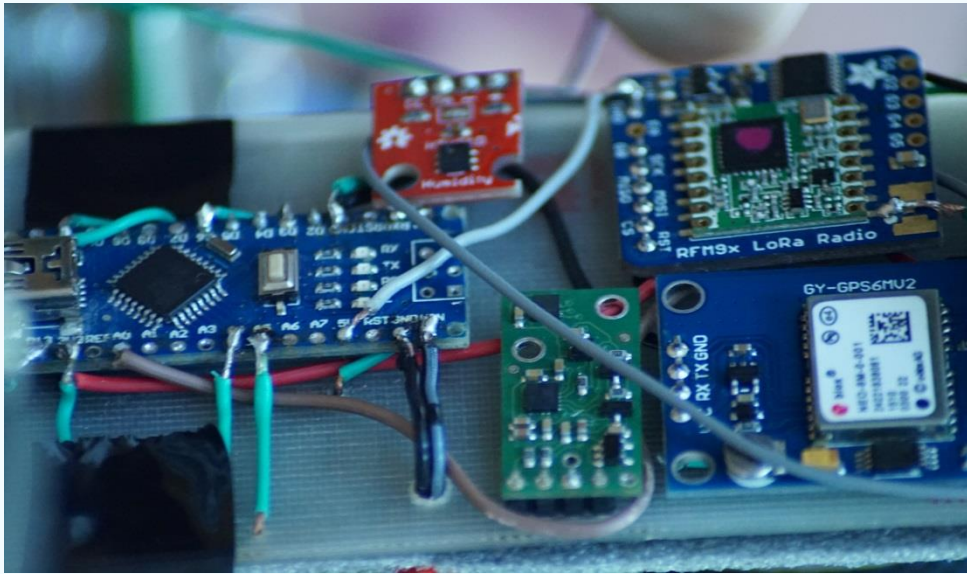
szenzorok:
nyomás;
hőmérséklet;
Magasság:
MPL3115A2;
Relatív
páratartalom
HTU21D;
LSM303D
magnetometer;
UV index,
MQ-2 gázok ;
gyorsulás;
giroszkóp;
GPS és CMOS
kamera;
Talajnedvesség,
Piezo knock



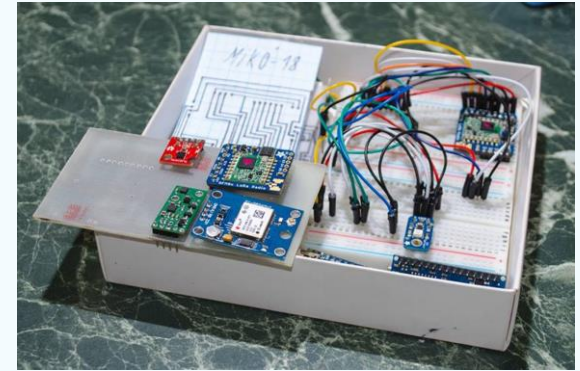


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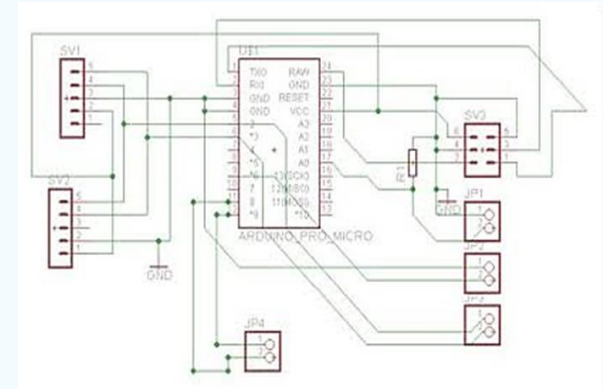
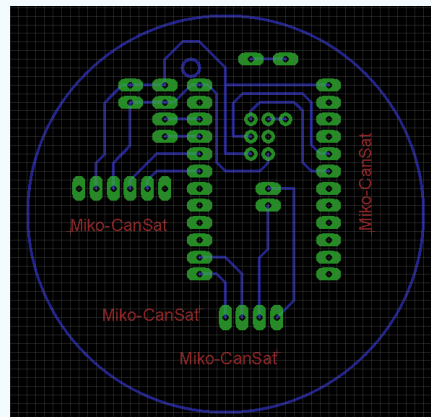
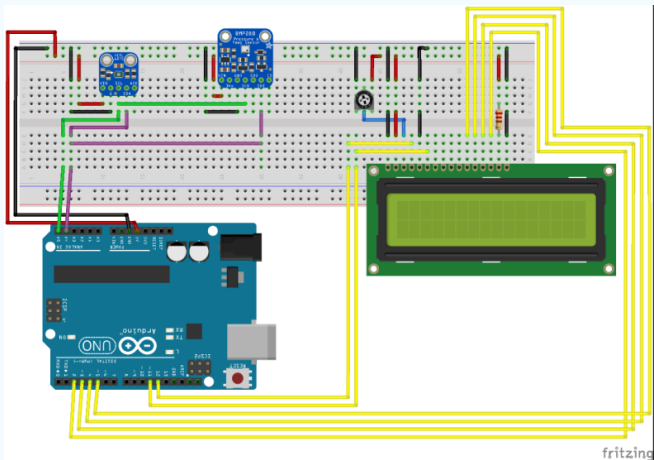
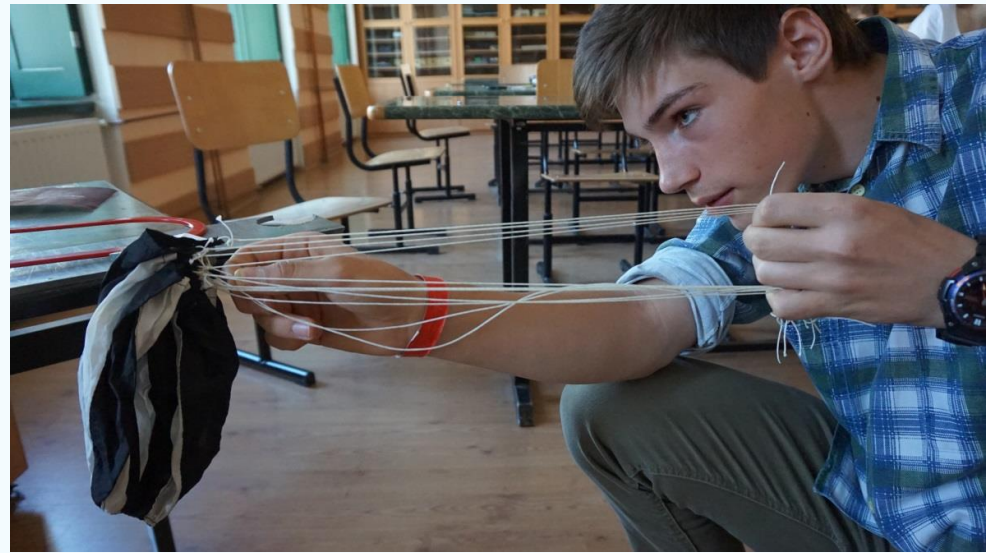
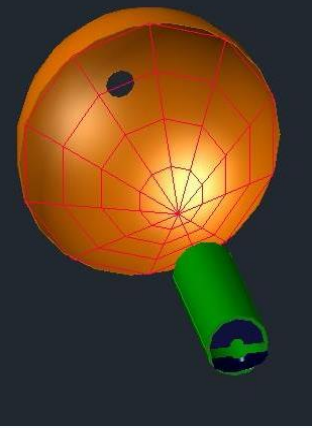




Tervezés - építés



Tervezés - építés



Ejtőernyő teszt

Tracker

File Edit Video Track Coordinate System View Help

calibration stick A length 2.500 angle from x-axis 86.1°

memory in use: 48MB of 247MB

Track Control

mass A

Plot mass A

mass A (t, v_y)

t	x	y
0	11.083	1.706
0.033	10.999	1.748
0.067	11.041	1.748
0.1	11.041	1.663
0.133	11.083	1.621
0.167	11.126	1.536
0.2	11.126	1.494
0.234	11.126	1.41
0.267	11.126	1.325
0.3	11.168	1.198
0.334	11.21	1.071
0.367	11.21	1.071
0.4	11.168	0.987
0.434	11.168	0.86

calibration stick A selected (set length to change scale, set angle to change tilt)

233 100%

Untitled4.mp4



Tracker

File Edit Video Track Coordinate System View Help

mass B m 1.000 step 65: x 10.73 y -5.214 r 11.93 theta -25.9°

memory in use: 55MB of 247MB

Track Control

mass A model A mass B

adatfeldolgozás

Plot mass B

mass B (t, y)

t	x	y
2.102	10.65	-4.873
2.135	10.65	-5.025
2.169	10.726	-5.214
2.202	10.726	-5.366
2.236	10.726	-5.479
2.269	10.764	-5.669
2.302	10.84	-5.707
2.336	10.84	-5.972
2.369	10.84	-6.085
2.402	10.953	-6.313
2.436	11.029	-6.426
2.469	11.029	-6.54
2.502	11.105	-6.729
2.536	11.294	-7.032

t=2.17 y=-5.21

x=10.73 y=-5.21

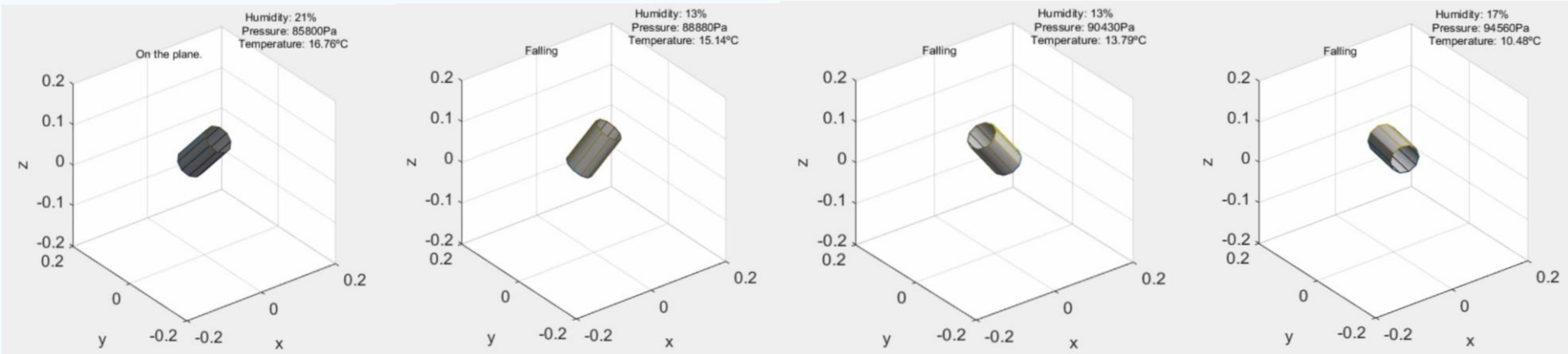
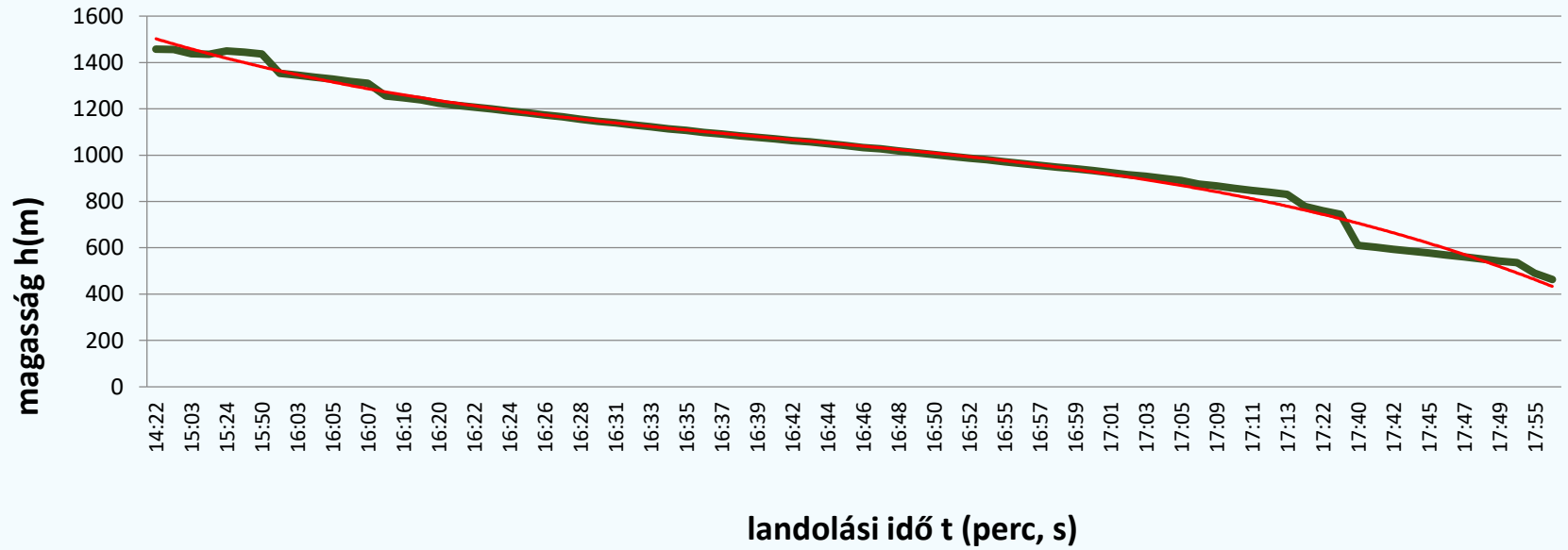
mass B position selected (drag or enter position on toolbar)

301 100%

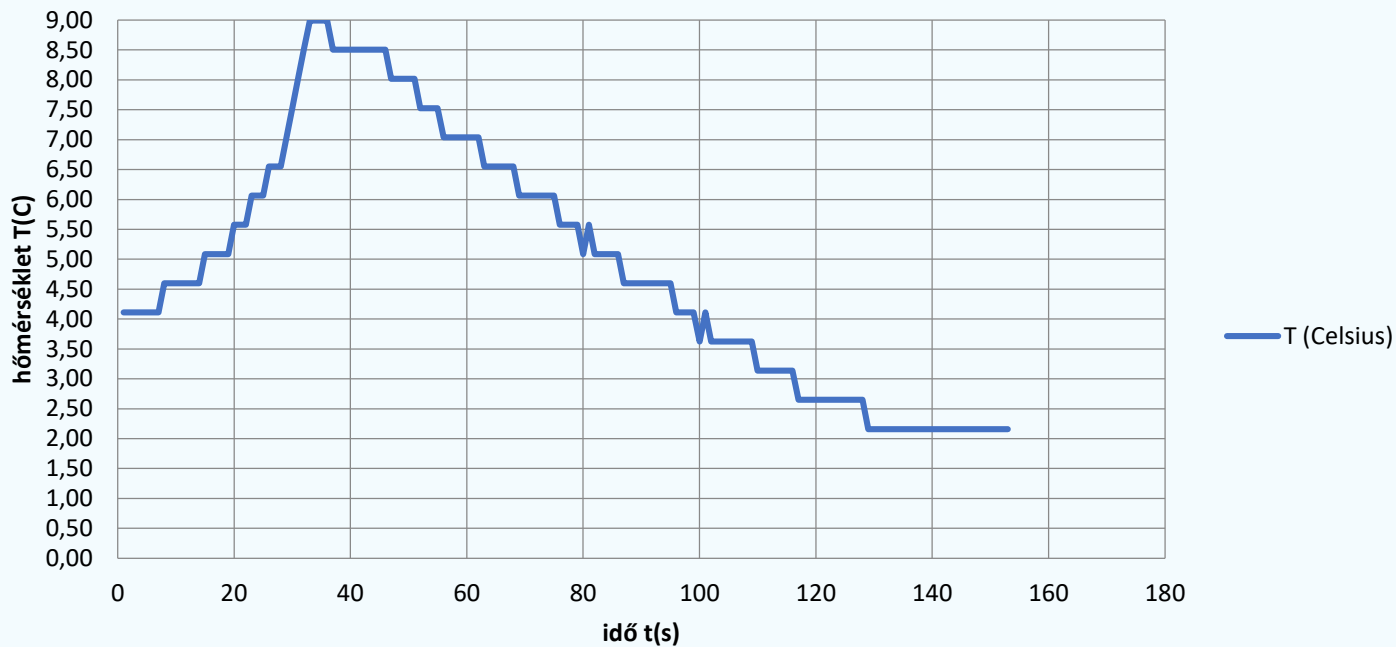
Untitled.trk

Adatfeldolgozás

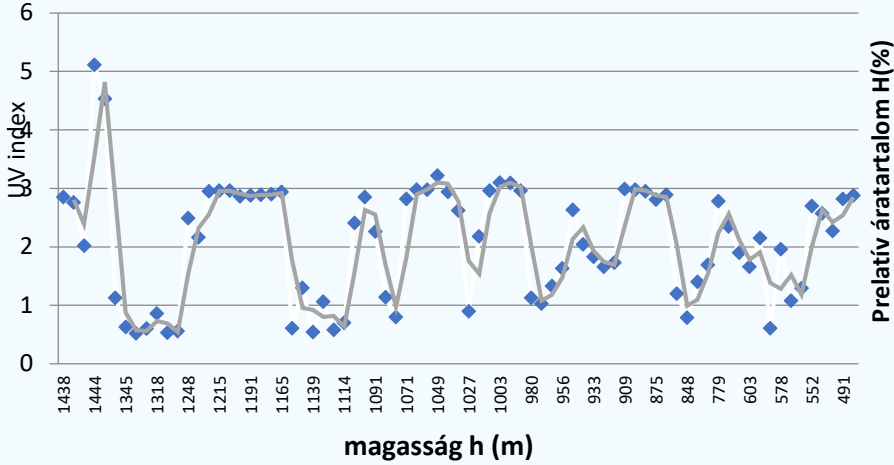
A Cansat landolási útja



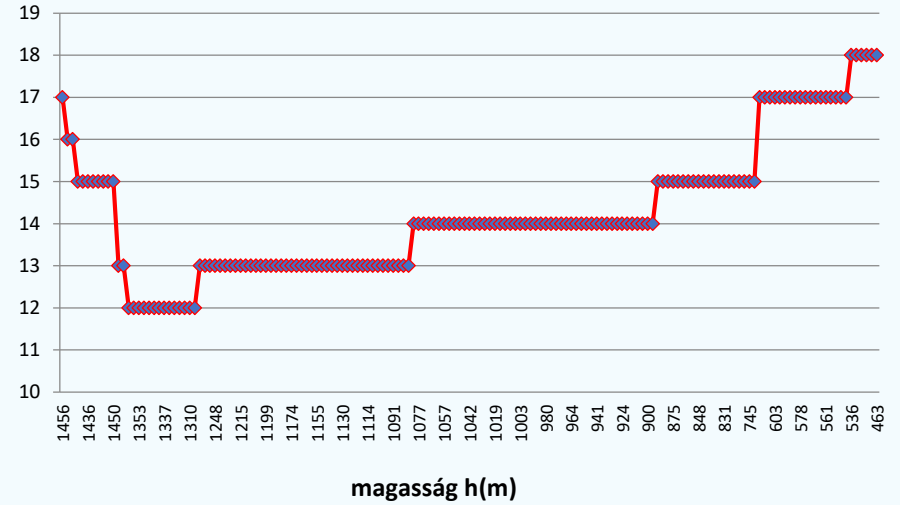
A hőmérséklet változása az egység emelkedése és esése alatt



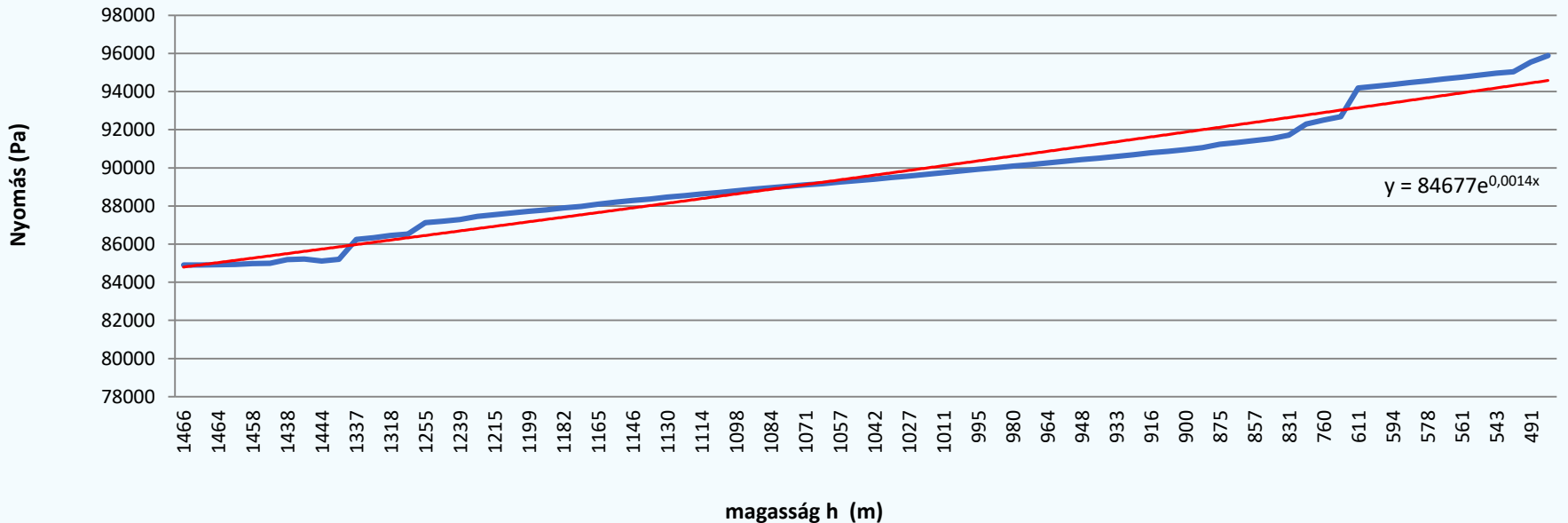
UV index



Relatív páratartalom H(%)



A nyomás változása a magasság függvényében





Az új mini-szatellitünk

Most repülővel indítják az
egységeket...



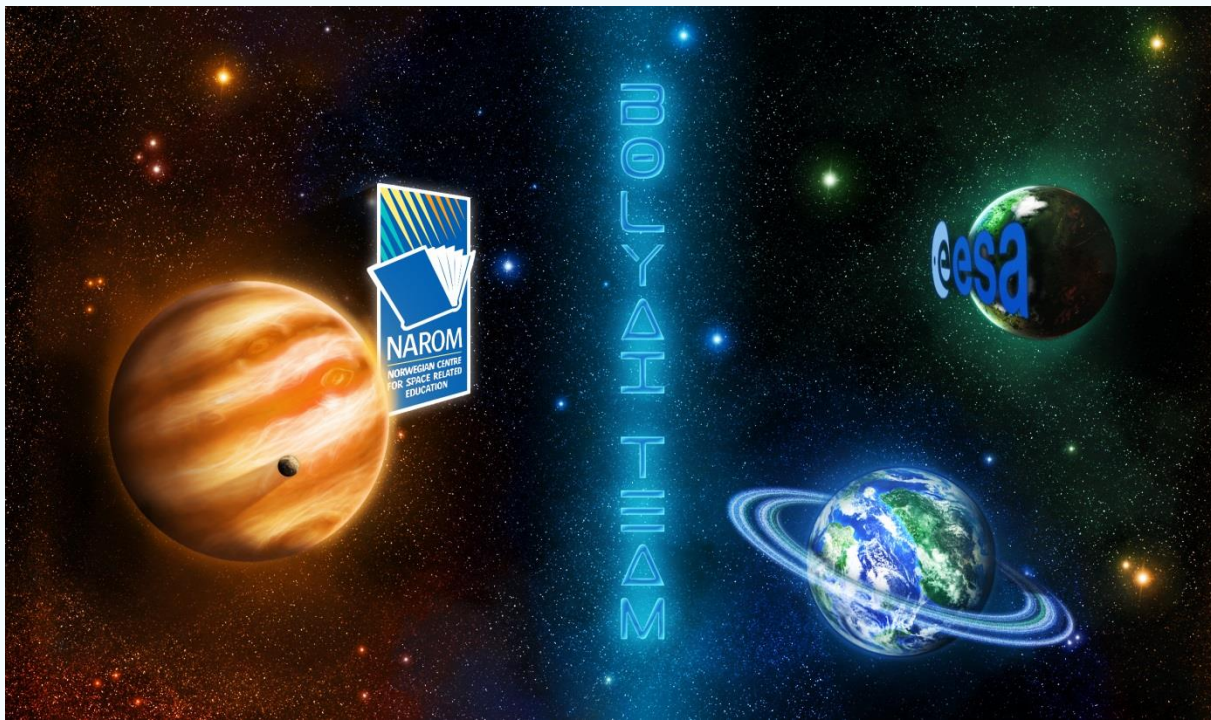
CanSat 2018

A Mikó18 csapat, akik II. díjat nyertek

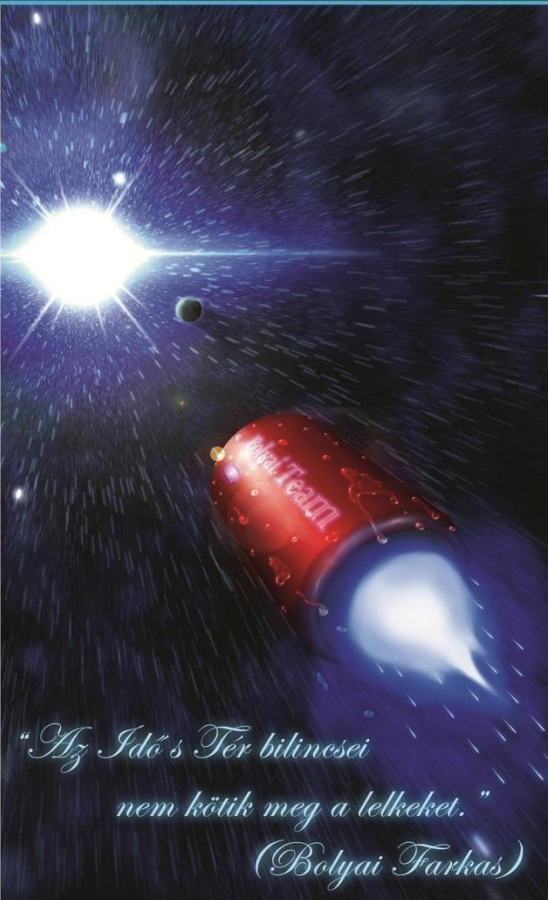


„Frekvenciára” hangolva...





- gnome DESIGN & IT SOLUTIONS
- ROTARIUS MEGHEORGHE
- Sepsiszentgyörgy Megyei Jogú Város Tanácsa
- BERTIS
- AQUARIS DISTRIBUTION
- MOBLUK KFT
- HELP Szemerjai és központi lelkesítő hivatalok
- Mingelo Jolo Köntés
- Háromszék
- Slager Radio
- krónika
- Hirmondó
- OBSERVATORUL
- IK



*"Az Idő s Tér bilincsei nem kötik meg a lelkeket."
(Bolyai Farkas)*

2012

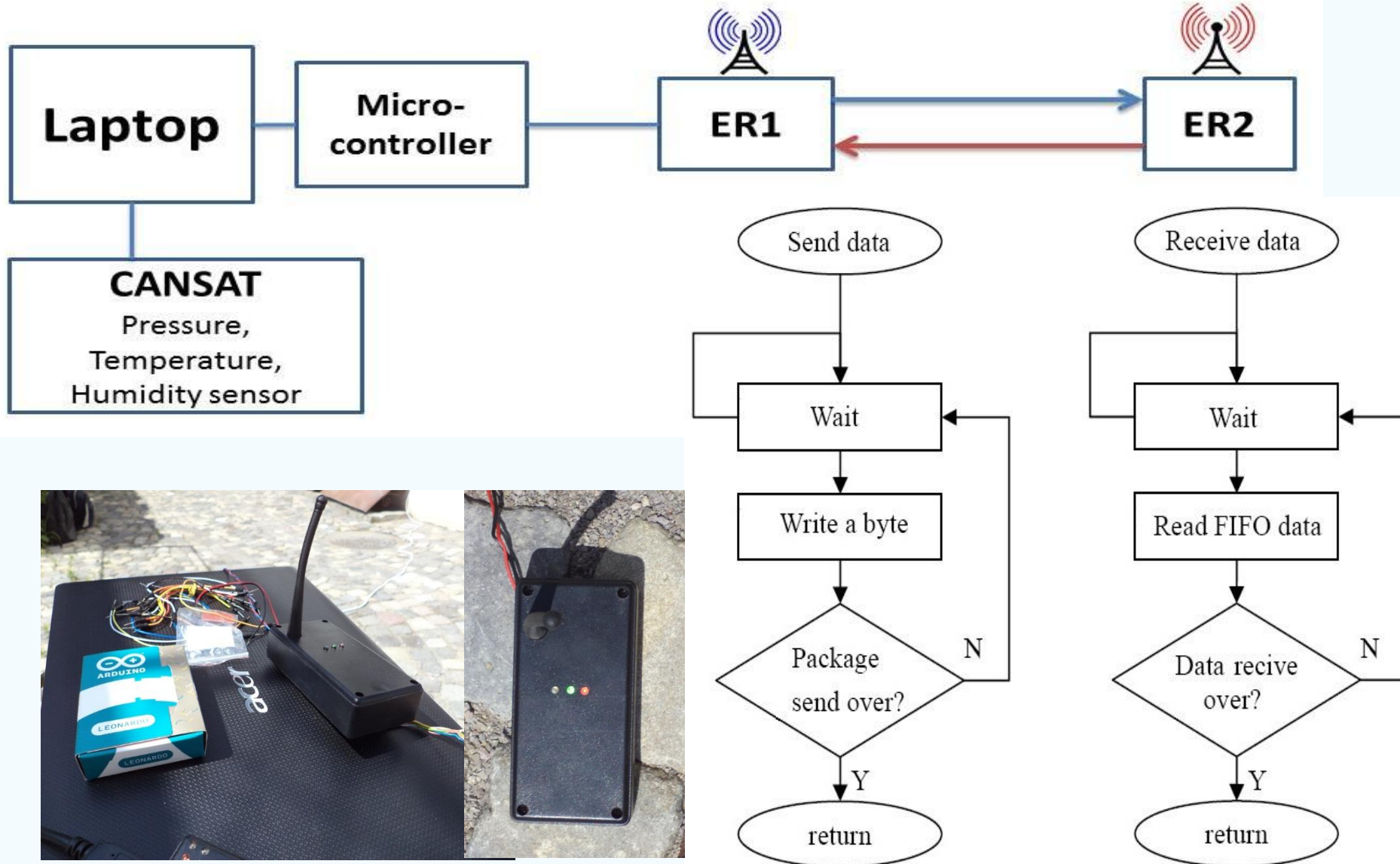


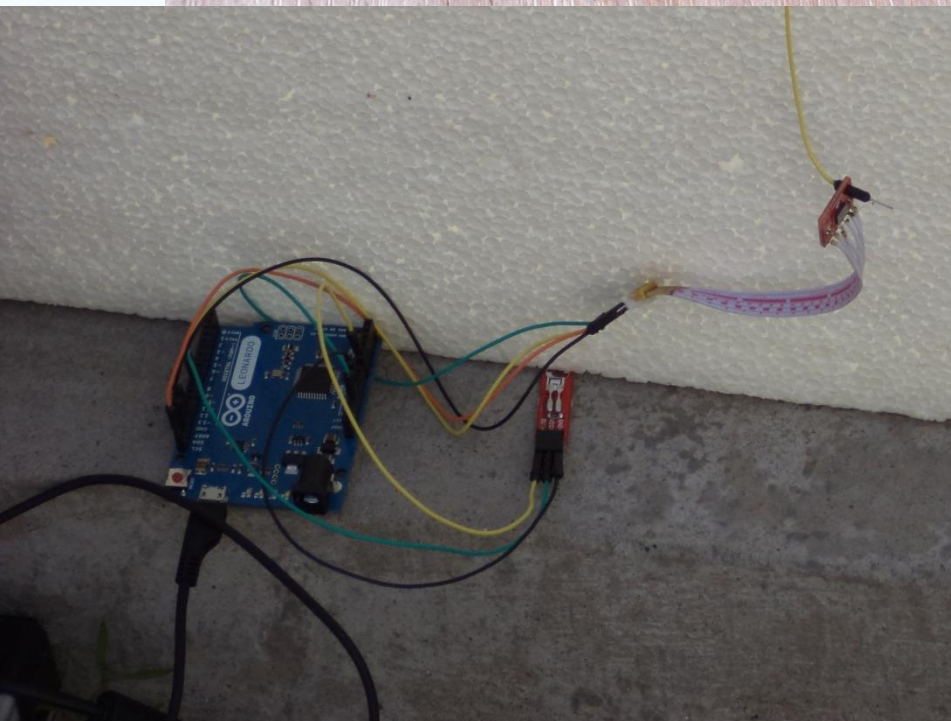
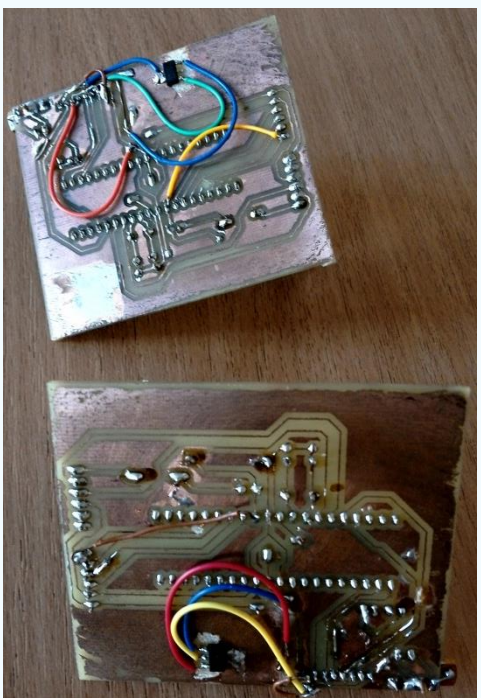
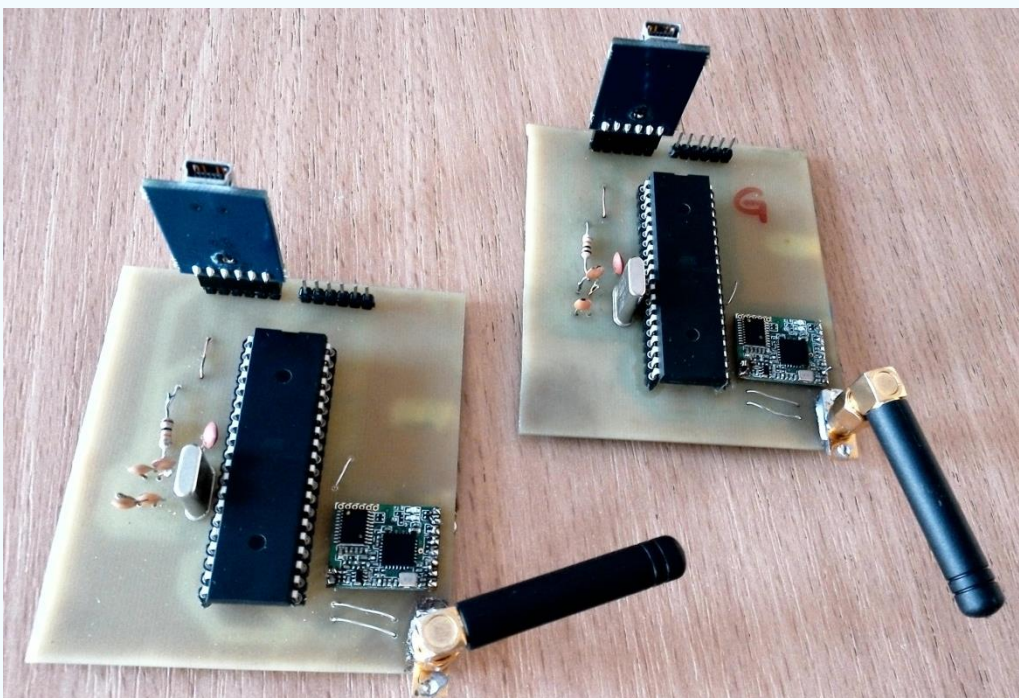
2016

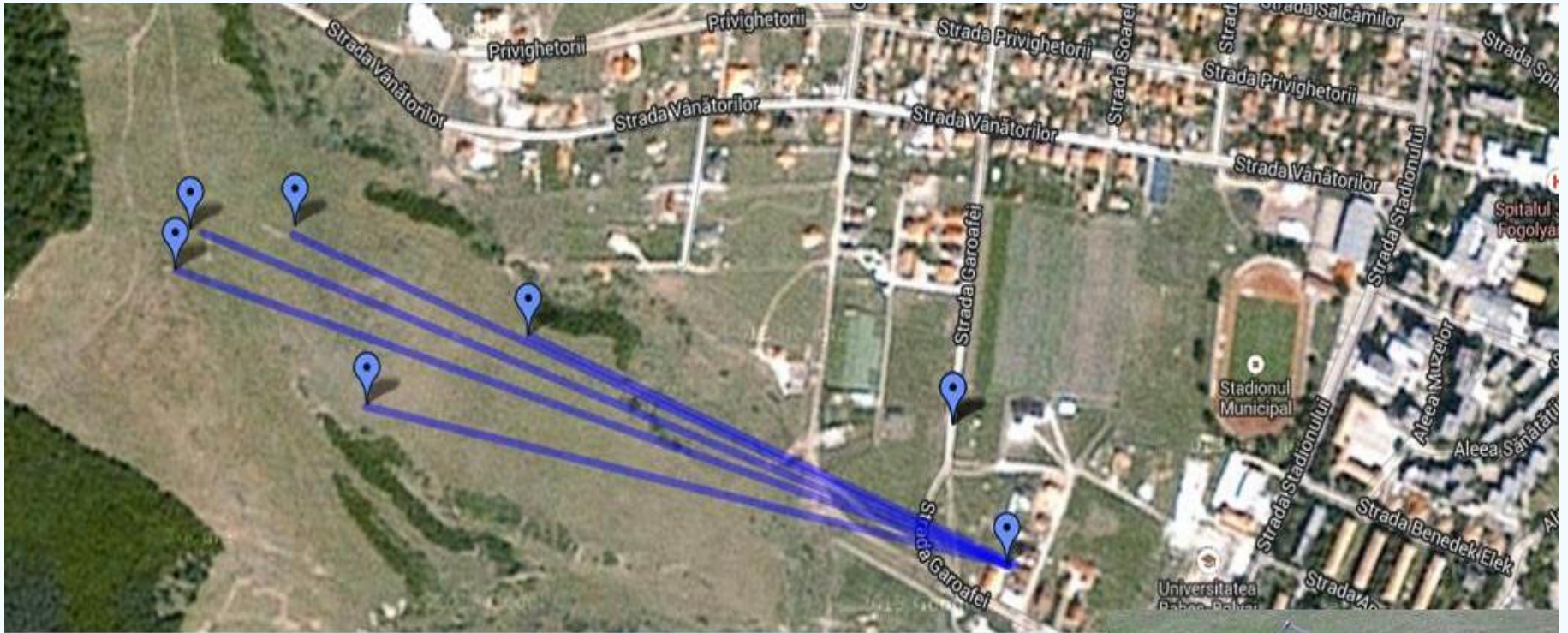
MIKÓ-CANSAT TEAM
2016 SEPSISZENTGYÖRGY
SEPSISZENTGYÖRGY



Az elektromágneses sugárzás sebességének meghatározása

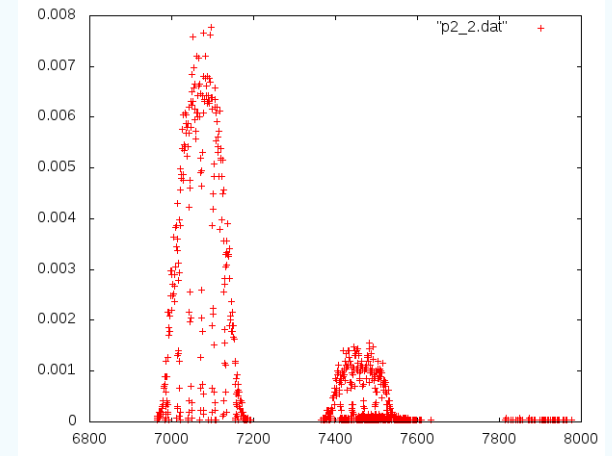
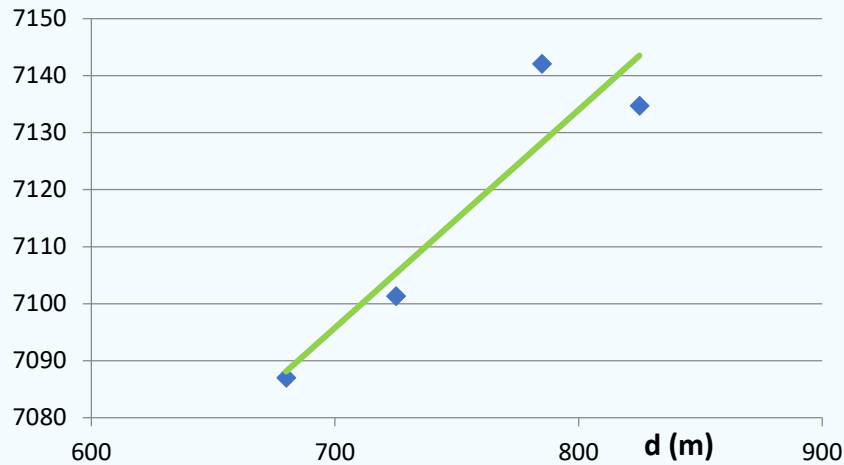






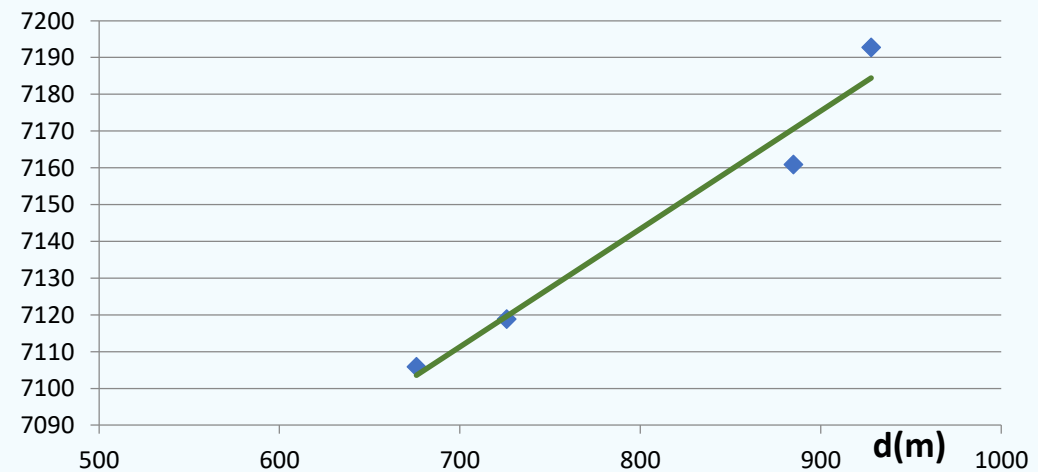
a	0,321058	0,31883	0,3508146	average
c (10⁸ m/s)	3,114702	3,13644	2,8505086	3,033882
a (day2)	0,38215	0,368516	0,329877	average
c(10⁸ m/s)	2,616776	2,713584	3,031431	2,787264

Day2 time (μs)

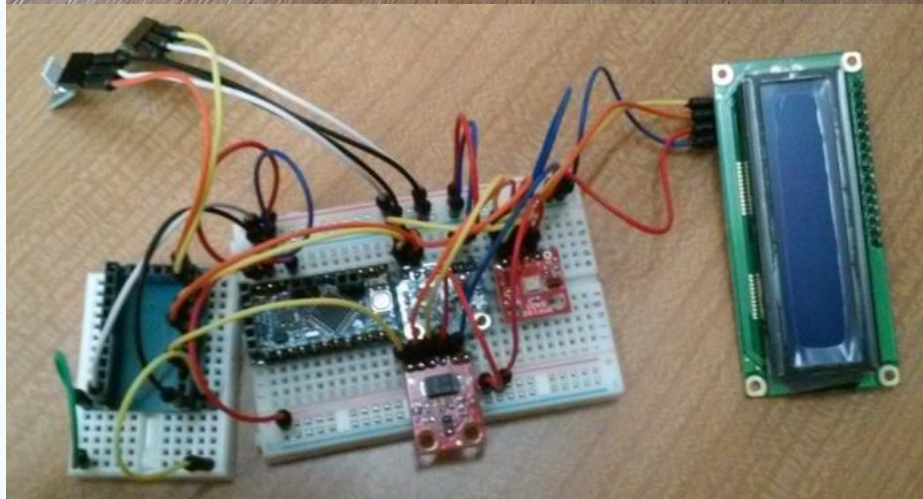
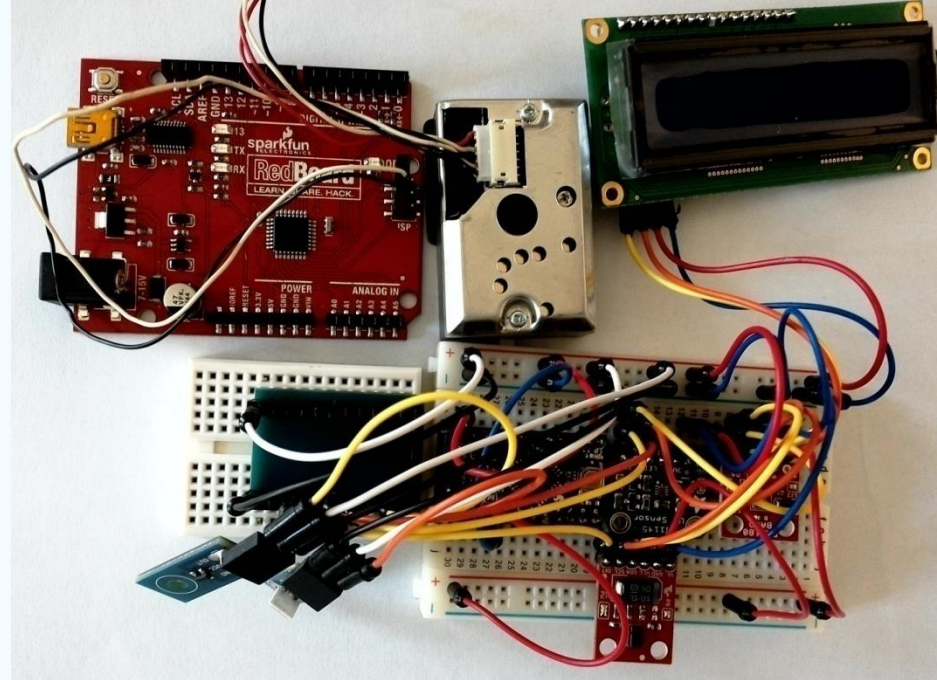
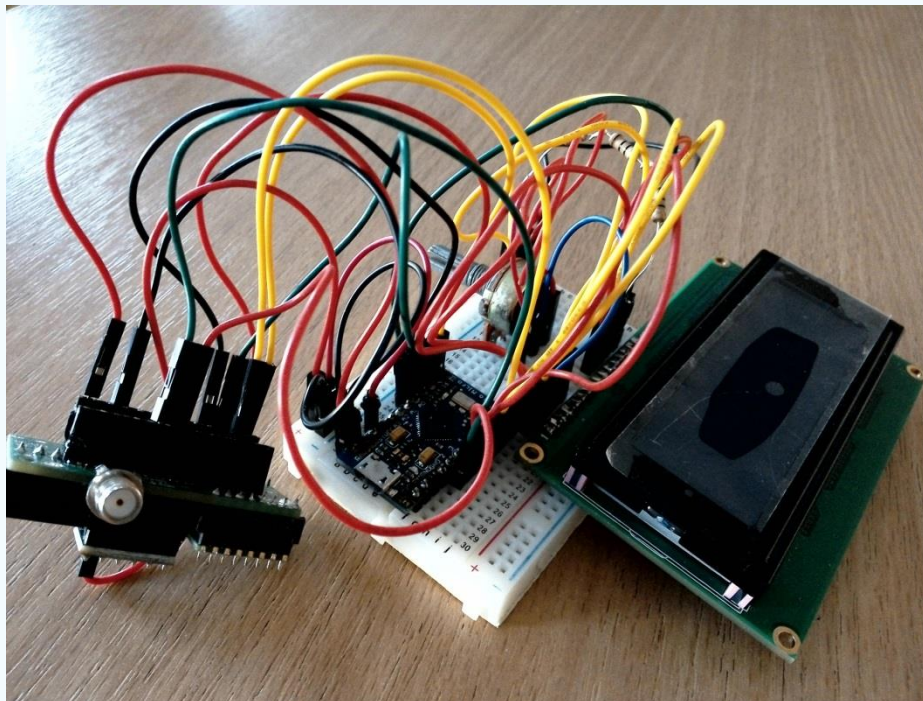


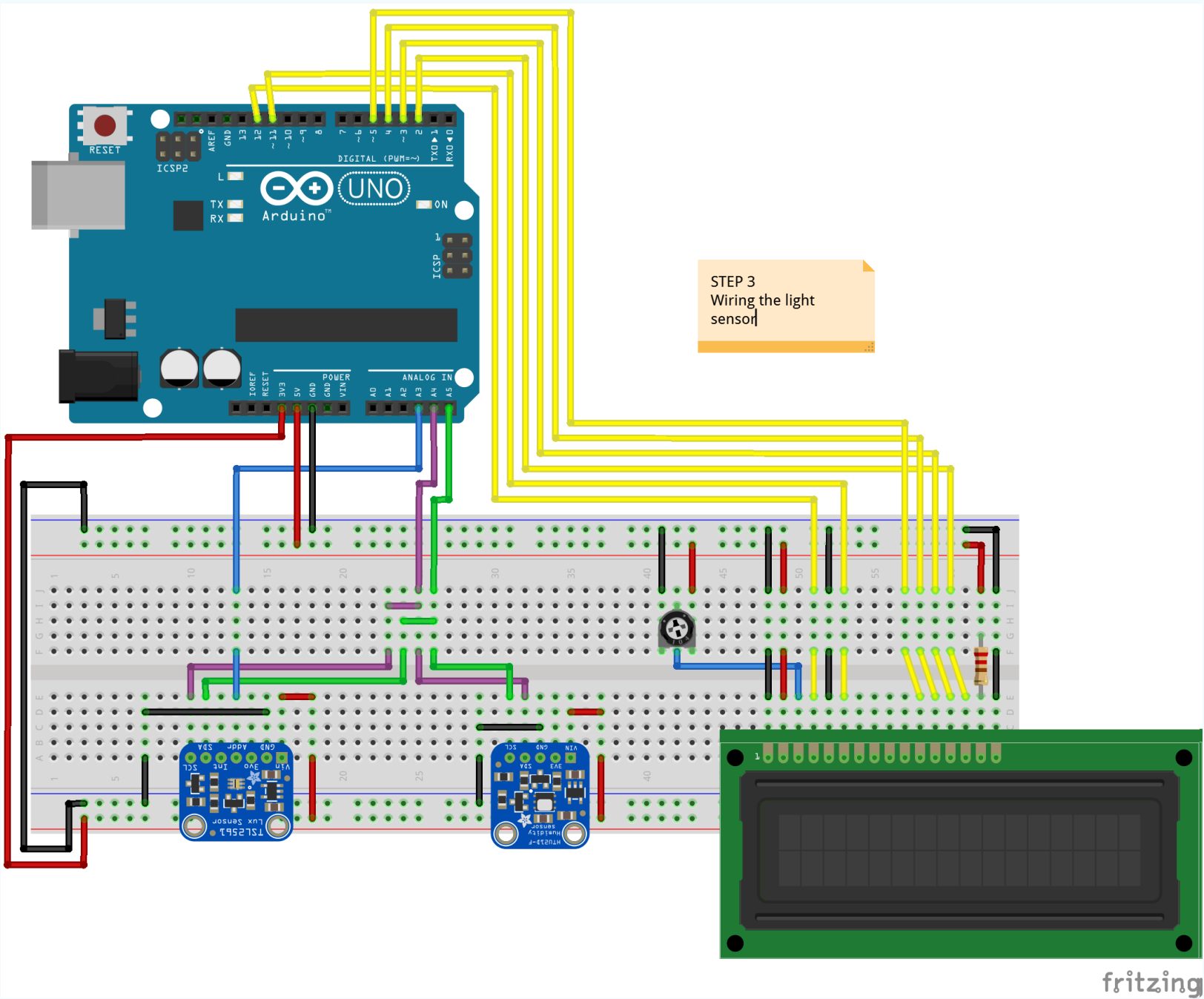
$f(x)=ax+b$, $f(x)$ -idő,
 x -távolság (d)

day1 time (μs)



Légkörfizikai mérések

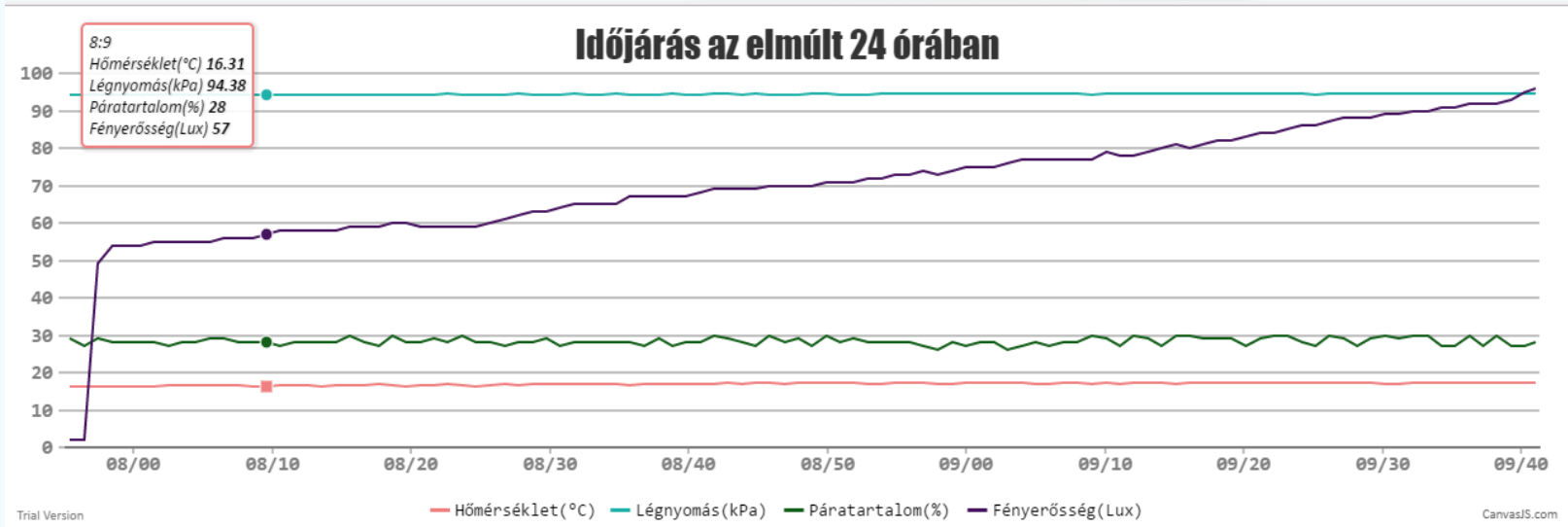
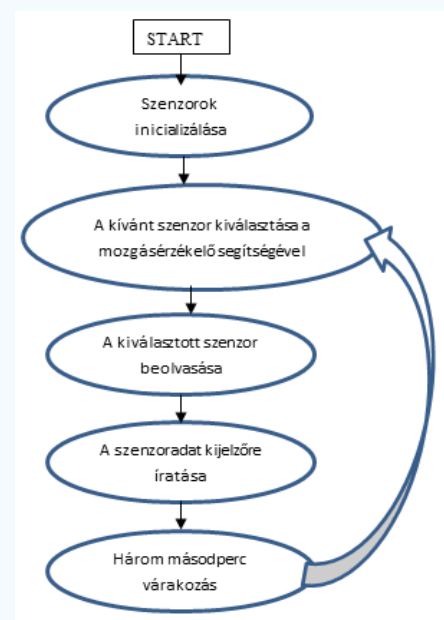
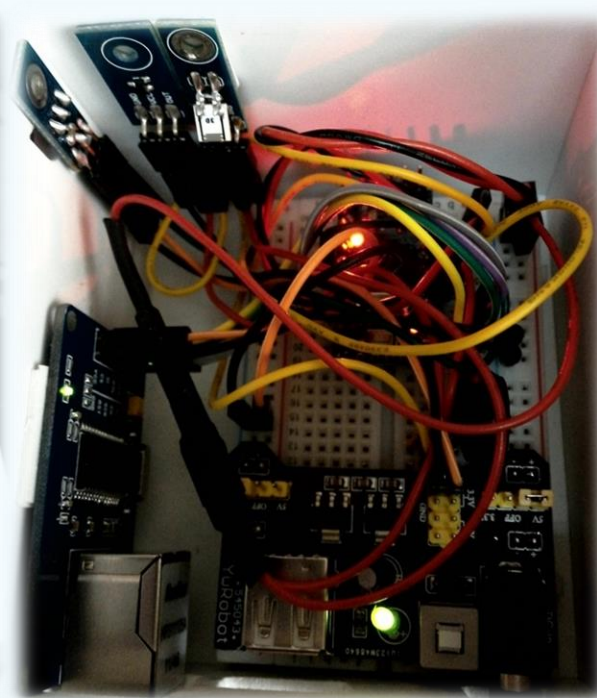
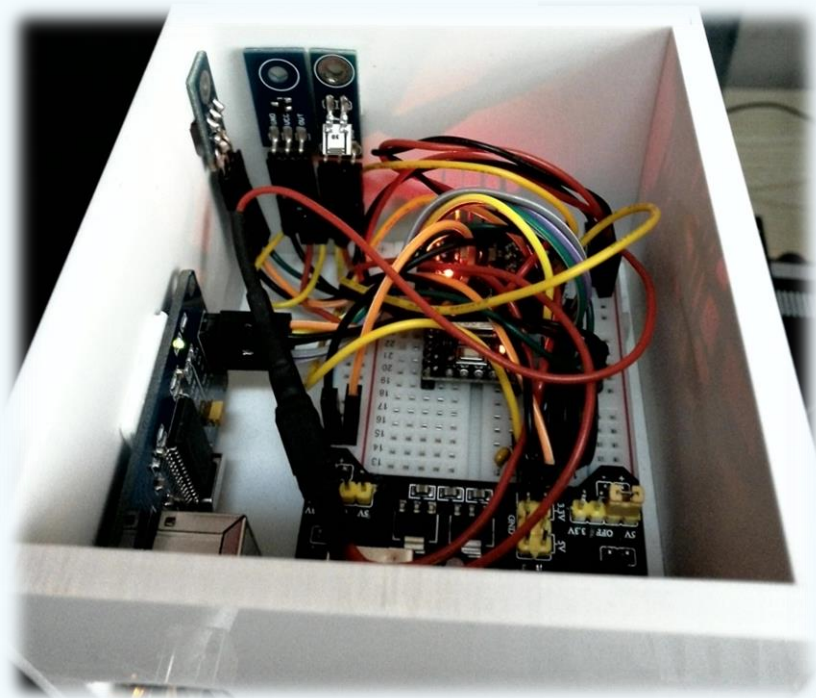




STEP 3
Wiring the light sensor

Meteo egység építése

V.V. Áron munkája



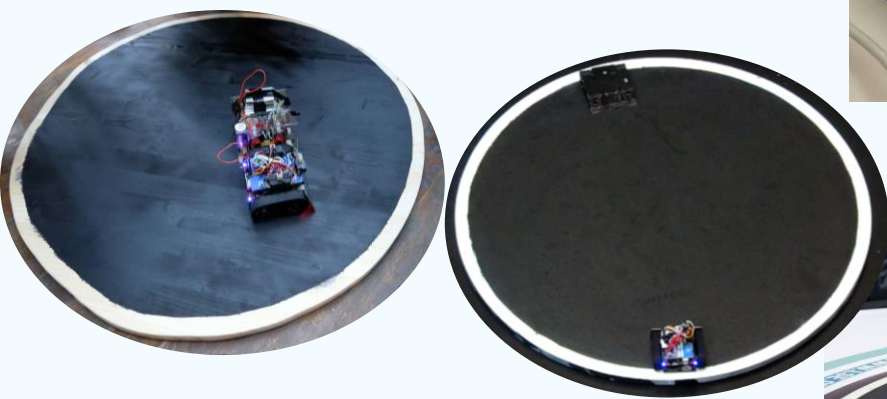
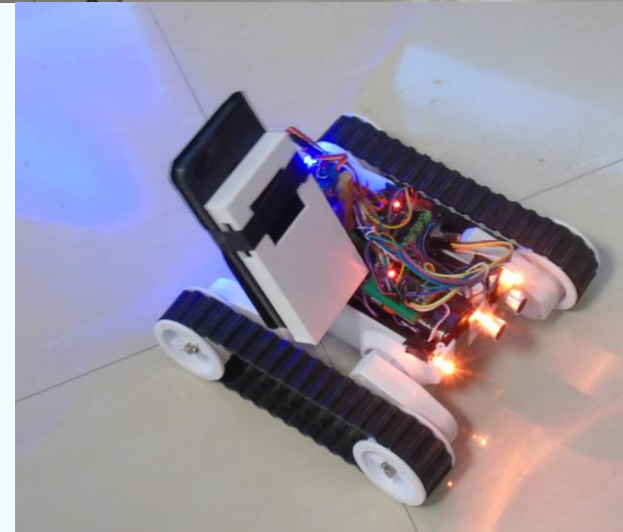
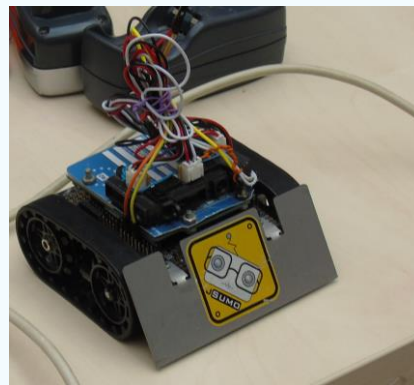
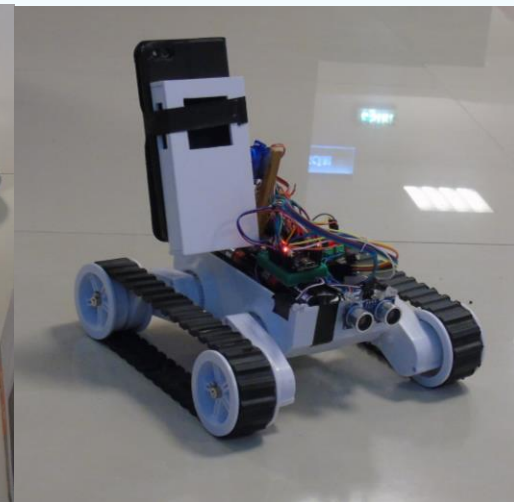
Hőmérséklet: 17.14 C
Páratartalom: 28 %
Fényerősség: 96 Lux
Légnyomás: 94.48 kPa
Dátum: 2016-12-07 09:41:01

<http://globalweather.000webhostapp.com/>

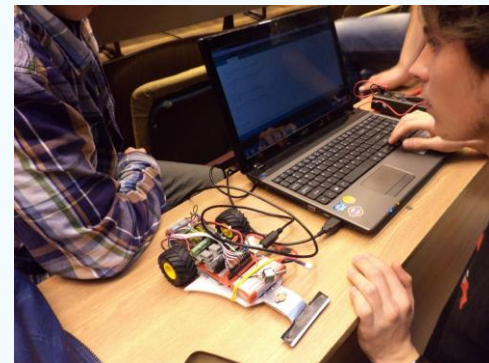
Medgyesi A. és V. V. Álmos munkája

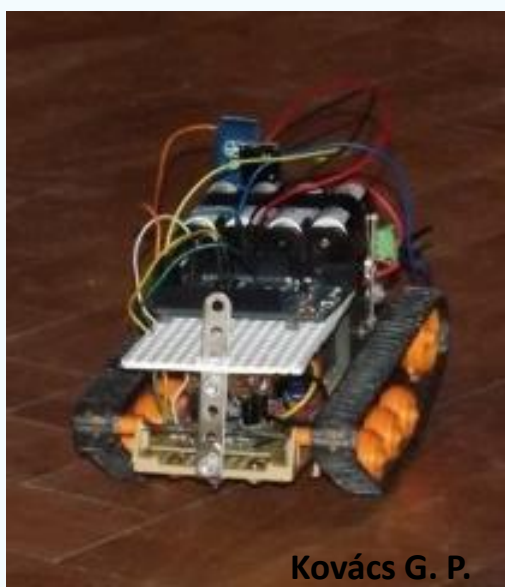


A „szumóka” versenyre kész

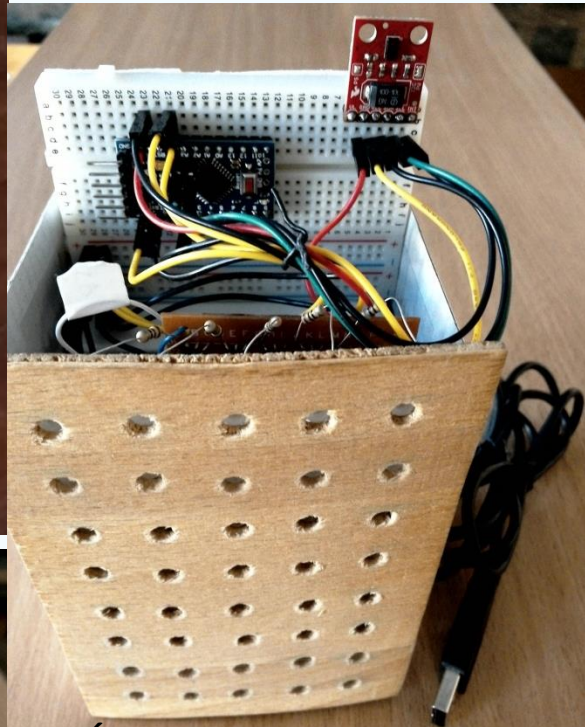


Arduino robotok

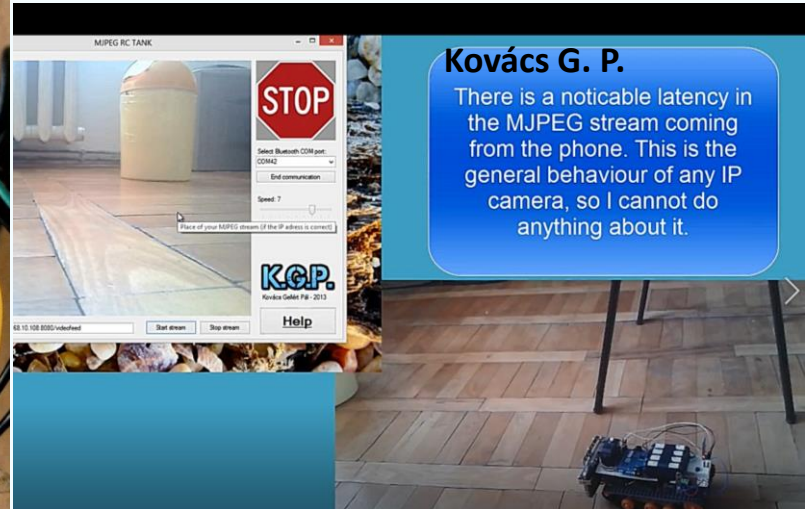
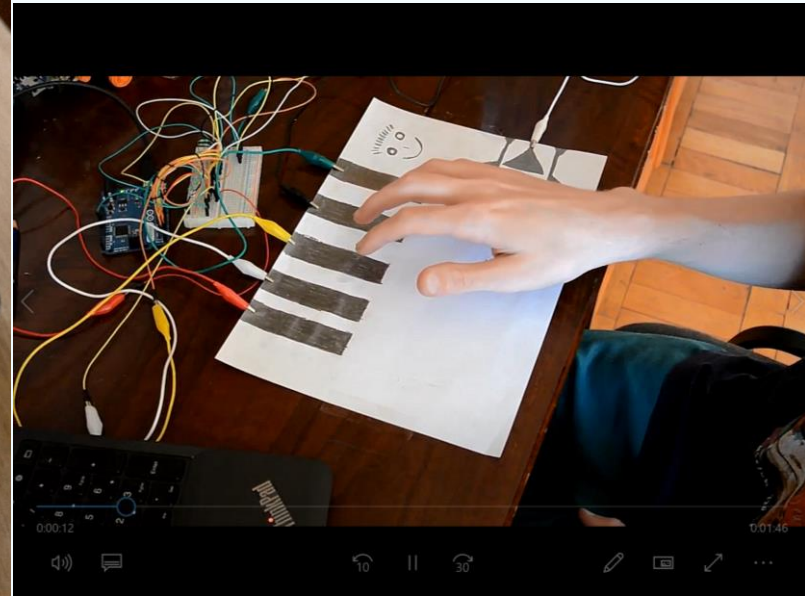
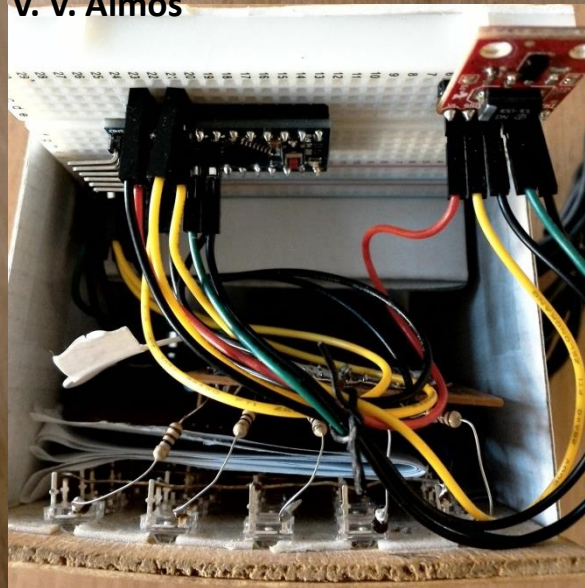
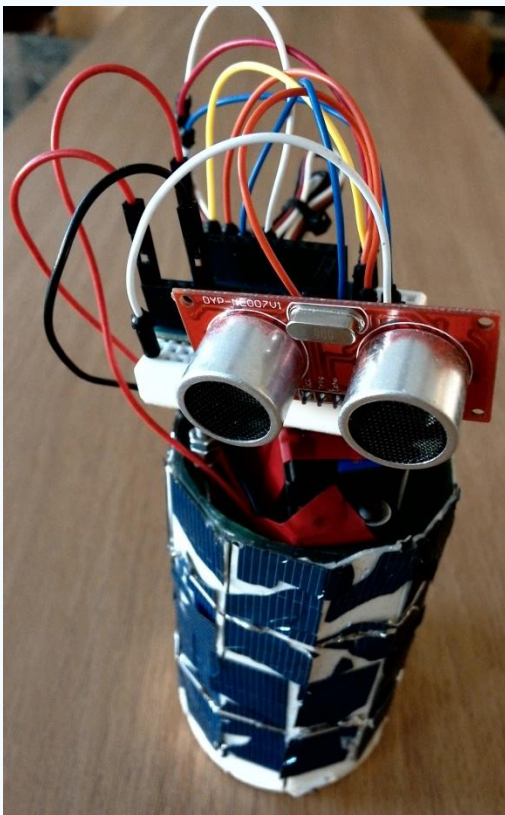




Kovács G. P.



V. V. Álmos

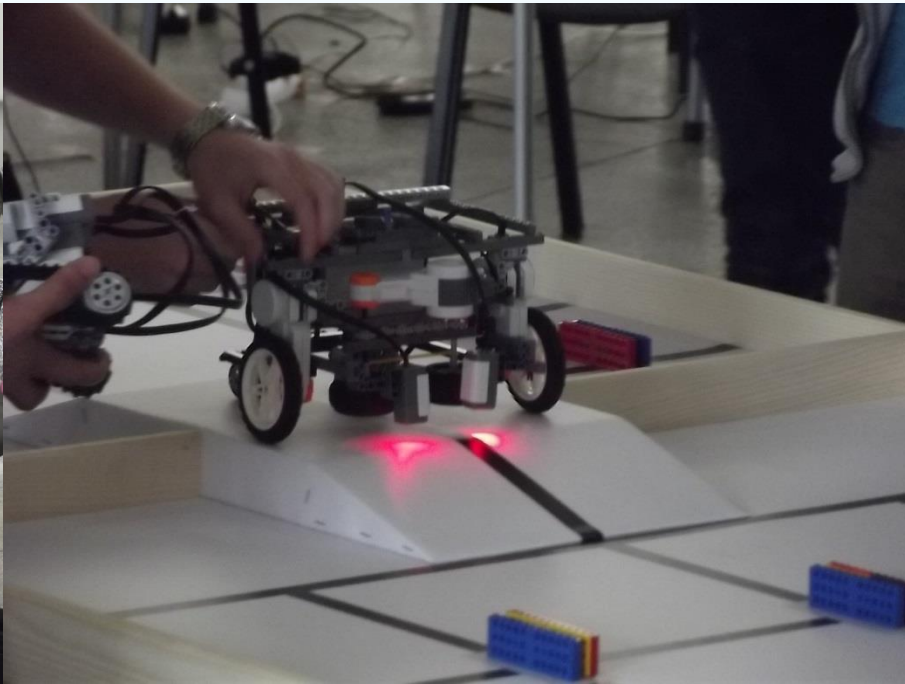


Kovács G. P.

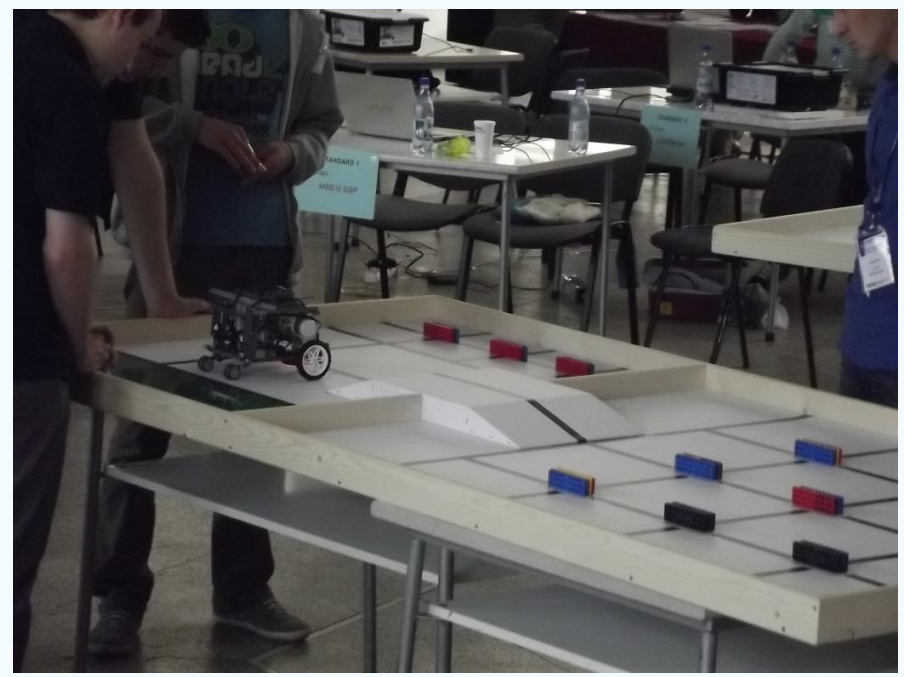
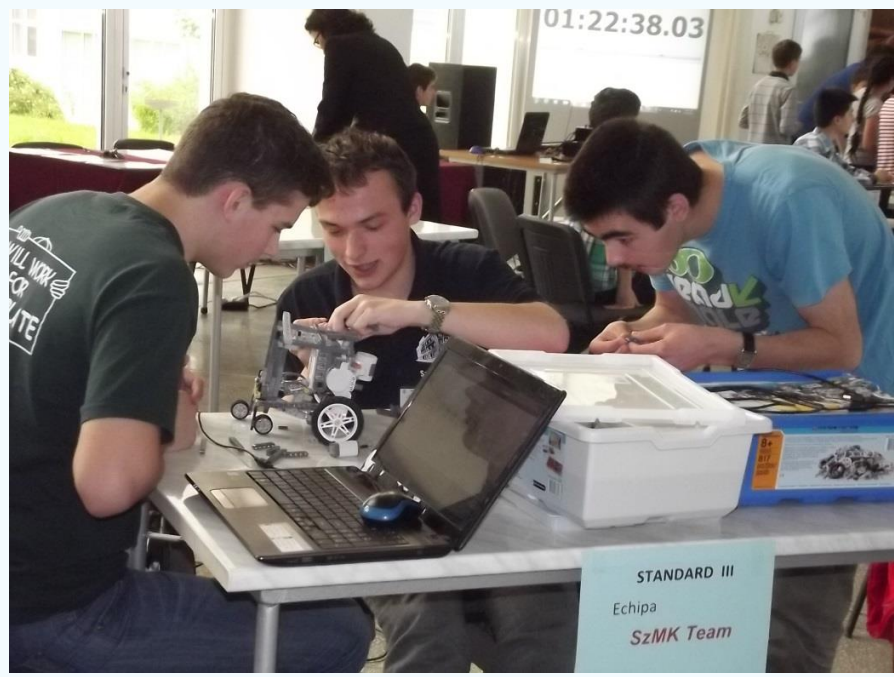
There is a noticeable latency in the MJPEG stream coming from the phone. This is the general behaviour of any IP camera, so I cannot do anything about it.

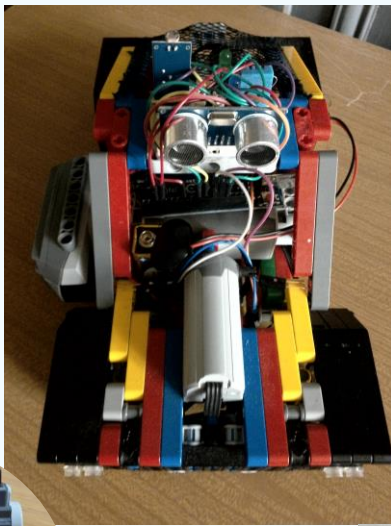


15.85

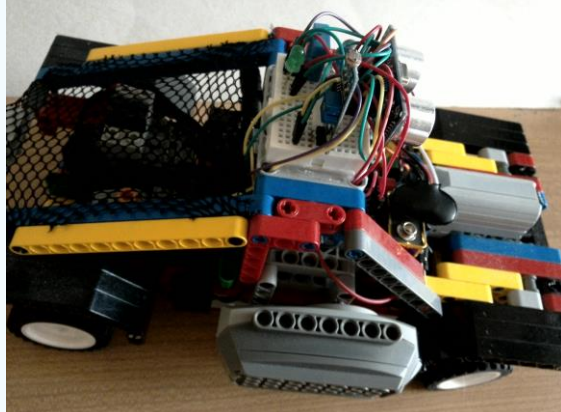


WRO

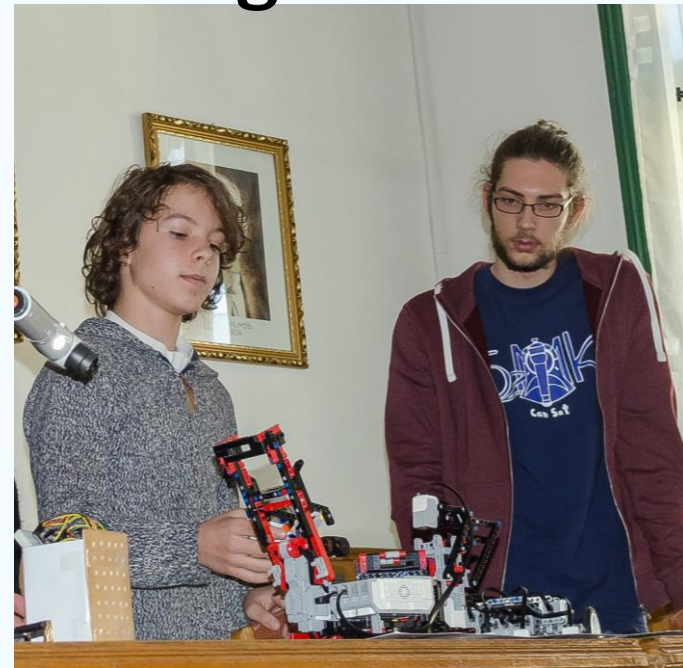




NXT



Lego robotok

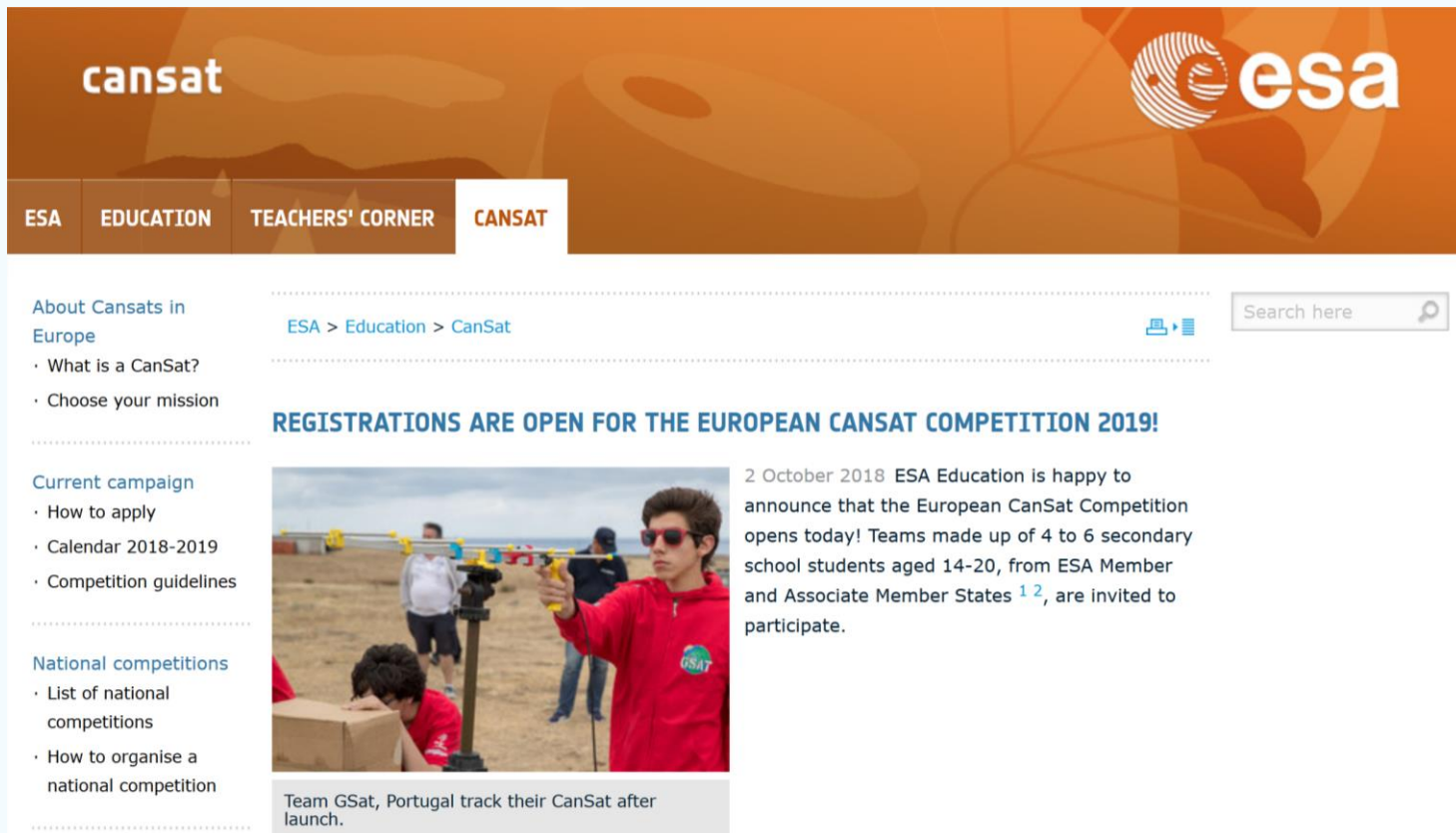


Hasznos linkek: ARDUINO, CANSAT

<https://www.arduino.cc/>

<https://store.arduino.cc/>

[https://www.esa.int/Education/CanSat/Registrations are open for the European CanSat Competition 2019](https://www.esa.int/Education/CanSat/Registrations_are_open_for_the_European_CanSat_Competition_2019)



The screenshot shows the ESA CanSat website. The header features the 'cansat' logo on the left and the ESA logo on the right. Below the header is a navigation menu with four items: 'ESA', 'EDUCATION', 'TEACHERS' CORNER', and 'CANSAT'. The 'CANSAT' item is highlighted. Below the navigation menu, there is a search bar on the right and a breadcrumb trail: 'ESA > Education > CanSat'. The main content area has a heading: 'REGISTRATIONS ARE OPEN FOR THE EUROPEAN CANSAT COMPETITION 2019!'. Below this heading is a photograph of a young man in a red jacket with 'GSAT' on it, holding a yellow object, standing next to a CanSat launch system. To the right of the photograph is a text block: '2 October 2018 ESA Education is happy to announce that the European CanSat Competition opens today! Teams made up of 4 to 6 secondary school students aged 14-20, from ESA Member and Associate Member States ¹ ², are invited to participate.' Below the photograph is a caption: 'Team GSat, Portugal track their CanSat after launch.' On the left side of the page, there is a sidebar with a list of links: 'About Cansats in Europe' (with sub-links: 'What is a CanSat?', 'Choose your mission'), 'Current campaign' (with sub-links: 'How to apply', 'Calendar 2018-2019', 'Competition guidelines'), and 'National competitions' (with sub-links: 'List of national competitions', 'How to organise a national competition').

Köszönöm a figyelmet.

Az előadás elkészítését a Magyar Tudományos Akadémia Tantárgy-
pedagógiai Kutatási Programja (471027) támogatta.