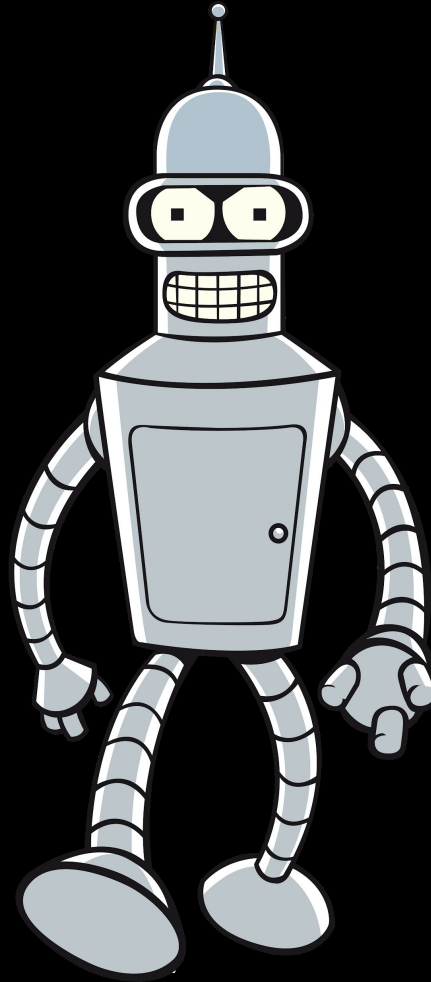




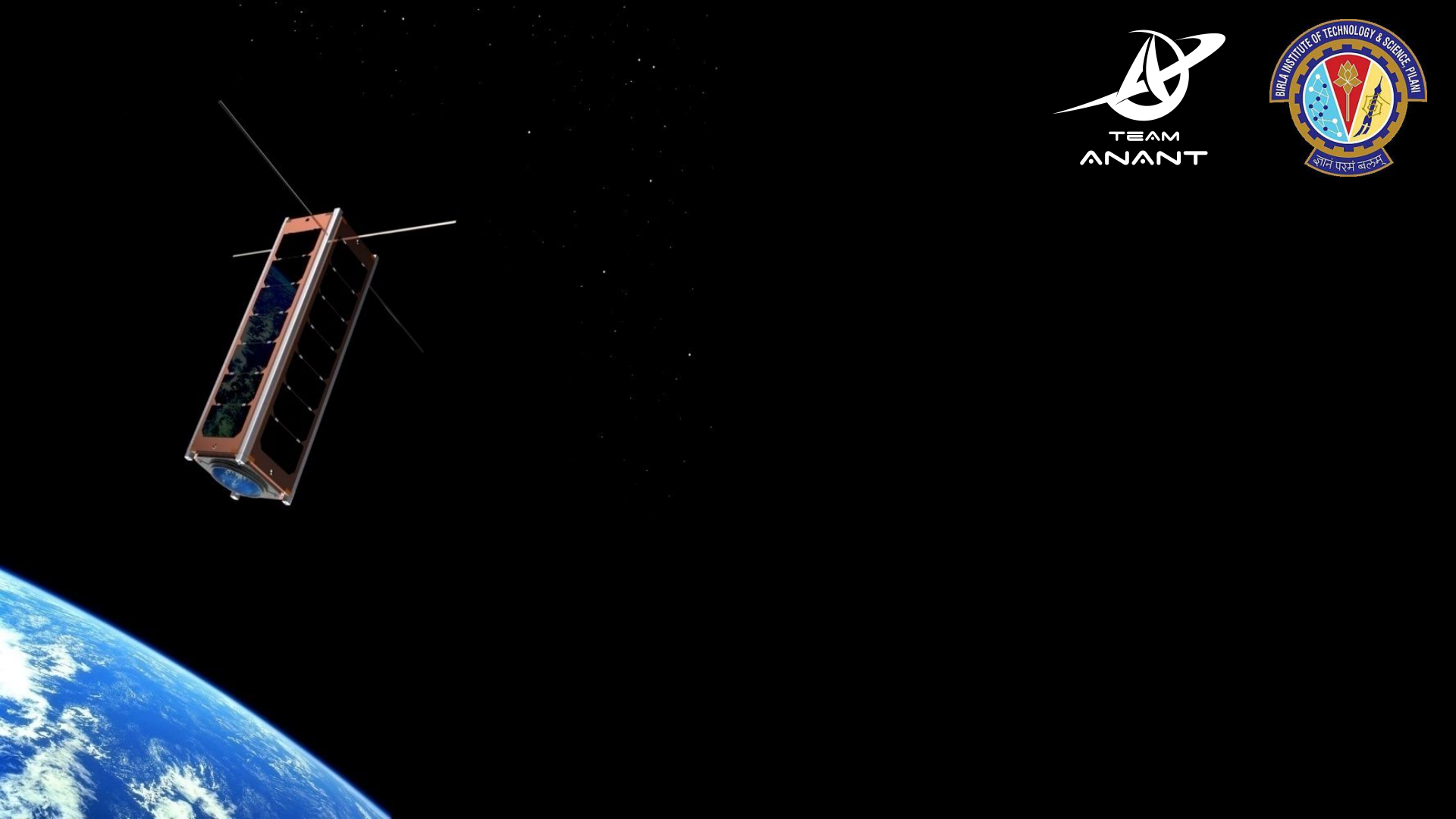
# Sending an Aluminium Box to orbit with Open Source

[team-anant.org](http://team-anant.org)

An AI box to space,  
you say?

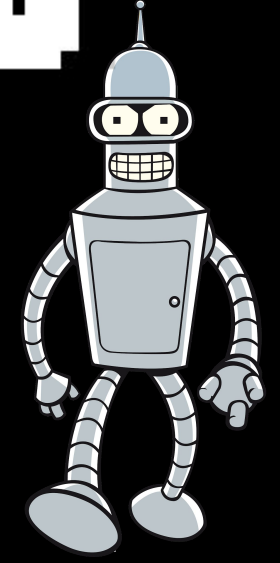


(Futurama  
reference)





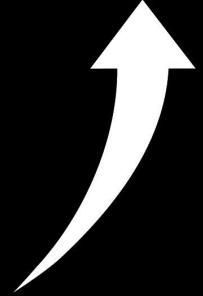
DANG IT





Tanuj who?

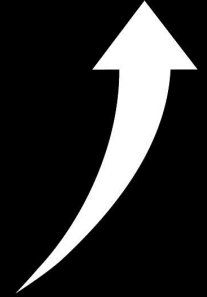
- BITS, Pilani





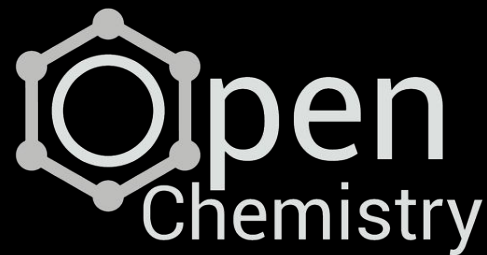
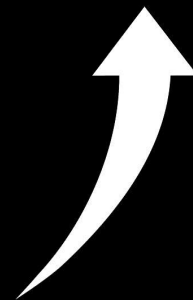
- BITS, Pilani

- ISRO





- BITS, Pilani
- ISRO
- Open Source experiences







Why is this talk happening?

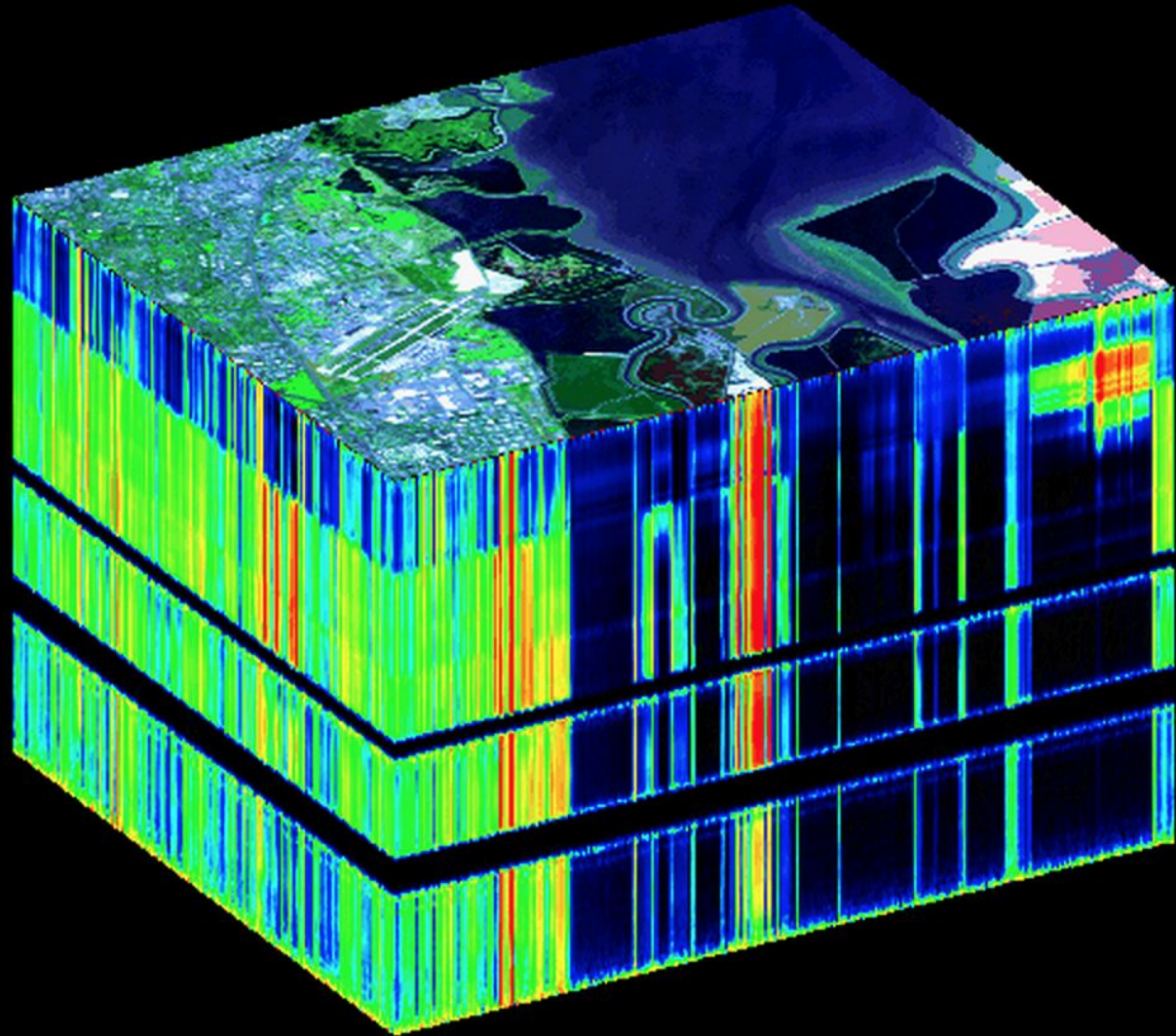


TEAM  
ANANT

[team-anant.org](http://team-anant.org)



First HyS imager in India



Courtesy of  
[NASA/JPL-Caltech](#)



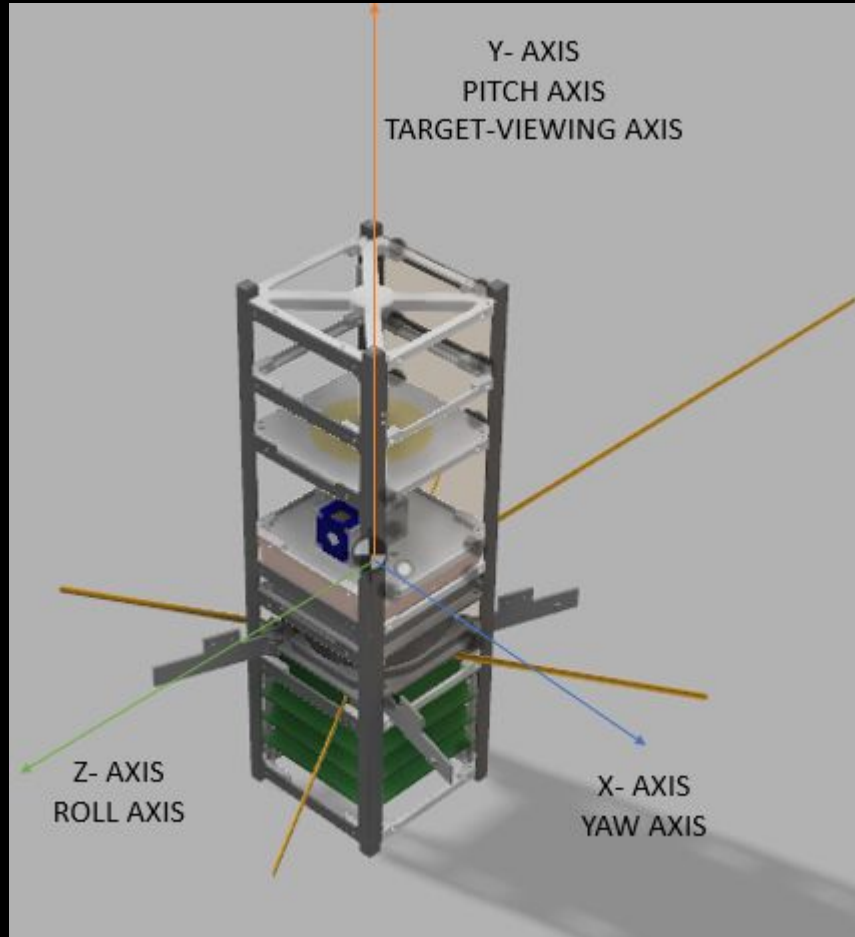
- Payload: First HyS imager in India
- Wavelengths: 400 - 1000 nm
- Resolution: 5 nm



Specs: 3U, 2.84 Kg

Team: 40 Undergrads

Application: CO<sub>2</sub> monitoring





Specs: 3U, 2.84 Kg

Team: 40 Undergrads

Application: CO<sub>2</sub> monitoring









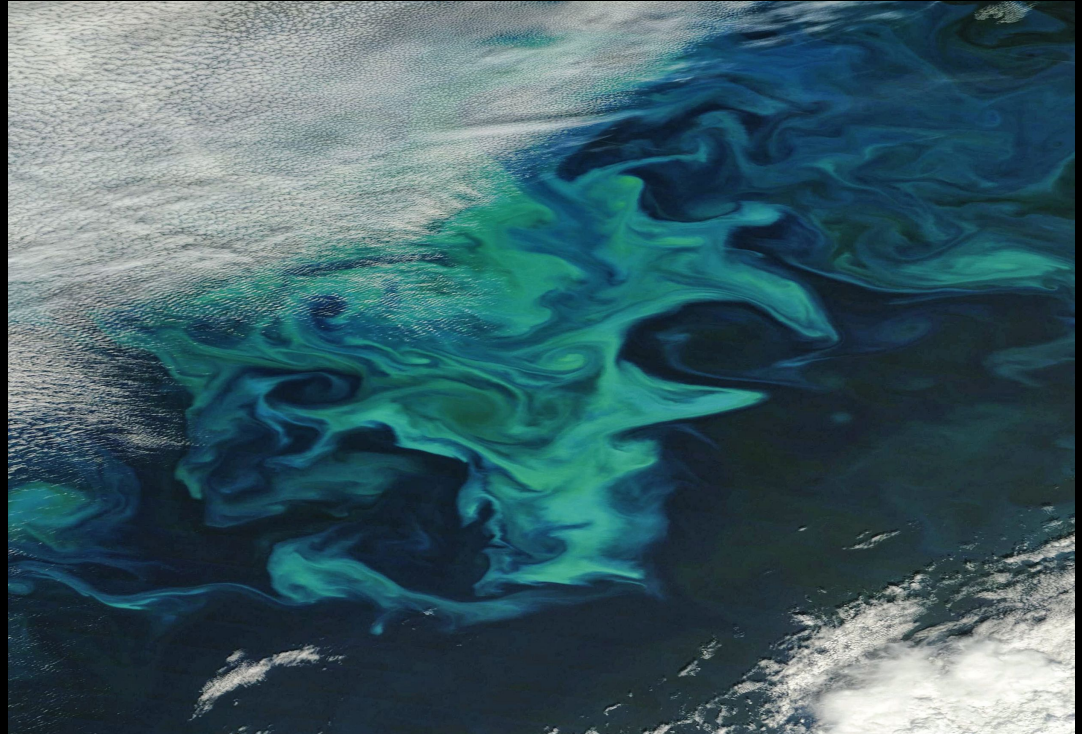


Specs: 3U, 2.84 Kg

Team: 40 Undergrads

Application: CO<sub>2</sub> monitoring

Source:  
NASA

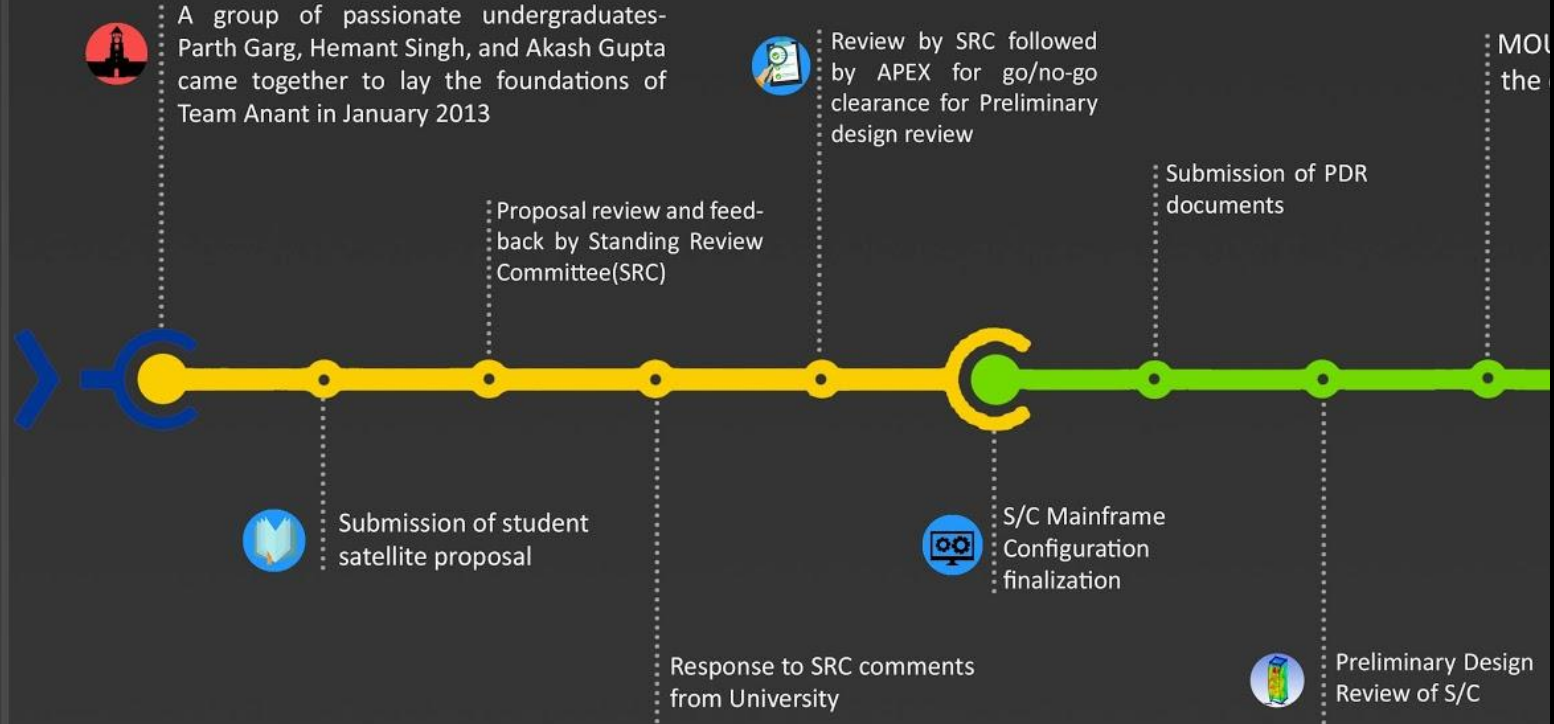




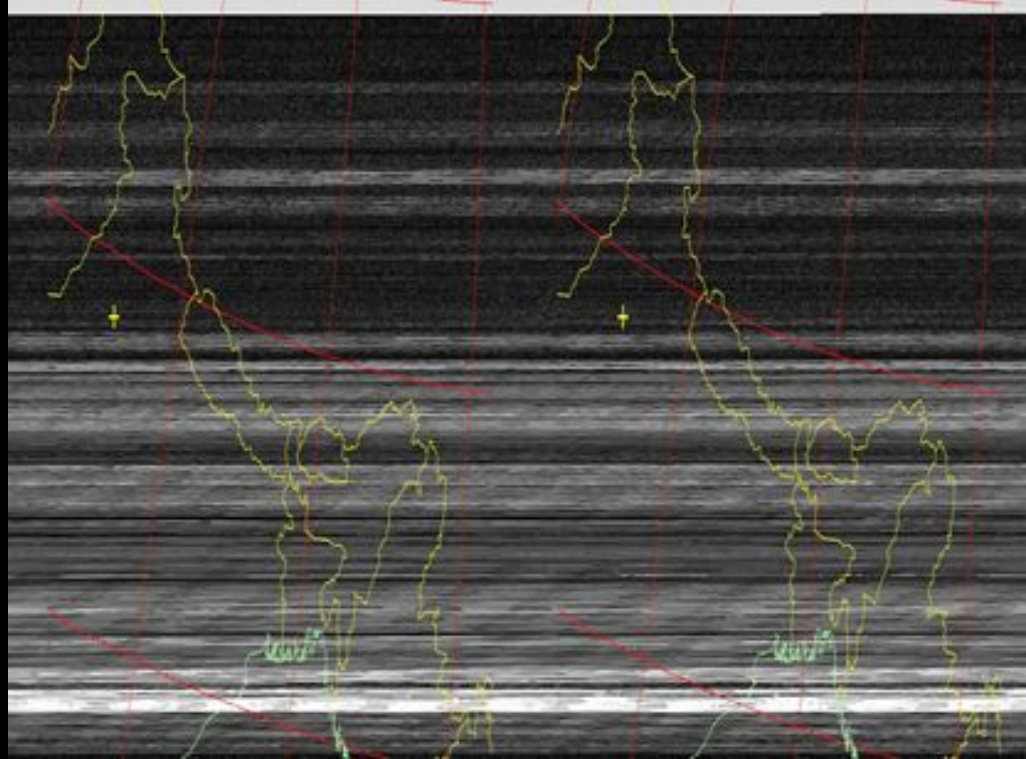


# Timeline

# TIMELINE AND OBJECTIVES



# First ground station





# Anant and Open Source

# Anant and Open Source



Research, not just follow known procedures

Correlate with academics





- Microprocessors
- Computer architecture
- Microelectronics!



How to correlate?

# On Board Computer

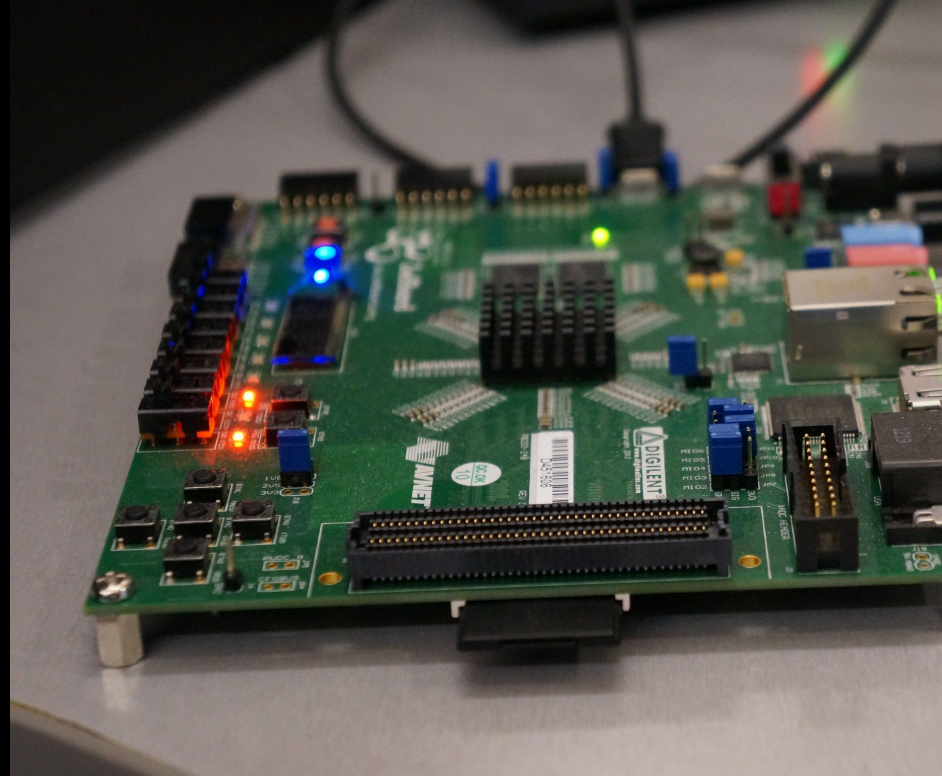
ZedBoard - Zynq 7000-SoC

- ARM Cortex A9 + FPGA

Runs PetaLinux

Also runs ADCS algos

Image compression on FPGA



# On Board Computer

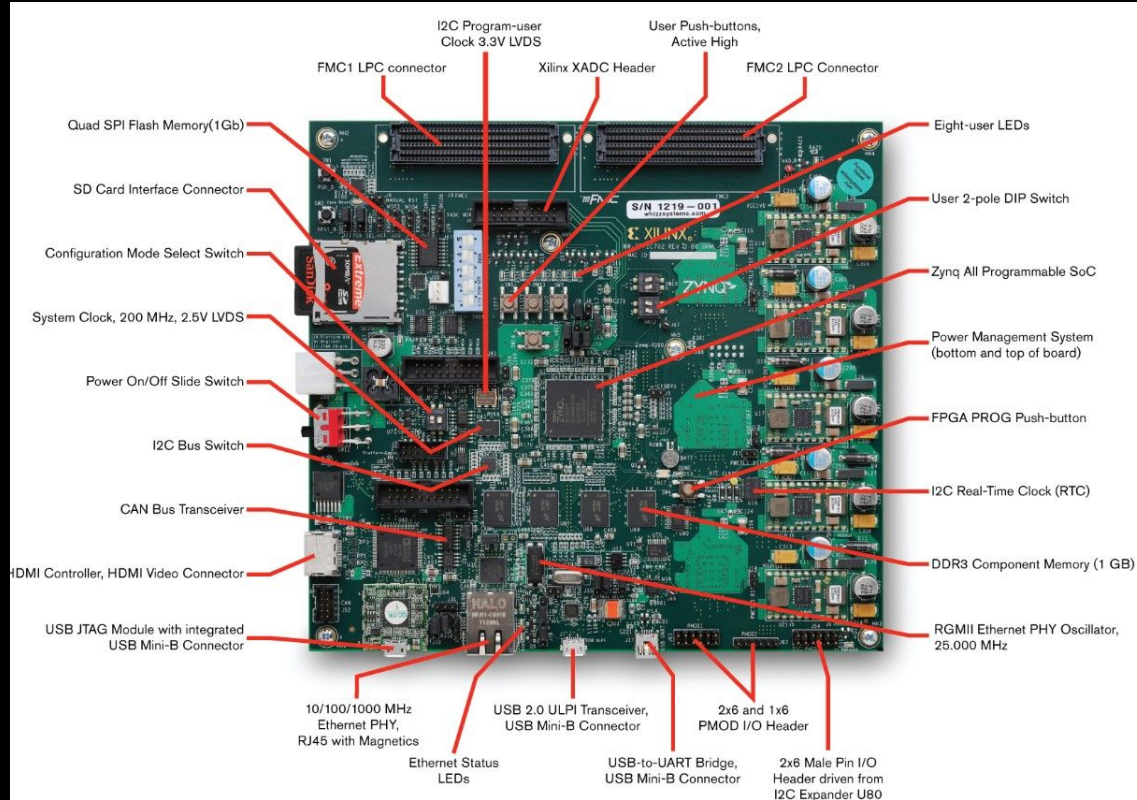
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# On Board Computer



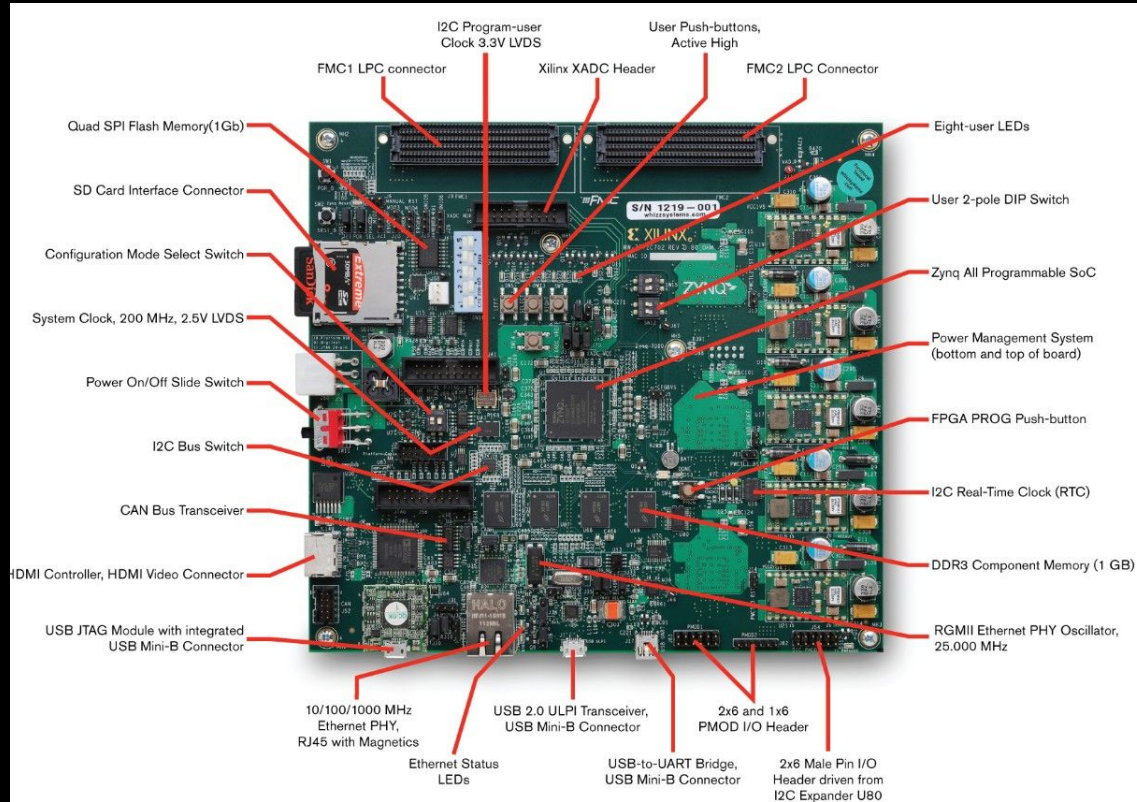
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# On Board Computer



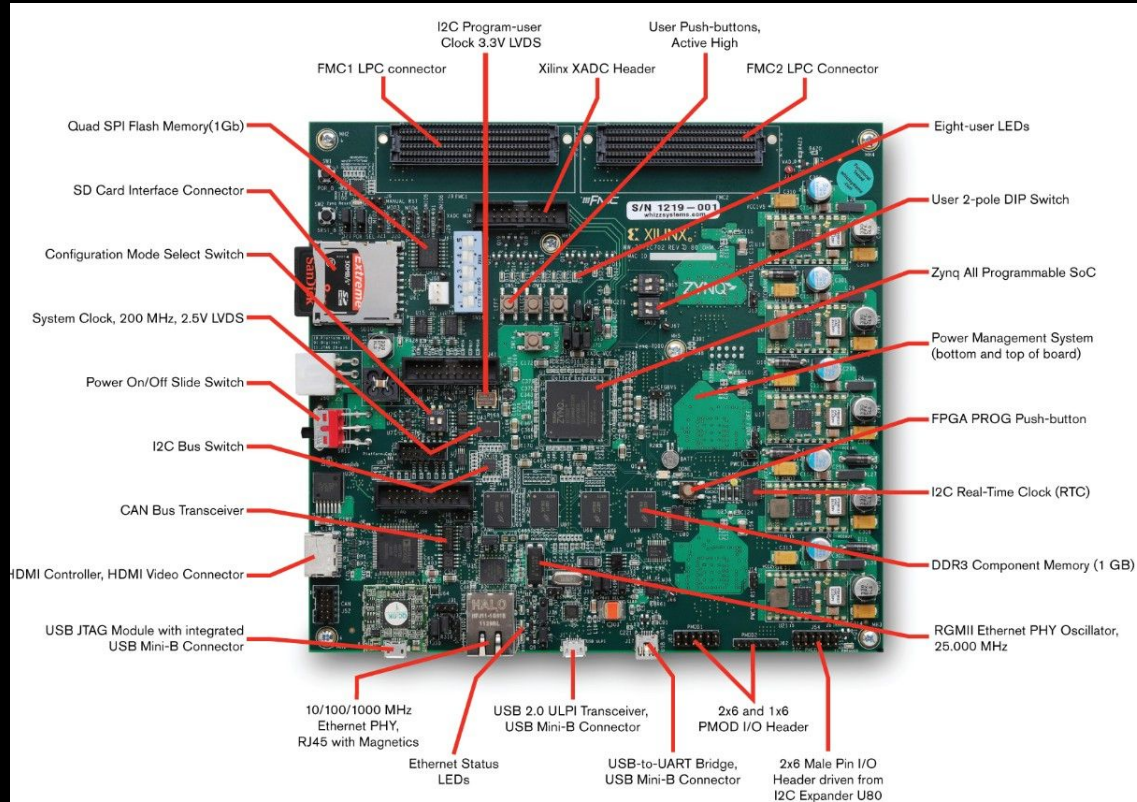
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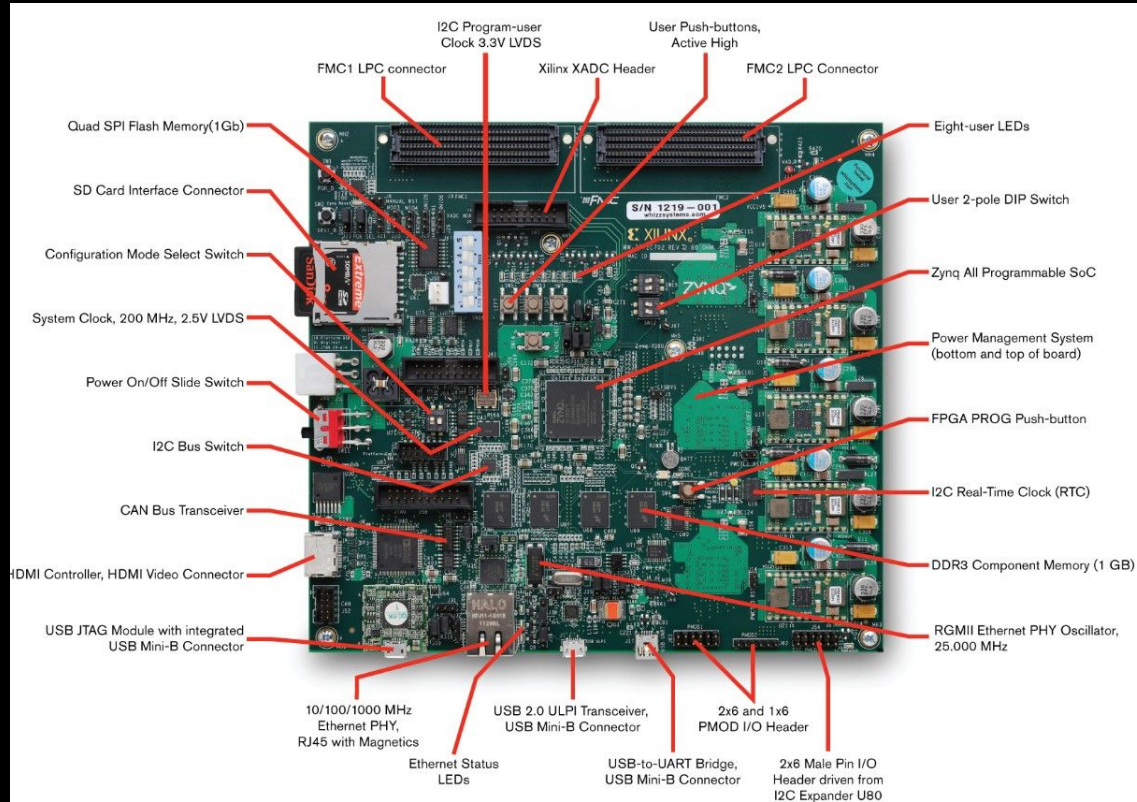
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# Image compression





# Image compression



Lossless multispectral and hyperspectral image  
compression

# Operating System



Linux - the best way to understand a computer

Specific: PetaLinux

Understand computers at low level: Embedded systems

Understand computers at hardware level: Computer Architecture

Low level systems programming

# Operating System



- Device drivers for custom low level actions
- Interrupts

Both devices and PS-PL

- Filesystems
- Flight Plan

# Operating System

- OBC boots at start up
- Start up sequence coded in Linux
- Multiple processes spawned



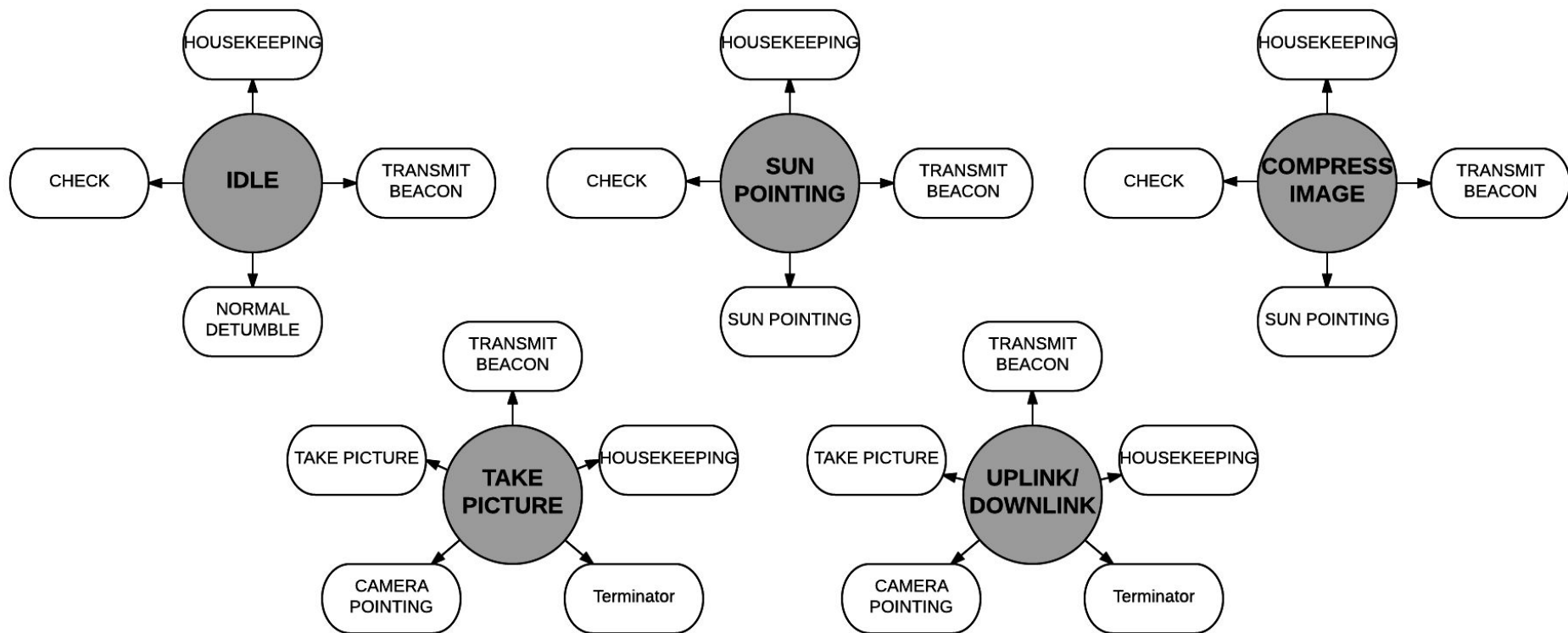


Figure 3 : Normal Modes and associated sub-tasks

**Flightplan**  
Task execution.  
Polling health metrics.  
Process health management.



**Mode specific tasks (modelled as Linux processes)**

Housekeeping

Transmit

Take picture

B-Dot Control

I/O Interface Library

**Operating System/Kernel space**

Device drivers



# And the rest of the satellite?







Shot on OnePlus  
By Nemish Murawat



Shot on OnePlus  
By Nemish Murawat

# Arduino

Versatile testing hardware

Used for HILS

Interrupts testing

Device simulation





End.

[tanuj.co](http://tanuj.co)

[@foowhiz](https://twitter.com/foowhiz) 