SATNOGS-GDN
Satellite Ground Station in Gdańsk

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Space and Satellite Technologies

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Long term objective:

Help building Polish space ecosystem by providing data downlink service

Project goals:

Design, implementation and operation of a ground station

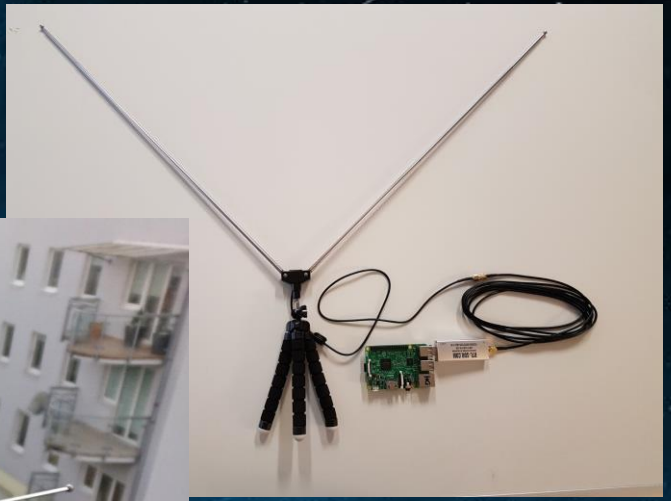
- Omnidirectional antenna (fixed)
- UHF or VHF bandwidth
- SDR (Software Defined Radio)
- Embedded platform (Raspberry Pi)

Architecture

Problems solved

- Hardware (band, SDR, antenna, LNA, computing platform, …)
- UHF or VHF bandwidth
- Location (antenna installation, cabling)
- Software configuration
- Automation
- Results visualization

Antenna v1



Antenna v2 - TA-1 Turnstile

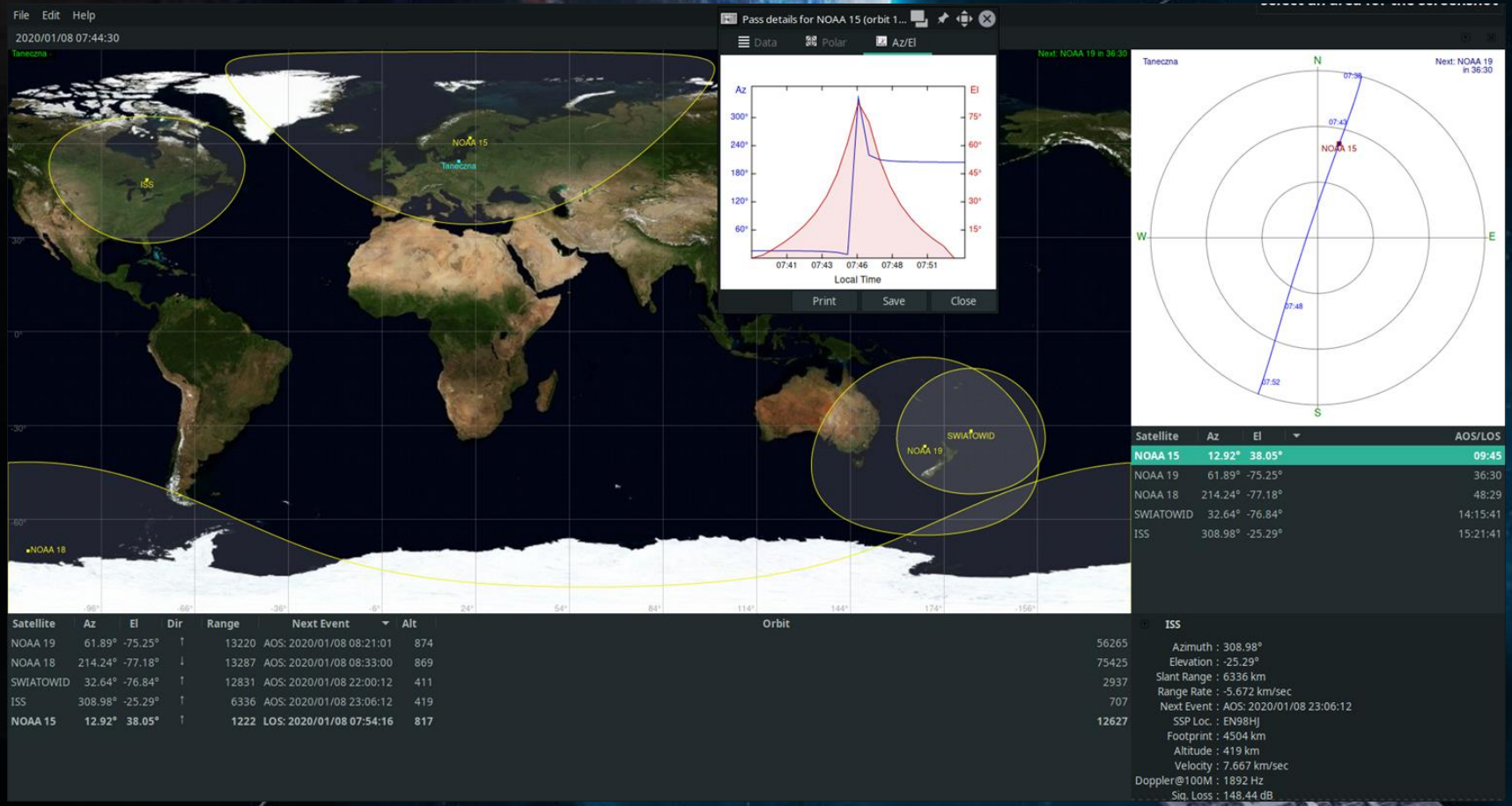
SDR + RPi


RTL-SDR.COM
QUICKSTART SETUP GUIDE: RTL-SDR.COM/QSG
DVB-T+DAB+FM+SDR
RTL2832U R820T2 TCXO+BIAS T+HF
V.3

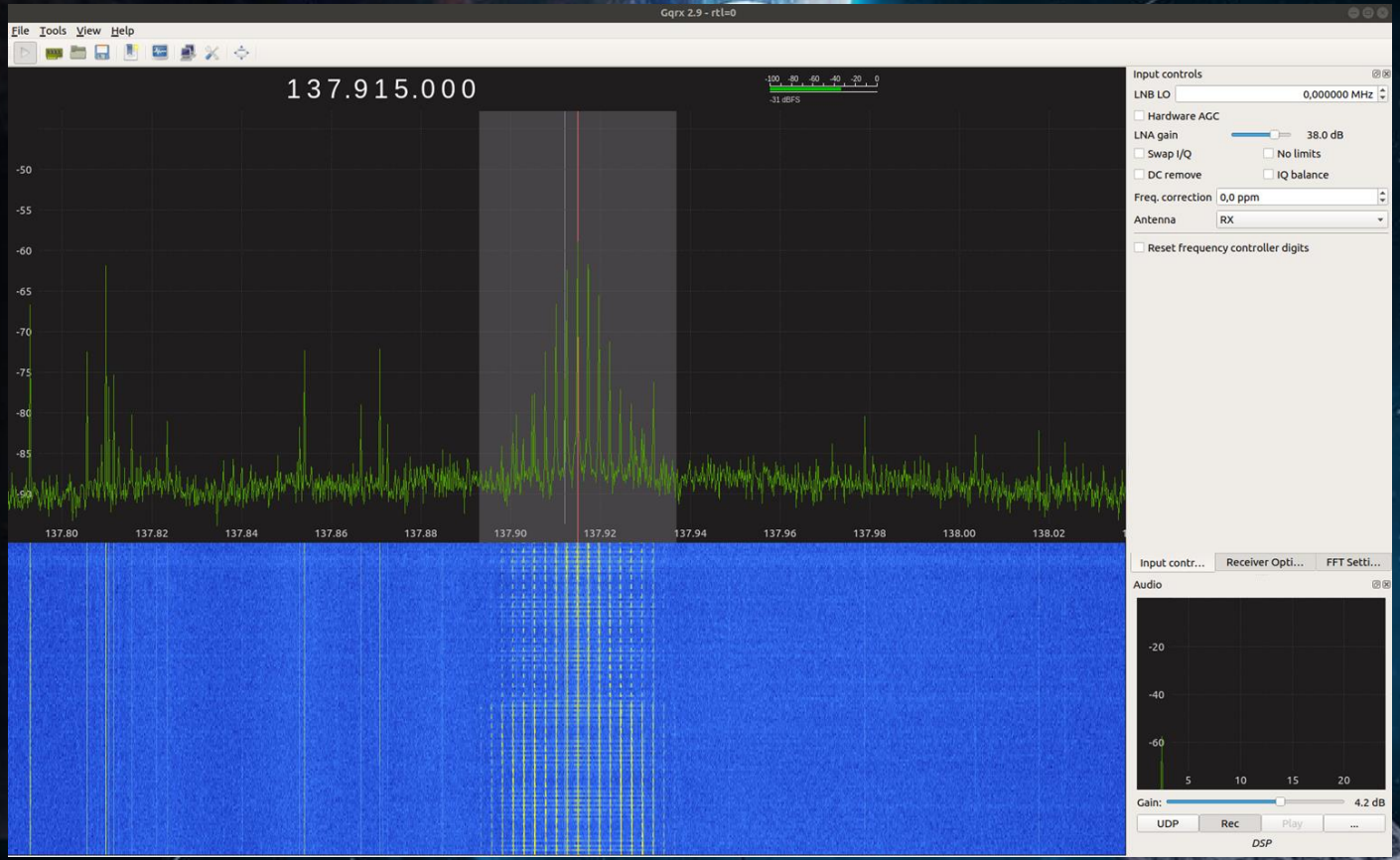

RTL-SDR.COM
DVB-T+DAB+FM+SDR
RTL2832U R820T2 TCXO+BIAS T+HF


How to receive a sat transmission in 5 easy steps

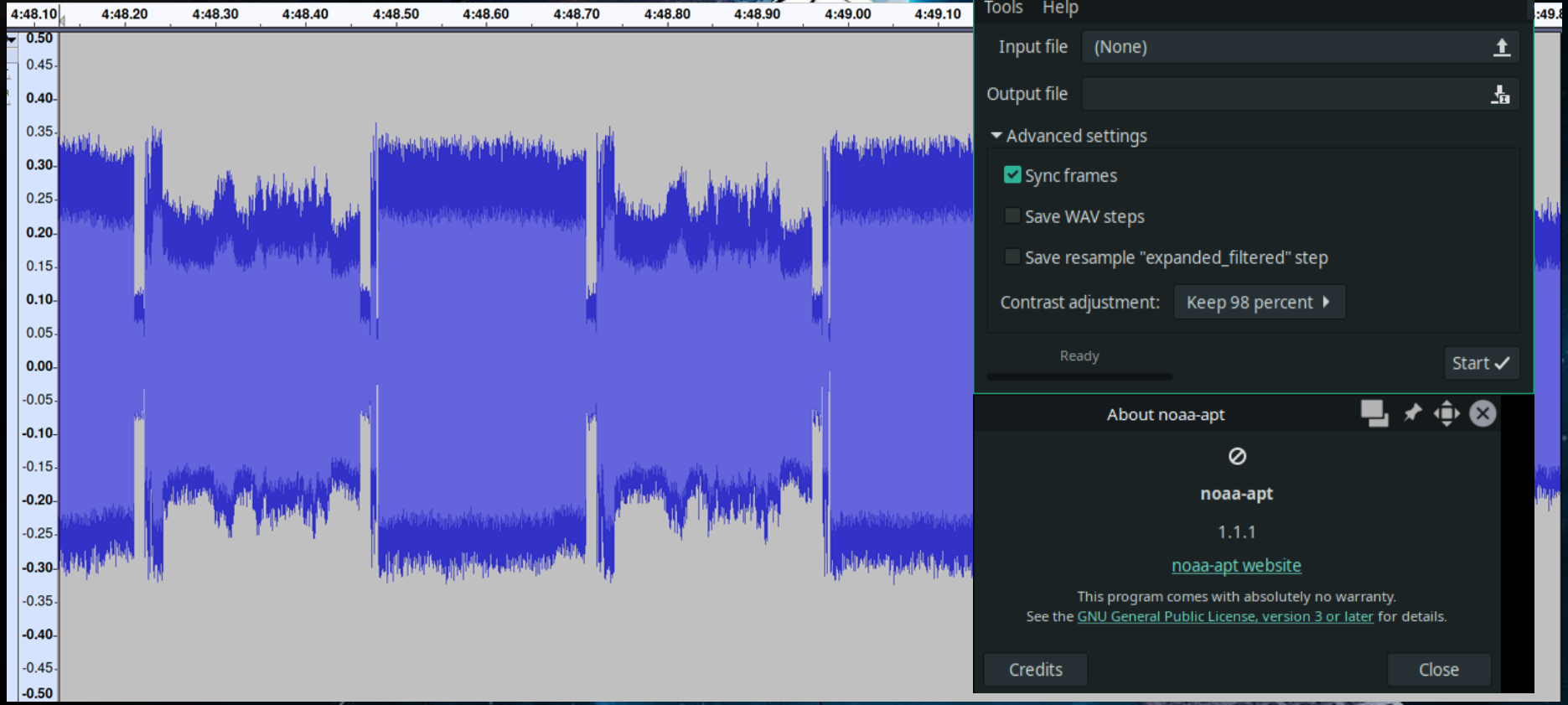
Step 1: Predict satellite fly-over



Step 2: Tune SDR to transmission frequency



Step 3: Decode transmission



Step 4: Upload to content server

```
pi@raspberrypi:~ $ noaa-apt -o gqrx_20200108_172745_137912500.png gqrx_20200108_172745_137912500.wav
noaa-apt image decoder version 1.1.1
2020-01-08 18:50:17,068 INFO  [noaa_apt] Reading WAV file
2020-01-08 18:50:17,069 WARN  [noaa_apt::wav] WAV file has 2 channels (probably stereo), processing only the first one
2020-01-08 18:50:28,332 INFO  [noaa_apt] Resampling to 12480
2020-01-08 18:50:39,819 INFO  [noaa_apt] Demodulating
2020-01-08 18:50:39,966 INFO  [noaa_apt] Filtering
2020-01-08 18:50:41,497 INFO  [noaa_apt] Syncing
2020-01-08 18:50:45,877 INFO  [noaa_apt::noaa_apt] Found 1391 s
2020-01-08 18:50:45,973 INFO  [noaa_apt] Resampling to 4160
2020-01-08 18:50:46,154 INFO  [noaa_apt::noaa_apt] Adjusting co
2020-01-08 18:50:46,360 INFO  [noaa_apt] Writing PNG to 'gqrx_2
2020-01-08 18:50:46,707 INFO  [noaa_apt] Finished
pi@raspberrypi:~ $ python3 devel/satnog-gdn/tools/submit-obs.py
29" "2020-01-08 18:33:00" "2020-01-08 18:41:20"
Detected python: 3.7.3
Uploading file: cmd=[scp gqrx_20200108_172745_137912500.png sat
gqrx_20200108_172745_137912500.png                          100
Adding record in the db: sqlcmd=[INSERT INTO observations(aos,t
-08 18:26:29', '2020-01-08 18:26:29', 'NOAA 15', 'gqrx_2020010
INSERT 0 1
pi@raspberrypi:~ $
```

SATNOGS-GDN

This is a Gdańsk ground station, aiming to join the global network of satellite ground-stations. It's a project created by Sławek Figiel, Tomek Mrugalski and Ewelina Omernik, three students of Space and Satellite Technologies studies of Gdańsk University of Technology.

6 observations from 4 satellite(s), between 2019-12-15 08:54:53 and 2020-01-08 18:26:29.

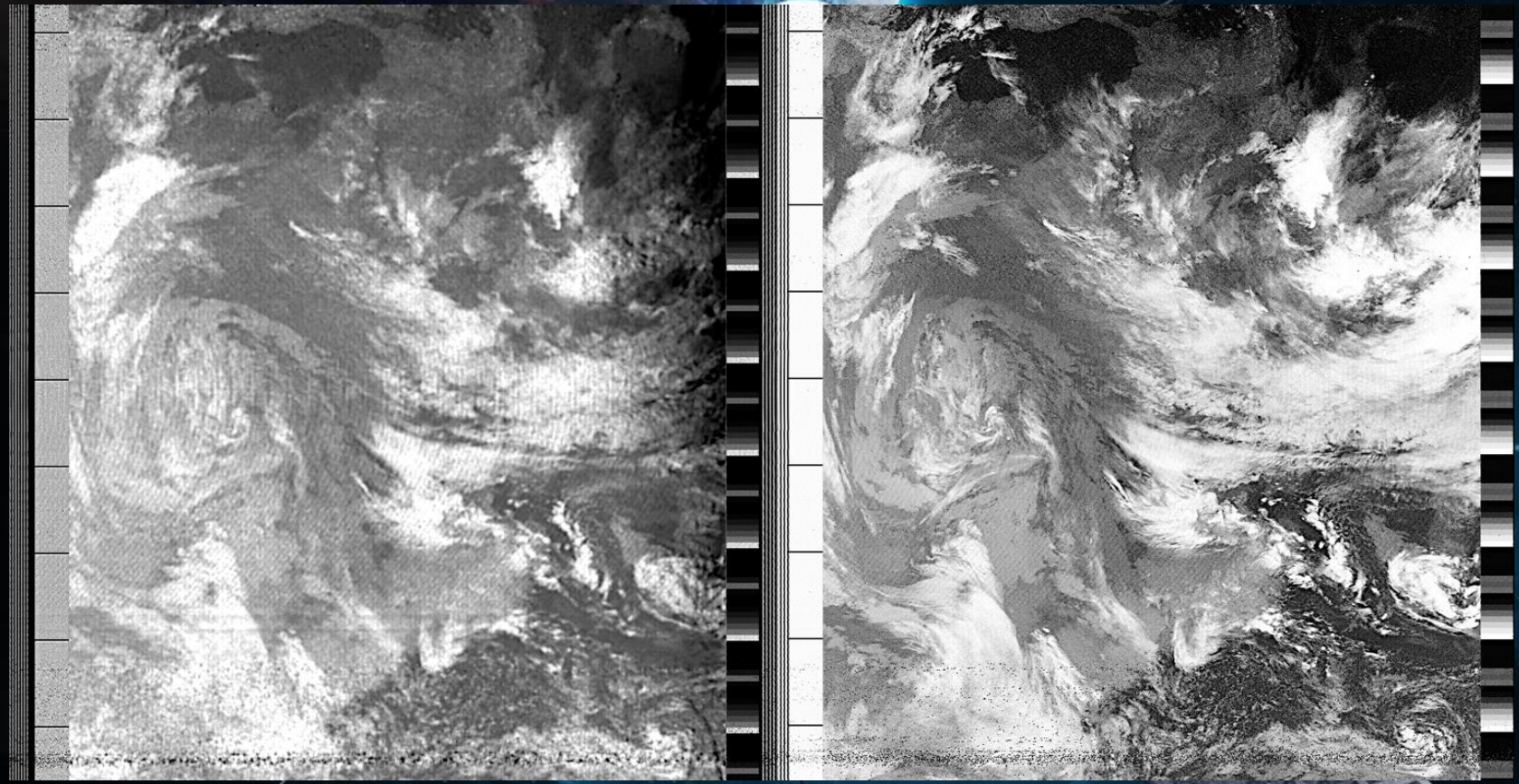
Observations

ID	AOS	TCA	LOS	Satellite	Image
32	2019-12-15 08:54:53	2019-12-15 08:54:53	2019-12-15 08:54:53	NOAA-18	20191215-0854-noaa-18.png
33	2019-12-15 19:46:48	2019-12-15 19:46:48	2019-12-15 19:46:48	NOAA-18	gqrx_20191215_184701_137912500-telemetry_contrast.png
34	2019-12-16 14:59:20	2019-12-16 14:59:20	2019-12-16 14:59:20	NOAA-19	output-curves.png
35	2019-12-17 18:23:00	2019-12-17 18:23:00	2019-12-17 18:23:00	NOAA-18	output.png
36	2019-12-26 20:59:00	2019-12-26 20:59:00	2019-12-26 20:59:00	NOAA-18	output2.png
37	2020-01-08 18:26:29	2020-01-08 18:26:29	2020-01-08 18:26:29	NOAA 15	gqrx_20200108_172745_137912500.png

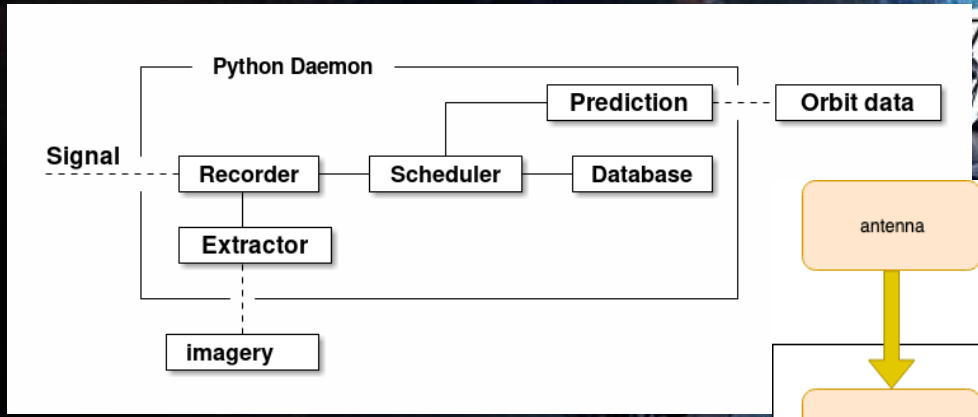
Satellites

ID	Name
NOAA-15	25338
NOAA-18	28654
NOAA-19	33591

Step 5: Profit!

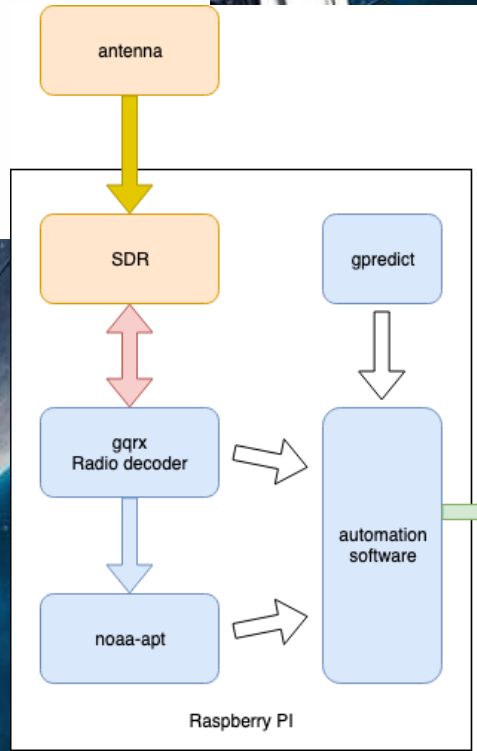


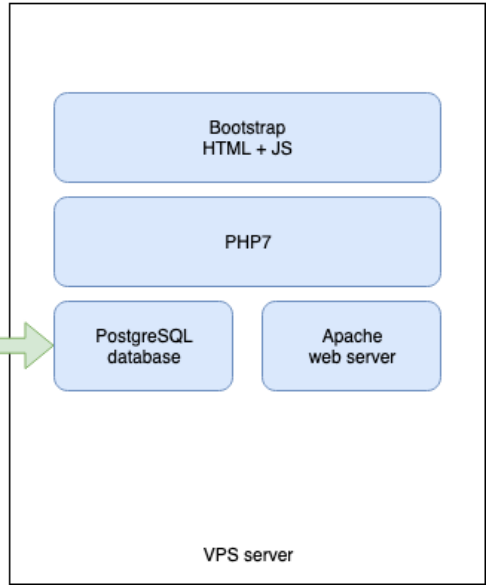
Automation



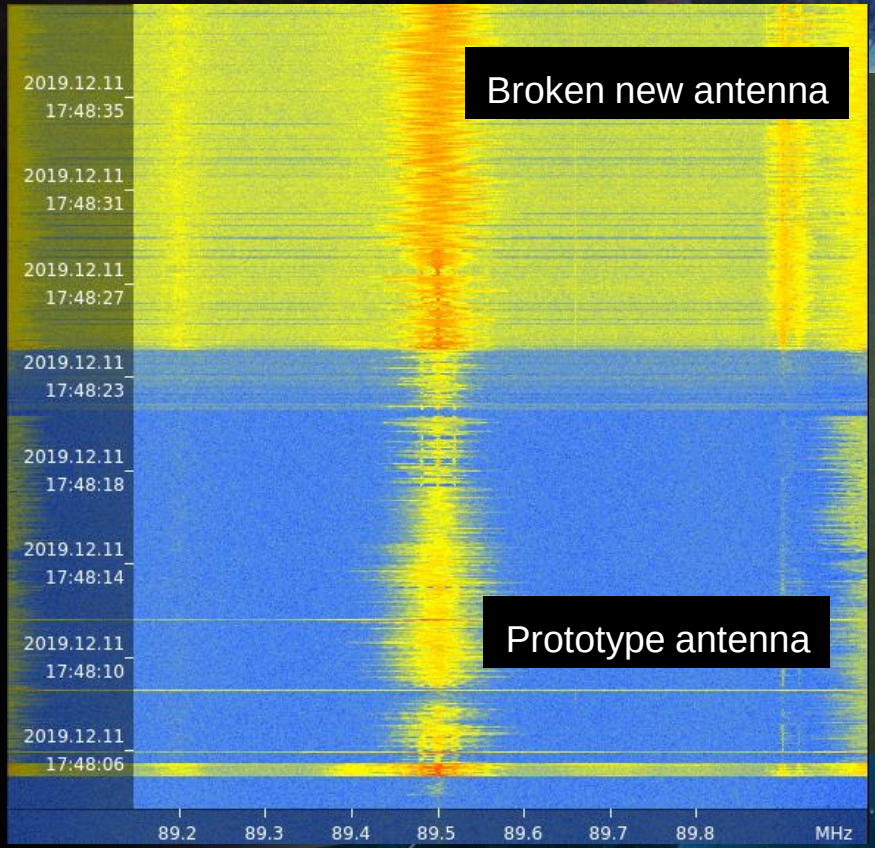
Realization

Concept





Troubleshooting

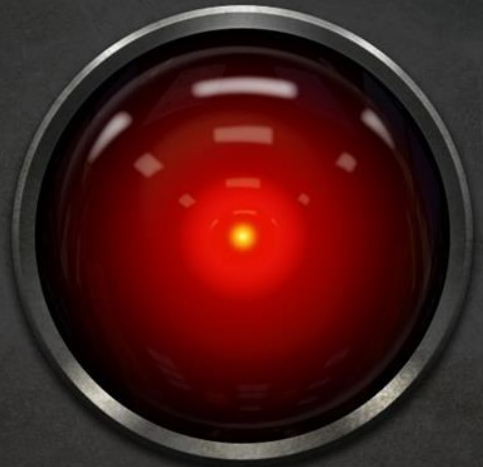


SWR measurements

Next steps

- Better code and web interface
- Connect to SATNOG network
- Switch to directional antenna
- Switch to UHF and S band
- Cooperation with amateur Cubesat projects

Q&A



https://satnogs.klub.com.pl/