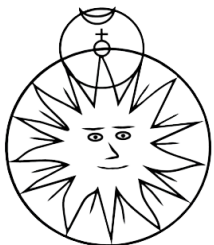




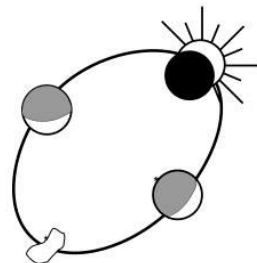
Do It Yourself ...

- a cheap Video Time Inserter based on the Arduino project



E PUR SI MUOVE

Wojciech Burzyński
Occultation Section of Polish Amateur Astronomers Society



smopiVTI = VTI made by Smolarz Piotr

- developed since 2015 by Polish amateur astronomer and IT specialist, Piotr Smolarz
- check the website: <http://smopi.news.nstrefa.pl/index.php?pages/Video-Time-Inserter>
- contact with Piotr: smopi.pl@gmail.com



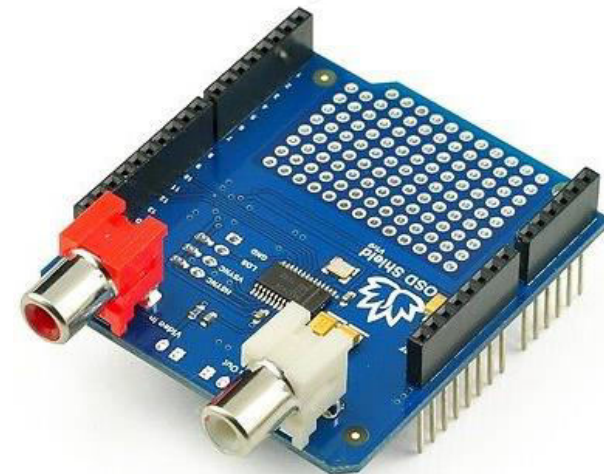
Piotr Smolarz

Basic assumptions

- **Low costs:** should not exceed 70 EUR
- **Simple assembly:** built of prepared „blocks” , no need of special workshop equipment, soldered joints as little as possible
- **Available for everyone:** all documentation and source code are available as Open Source therefore everyone can create their own version of the device or introduce new functionality, improvements and fixes
- **Time accuracy:** time keeping uncertainty should be less than 1ms
- **Versatility:** during the observation the inserter must be able to read geographic coordinates or other parameters sent by GPS system (by pressing dedicated button)
- **Educational value:** even very complicated projects are now possible with most popular small single-board computer like Arduino or Raspberry Pi (Piotr have chosen the Arduino). These projects can be implemented by children and school youth!

Main Components

- **Arduino UNO R3 board** – basic and the most popular of Arduino's printed circuits boards contains microcontroller ATmega328 , 14 digital inputs/outputs which 6 of them can work as analog inputs, internal 16 MHz clock.
- **GPS U-Blox NEO-6m** – complete GPS receiver module with built-in antenna and battery back up. Please make sure to buy a model with derived PPS signal output. It is necessary to precise time synchronization.
- **Video OSD Shield** – extension of Arduino UNO board, in the form of a superimposed plate, contains the OSD MAX7456.

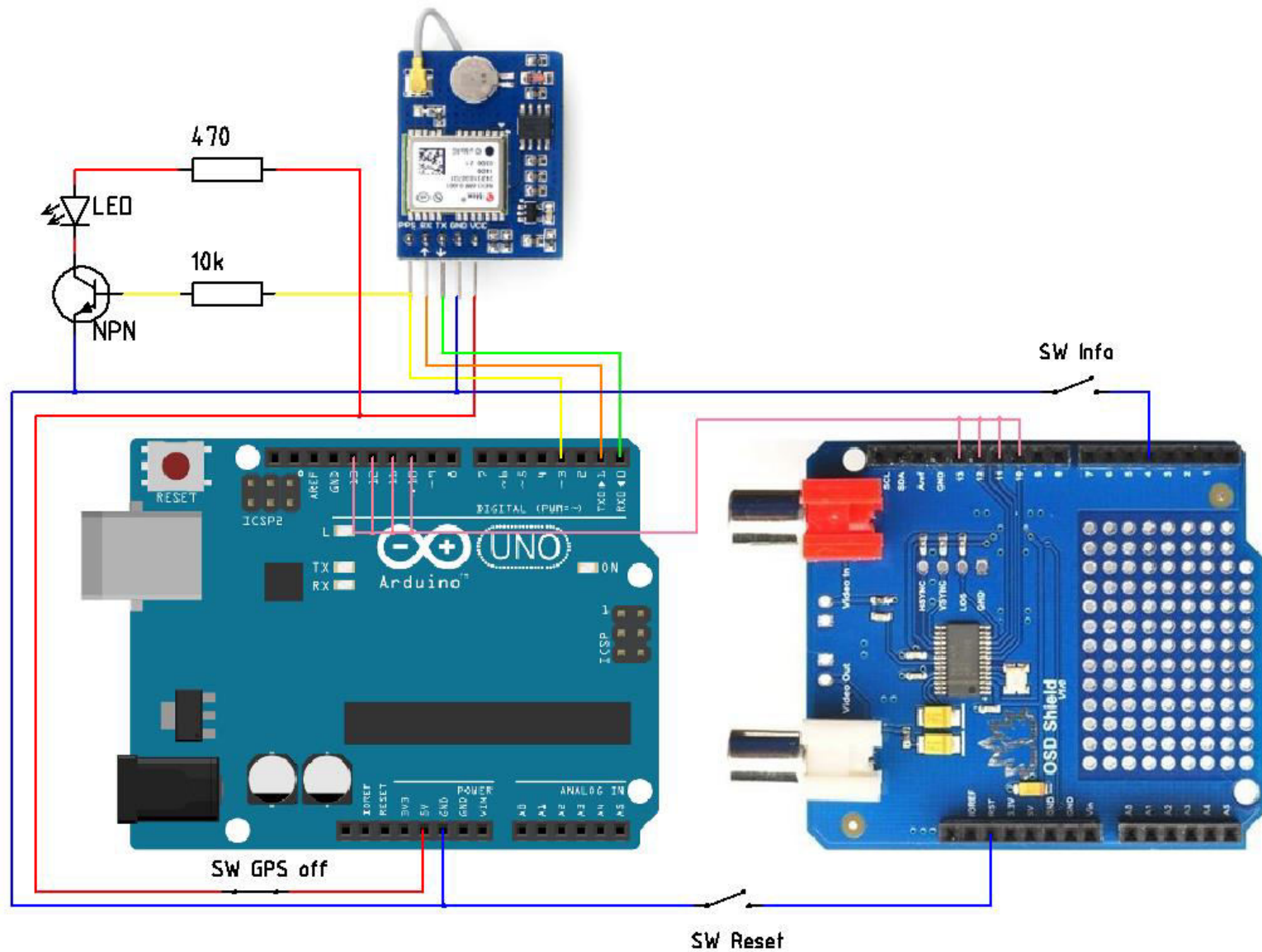


Costs

- Arduino UNO R3 board (clone = not original) – 9 EUR
- GPS U-Blox NEO-6m module – 18 EUR
- Video OSD Shield module (airmail from China – delivery time 14 days) – 28 EUR
- cover, made of ABS plastics – 3,75 EUR
- universal PCB – 1,25 EUR
- red LED, 5 mm – 0,25 EUR
- NPN transistor – 0,035 EUR
- 3 switches – 1,35 EUR
- 470 and 10 k resistors - 0,025 EUR
- wires – 0,45 EUR

Moreless 62 EUR and few hours of learning and playing 😊

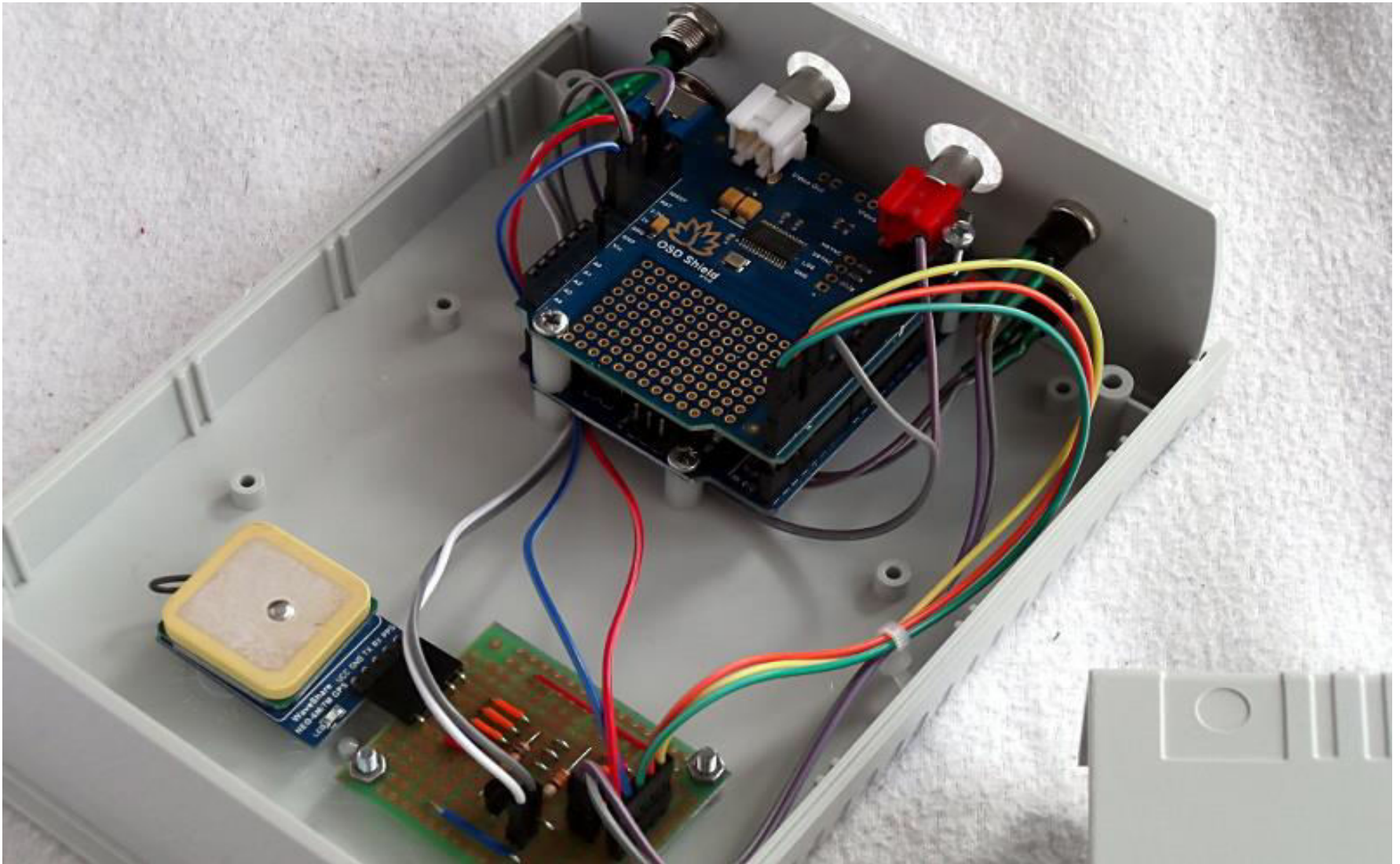
Wiring diagram



Device cover (136 x 185 x 60 mm)



What's inside ?

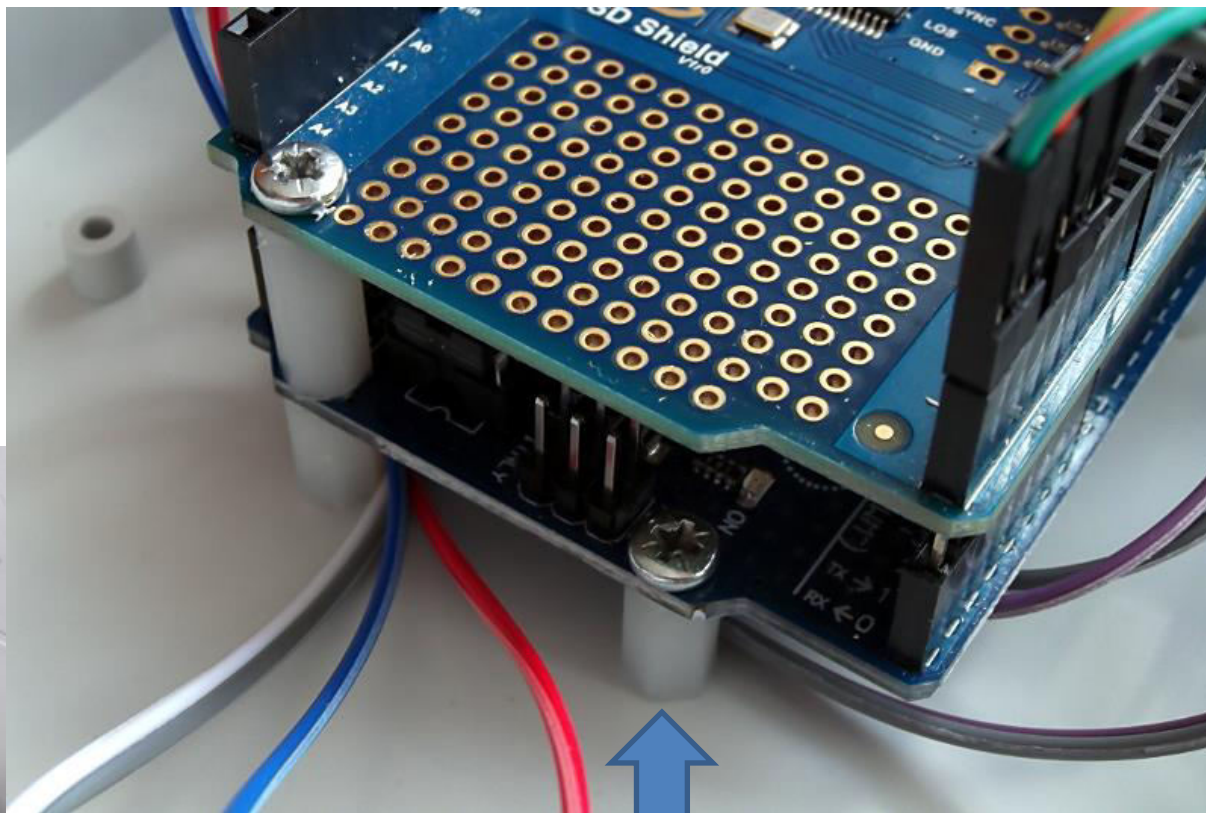


The Arduino board with OSD module was attached directly to the front panel of cover.

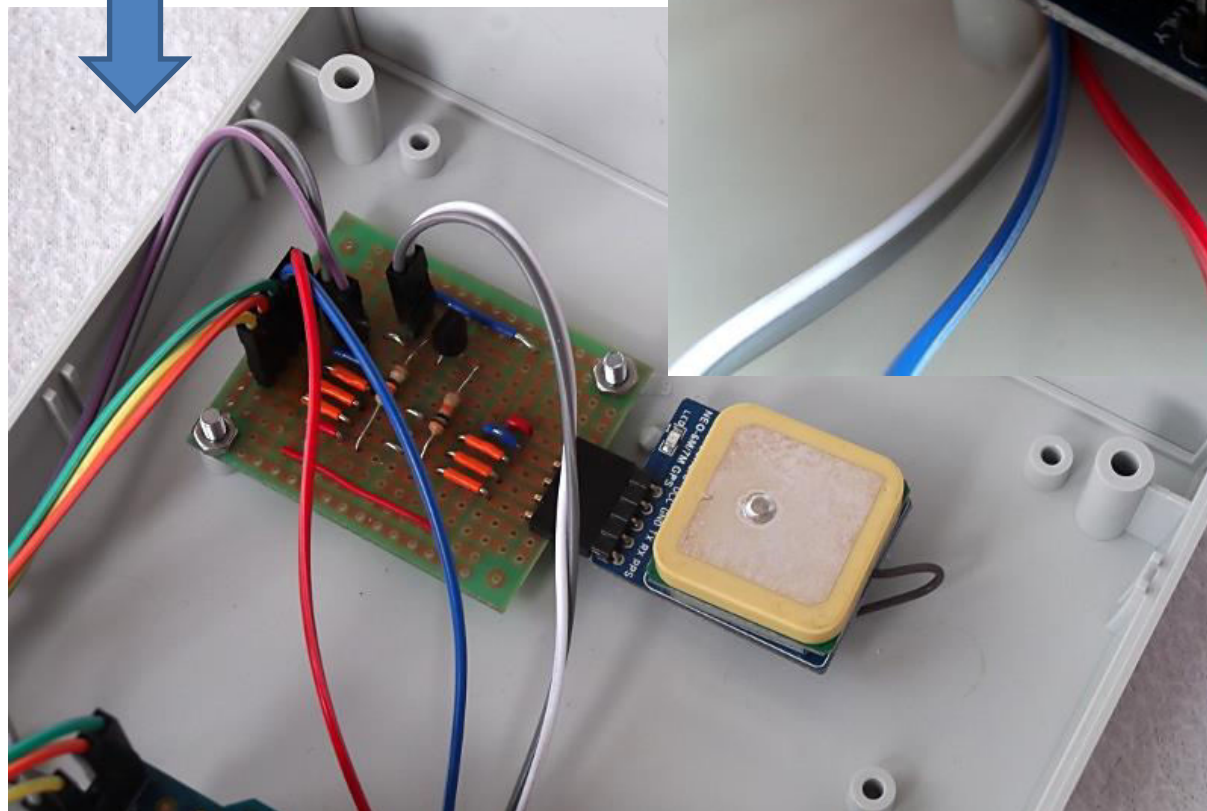
What's inside ?

The PPS signal output to the LED was made on the universal PCB.

The GPS receiver module was connected to PCB as well.



The PCBs are screwed to the cover using M3 screws and spacers.



letter ,P' indicates
proper synchro
with the PPS signal

two time stamps representing the start
time of the previous field output and the
start time of the current field output

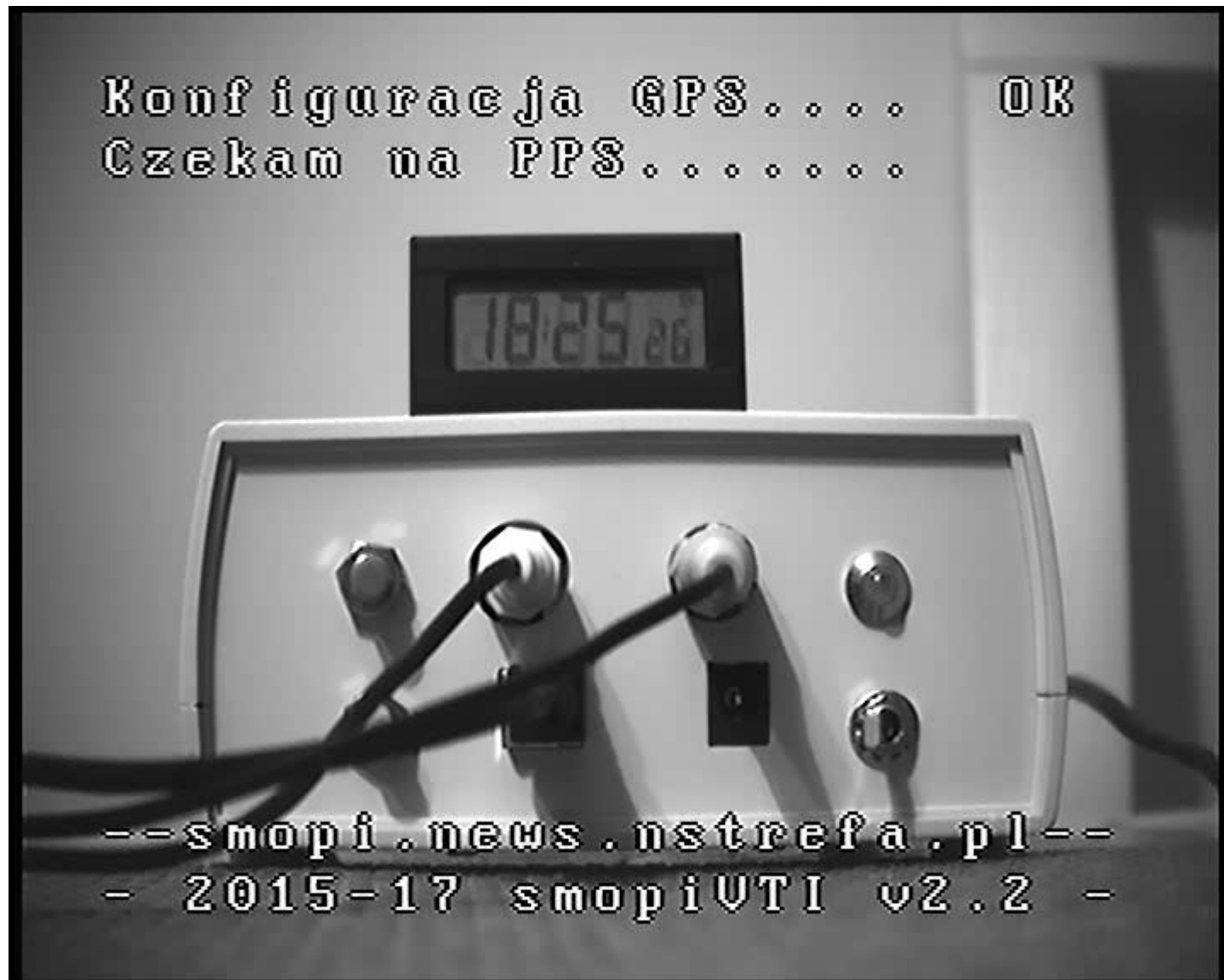


half-frames counter
(from beginning of
recording)

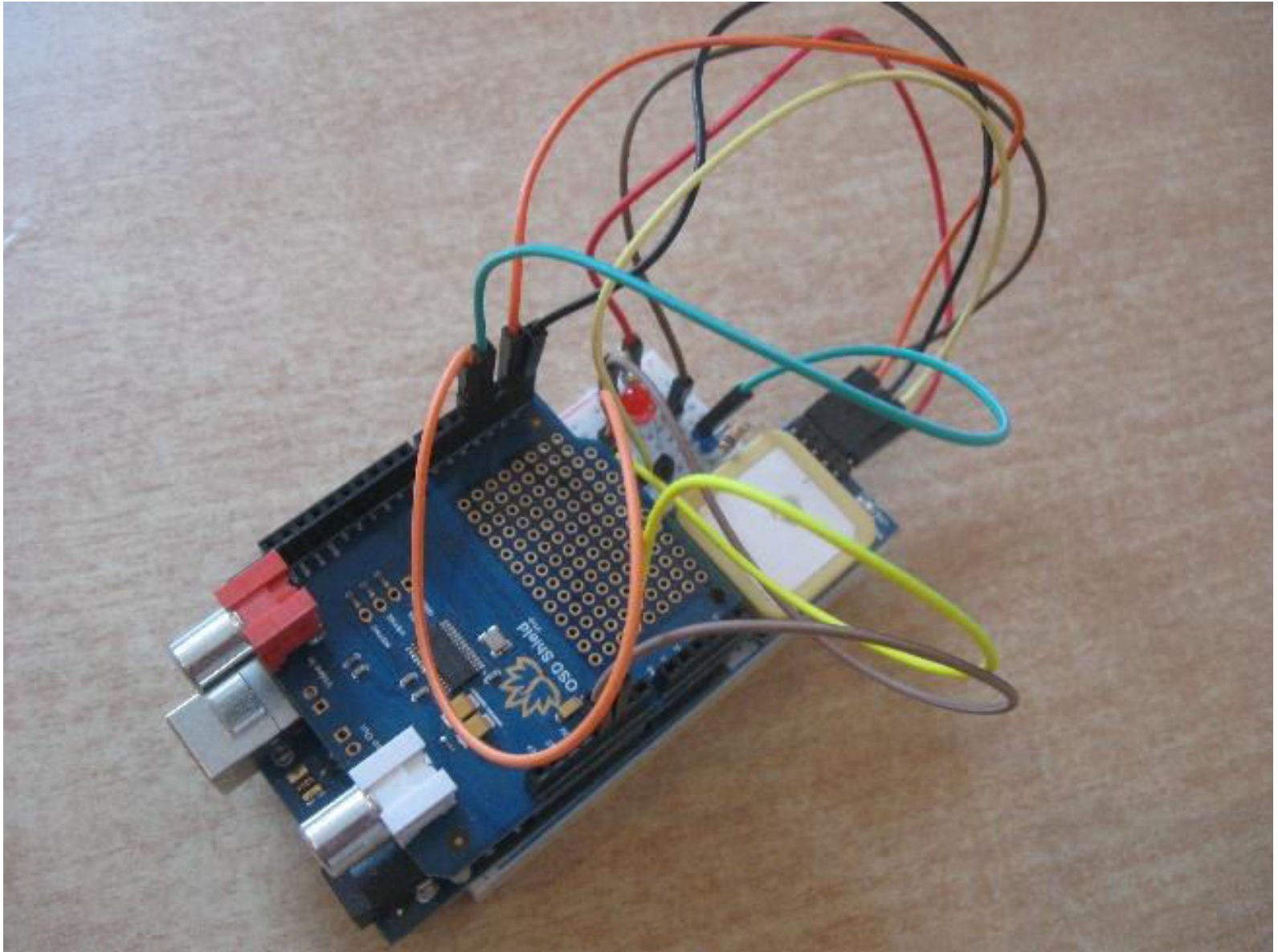
How It Works?

number of currently visible satellites of the GPS system

How It Works?



My own prototype...



Project of Pascal Andre – MinimOSD

In the first half of 2016 Pascal Andre from France has made his own version of the VTI based on Piotr's project. He has build the VTI on single **MinimOSD** board.

MinimOSD is the Arduino-based micro controller and the OSD module joined together, often used in airplane modeling. After modifying the code, it was able to run the software. It is probably the cheapest VTI on the world.

Detailed description of how to install and modify the code (in French) is here:

http://smopi.news.nstrefa.pl/public/VTI/Pascal/minimOSD/MinimOSD_VTIv4.pdf



Project of Pascal Andre – MinimOSD



Synchronized...



Minimalize it !?

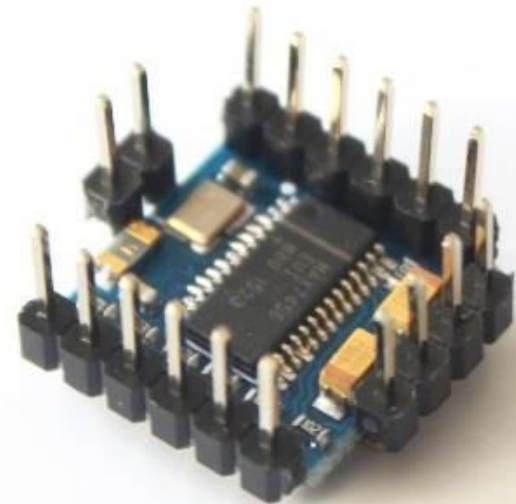
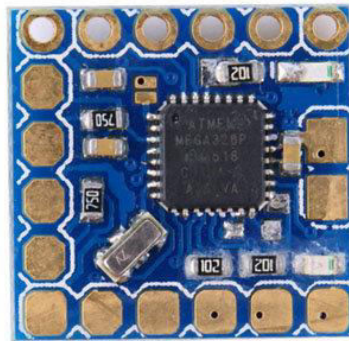
Is it possible to minimize dimensions of the VTI much more?

Probably YES!

There is a much smaller board than Minim OSD called **Micro Minim OSD!**

For only **9 EUR** you can get a minimal Arduino-based OSD board of 18 x 18 mm.

Probably nobody has built the VTI based on this module... yet...



smopiVTI compared to other VTIs....

Piotr wanted to know how his device works in comparison to well-known VTI's. He asked people to do reliability tests.

- **Pascal Andre** made test with **IOTA VTI...**



- and **GPSBOXSPRITE2**



- **Geoff Hitchcox** made test with his **KIWI-OSD**



smopiVTI vs IOTA-VTI

smopiVTI 14:18:27 100
IOTA-VTI 14:18:27 100,7

smopiVTI 14:19:39 887
IOTA-VTI 14:19:39 887,4



smopiVTI vs. GPSBOXSPRITE2

smopiVTI 15:17:44 487

GPSBOXSPRITE2 15:17:44 487

smopiVTI 15:22:33 193

GPSBOXSPRITE2 15:22:33 193



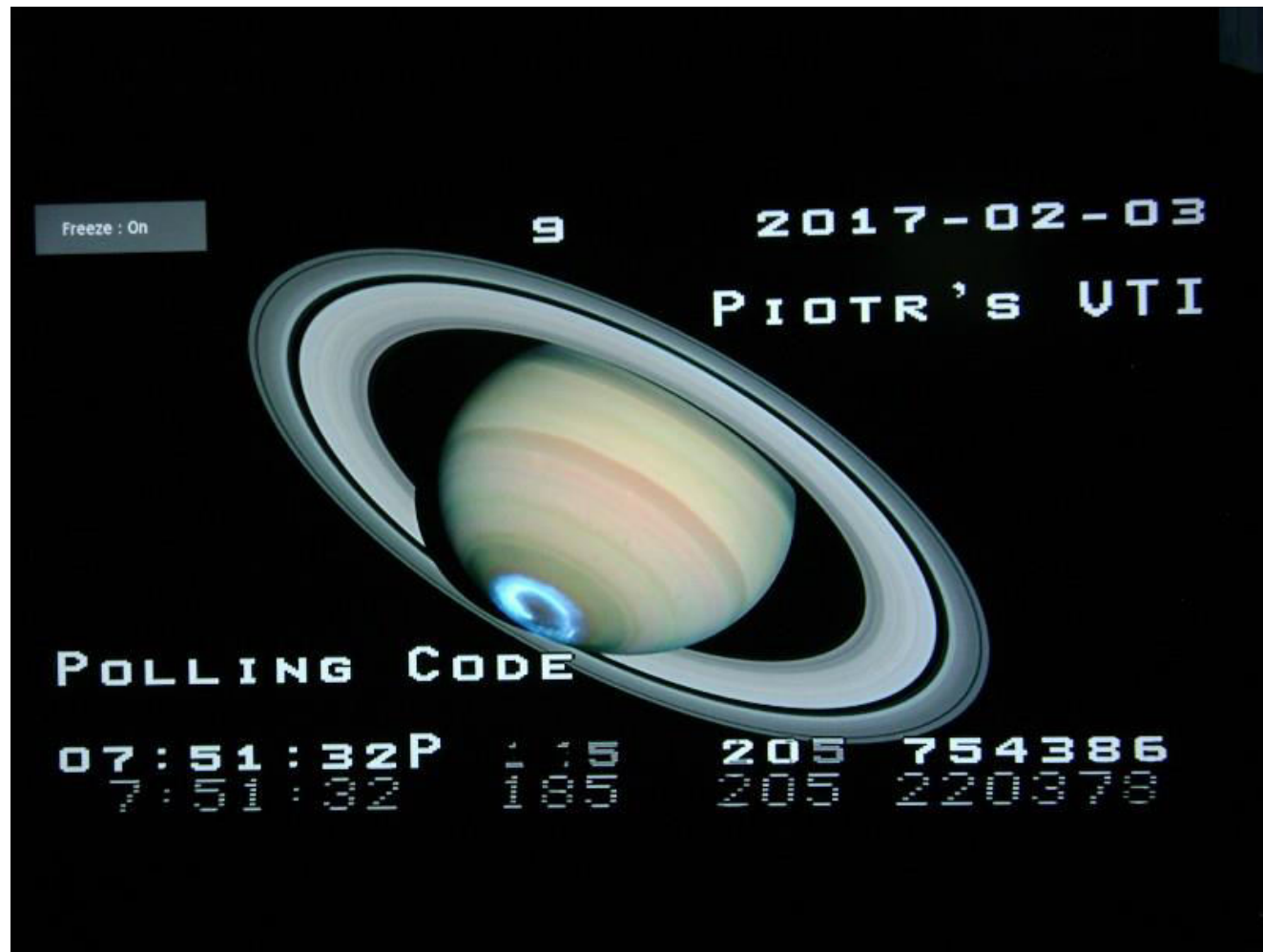
smopiVTI vs. KIWI-OSD

smopiVTI 07:51:32 185

KIWI-OSD 07:51:32 185

smopiVTI 07:49:45 027

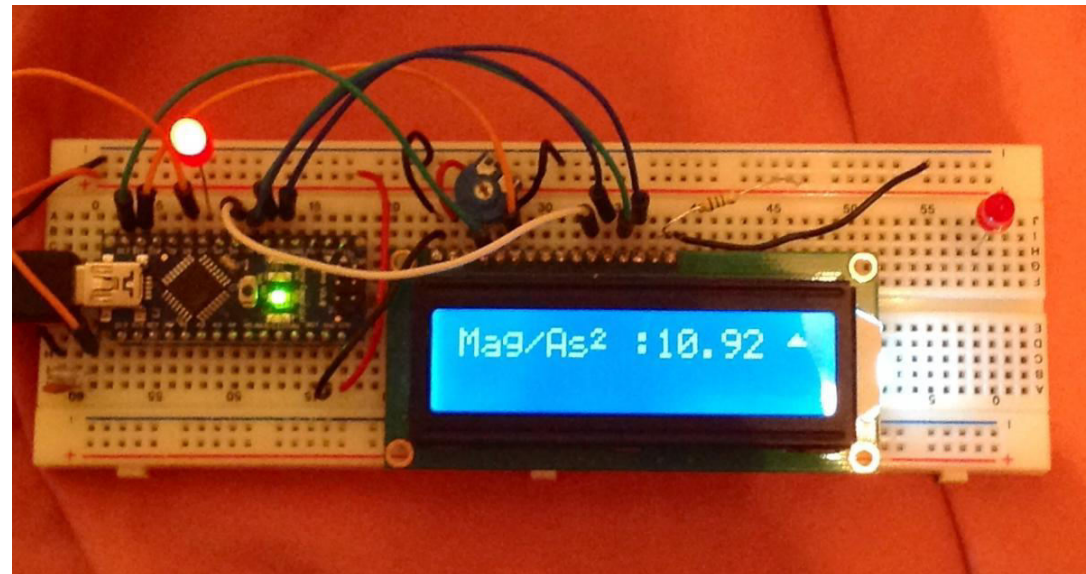
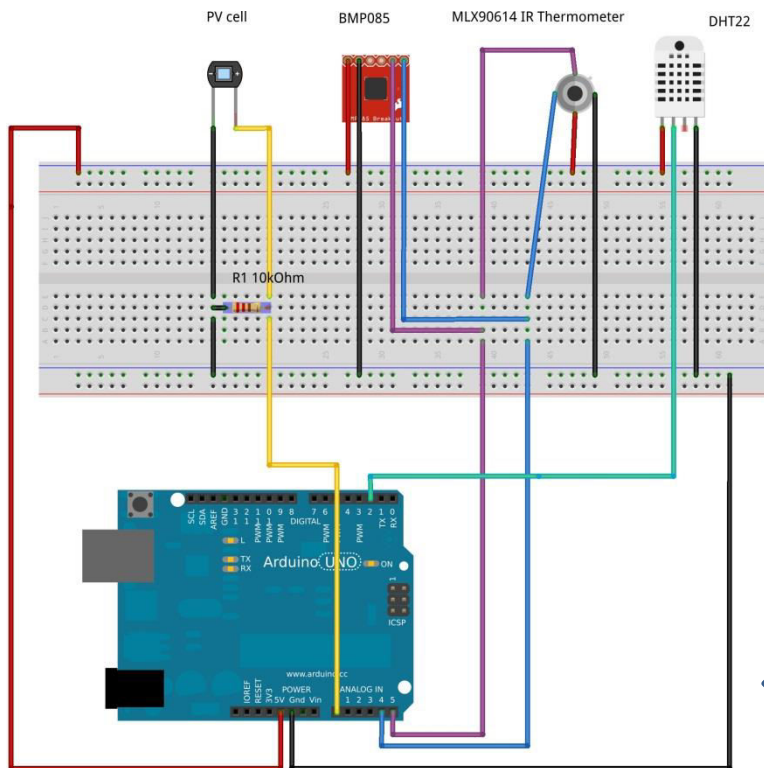
KIWI-OSD 07:49:45 027



What's more to build... ?

You can use the Arduino UNO / NANO / LEONARDO / PRO MINI boards to build devices useful in amateur astronomical observations like:

- cloud detector – based on measurement of sky temperature
- sky quality meter (SQM) – measurement of night sky darkness [mag/arcsec²]
- simple meteo station – temperature, air pressure, humidity, solar radiation intensity...



← meteo station with cloud detector

↑
SQM

Thank you for your attention

Any questions ?