

End to end developments for the Multipurpose Interferometer Array Pathfinder from the IAR Electronics Laboratory.

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Front-End



Back-End

The Smart Network ADC Processor (SNAP) board consists of three HMCAD1511 8-bit analogue to digital converters (ADCs), capable of sampling 500 MHz for three signals per board.

The ADCs are connected to a Kintex-7 160T field-programmable gate array (FPGA),

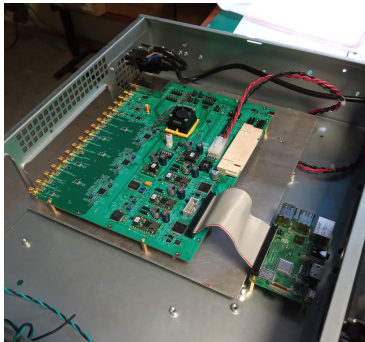
with an associated dual 10 GbE port.

Each SNAP board is controlled via Raspberry Pi, which interacts with a controlling PC over ethernet via a series of PYTHON scripts.

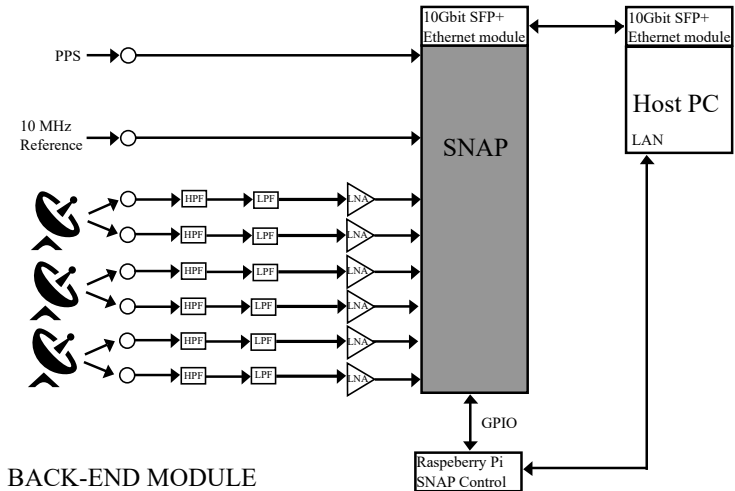
System features



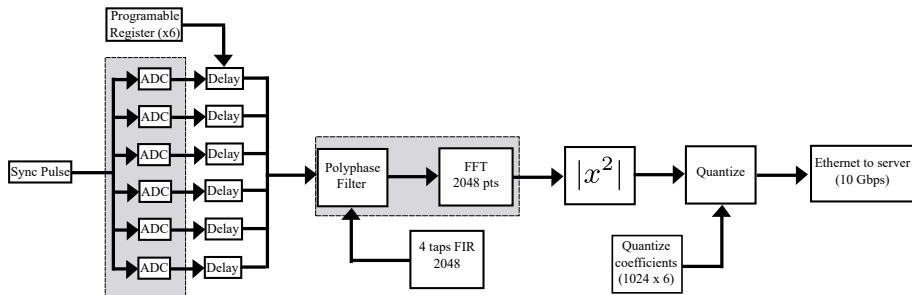
Parameter	Value
Sample Frequency	500 MHz
BW	250 MHz
Centered Frequency	1325 MHz
Board	SNAP (Casper)
Development environment	Casper Toolflow



Back-End Module



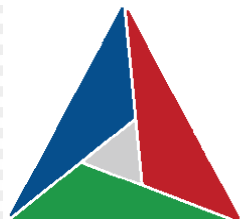
Spectrometer for system verification



Position Control

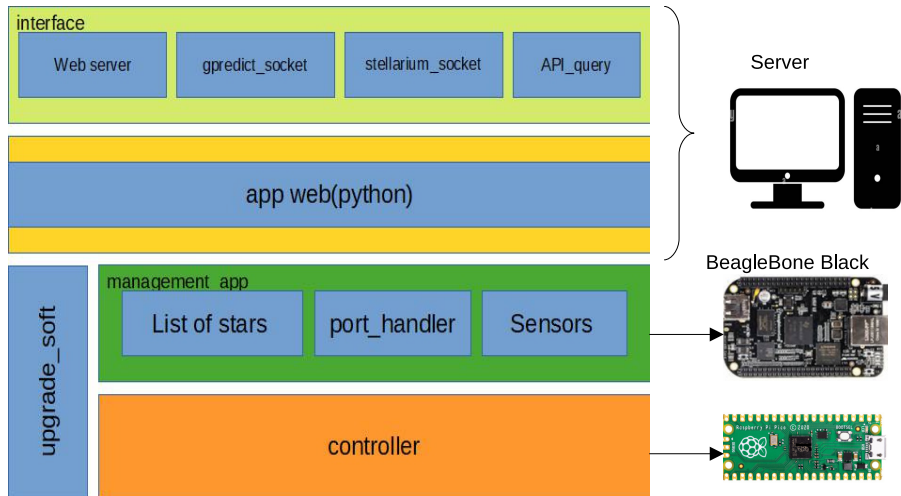
Design based open hardware and open software

- Python: Generate path trajectories stars for testing system.
- CMake : Tool for compile project and independent system build.
- Language programming: C/C++ and Python
- Ceedling: Framework for testing embebbed systems.



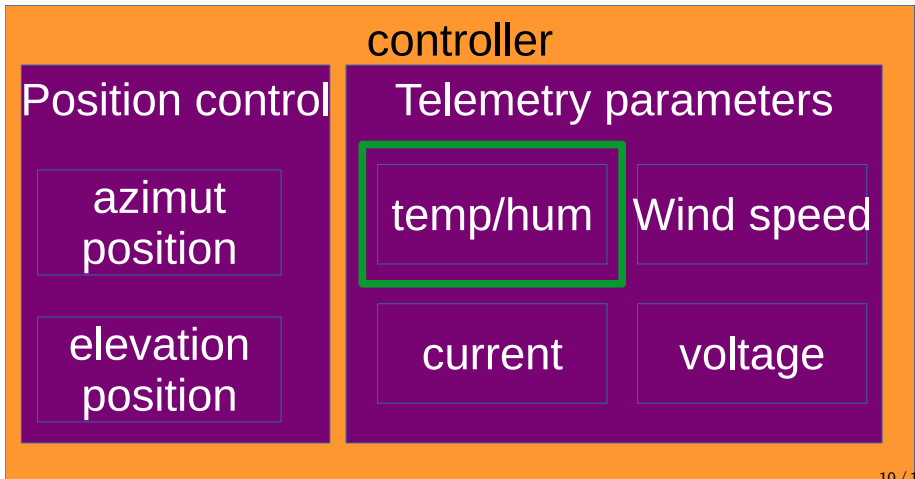
Position Control

The software design using architecture of layers.



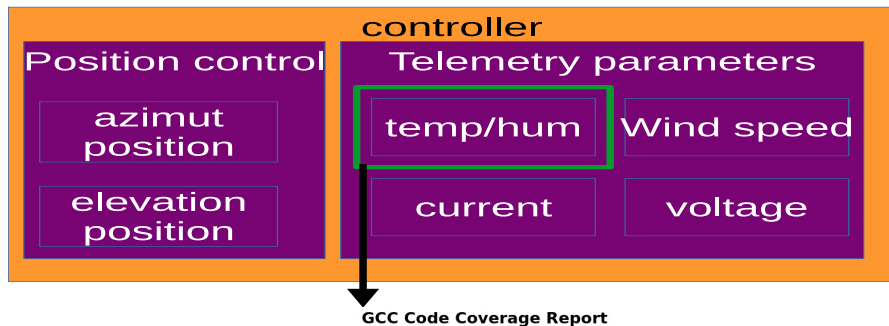
Position Control

The controller layer obtains environmental parameters and applies the control algorithm. A distributed system has been created using Raspberry Pi Pico (RP2040 microcontroller).



Position Control

Example reports generate automatically using ceedling (reports for Code Coverage using Ceedling).



Directory: src/
 Date: 2022-11-07 16:38:26
 Coverage: low: ≥ 0% medium: ≥ 75.0% high: ≥ 90.0%

	Exec	Total	Coverage
Lines:	27	27	100.0%
Functions:	7	7	100.0%
Branches:	2	2	100.0%

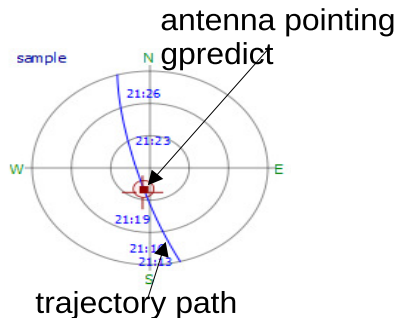
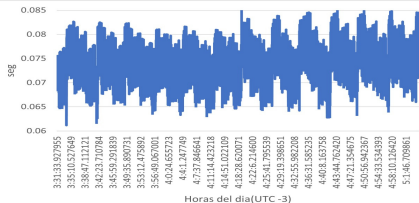
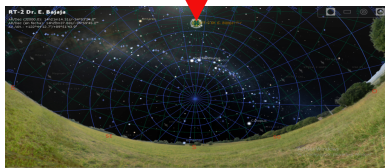
[List of functions](#)

File	Lines	Functions	Branches
dht11.c	<div style="width: 100%;"></div> 100.0% 27 / 27	100.0% 7 / 7	100.0% 2 / 2

Position Control

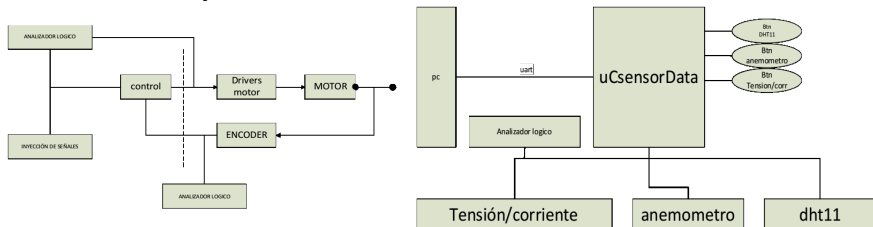
Connect antenna pointing to Gpredict and Stellarium software. Compute sidereal time using eight 8 bits microcontroller for a test and error obtained is 0.07 s. RP2040 is a 32 bits it is expected to improve the error. Testbench using astropy and algorithms for a calculus sidereal time.

antenna pointing
stellarium



Position Control

Tests for a final system controller.



Next steps:

- create a software diagrams (UML, state machines, etc) for a total system
- Talk to system management to define terminal interfaces.
- Create a test for a diagrams software.
- Integration systems with a mechanical movement antenna and test using a radiosource.
- Create repository to share with the community(TBD)

Conclusiones



1 C1

Conclusiones



1 C1

2 C2

Conclusiones



- ① C1
- ② C2
- ③ C3

Conclusiones



- ① C1
- ② C2
- ③ C3
- ④ C4

Questions ...