ICTP-IAEA School on LoRa Enabled Radiation and Environmental Monitoring Sensors, Trieste – Italy
April 23 - May 11, 2018

Real-time measurements of I-131 in wastewater of the hospital

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❖ Outlines

- Introduction
- I-131 measurement
- Challenges
- The target
- Expectation of the target

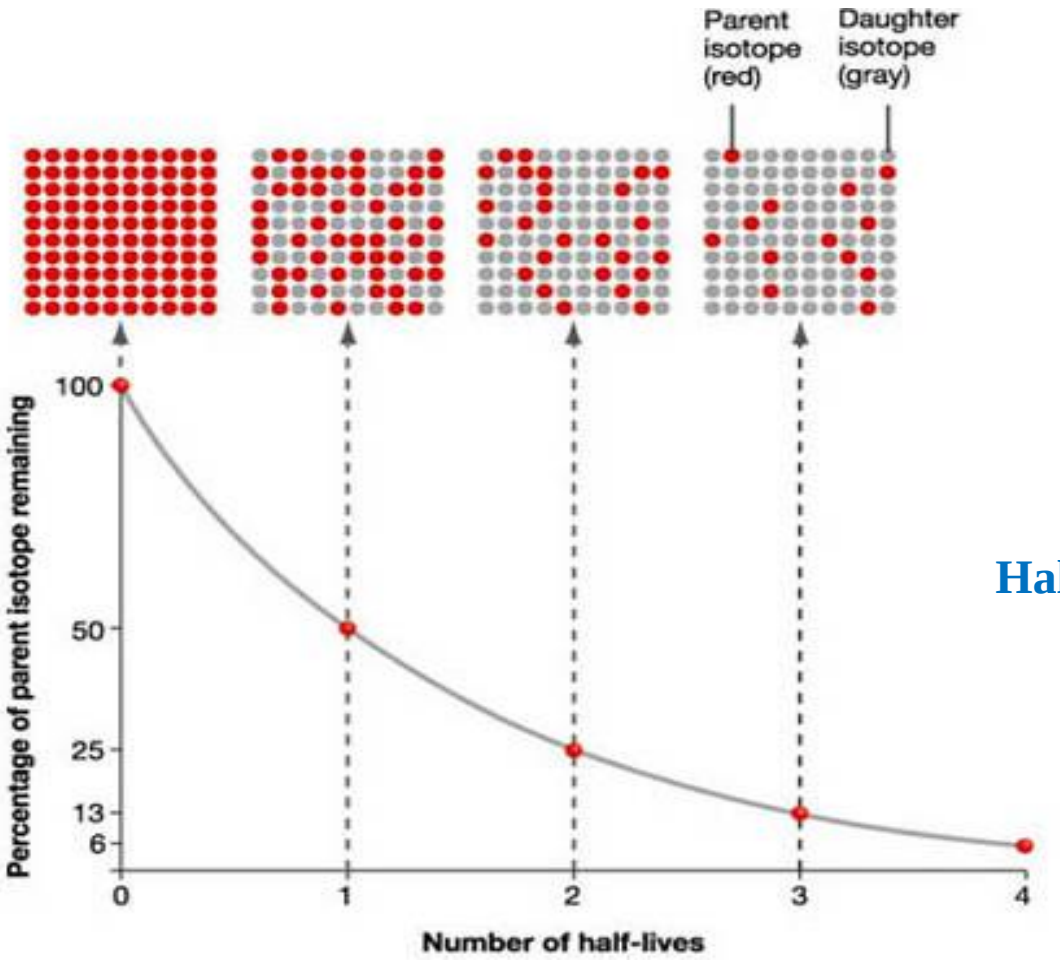
Iodine-131 a fission product

Nuclear power plants

Nuclear weapons tests

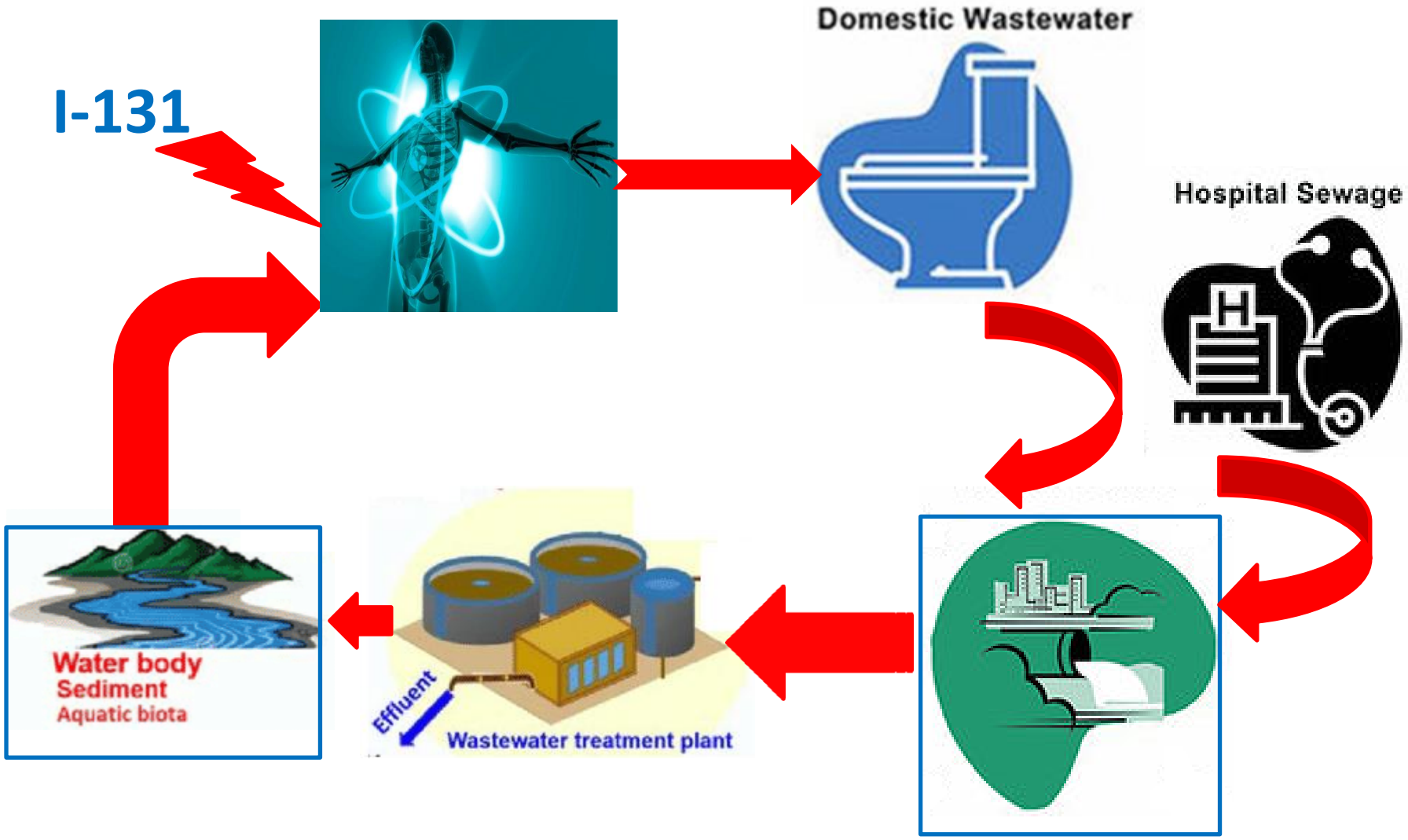
Nuclear medicine

Iodine-131

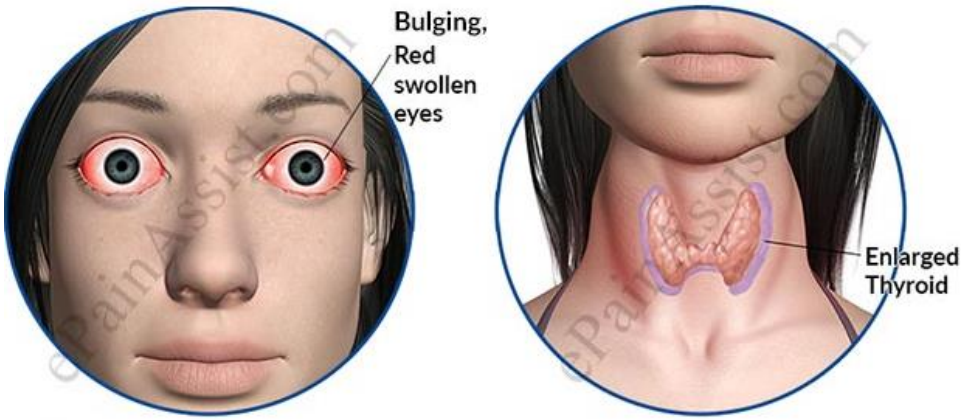


Half-life 8.04 days

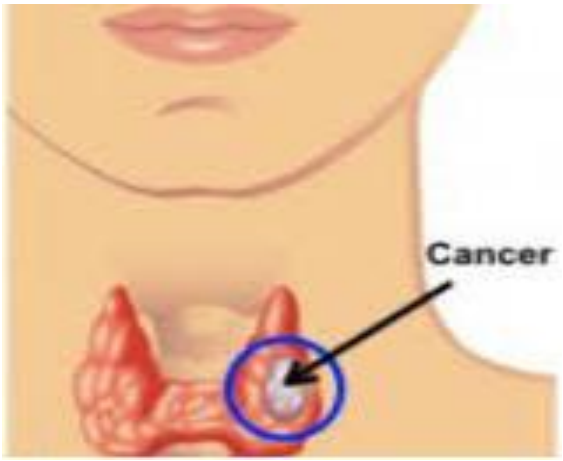
Pathway of I-131



Iodine-131

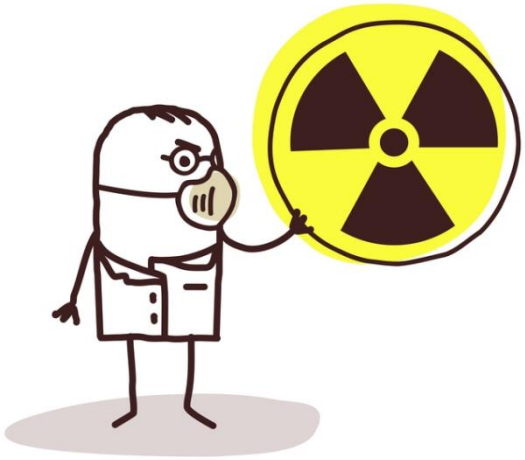


Hyperthyroidism treatments is 1.5 per 1000 people



Thyroid cancer treatments is 0.38 per 1000 people

Rose,P.S., Lawrence Swanson,R., Kirk Cochran,J.,2012. Medically-derived ^{131}I in municipal sewage effluent. Water research ,46, 5663-5671.

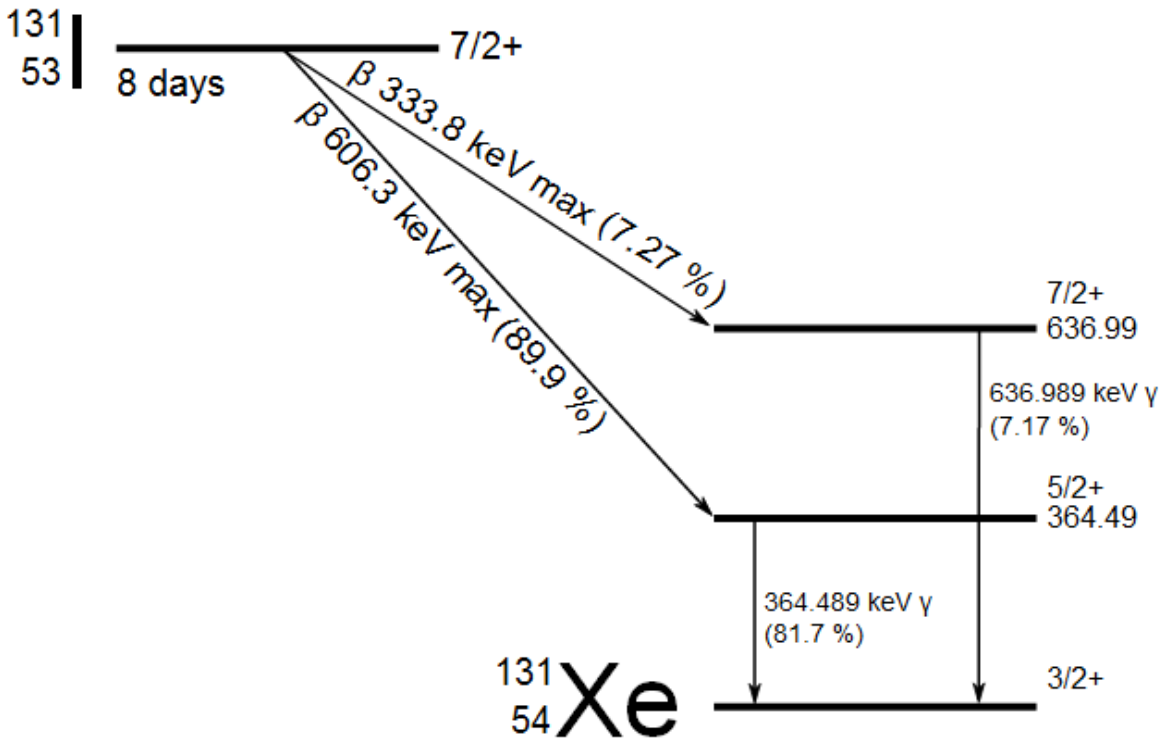


Exposures to I-131

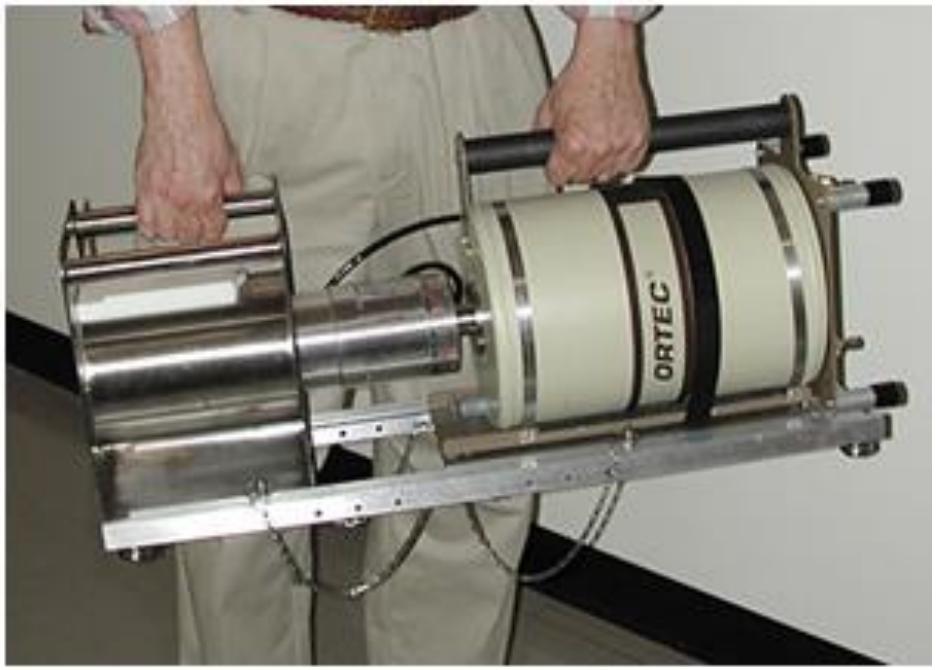
Sewer workers

Contaminate fish + Polluted water

I-131


131
53
8 days
7/2+
β 333.8 keV max (7.27 %)
β 606.3 keV max (89.9 %)
7/2+
636.99
636.989 keV γ
(7.17 %)
5/2+
364.49
364.489 keV γ
(81.7 %)
131
54
Xe
3/2+

I-131 can measure



ISO-CART-II LN2, HPGe detector
www.ortec-online.com

NaI detector
www.ortec-online.com

Challenges
(Why I use LoRa)

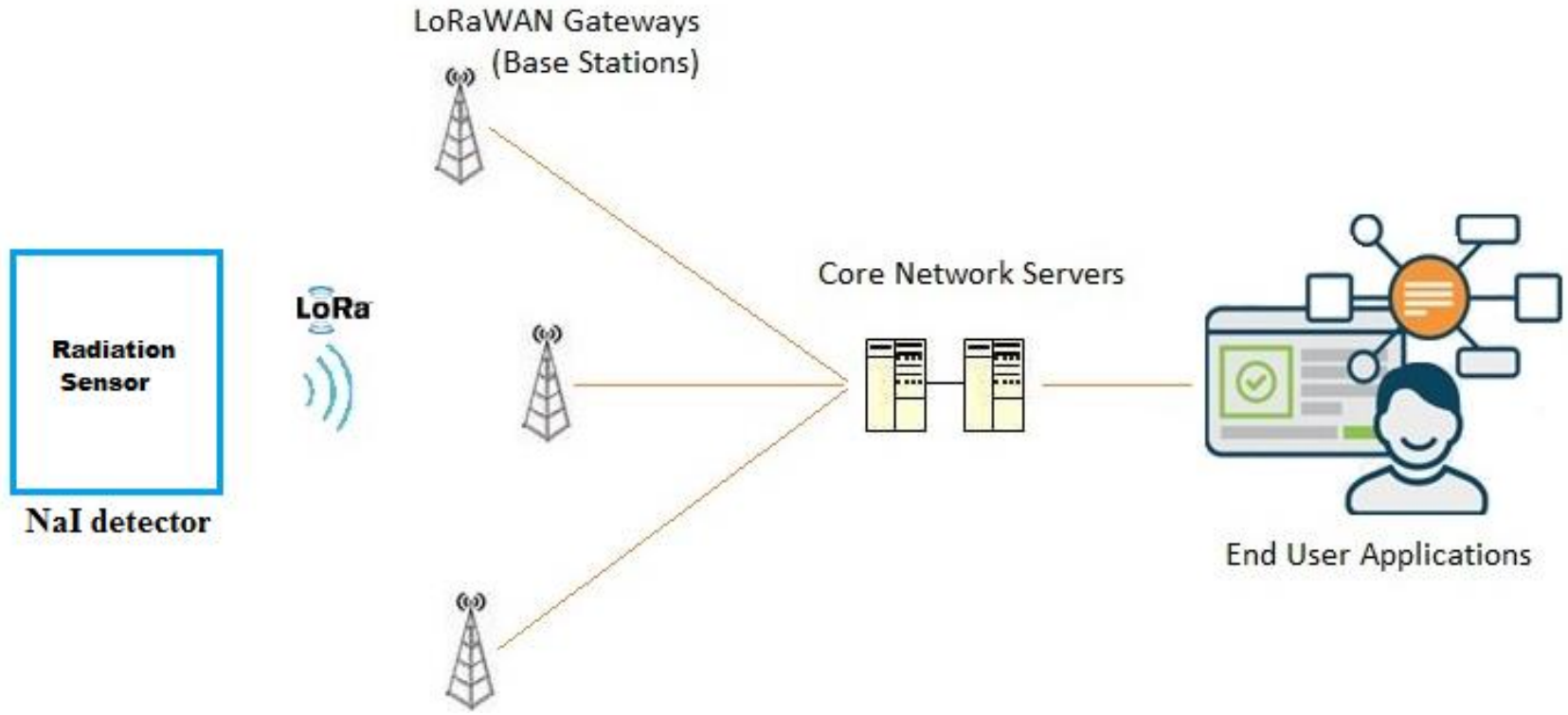
- Difficult to collect samples with tradition methods.
- Measure of dose rate in situ of wastewater the hospital.
- Real time measurement of dose rate.

The Target

- To measure dose rate in sewer of the hospital and at end point of discharge (river ,lake)

  (An important concern in terms of cost, detection precision, real time data processing, flexibility)
- The goal is to deploy devices integrating detector to capture radiation doses in real time and to wirelessly dispatch them to a remote database where the radiation values are stored.
- Response to data measurements (Action)

Detector LoRa design



www.rfwireless-world.com

Expectation of the target

- The real-time monitoring of the I-131 concentration in wastewater and discharge point , the effective dose rate.
- we can make timetable for workers of sewer to check or repairs the down-stream of the hospital .

Thank you

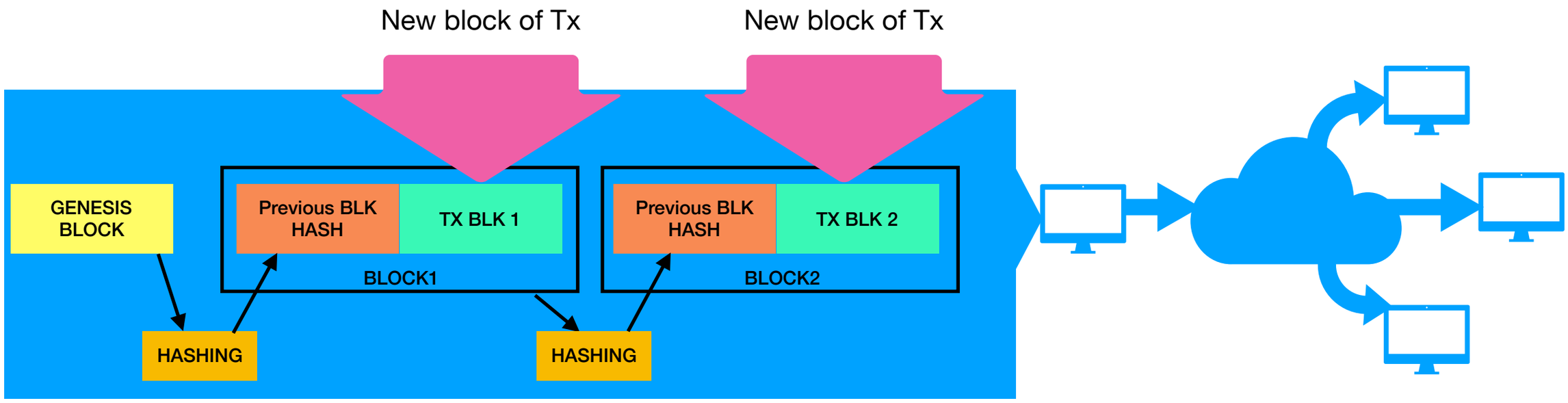
Towards Blockchain Based Wireless Mesh Networks

Aniruddh Rao Kabbinale
@ICTP on10th May 2018

UNIVERSITY OF CAMBRIDGE

Ammbr

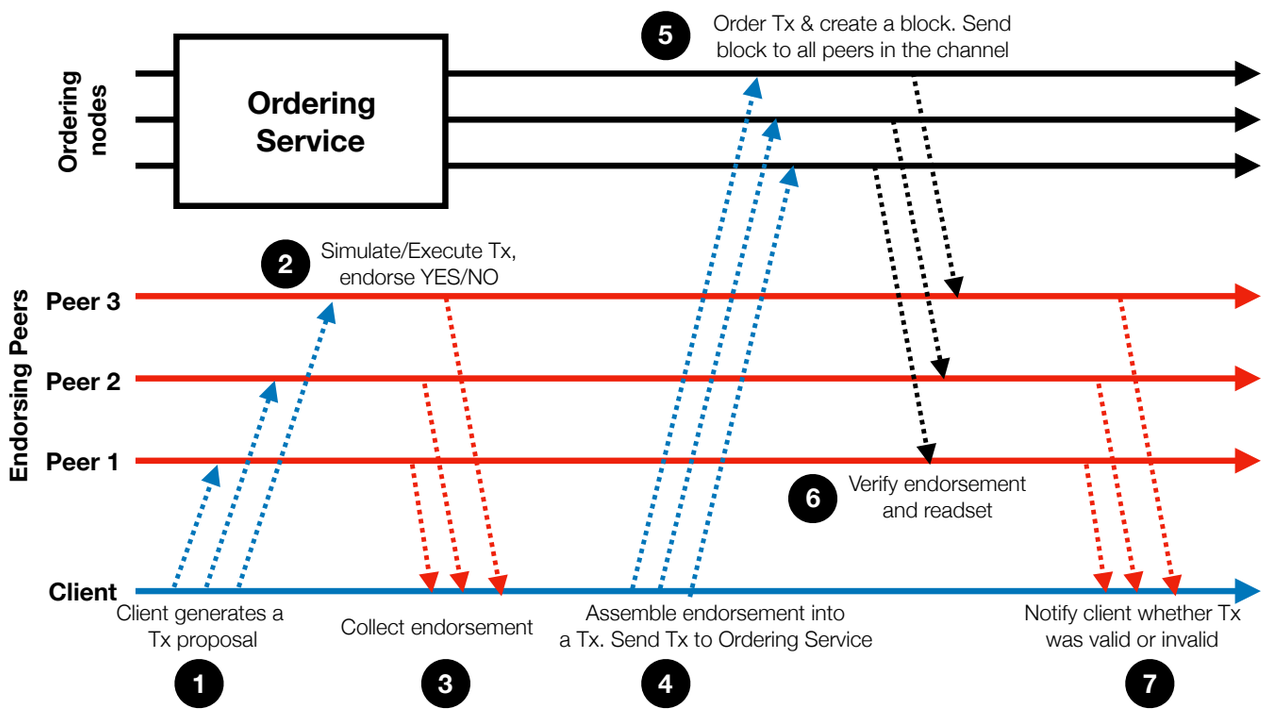
Blockchains



- An **append only immutable data structure**
    - data appended in chunks/blocks
    - Bitcoin was the 1st implementation, permission-less. ANYBODY CAN JOIN AND MINE
    - **Why is it so popular??** Enables trust in transactions among non trusting parties
- It is a **distributed ledger**
    - All nodes in the network have a copy of all transaction data
    - A new block is appended only after **consensus**
    - **Smart contracts** executed when appending a new block
    - Tampering a block corrupts all data after the corrupted block. Demo: https://anders.com/blockchain/blockchain.html
- Permission-less and permissioned blockchains
    - Bitcoin, ethereum etc are permission-less
    - Hyperledger fabric is permissioned. Only authorised members can be part of blockchain network

Permissioned Blockchains

- Hyperledger Fabric is a permissioned Blockchain platform
  - A Linux foundation hosted project
  - Components: Peers, Endorsers, Orderer/Ordering service and clients
  - Endorsing and consensus validate/order the transactions
  - Smart contracts enable automation
- Flow: Endorse or validate the Tx, execute TX, Order and Commit



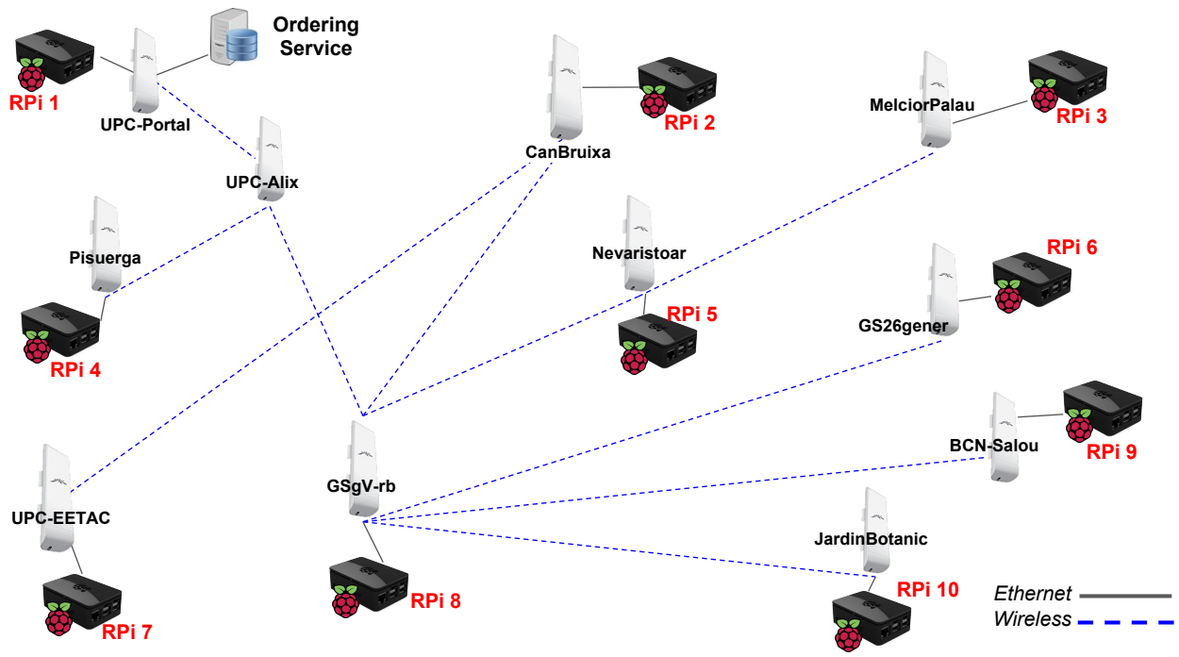
Wireless Mesh Network

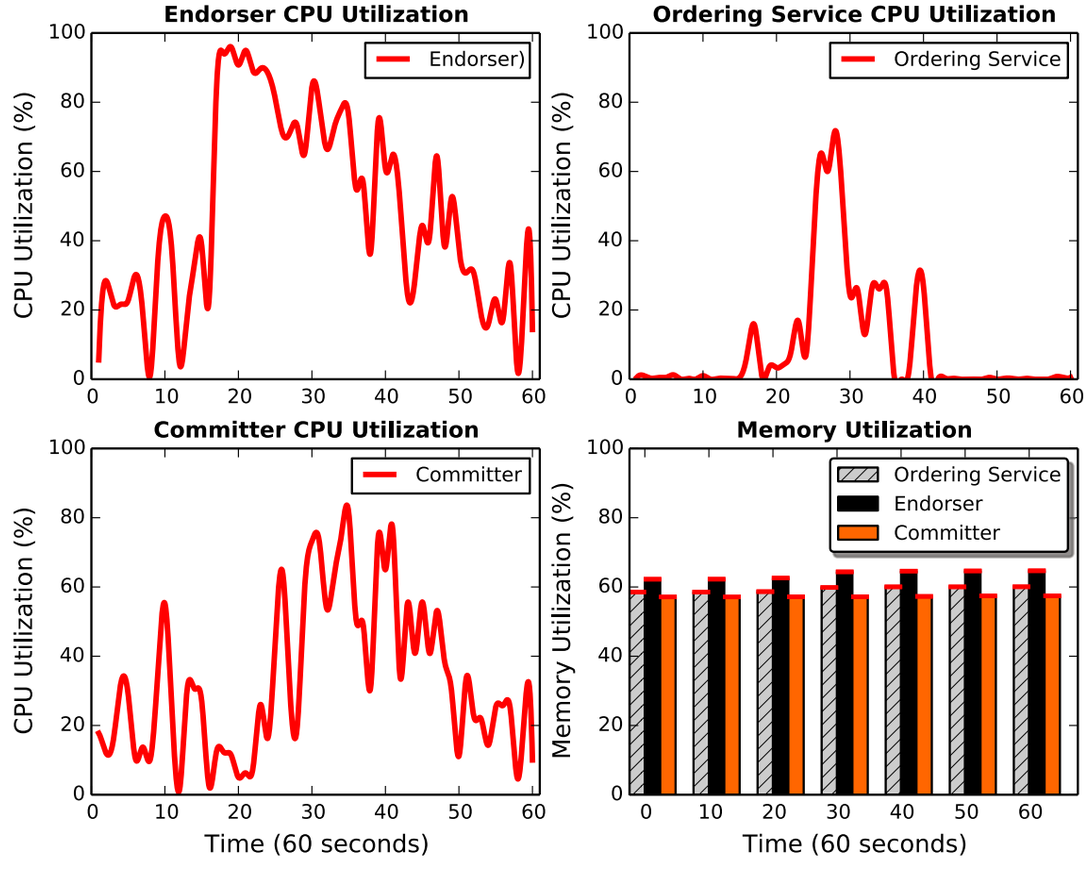
- WMNs are a kind of access network
    - Connectivity provided by wireless routers connected in a mesh
    - A router typically connected to multiple routers wirelessly.
    - Multi hops and multiple gateways
- **Community Networks** - Network infrastructure commons built by citizens
    - Resources pooled
    - Managed by a organisation characterised as open, free and neutral
    - guifi.net is one such successful CN in Spain
- **Quick Mesh Project** - Community WMN in guifi.net
    - Sharing bandwidth, easing connectivity
    - Long distance WiFi
    - Economic compensation system is currently manual

DashBoard of guifi.net

Evaluation of HLF in QMP

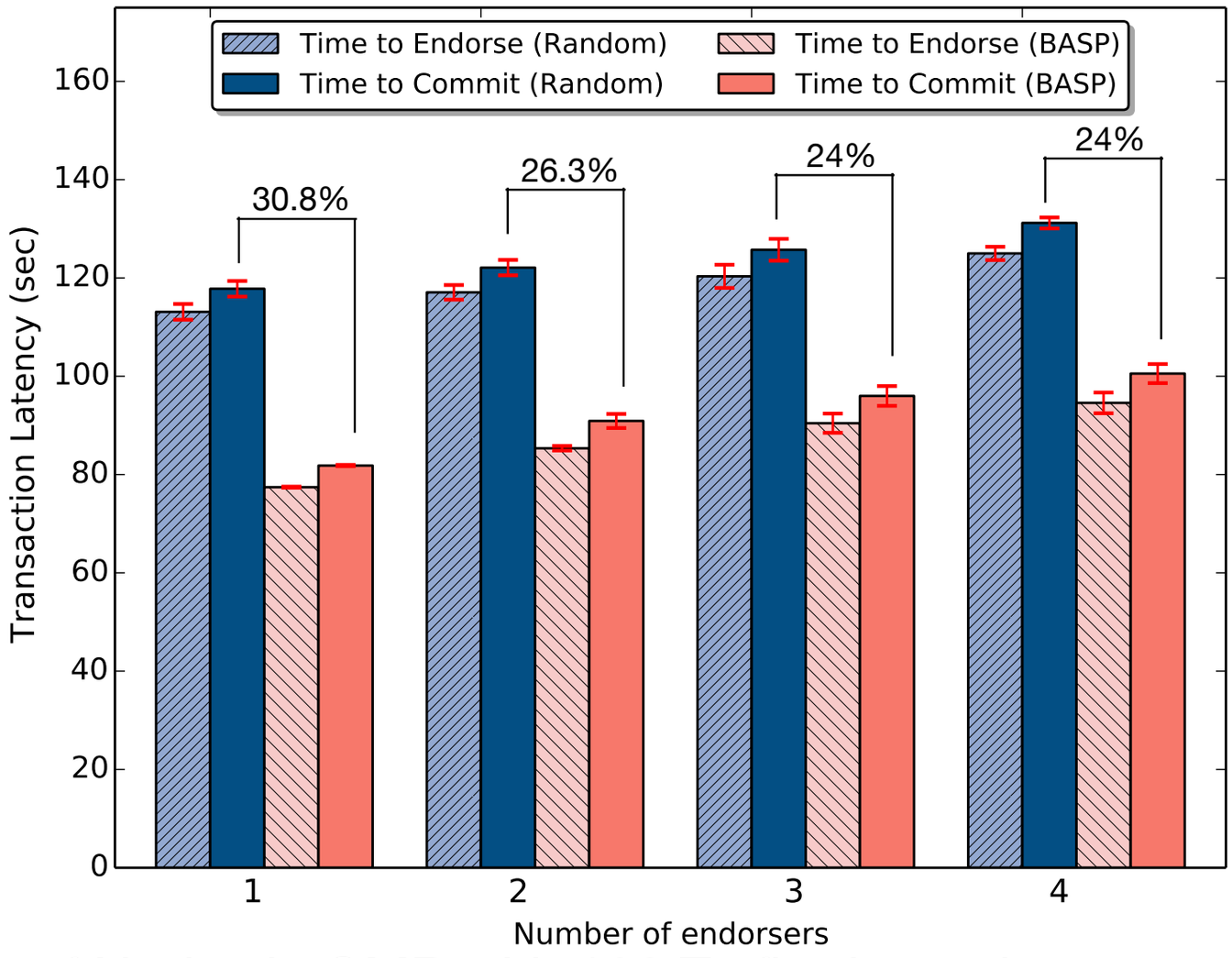
- HLF in QMP
  - Smart contracts to automate economic compensation system
  - Usage recorded on top of blockchain
  - Disputes resolved
- RPI3 deployed as HLF nodes
  - CPU usage and memory usage measured in various components[1]
  - Endorser - A bottleneck
  - Real time Tx latencies measured
    - BMx used for routing
    - Can HLF be used for pricing?
- **HLF is light!!! I can run entire Blockchain network on a RPI**





1 http://arxiv.org/abs/1804.00561

Evaluation of HLF in QMP



- Placement of Nodes in QMP with 100 Tx fired together
  - Orderer in node with high degree centrality
  - Lesser number of endorsers, means less time to complete transaction

1 http://arxiv.org/abs/1804.00561

AMMBR: https://ammbr.com

- Sharing Bandwidth made profitable
    - Mesh networks on top of Blockchains
    - Ammbr tokens based on ERC20 wallet
    - EDGE platform for local content hosting
    - Modular router design
    - Primarily targeting developing countries

Ammbr

Blockchains in IoT

- Hype apart - Blockchains can address various IoT issues
- Automation in supply-chain management and e-commerce logistic
- Add on feature in industrial IoT where tracing/tracking is necessary
- IoT infrastructure resource pooling
- IoT Security
  - Using blockchain for Identity management
  - removing chances of rogue devices getting into network

Blockchains in IoT

- Supply-chain management and e-commerce logistics
    - Sensor readings communicated or RF tag readings recorded on top of blockchains
    - **Arriving** or **Dispatch** of every good is recorded on top of blockchain
- Settlement/payment done only after consensus from both parties involved in transaction
    - Any faulty reading/measurement is traceable
- IoT infrastructure resource pooling
    - Sharing of resources between TTN gateways and private LoRa gateways
    - Integrating services and sharing resources between LoRa gateways and other ~~IoT~~ technology devices

LoRaWAN Gateway

Thank You.

Questions?

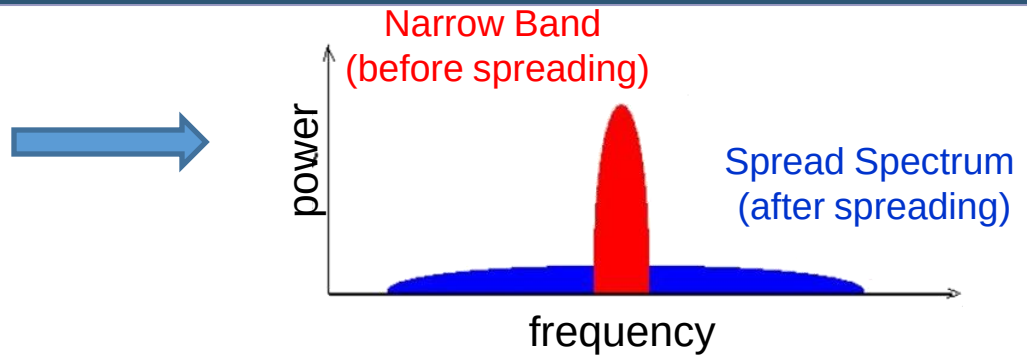
University of Belgrade
School of Electrical Engineering
Department for Electronics

Improving The Performances of LoRa Based Wireless Transceivers

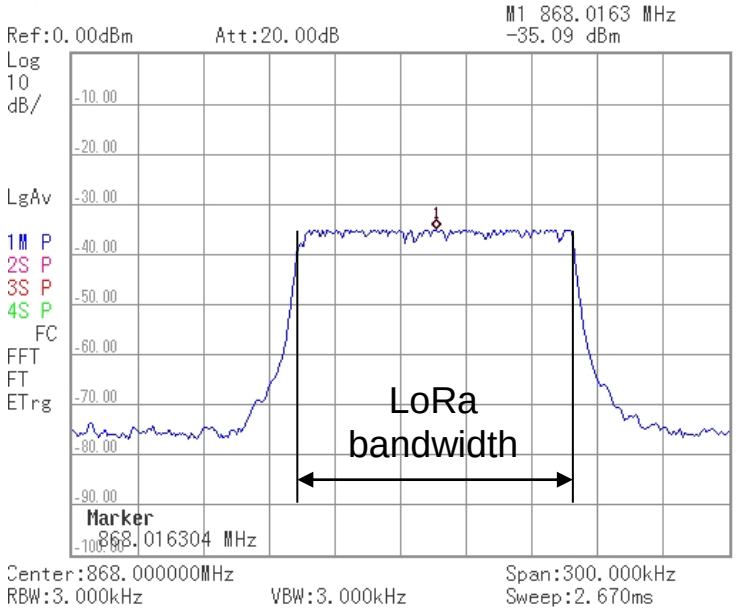
Nikola Jovalekic 5063/10

Intro, Fundamentals

- LoRa: new type of the modulation based on spread spectrum techniques



- LoRa transmission can be customized by:
  - LoRa Bandwidth
  - Spreading Factor
  - Coding Rate



LoRa Signal Spectrum:
BW = 125 kHz, SF = 10, CR = 4/6.

Intro, Fundamentals

- LoRa enables trade off between the following parameters:

Power Consumption

Sensitivity

Bit rate

Spreading Factor

Bandwidth

Coding Rate

- LoRa Characteristics:
  - Inherent better immunity to interference
  - Detection of very weak signals (below noise floor)
  - Flexibility in network design

→ LoRaWAN™

Wide Area Network for IoT

Motivation

- Usual scenario for LoRa experiments:

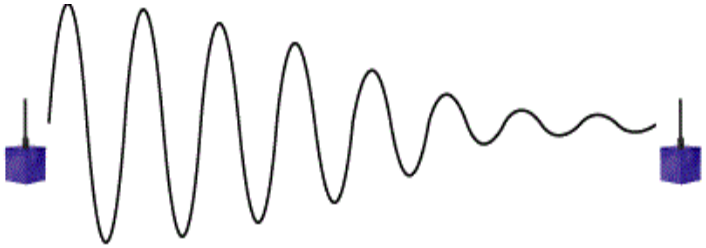
  - Experiments are done in indoor or urban scenarios (links shorter than 15km).
  - There is no data about RSSI calibration.
  - Small number of packets sent in the experiments
  - Commercial devices deployed

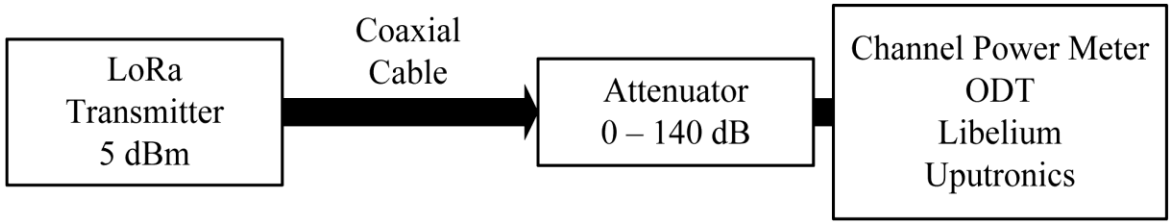
Sensitivity and immunity to external disturbances?

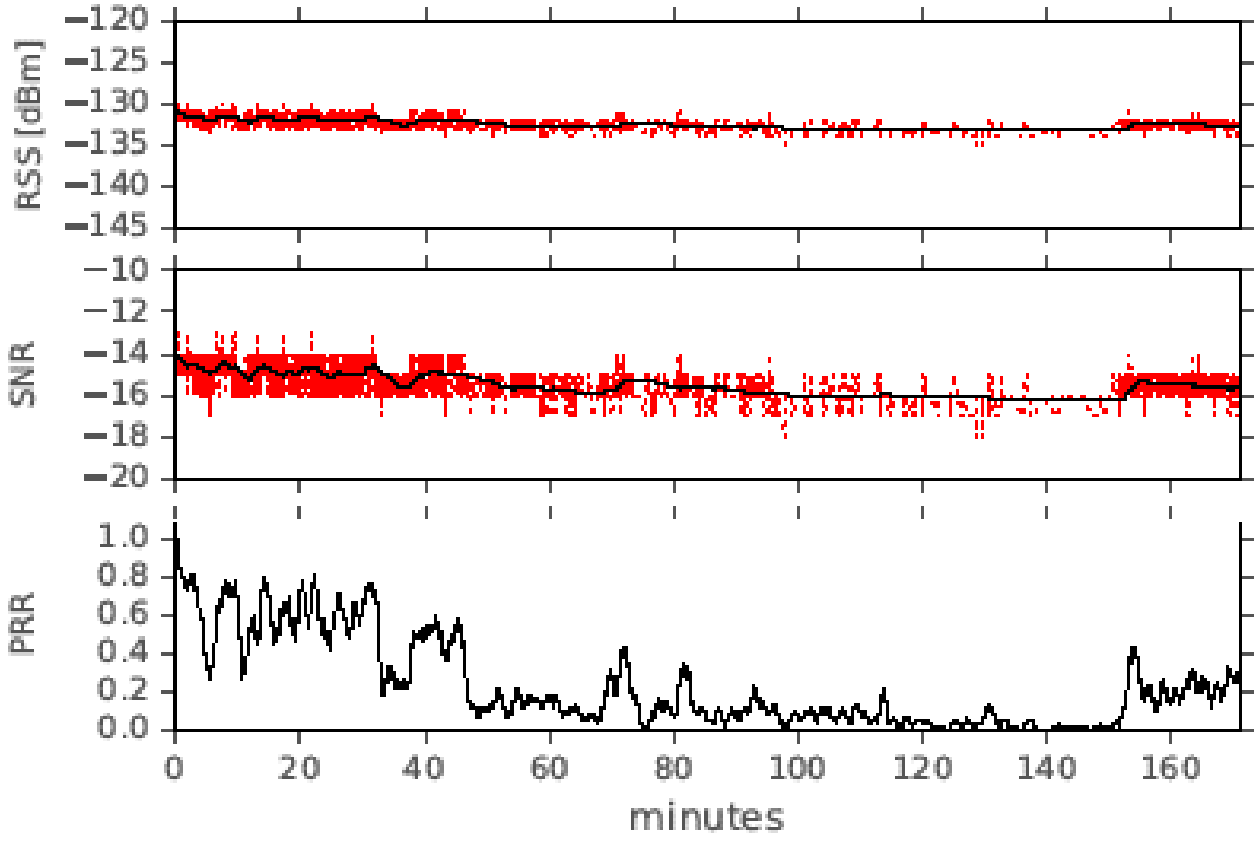
Note: Based on reading app. 70 papers about LoRa experiments

Motivation

- Sensitivity of the commercial transceiver?







- Libelium transceiver:
  - SX1272
  - BW = 125 kHz
  - SF = 10
  - Sensitivity: -132 dBm

→ Packet Loss: 77.38 %

Goal: improved LoRa transceiver, analysis of very long LoRa links (> 100 km)

The current state in the field

Commercial Transceivers

Measurement results without data for RSSI calibration

Small number of packet sent

Short range experiments (>15 km)

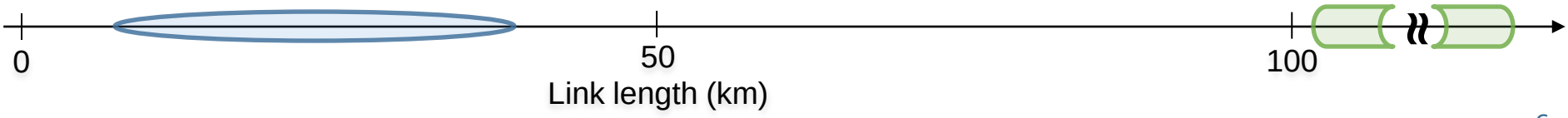
Research Work

Goals

To design new, improved LoRa transceiver

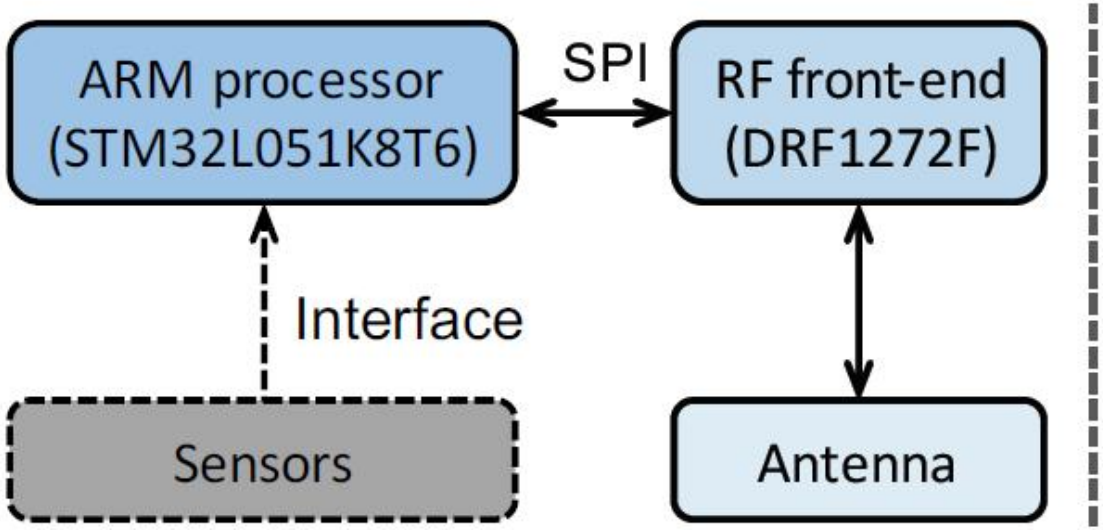
Develop the calibration method for RSS indicator

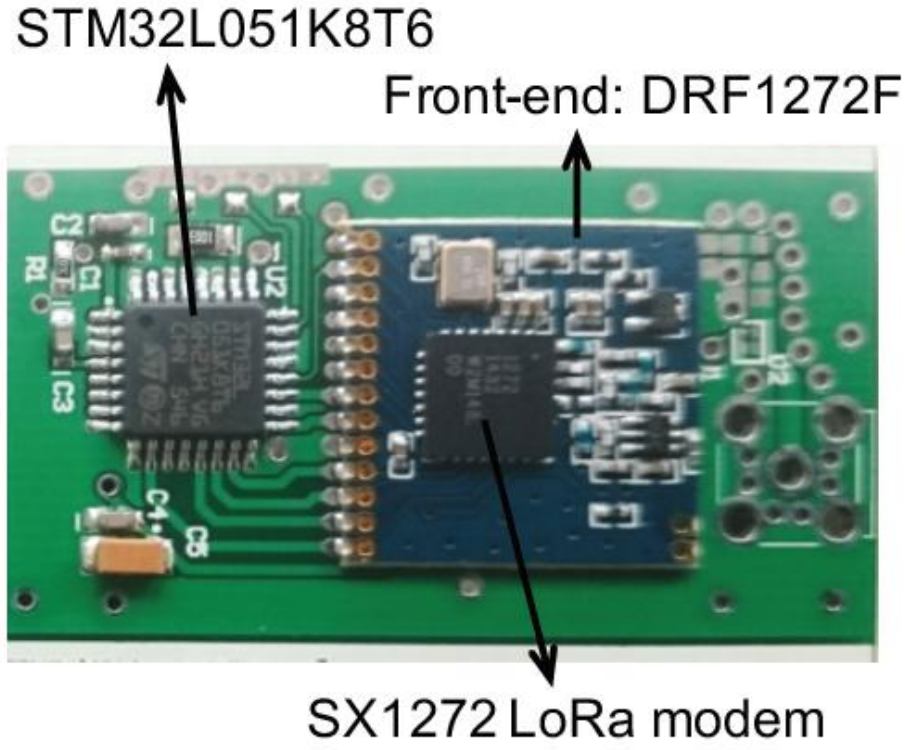
Carry out experiments on very long trajectories (> 100 km)



Current State in the Field

- Only one research group has developed the LoRa transceiver so far

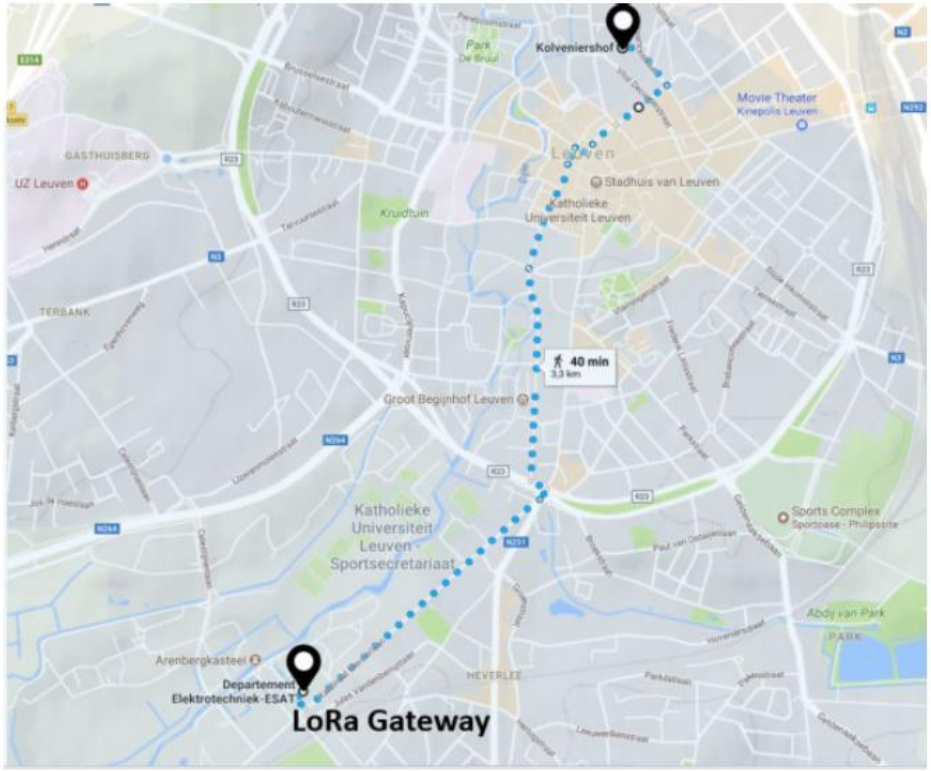




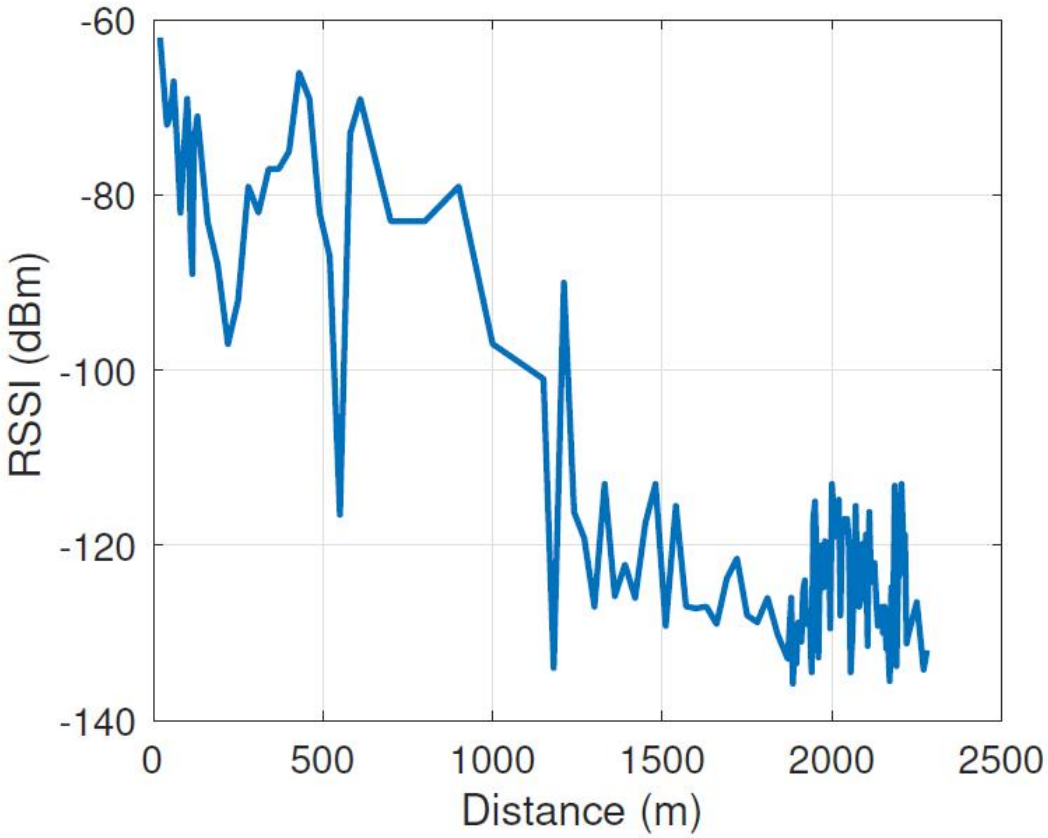
Published in: H. Sallouha *et al.* "uLoRa: *Ultra Low-Power, Low-Cost and Open Platform for the LoRa Networks*", Proceedings of Mobicom Conference 2017, Salt Lake City, USA

Current State in the Field

- Transceiver is otimized in terms of power consumption, physical dimensions, and cost
- Indoor and urban scenario experiments (up to 2.3 km)



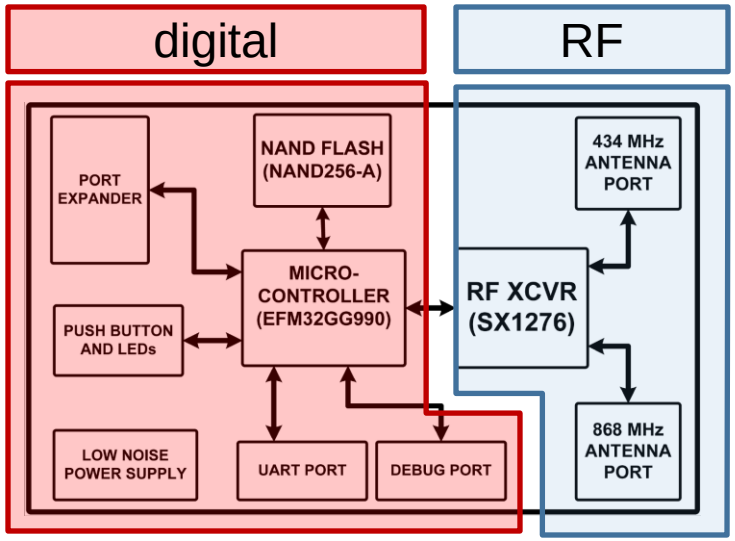
Experimental Trajectory



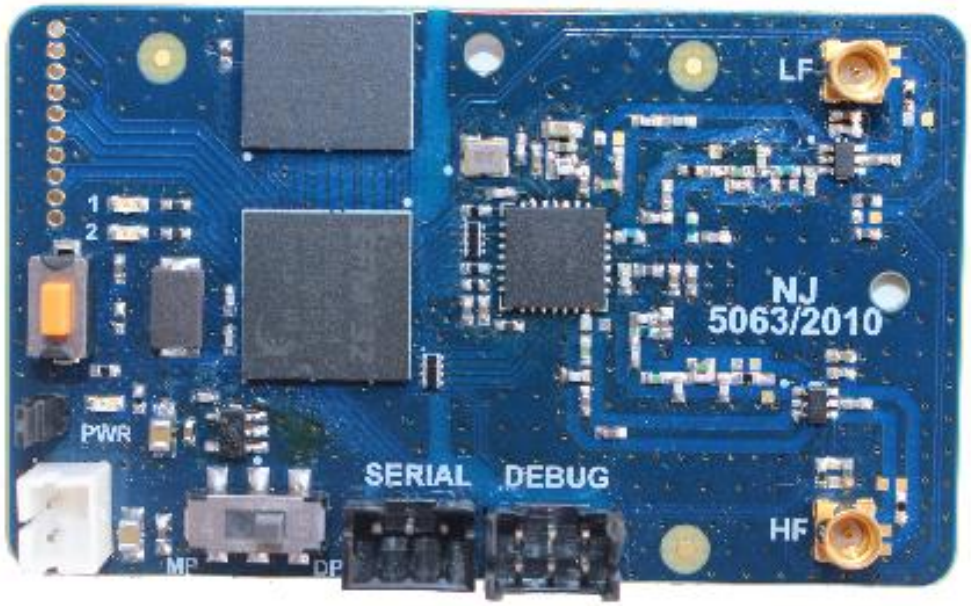
Experimental Results

KU LEUVEN RESEARCH & DEVELOPMENT

Developed Transceiver

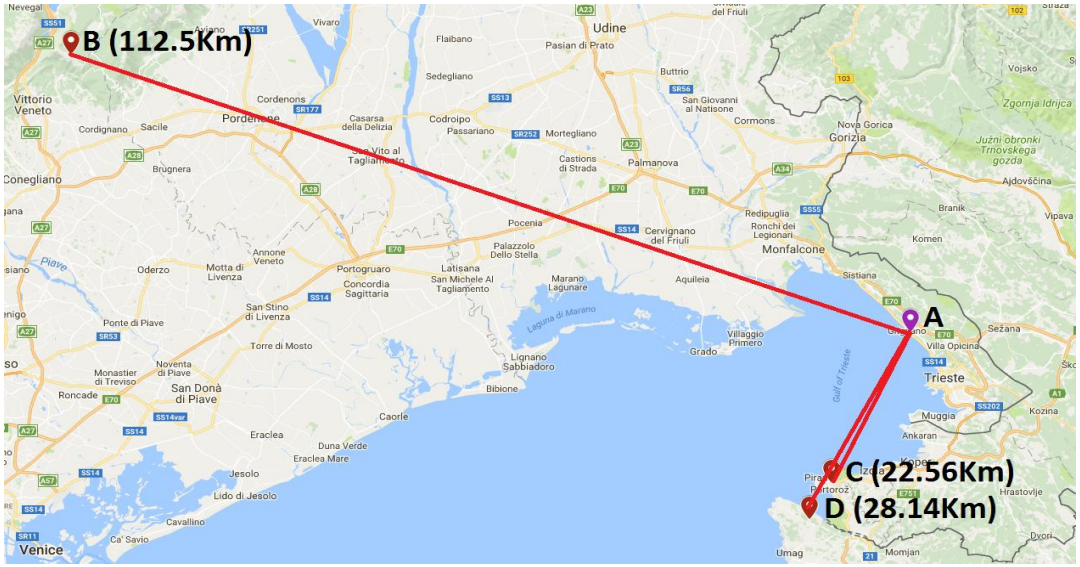


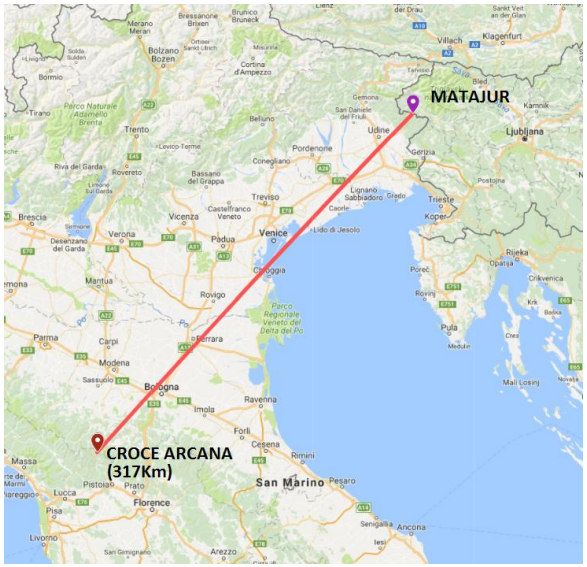
Block Diagram of the Transceiver



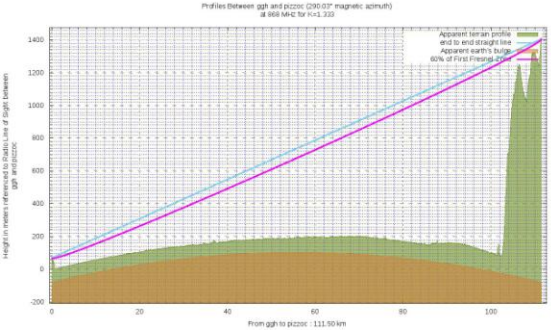
Physical Appearance of the Transceiver

Test Beds used in the Experiments

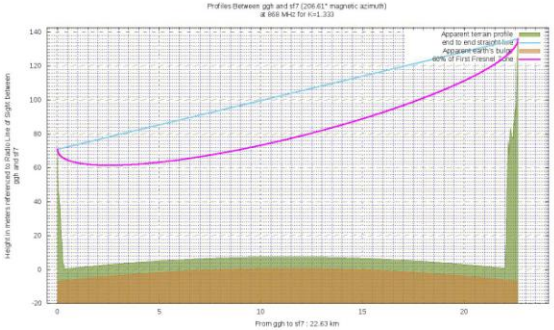




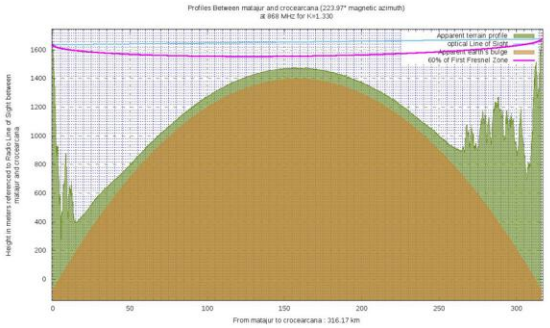
Link **AB (112.5 km)**

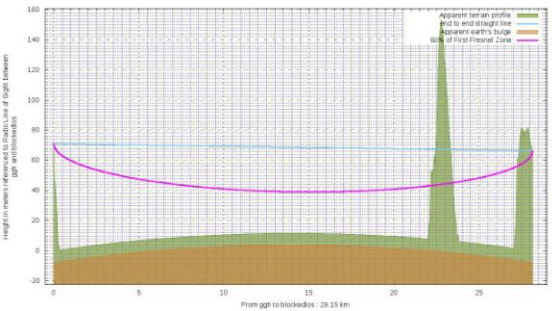


Link **AC (22.56 km)**



Link **MC (317 km)**





Link **AD (28.14 km)**

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Improving The Performances of LoRa Based Wireless Transceivers

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Testbed experiences in IoTs

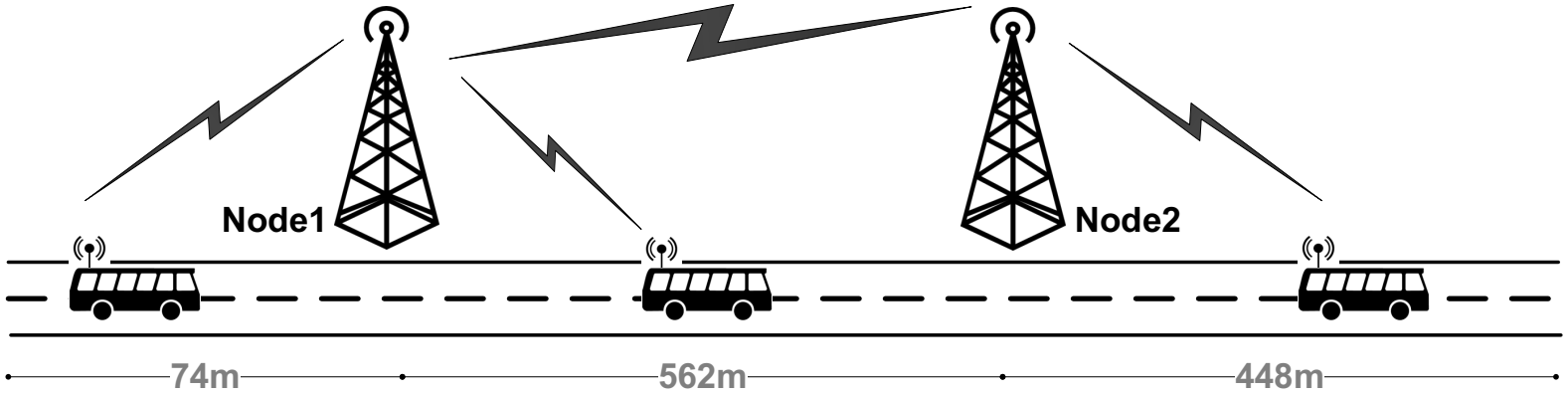
Adnan Noor Mian

Information Technology University (ITU),
Lahore, Pakistan

IEEE 802.11s under mobility

1. Coverage of standard wifi (IEEE 802.11) can be increased by increasing the number of access points (APs).
2. Standard IEEE 802.11 variants support limited mobility between APs due to lack of seamless handoff.
3. IEEE 802.11s MAC layer adds features of mesh networking and mobility to standard Wi-Fi through
    i. Layer-2 routing
    ii. Seamless handoff mechanism
4. Handoff mechanism is an important mobility support mechanism and effects communication performance.
5. IEEE 802.11s uses Airtime Link Metric which uses channel conditions to decide about the route/link.

IEEE 802.11s under mobility

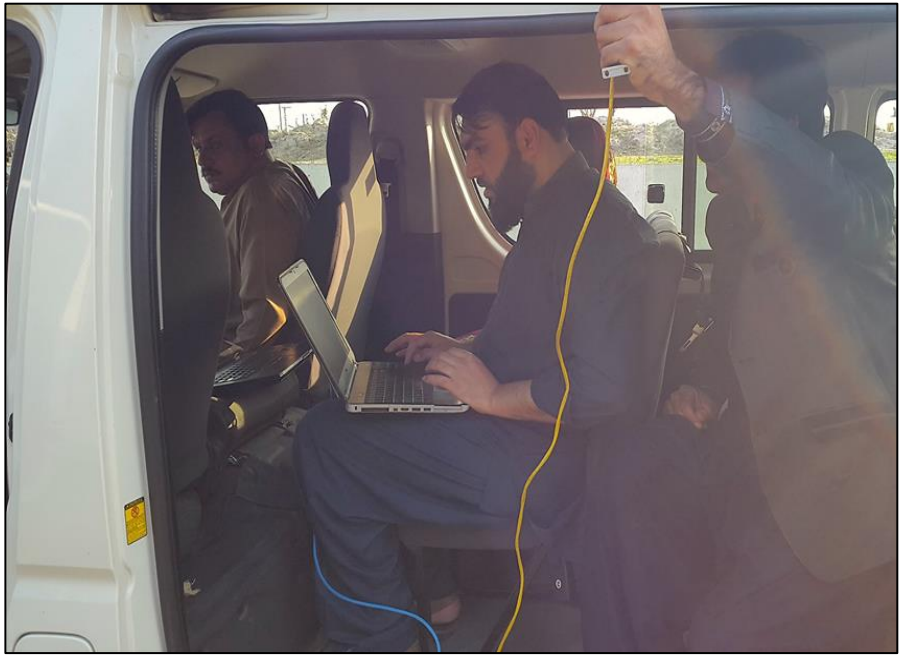


[2] Mian, A. N., Liaqat, T., Hameed, A., (2017, September). A Fresh Look into the Handoff Mechanism of IEEE 802.11s under Mobility. In Vehicular Technology Conference (VTC2017-Fall), *2017 International*.

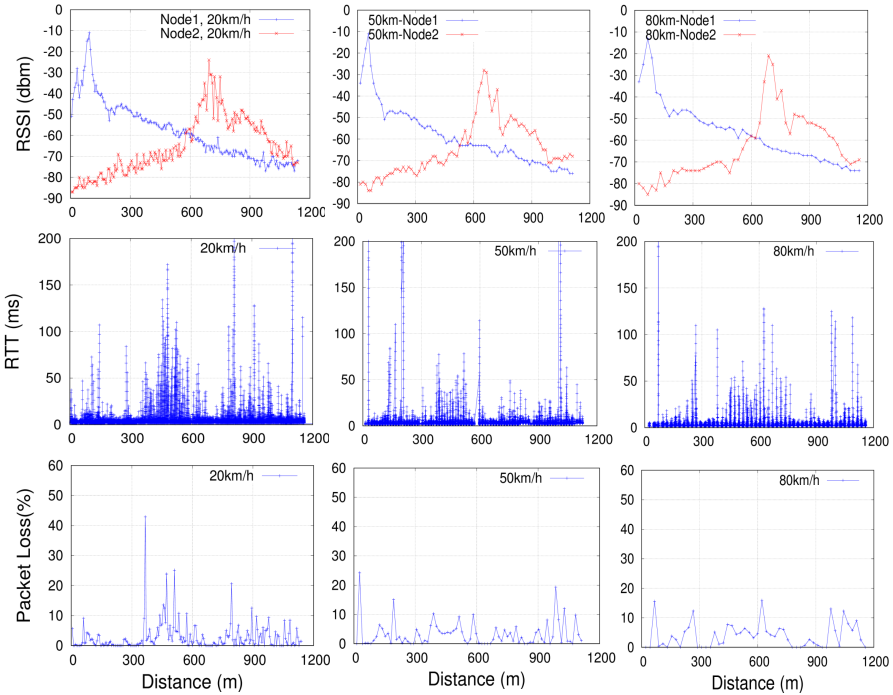
IEEE 802.11s under mobility

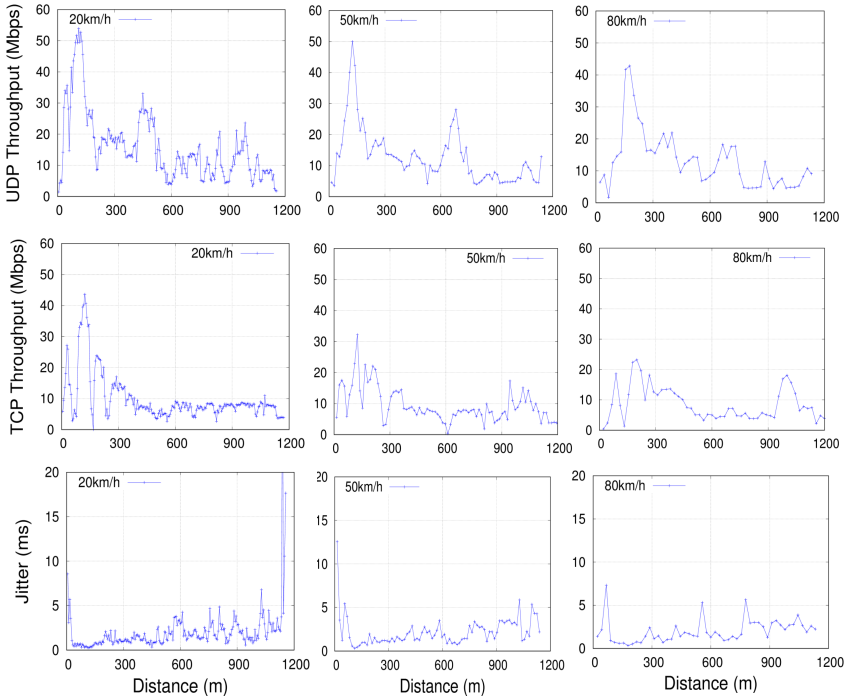
IEEE 802.11s under mobility

IEEE 802.11s under mobility

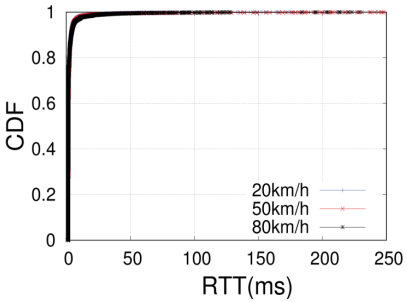


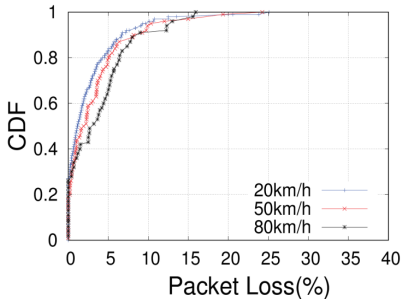
IEEE 802.11s under mobility

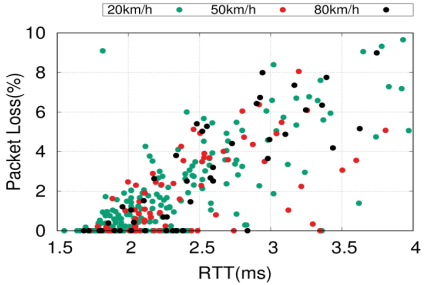


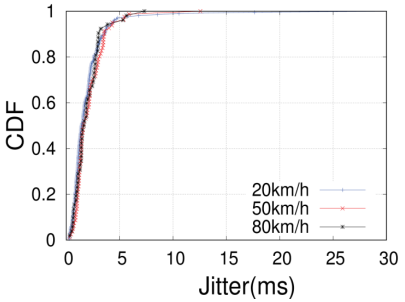


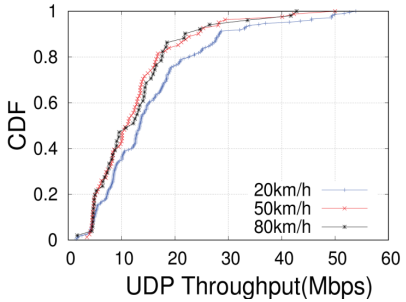
IEEE 802.11s under mobility

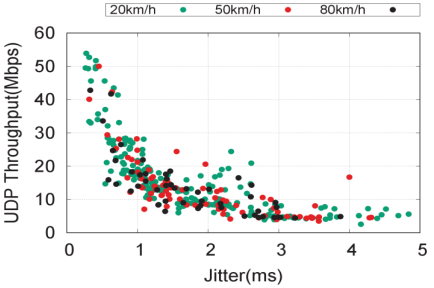












IoT based Hospital Bed Management System

Pakistan's scenario

1. Pakistan is spending 0.6-0.8% of its GDP on health sector which should be at least 6% GDP (WHO).
2. Existing nurse-to-patient ratio is 1:50 which should be 1:10 (Pakistan Nursing Council).
3. Bed-to-population ratio is 0.6 beds per 1000 population which should be 5 beds per 1000 (WHO).
4. Even the bed availability is concealed by ward superintendent doctor on purpose (Hospital admin).

IoT based Hospital Bed Management System

Lack of hospital bed information leads to:

1. Delayed medical treatments: inducing congestion at hospital emergencies, CCU and ICU. Survival likelihood of a cardiac arrest patient decreases by 7-10% every minute, if remains untreated (American Heart Association)

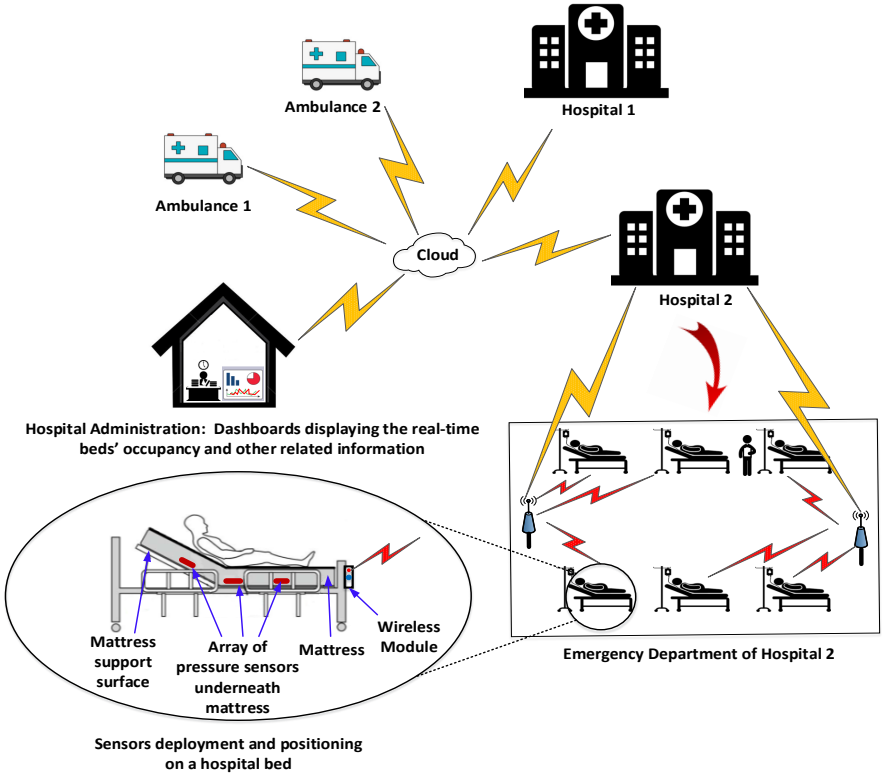
2. Poor ambulance diversion system: traditionally phone calls are made to inquire about hospital beds availability which involves human intervention causing delays.

➔

3. Uneven patient distribution at hospitals and wards. In Lahore Jinnah hospital the skin ward had many beds vacant whereas the cardiac wards were over crowded. Similarly in 5 public hospitals in Lahore the CCU remain almost vacant whereas the Punjab Institute of Cardiology (PIC) is overcrowded.

IoT based Hospital Bed Management System

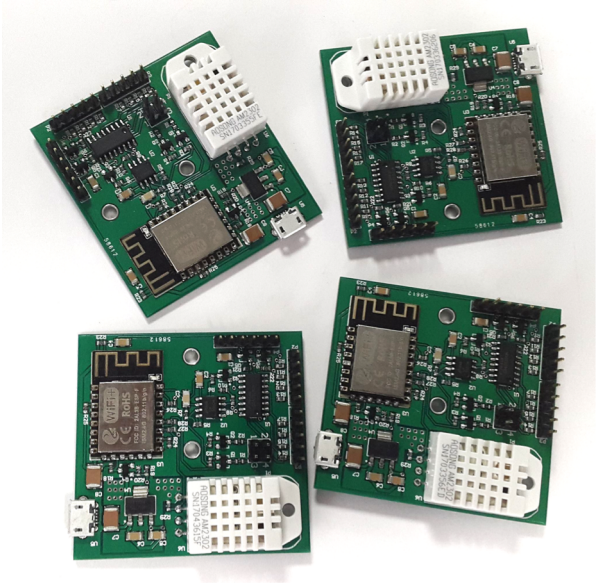
Proposed Architecture



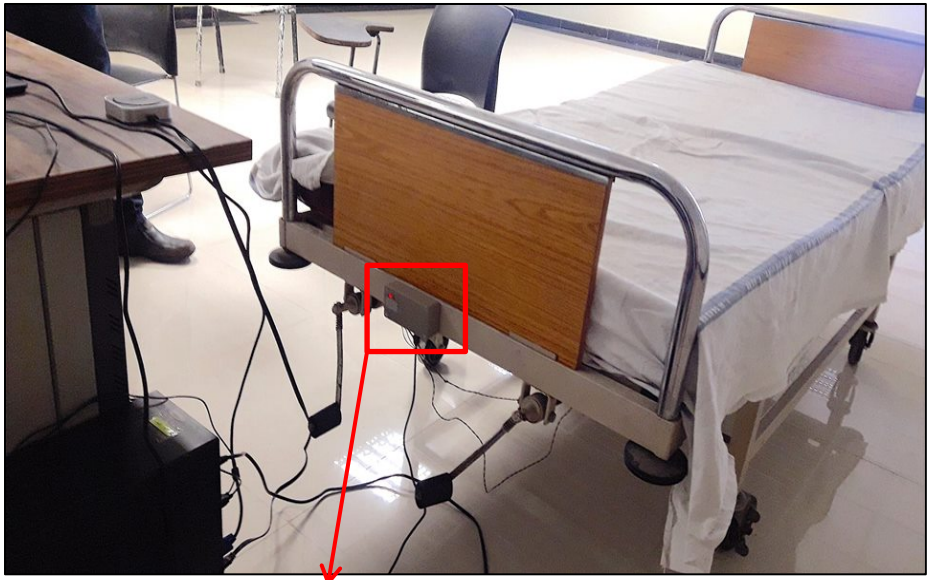
IoT based Hospital Bed Management System

Array of three pressure sensors deployed underneath the mattress of hospital bed

IoT based Hospital Bed Management System



Sensor controller 50 $/board for 5 boards



Wireless module attached to the sensors array to communicate data to the cloud

IoT based Hospital Bed Management System

Expected Benefits

1. Centralized bed management system
    i. Even patient distribution among hospitals

2. Instantaneous bed occupancy information
    i. Effective coordination among emergency response vehicles and hospital administration
    ii. Improved ambulance route planning
    iii. Reduced emergency response times

3. Real-time data collection
    1. Hospital status visualization i.e. overcrowding peaks
    2. Data analysis based on facts, not opinions.

The system can also be used to

1. To find patient breathing rate
2. To get gender information
3. To find the time a patient has been on the same position. This would help in reducing bed sores.
4. Can be used in old Age homes: Old people may leave the bed without intimation.

Thanks!

adnan.noor@itu.edu.pk

University of Abomey-Calavi

Autonomous management and distribution of intelligence in the context of smart cities

Frantz Tossa
Doctoral School of Engineering Sciences (ED-SDI)
Laboratory of Electronics, Telecommunications, and Applied Informatics (LETIA)

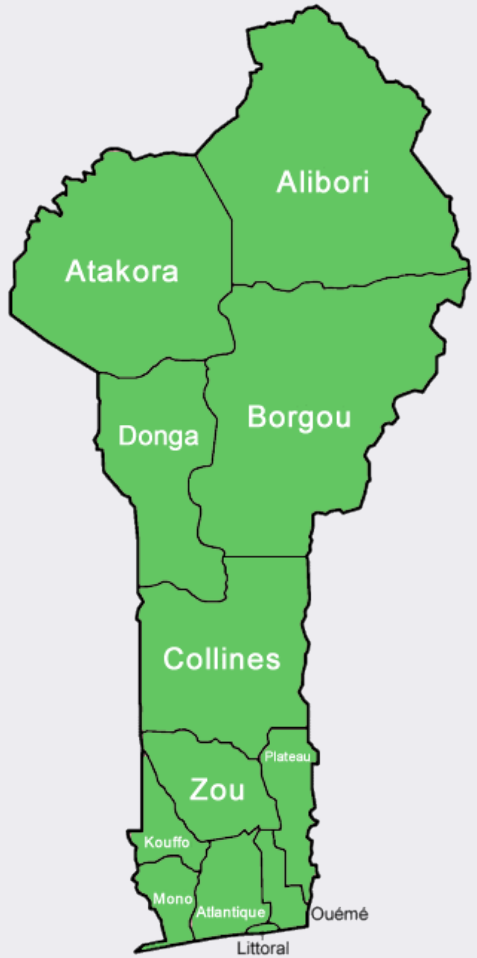
May 10, 2018

Content

A little information

- 114 764 km^2 for a population of 11 737 819
- Surrounded by Burkina Faso, Niger, Nigeria and Togo
- 12 county, 35 cities

Benin's map



What about this project
Context

Context

In recent years, Benin faces environmental challenges. The north of the country with its savannah landscapes is affected by desertification and the south by deforestation.

Context

In 2014, 44% of the population lived in cities, while the urban environment is vulnerable, polluted and degraded.

Source : `http://www.crubn.com/pages/cnu/benin.html`

What about this projetc
Context

Some causes

- Most of the country's industries are based at Cotonou
- The quality of vehicles and gasoline
- Exhaust gas produced by the 10,000 zemidjans and other motorcycle users

The usual mode of transport

What about this project
The idea

The idea

The idea is to set up a network of sensors, to monitor air quality in order to take good decisions against pollution. This will allow us for example to see more polluted areas and periods of pollution.For instance we can grab

- carbon dioxide CO_2
- nitrogen dioxide NO_2

What about this project ?
Problem statement

Questioning

In the context of a Smart city, how to :

- Deploy an autonomous system with the less human interraction based on sensors
- Make this system optimal

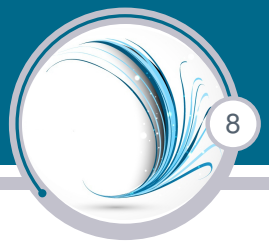
More technically

We focus on:

- the deployement of sensors by studing
  - a set of Ant Colony Optimisation
  - optimization by particle swarms

More technically

The idea is that a group of individuals not really smart can have a complex global organization. At the start of the algorithm each particle is positioned (randomly or not) in the search space of the problem.

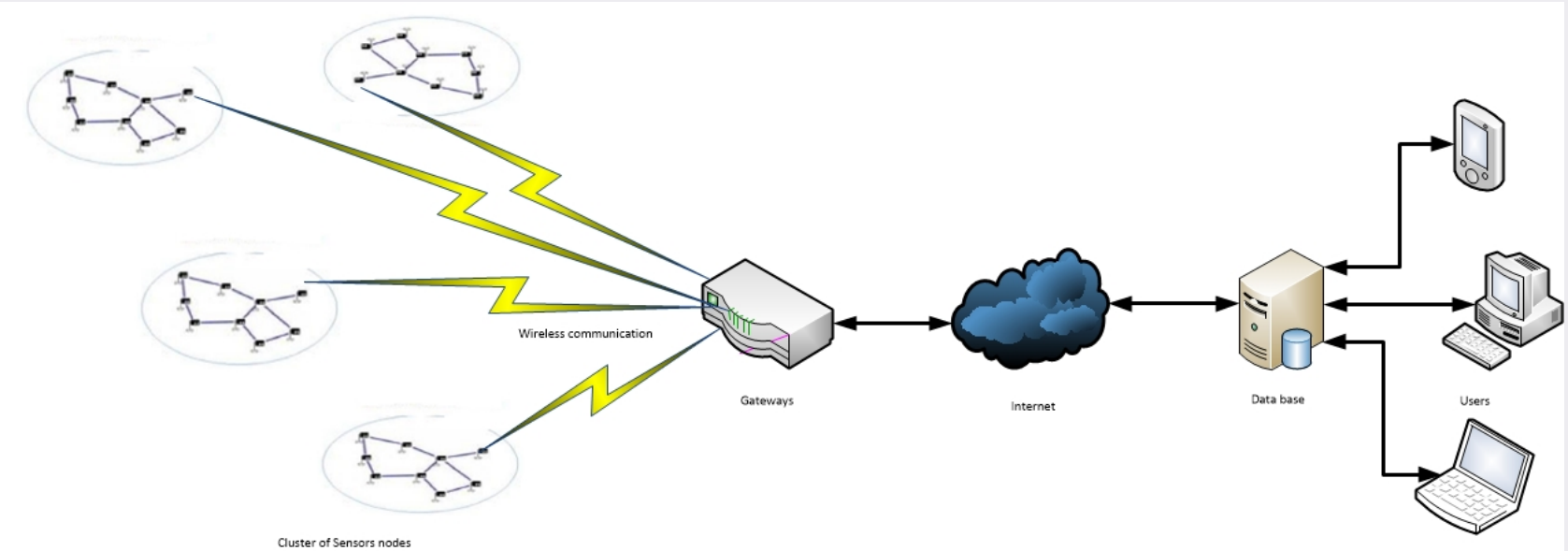


More technically

- the mechanisms of organization (physical and logical) and configuration
  - Fault tolerance
  - distributed election algorithm
- communication via wireless technologies in a low-resource environment

Expected outcome

Nodes deployement



Thank You

Thank you !

phew!

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Guatemala's Remote Sensing CubeSat

José Antonio Bagur Nájera

Joint ICTP-IAEA School on LoRa Enabled Radiation and Environmental Monitoring Sensors

May 10, 2018. ICTP, Trieste – Italy

Agenda

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- Motivation of the project.
- Background of the project.
- Mission summary.
- CubeSat’s subsystems overview.
- Outreach campaign.

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Motivation

Motivation

- Lack of **aerospace opportunities** for students and engineers in Guatemala. And mostly, **technology development**.

- Lack of use of **benefits from space-based assets** – namely, remote sensing.

    - Example: Cyanobacterial blooms on Lake Atitlán.

Source: https://earthobservatory.nasa.gov/IOTD/view.php?id=41385

Motivation (2)

But our most important motivation is **youth**. There is an **alarming lack of interest in science and engineering in Guatemala's youth**, nowadays.

Motivation (3)

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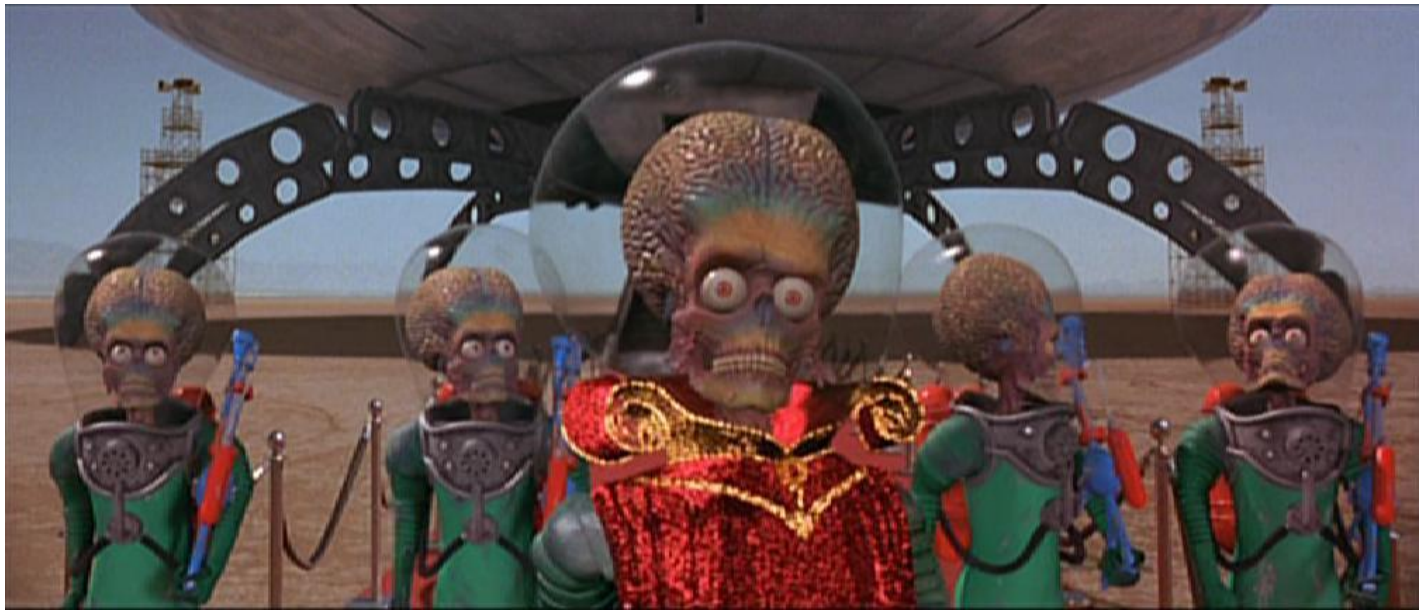
And also **aliens**. We want real pictures of them.



Source: https://it.wikipedia.org/wiki/Mars_Attacks!

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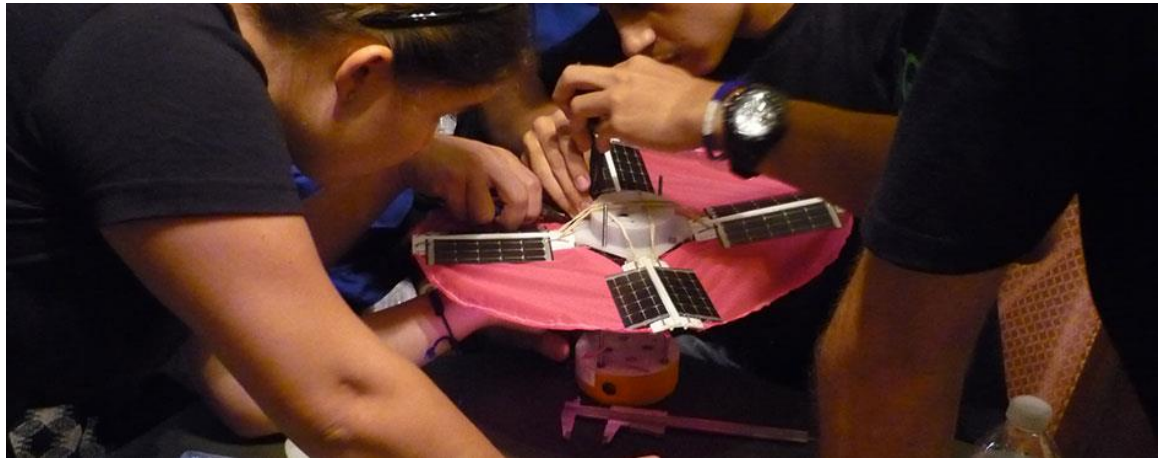
Background

Background

- UVG started its aerospace journey with a **CanSat** project.

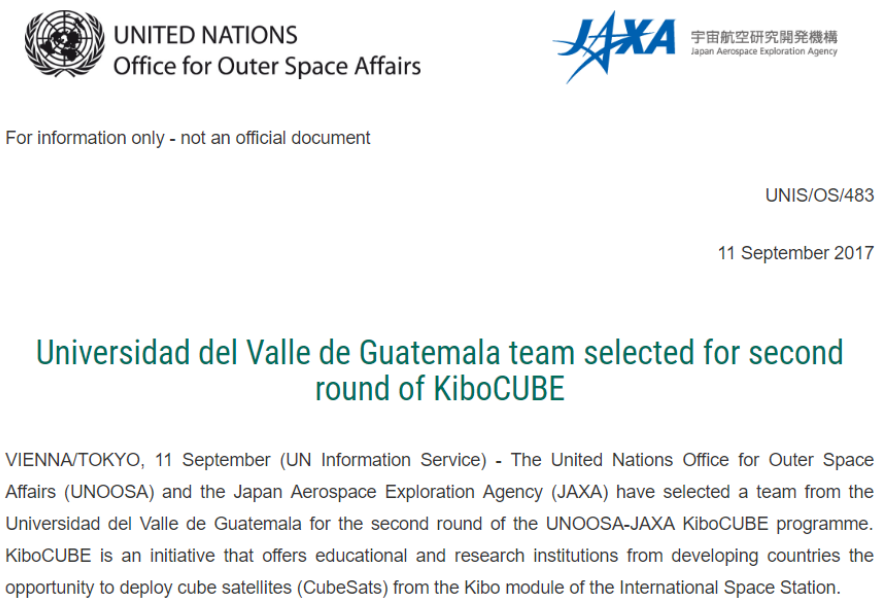
- The **1U CubeSat project started in 2014**, after two successful CanSat missions.



Source: http://www.uvg.edu.gt/ingenieria/mecanica/actividades/ek.html

Background (2)

- In September 2017, UVG's CubeSat project was selected as the **winner of the second round of the KiboCUBE programme**.



UNITED NATIONS
Office for Outer Space Affairs

JAXA 宇宙航空研究開発機構 Japan Aerospace Exploration Agency

For information only - not an official document

UNIS/OS/483

11 September 2017

Universidad del Valle de Guatemala team selected for second round of KiboCUBE

VIENNA/TOKYO, 11 September (UN Information Service) - The United Nations Office for Outer Space Affairs (UNOOSA) and the Japan Aerospace Exploration Agency (JAXA) have selected a team from the Universidad del Valle de Guatemala for the second round of the UNOOSA-JAXA KiboCUBE programme. KiboCUBE is an initiative that offers educational and research institutions from developing countries the opportunity to deploy cube satellites (CubeSats) from the Kibo module of the International Space Station.

Source: http://www.unoosa.org/oosa/en/informationfor/media/2017-unis-os-483.html

Background (3)

The KiboCUBE programme is an **initiative** that offers **educational and research institutions** from **developing countries** the opportunity to **deploy a 1U CubeSat from the Kibo module of the International Space Station** (ISS).

Background (4)

- 58 people are currently working in the project. **41 are undergraduate students**.

- **CubeSat's components and materials mostly internally-funded until now.**

Background (5)

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- Our **short term goal**:

Test the technologies needed for **multispectral remote sensing** using a 1U CubeSat as platform.

Background (6)

UVG UNIVERSIDAD DEL VALLE DE GUATEMALA

- Our **long term goal**:

Enable the **indigenous acquisition of remote sensing data** for **peaceful purposes**.

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Mission Summary

Mission Summary

"To **design, develop, and operate a CubeSat-class satellite to test a multispectral sensor prototype**, opening the field of space science and technology in Guatemala, developing **Guatemala´s human capital**, and enabling the **independent acquisition of remote sensing data for natural resource management**."

Mission Summary (2)

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Event	Date
Local tests and assembly	May to August 2018
Preliminary tests (Germany)	September 2018
Final tests	August 25
Handover to JAXA	December 2018
Launch	2019

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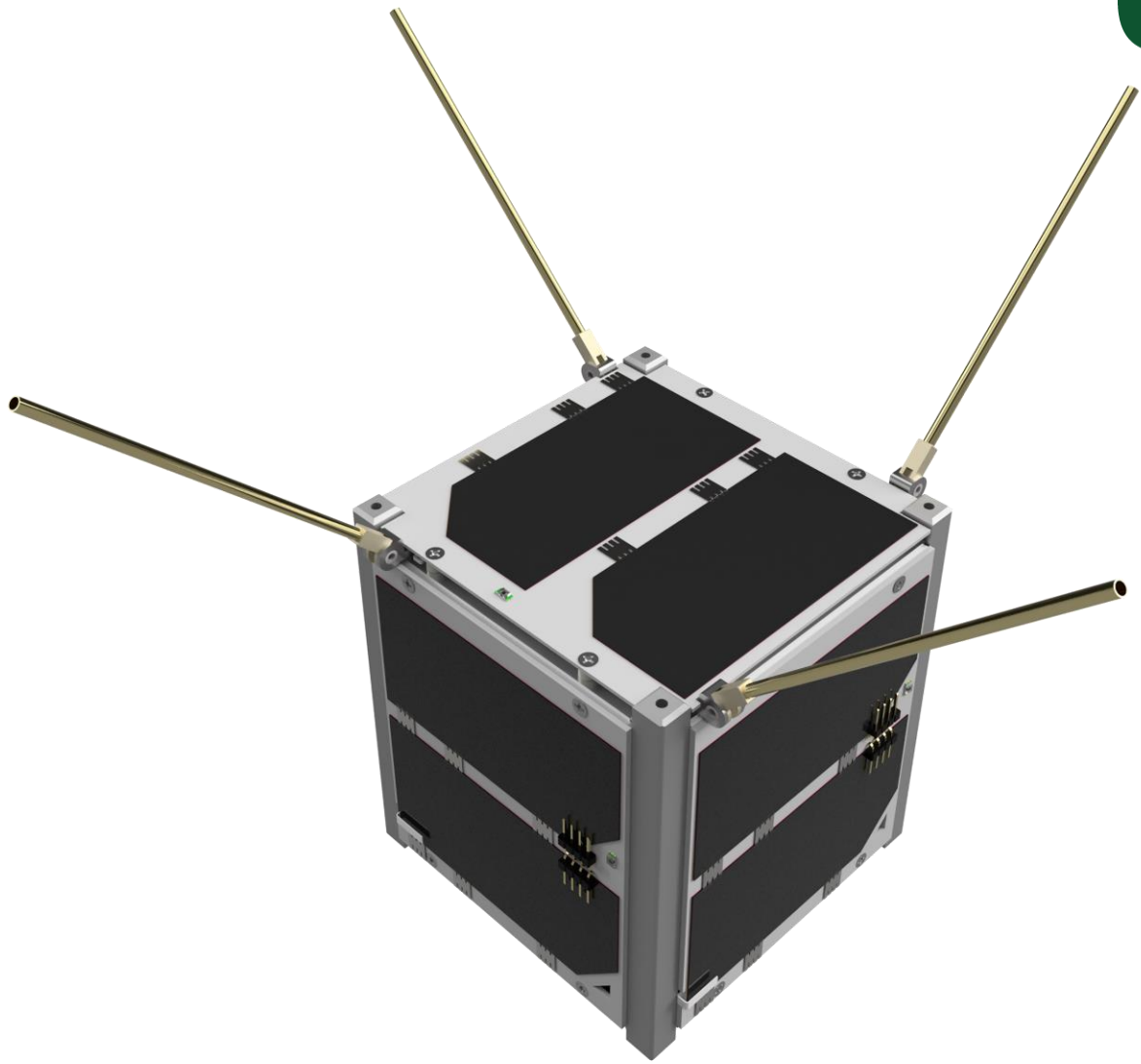

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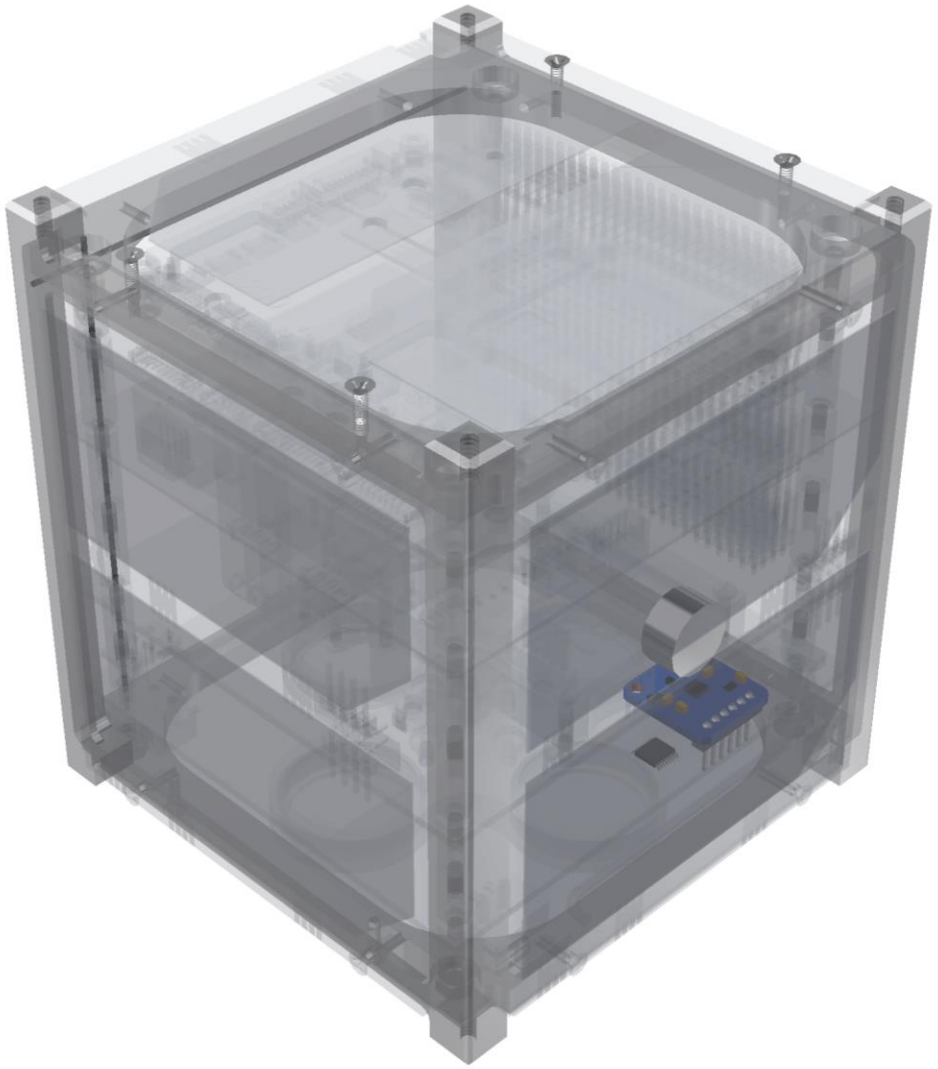
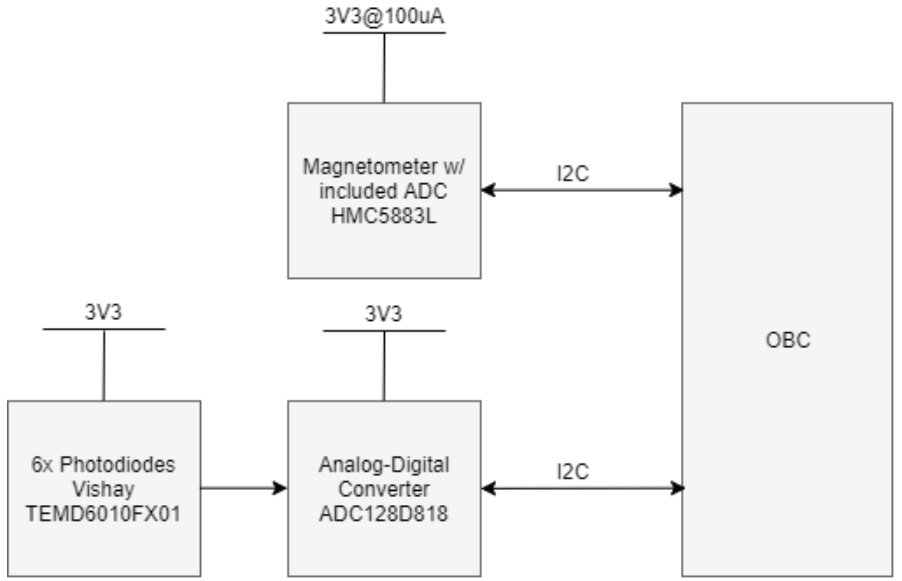
Subsystems Overview

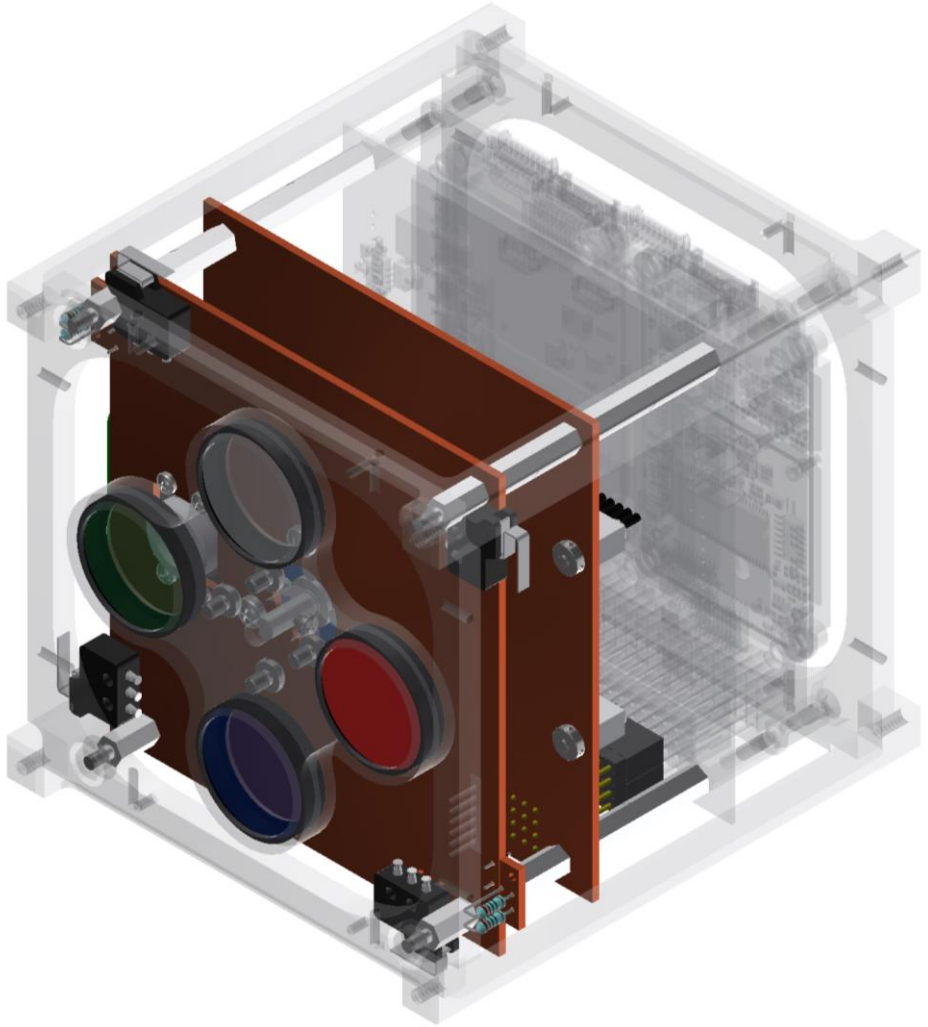


Attitude Determination and Control System Subsystem

ADCS Overview

- ADCS's subsystem design:
  - Our design is **passive**, it uses a **bar magnet**, **hysteresis rods**, **photodiodes** and an **magnetometer** to control the CubeSat's orientation in-orbit.

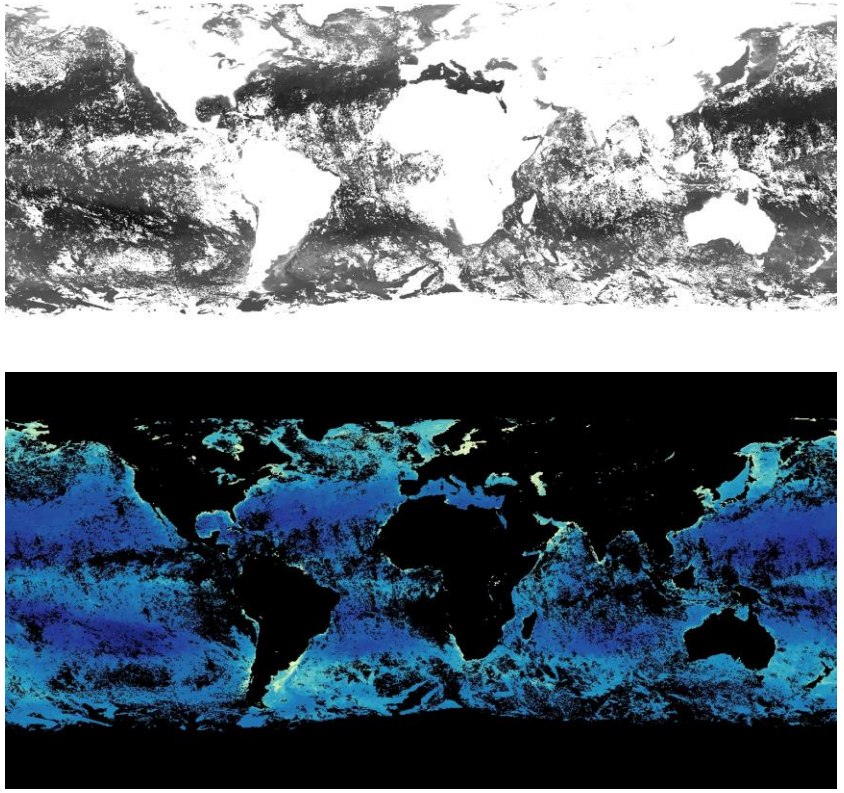




Payload Subsystem

Module Overview

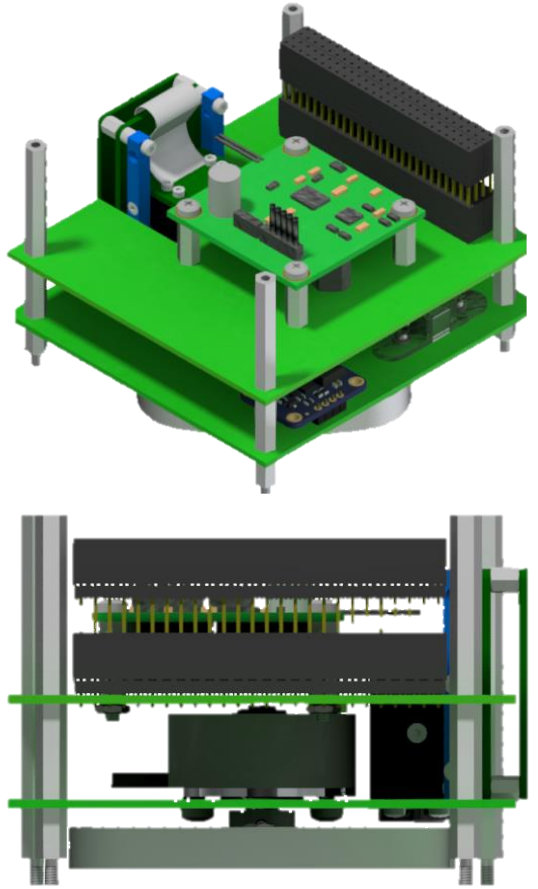
- Payload's subsystem objective:
  - Based on data acquired in four wavelengths (450nm, 555nm, 680nm and 705nm) by a monochromatic sensor the **concentration of Chlorophyll-a will be determined**.
  - Photos will be taken pointing to **bodies of water**.



Source: https://modis.gsfc.nasa.gov/data/dataprod/chlor_a.php

Module Overview (2)

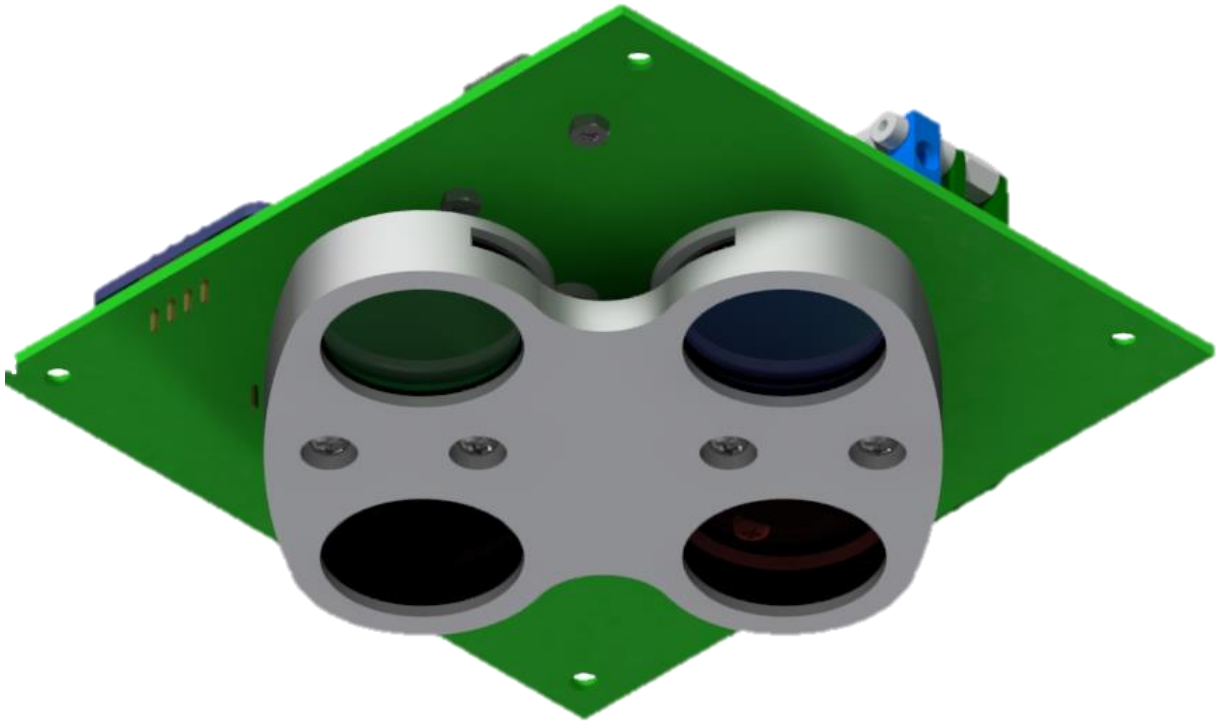
- Payload's subsystem design:
  - The subsystem consists in a **piezoelectric motor** with a **4-filter carrousel** attached, and a **monochromatic sensor**.
  - CrystalSpace C1U CubeSat Camera and Tekceleo WLG-30 piezo electric motor were selected.
  - **In-house designed filter carrousel**.



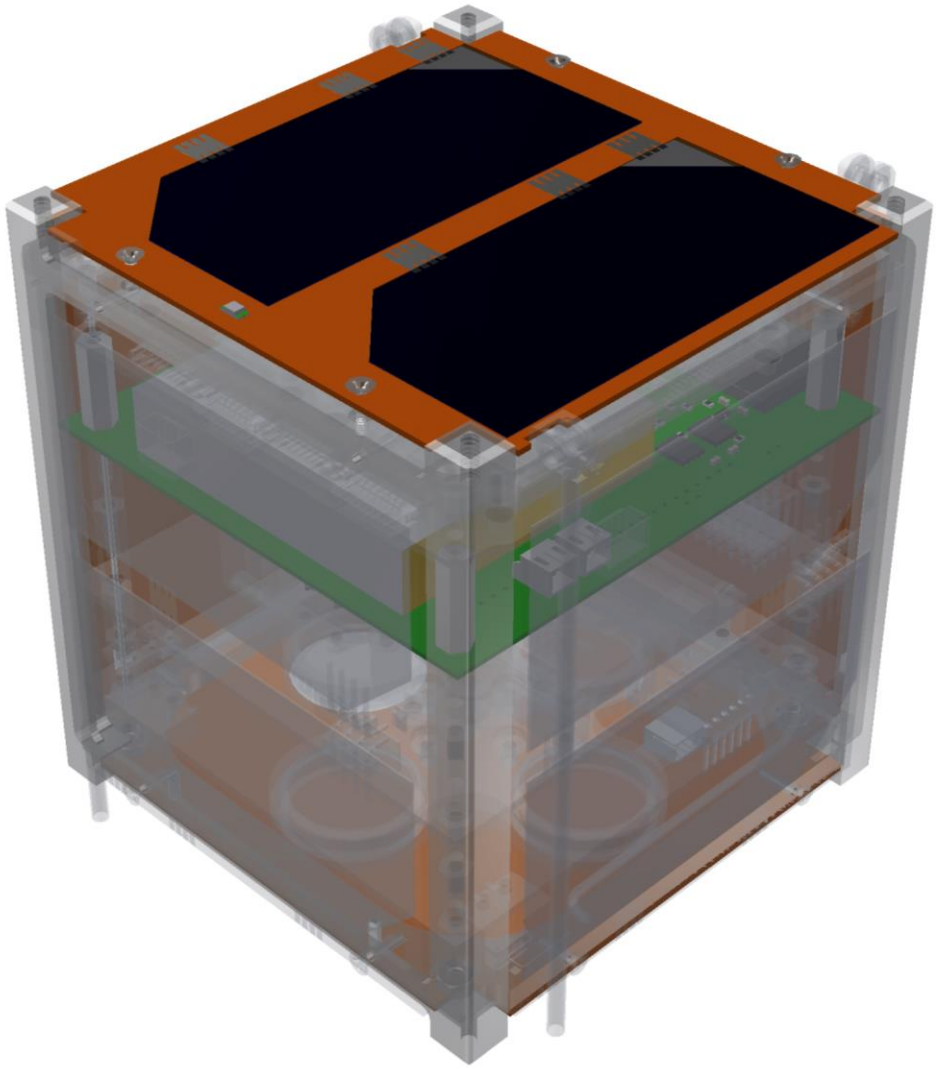
Source: UVG CubeSat Team

Module Overview (3)

- In-house designed filter carrousel:



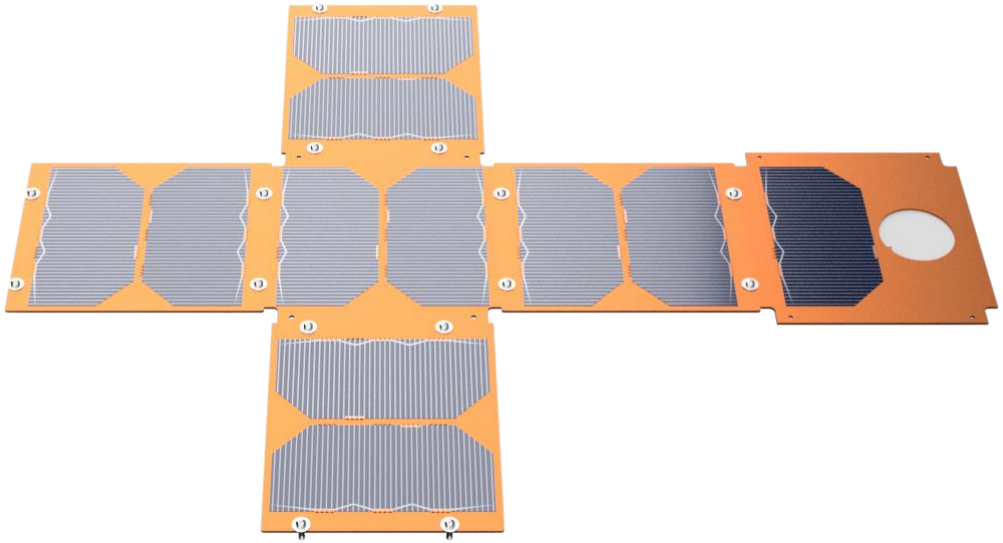
Source: UVG CubeSat Team



Power Subsystem

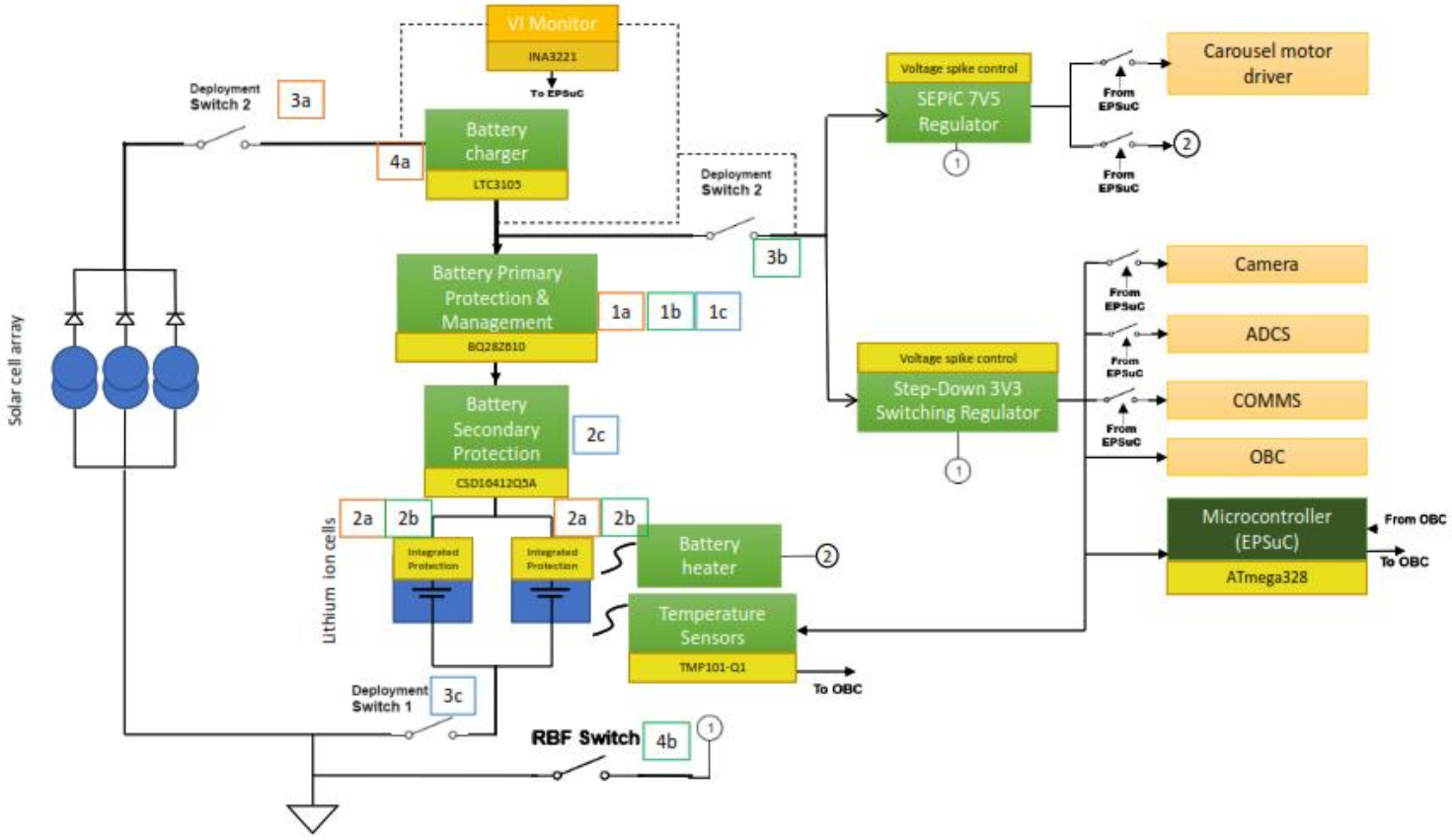
Module Overview

- Power subsystem design:
  - AZUR SPACE's 3G30A Solar Cells.
  - Sparkfun 2000 mAh Li-Po battery

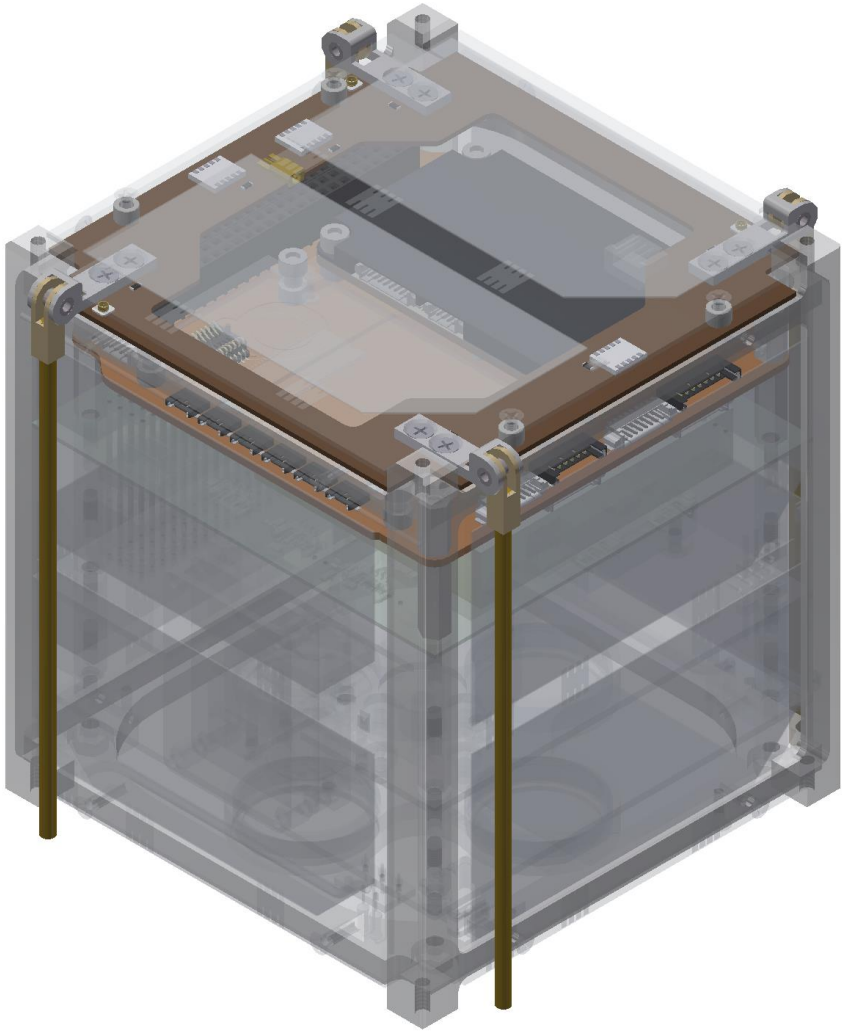


Source: UVG CubeSat Team

Module Overview (2)



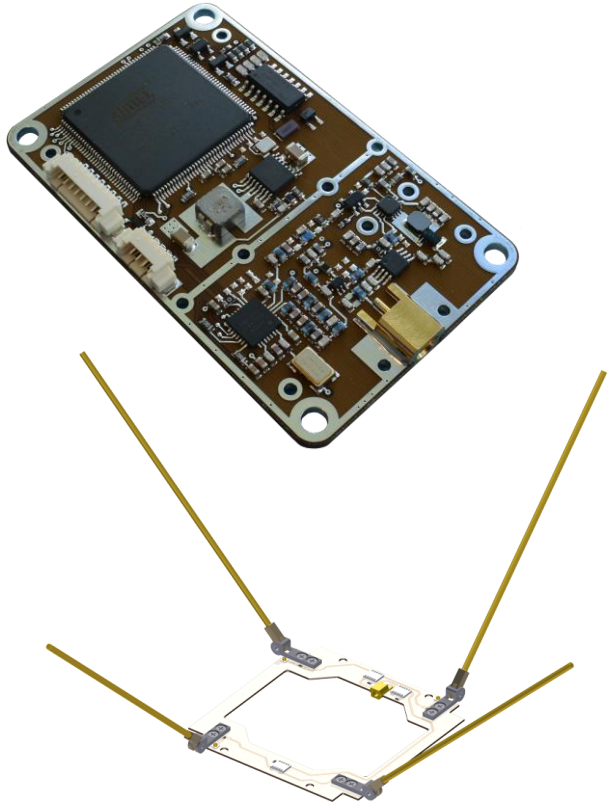
Source: UVG CubeSat Team



Communications Subsystem

Module Overview

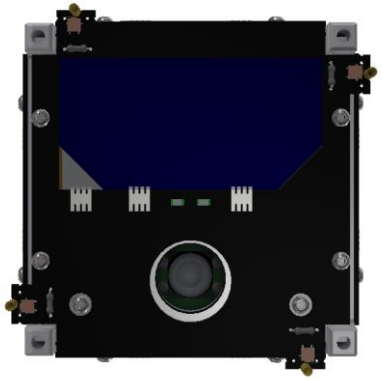
- Communications subsystem design:
  - A COTS radio module was selected: **GomSpace NanoCom AX100 UHF transceiver**.
  - Also, a COTS antenna was selected: **GomSpace NanoCom ANT430**.
  - **Half-duplex communication channel** between the CubeSat and UVG's GCS. Selected RX/TX frequency: 437.505 MHz.

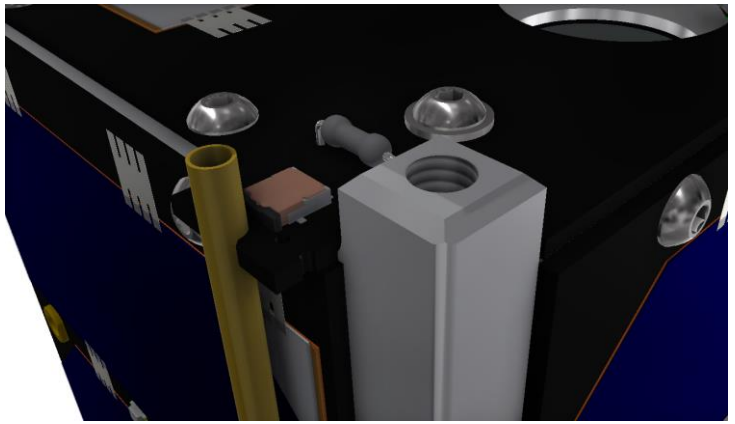


Source: GomSpace

Module Overview (2)

- Antenna deployment system design:
  - **In-house designed the antenna deployment system**. It uses resistors and fishing line.
  - Our design is based on the antenna deployment mechanism of the MinXSS CubeSat, from the University of Colorado.

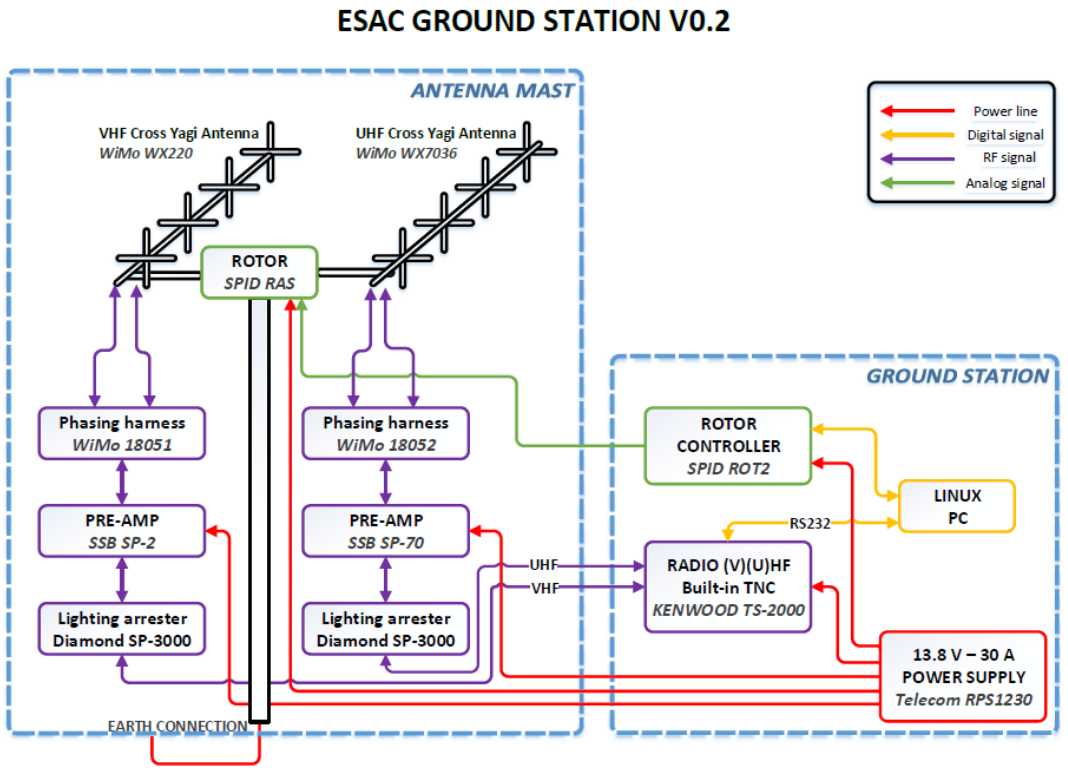




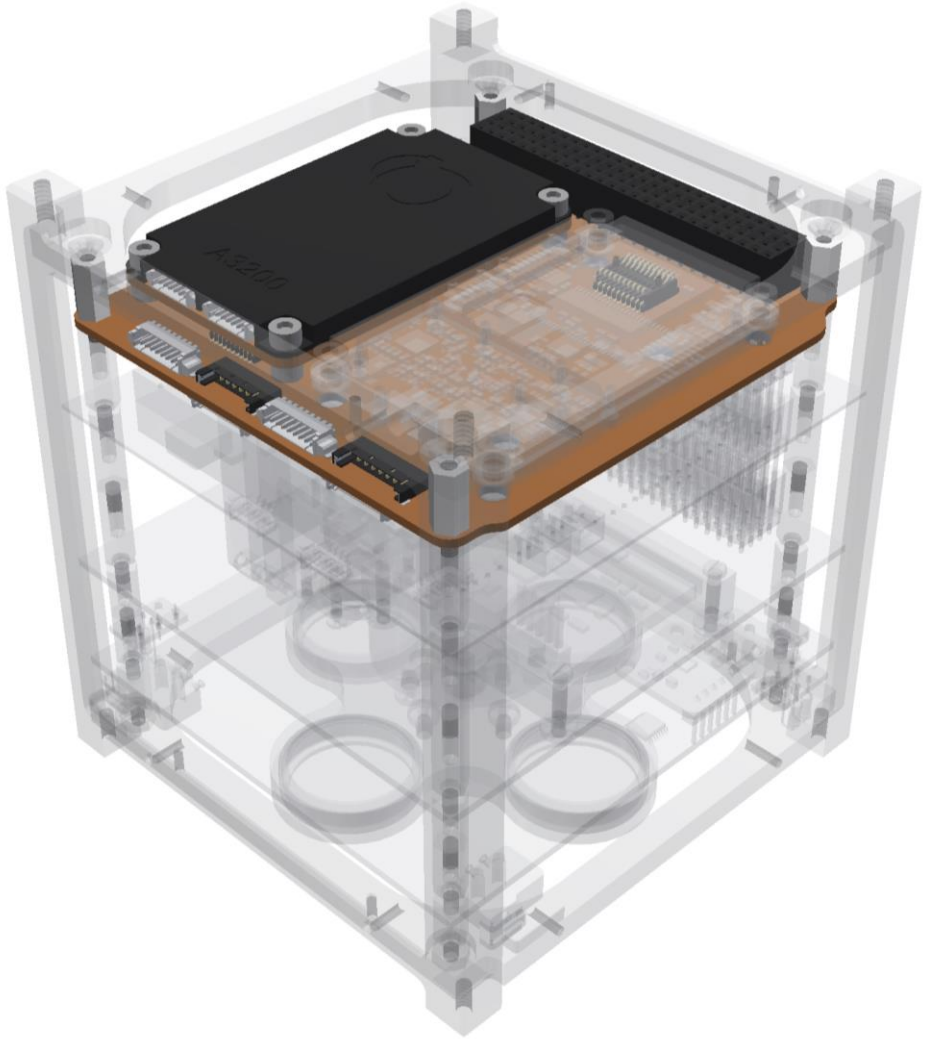
Source: UVG CubeSat Team

Module Overview (3)

- Ground Control Station design:
  - Our GCS **design is based on ESAC Ground Station v0.2 (Spain)** GCS documentation.
  - Amateur Radio frequencies are going to be used on UVG's GCS (UHF for both, uplink and downlink).



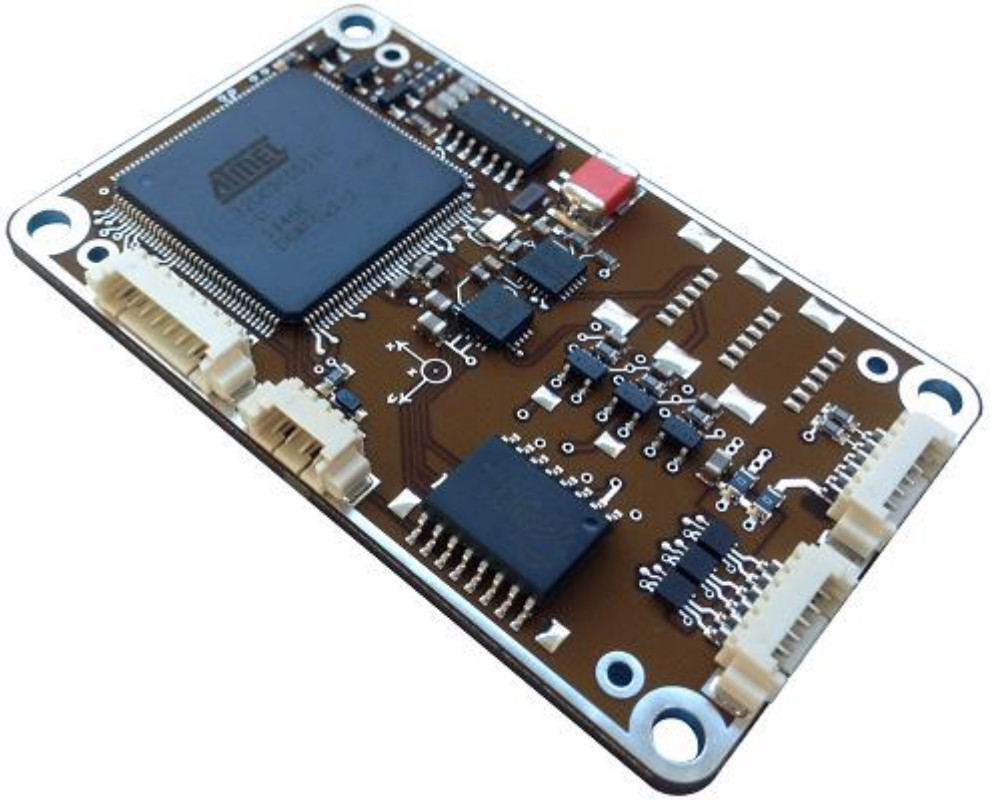
Source: ESAC/Julio Gallegos



Command and Data Handling Subsystem

Module Overview

- Command and Data Handling subsystem design:
  - A COTS on-board computer was selected: **GomSpace NanoMind A3200.**
  - **Hardware features**: AVR32 MCU, 512KB build-in flash, 128MB NOR flash, 32kB FRAM, 32MB SDRAM, RTC Clock, on-board temperature sensors, I2C, UART, SPI, CAN-Bus, ADC, GPIOs.



Source: GomSpace

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Outreach

Outreach


UVG
UNIVERSIDAD DEL VALLE DE GUATEMALA
PONELE NOMBRE AL PRIMER SATÉLITE GUATEMALTECO
INGRESA TU PROPUESTA EN:
WWW.UVG.EDU.GT/CUBESAT
PARTICIPA Y GANA UN AÑO DE PIZZA GRATIS
¡SE PARTE DEL ORGULLO NACIONAL!
TIENES DEL 16 DE MARZO AL 15 DE ABRIL 2018
CON EL APOYO DE:
PRENSA LIBRE
AULA
ANSYS
Domino's


EL PRIMER SATELITE
UVG
GUATEMALTECO


PLAN DE VUELO 2018
Buscando el centro de nuestro universo
BAM
Bancolombia


UVG
APÓYANOS A TERMINAR DE CON
PRIMER SATÉL
GUATEMALTE
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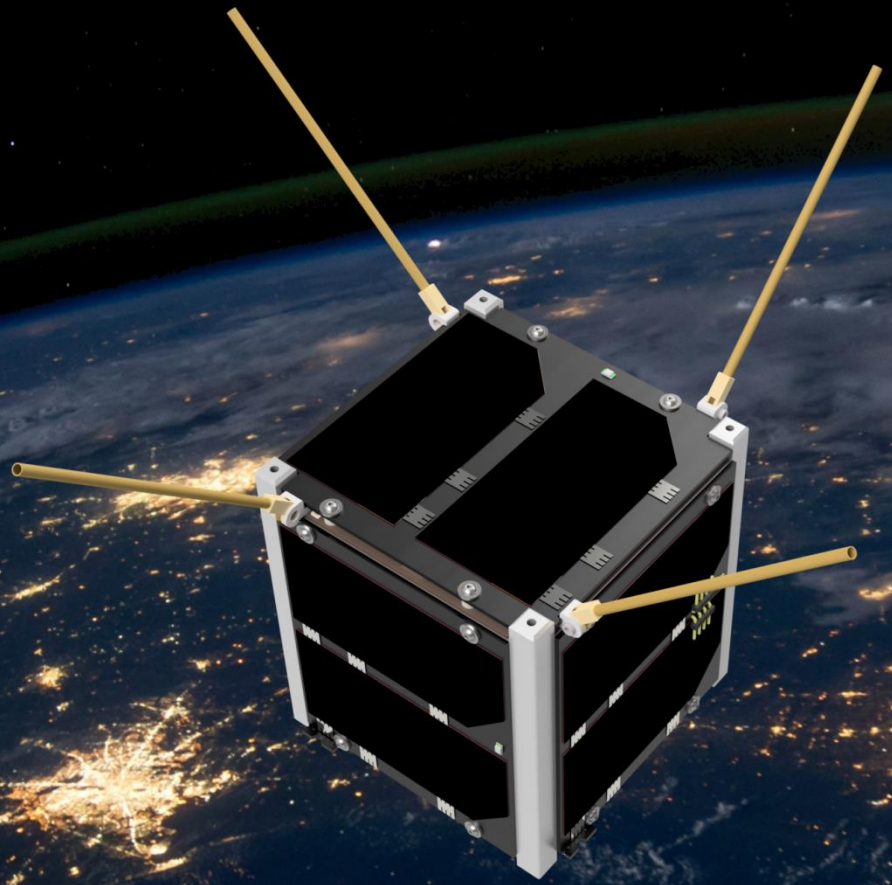
Upcoming Work

Upcoming Work

UVG UNIVERSIDAD DEL VALLE DE GUATEMALA

- Integrated **tests** of all the CubeSat subsystems.
- CubeSat **assembly**.
- Fundraising for:
  - Testing in external facilities: approx. **US$12,000** (which includes staff and students' travel costs to testing facilities).
  - Electronic components and PCB fabrication. Approx. **US$4,000**.



Thank you!

jabagur@uvg.edu.gt

UVG UNIVERSIDAD DEL VALLE DE GUATEMALA

www.uvg.edu.gt/cubesat

Universales

ICTP The Abdus Salam International Centre for Theoretical Physics

ANSYS

PRENSA LIBRE UN PERIODISMO INDEPENDIENTE, HONRADO Y DIGNO

Claro

GrupoSSC

ROBOT SAVE

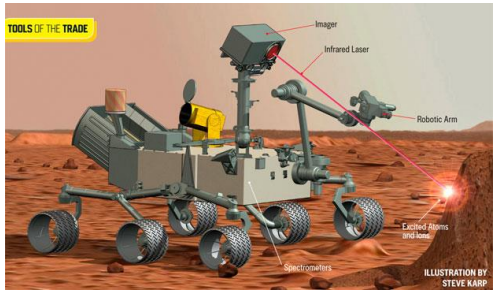
Conception of Exploratory Robots for Survey Premises

DESSAP FOMEKONG LOIC JOFFREE
Student engineer in Radio Communication
National Advanced School of Post and Telecommunication Information Communication and Technology

PROBLEMATICS

In my country particularly in the Nord region we encounter many disasters due to Gas leakage, landmines(anti-personnels and anti-tank) and others…

To solve this problems , we think towards of designing a robot allowing us to prevent these disasters. The same robot can also served for exploration of inaccessible zones in other to remedy to behavior of the environment.



MAINS OBJECTIVES:

Setup of a robot call RobotSave for:

1. Gas leakage
2. Landmines detection
3. Survey premises

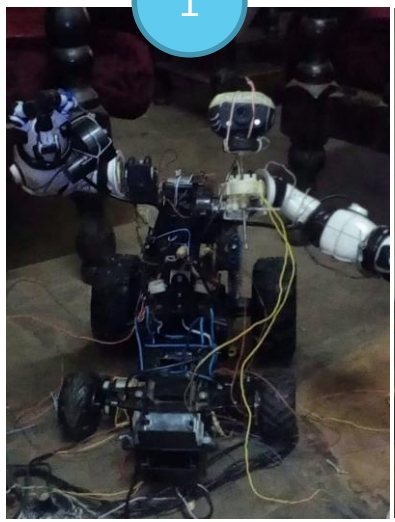
WHAT APPROACH?

1KM USING NRF24L01

- From here i use the nrf24l01with with LNA which operate in 2.4 – 2.5 GHz ISM band but payload of 32Ko range of 1Km LOS.
- With an intelligent solar pannel that track sunlight to charge constantly the batteries

EVOLUTION OF THE FIRST PROTOYPE

1



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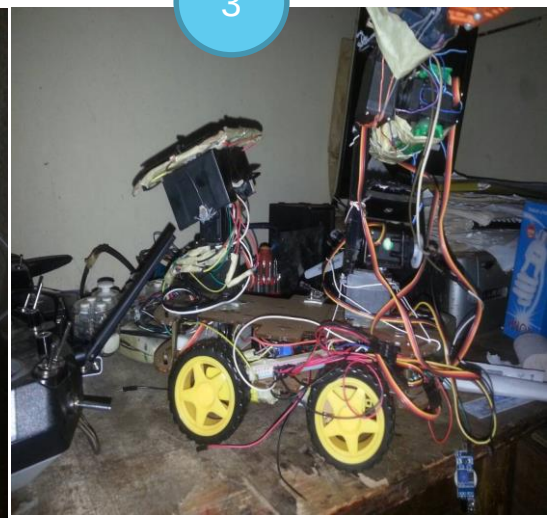

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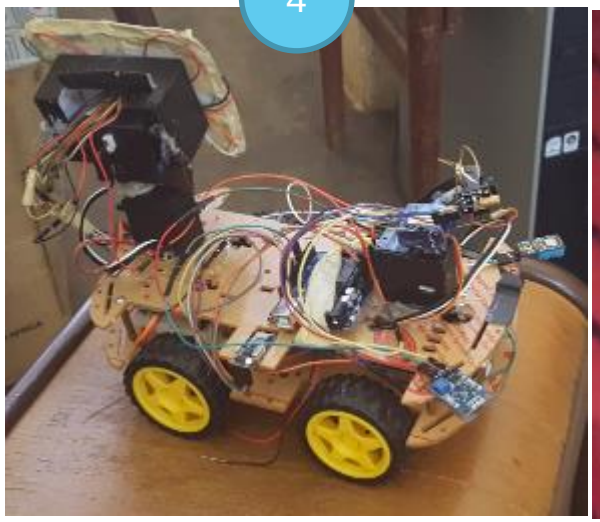

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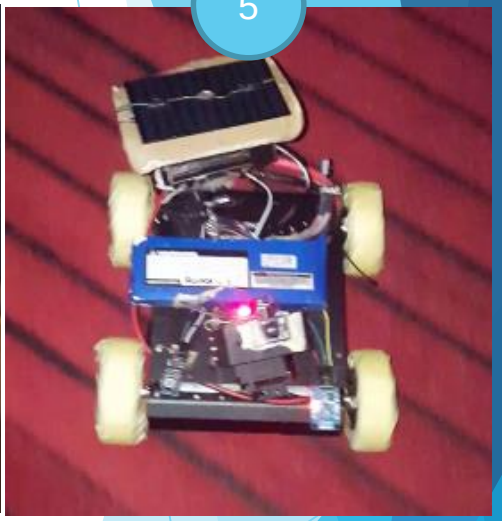


FACING DIFICULTY

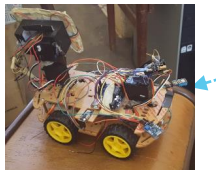
- The main dificulty we face is the range at which we control the robot using LORAWAN which goes up to may be 150Km LOS(point to point communication) which will easy our work .
- Video transfering using same device.
- Battery availability,Discharge rate.

TASK TO DO NEXT:

- To detect the specific type of gas.
- To detect the landmine using the metal detector and others.
- Use the LoRaWAN to do point to point communication with Robot embedded with sensors.
- Use gps module for the mapping with tft touch screen for visualisation of data .
- Creations of LoRaWAN gateways to visualise data from the robot using the TTN .

Approach with LoRaWAN

More than 150KM USING LoRaWan



CONCLUSION

- In reality this is just a tinker or craft work which really push me in the robotics domain. Is this domain that I really love, but I never had the chance to study in this in particularly.
- In the state of this project , I just tinker but I would be very interested to put in place a good prototype and Search a good Framework for implementations .

Thanks for your kind kind attention

IoT monitoring the frequency spectrum, radio coverage, QoS (2G, 3G, 4G) by using LoRa Network

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Telecommunications Regulatory Agency (ART/ARCEP)
Central African Republic

PLAN

- Context
- Challenge
- Solution

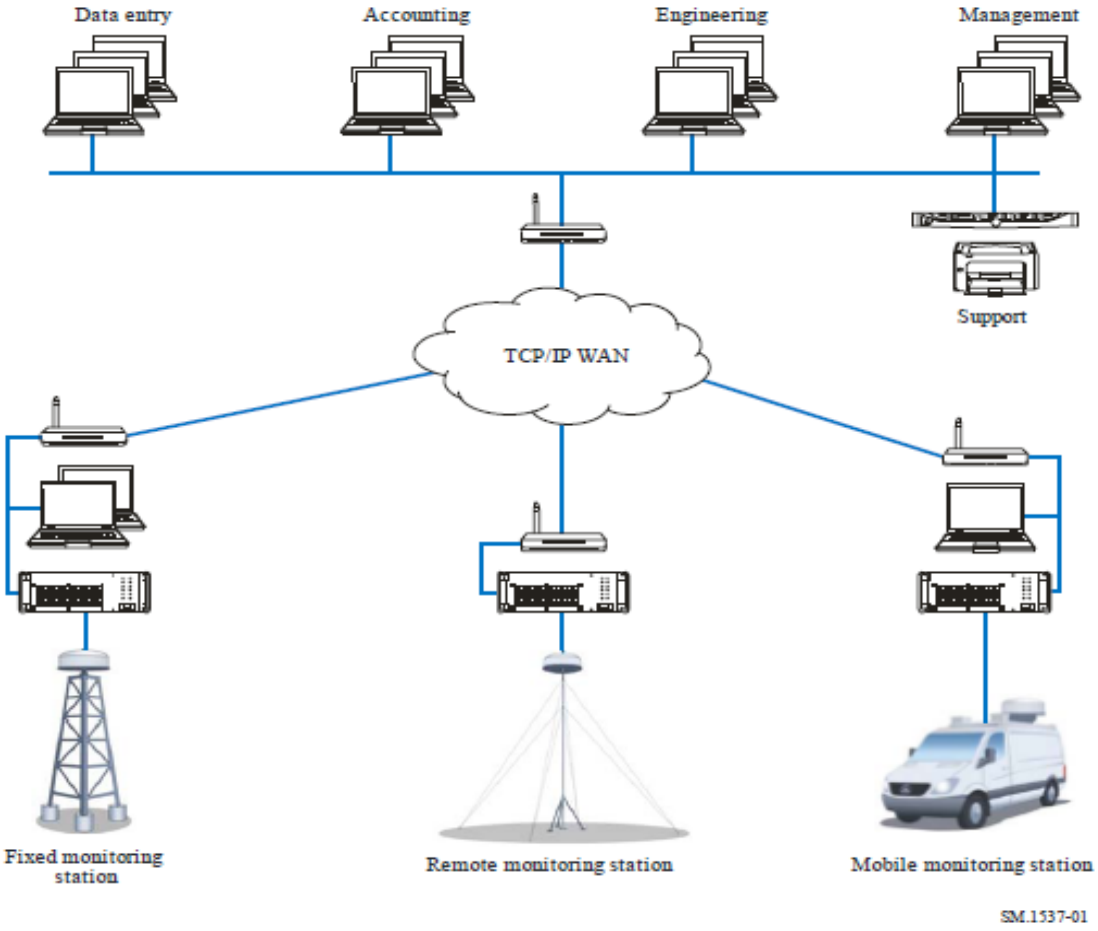
○ Context

- ENERCA : The only Electricity provider in CAR
  - ➢ Difficulty to product electricity 24h/24 since more 6 year ago
  - ➢ The electricity limited in Bangui (capital) and few provinces towns

  Result : around 12 hours per day electricity
- REGULATOR :
  - ➢ The Telecommunications Regulatory Agency use only 1 mobile monitoring station

○ Context

- MANAGEMENT AND MONITORING SYSTEM *(R-REC-SM 1537, IUT)* : High cost (around 6 to 8 million euros for minimum deployment)

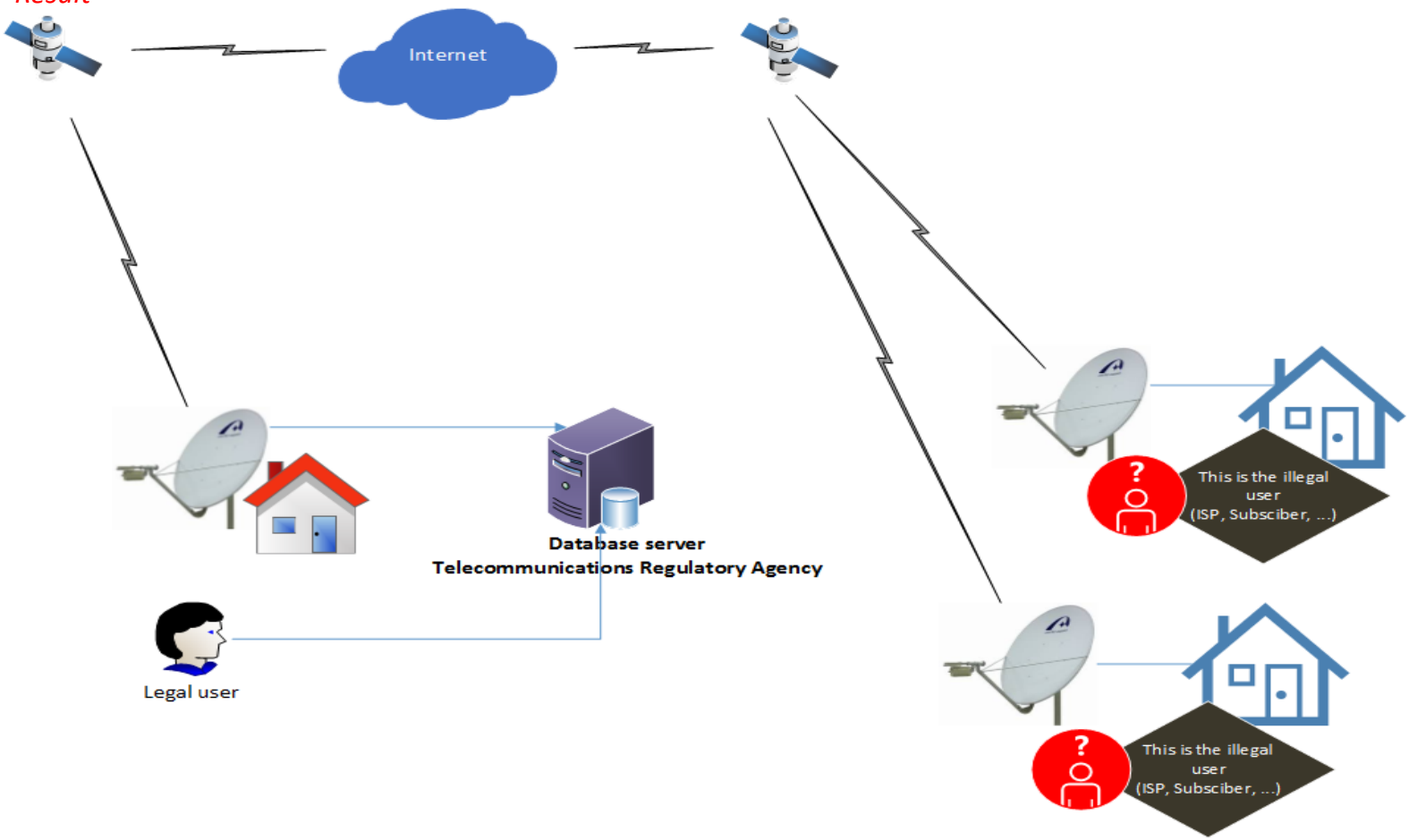


○ Context

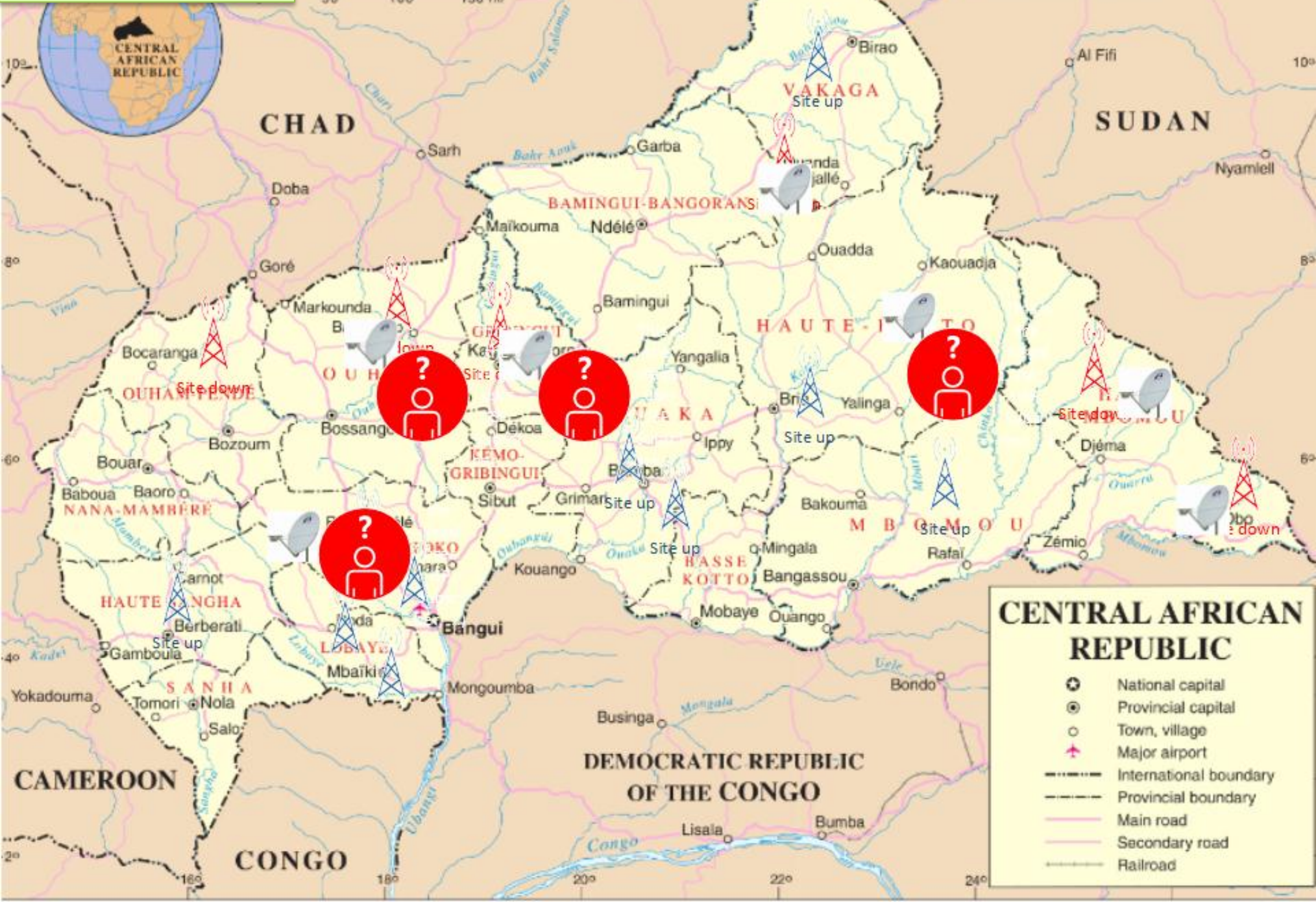
- <u>MOBILE OPERATOR</u> (ORANG*E CAR, TELECEL CAR, MOOV CAR and AZUR CAR) : Some Base station has been temporally closed for reason insecurity or start up few times for problem electricity*

○ Context

- MOBILE OPERATOR (ORANGE *CAR, TELECEL CAR, MOOV CAR and AZUR CAR) : Some Base station has been temporally closed for reason insecurity or start up few times for problem electricity*
  - *Result*



o Context


CENTRAL AFRICAN REPUBLIC
CHAD
SUDAN
CAMEROON
CONGO
DEMOCRATIC REPUBLIC OF THE CONGO
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Am Timan
Birao
Al Fifi
Sarh
Garba
Doba
Nyamlell
Ndélé
Maïkouma
Goré
Ouadda
Kaouadja
Markounda
Bamingui
Bocaranga
Yangalia
Bossangoa
Dékoa
Ippy
Yalinga
Djéma
Bouar
Bozoum
Baboua
Baoro
Sibut
Grimari
Bakouma
Mingala
Zémio
Rafaï
Kouango
Bangassou
Mobaye
Ouango
Bangui
Berberati
Gamboula
Mbaïki
Mongoumba
Bondo
Yokadouma
Tomori
Nola
Salo
Businga
Lisala
Bumba
VAKAGA
BAMINGUI-BANGORAN
HAUTE-KOTTO
OUHAM-PENDE
KEMO-GRIBINGUI
NANA-MAMBERE
HAUTE-SANGHA
SANGHA
BASSE KOTTO
MBOMOU
Site up
Site down
National capital
Provincial capital
Town, village
Major airport
International boundary
Provincial boundary
Main road
Secondary road
Railroad

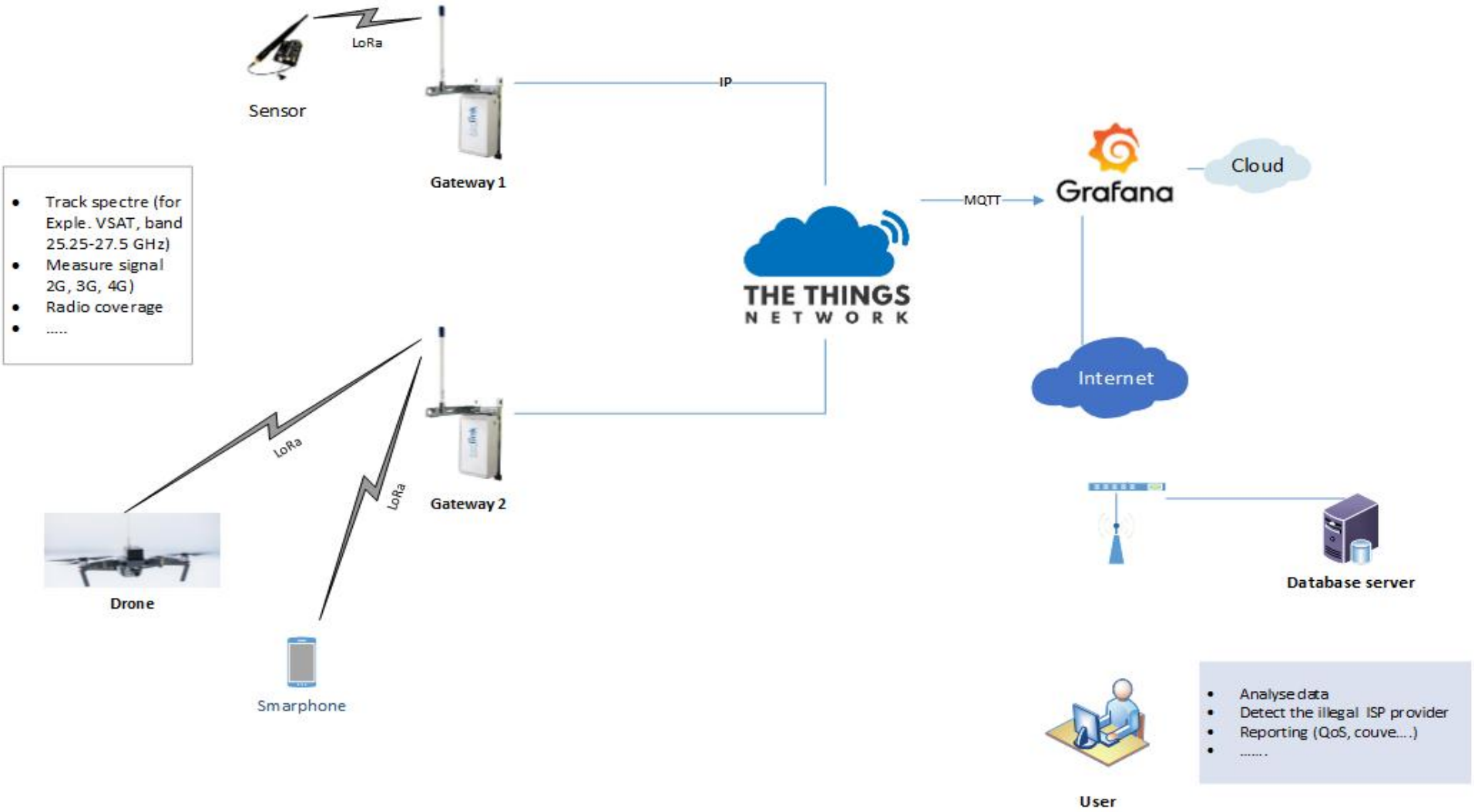
○ Challenge

Use alternative solution with possibilities below *:*

- *Limit the risks*
- *Consorsume little power*
- *Reduction the cost*
- *Long range*
- *Track the illegal ISP*
- *Measure radio coverage*
- *Measure the QoS*

○ Solution

Project : Monitoring the frequency spectrum, radio coverage, QoS (2G, 3G, 4G) by using LoRa Network



Question ?

- *What spectrum sensor could be used to detect the VSAT frequency band 25.25-27.5 GHz and other ???*
- The Drone include the module spectrum sensor *to detect the VSAT frequency band 25.25-27.5 GHz and other exist or no ??*

THANKS YOU