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Local Chapter Activity Report

at the Local Chapter Empowerment Meeting

Prof. Kamel BESBES

Unisec Tunisia

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Since 2013, Objectives:

- ✓ Promotion of National and International projects
- ✓ Working on Fundraising and Project Support
- ✓ Promotion of the alliance
- ✓ Organization of events
- ✓ Communication and dissemination
- ✓ Promotion of International Cooperation

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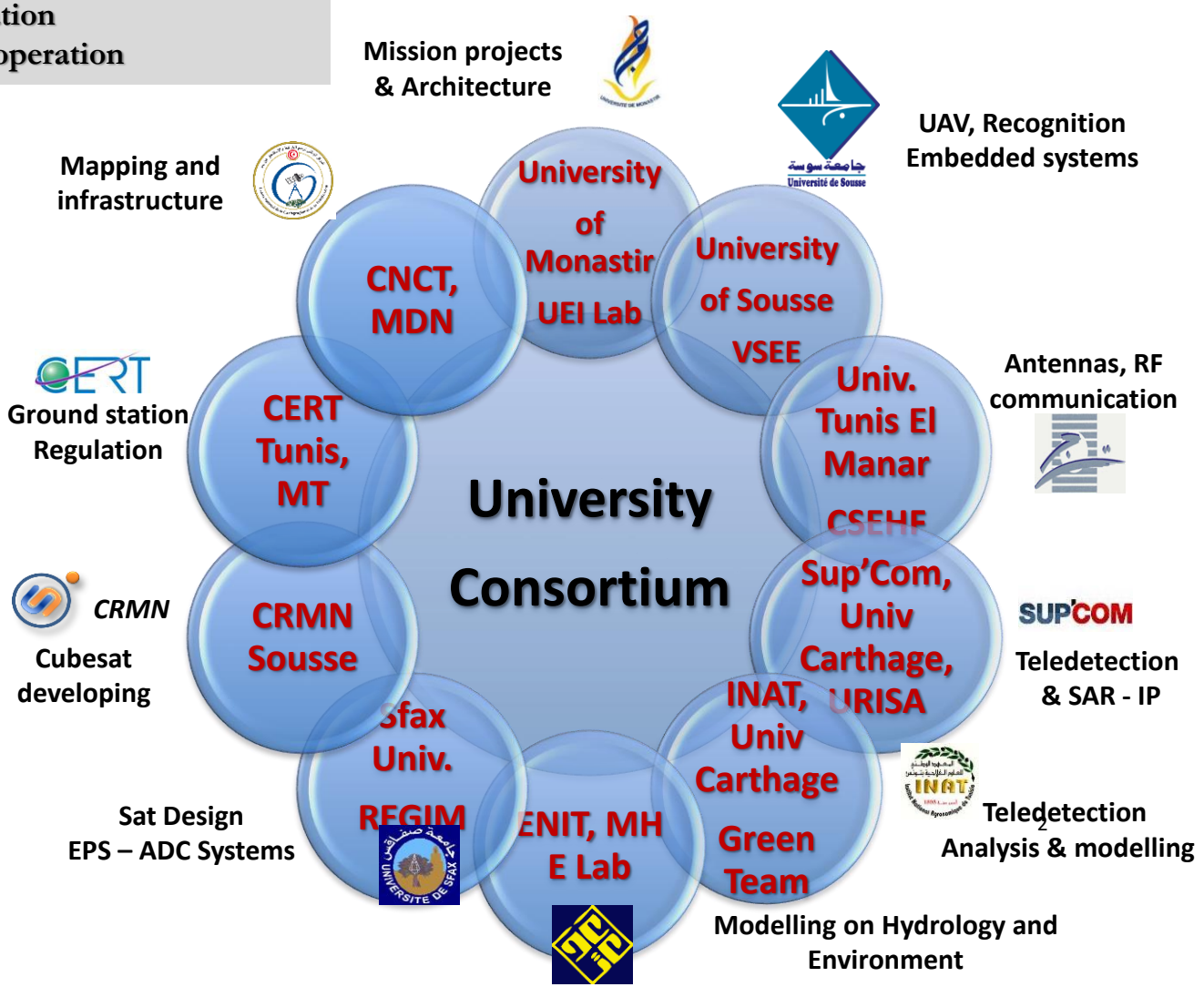

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History of Local Chapter Activities

Established in *2013*

- *Participated in MIC in (2nd) 2012 (semi finalist), (3rd) 2013, and (4th) 2016, 5th 2015,*
- *Attended UNISEC-Global Meeting in 2013*
- *Participated in CLTP in 2015 O Ben Bahri, 2016 N Gallah (travel cancelled)*
- *Organized MIC Seminars : for every call before 2019*
- **World CANSAT/ Rocketry Championship (WCRC)** *previsied in 2020 2021 (cancelled for covid)*
- *Participation and attendance of unisec virtual meetings*

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- *Practical Space Projects*

TUNISIA-TURKEY PROJECT 2016-2017, 114M843
Development of Intelligent Control Modules for Nano Satellites

Category	Field of studies	Number
Researcher	Electrical engineering	2
	Microelectronics	3
Early-Stage Researcher	Telecommunication	1
	Microelectronics	3
Engineer	Mechanical	1
	Geomatics	2
Graduate Student	Microelectronics	3
	Computer Engineering	1
	Electrical Engineering	3
	Information and Communication Technologies	2
	Electromechanical Engineering	1
Undergraduate Student	Electrical Engineering	4
	Computer Engineering	2
	Electromechanical Engineering	5

- Researchers: 9
- Engineers: 3
- Grad Students: 10
- Undergrad Students: 11

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CubeSat Mounting Facility: Cleanroom

Main Specifications:

- ISO 6 /Class 1000
- Work zone (12m^2): 3m x 4m x 2.4m
- Modular, transportable Hard Walls in plexiglass (5mm)
- Self-supporting epoxy-painted metallic Frame
- Metallic, epoxy-painted ceiling
- 4 Fan Filter Units (FFU) composed of HEPA Filters, pre-filters, and 3 fan speeds
- ESD Floor
- Anti-dust LED Lights

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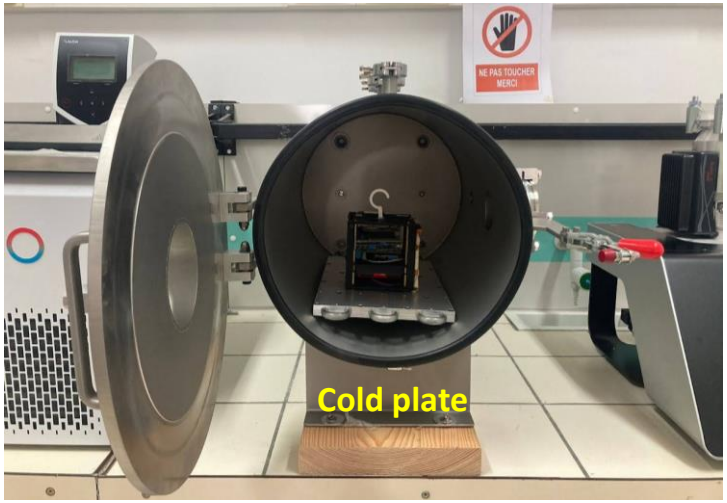
CubeSat Testing Facility

Thermal vacuum testing chamber:

- Shape: Stainless steel Cylinder
- Size: 30cm x 45cm (can test from a 1U up to 6U CubeSats)
- Temperature range: -20C to +50C
- Temperature change rate: ±1C per minute
- Vacuum pressure: 10^{-4} Pa



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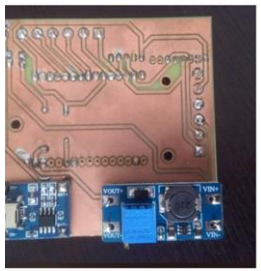
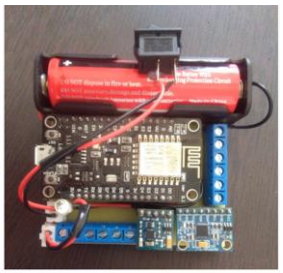
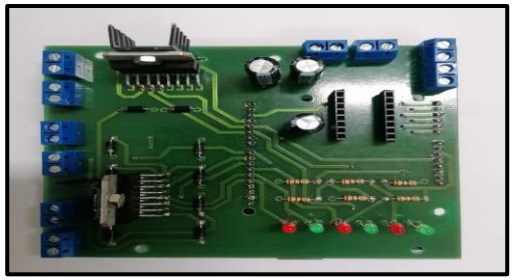
Attitude Determination and Control System

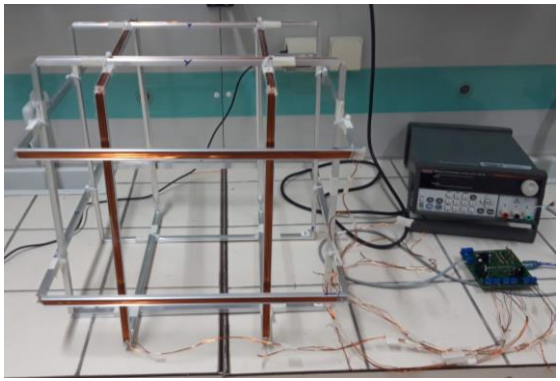
- Attitude acquisition System with wireless data transmission, autonomous power, and GUI:
  - Three-axis magnetometer
  - Three-axis gyroscope
  - Three-axis accelerometer
  - WiFi data transmission to GUI







- Helmholtz Cage: Earth magnetic field emulation
  - Dimensions: 45cm x 45cm x 45cm: 1U CubeSat testing
  - Aluminum frame
  - Magnetic field strength: ±100µT on each axis
  - Precise magnetic field control through the GUI



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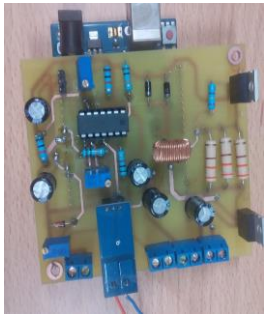
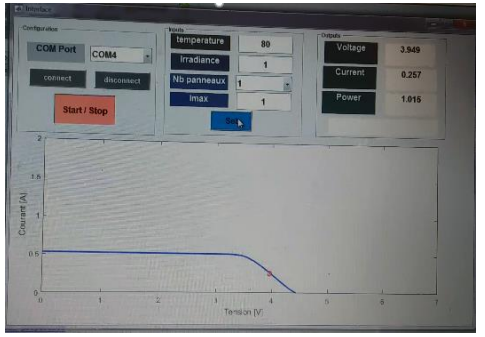
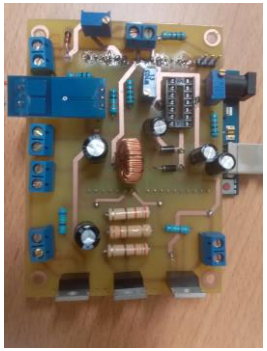
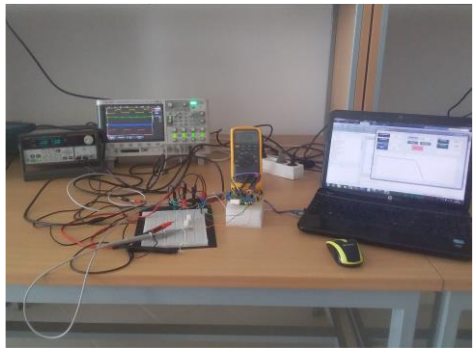
Electrical Power System projects

- Solar panel simulator
  - Generates power based on Solar radiation, Temperature and number of cells
  - Respects solar panel I-V curves
  - Outputs: Panel voltage, current, and power
  - Can be used to simulate different illumination scenarios
  - Controlled through a GUI









- Battery simulator:
  - Automatically detects functioning mode: Charging/Discharging
  - Respects battery Charging/Discharging curves
  - Outputs battery voltage, current, and capacity
  - Can be used to simulate different power scenarios
  - Controlled through a GUI

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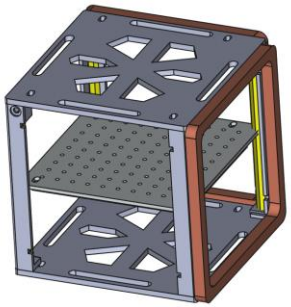
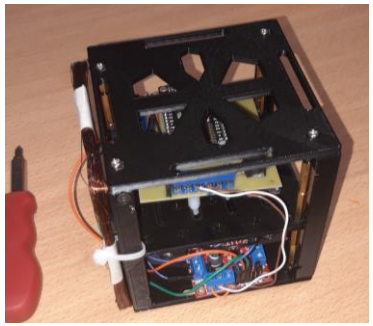
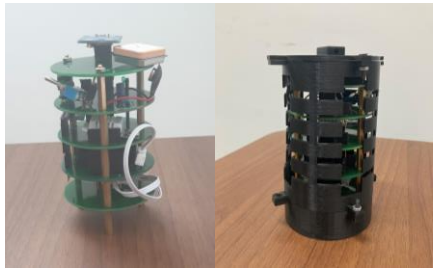
3D CubeSat Prototype

- Objectives:
  - Test the different subsystems of the CubeSat
  - Ensure their correct operation
- 1U CubeSat mechanical structure prototype designed in-house
- Fabricated with a 3D printer
- Can hold commercial or in-house made subsystems

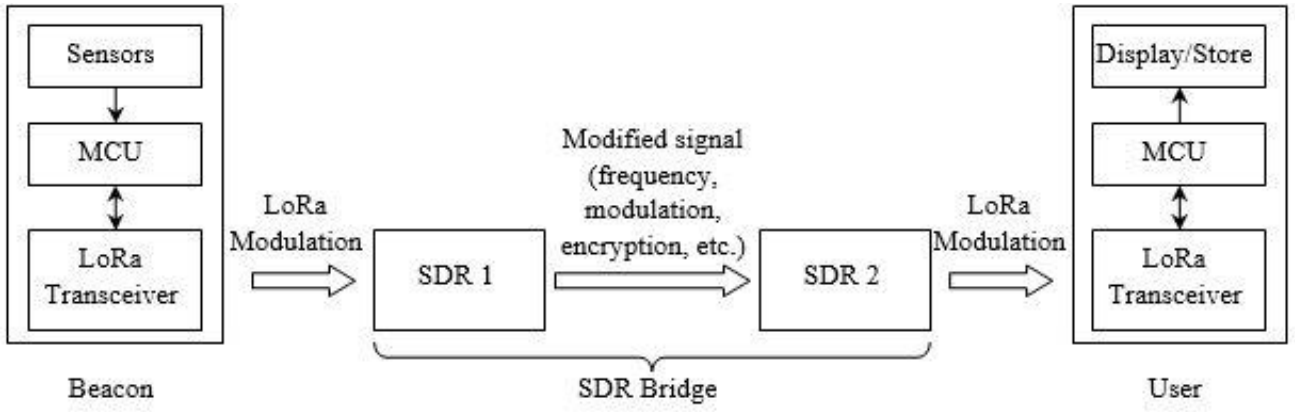






SDR based communication CubeSat system

- Receives signals from multiple transmitters working with different frequencies and modulations.
- Stores the received data onboard
- Forwards the data to a ground station



Hassayoun, S., Lahouar, S., Besbes, K.: SDR Bridge for a Secure Wireless Sensor Network (WSN), Proceedings of 2020 IEEE International Conference on Design & Test of Integrated Micro & Nano-Systems, June 2020

Salem Hassayoun, ENIM 2020, PhD thesis

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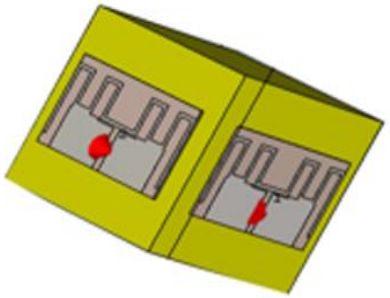
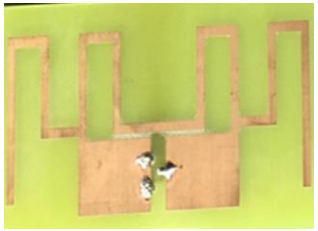
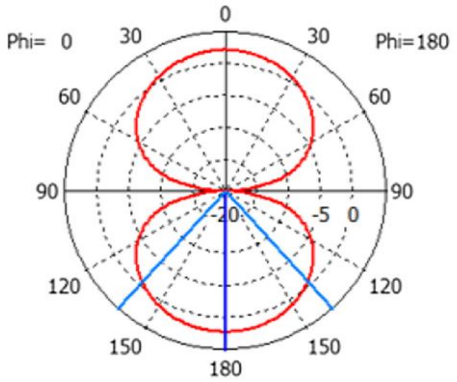
CubeSat Planar Antenna

Planar meander line antenna for UHF CubeSat communication:

430MHz
920 MHz
5,75GHz







Theta / Degree vs. dBi

Frequency = 0.919 GHz
Main lobe magnitude = 2.06 dBi
Main lobe direction = 180.0 deg.
Angular width (3 dB) = 84.9 deg.

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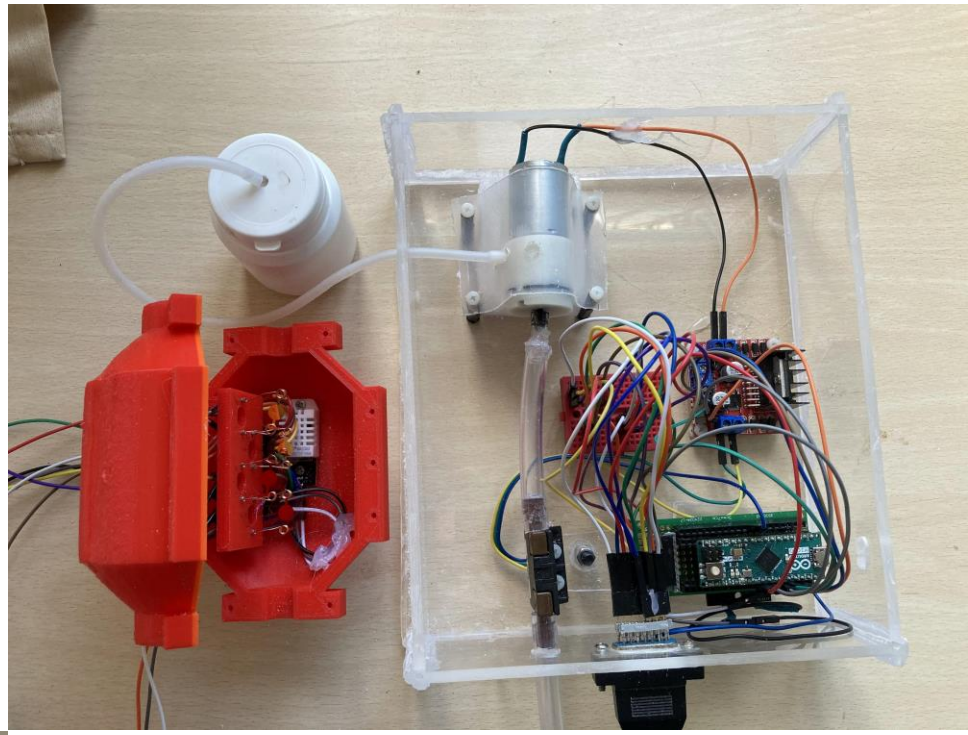
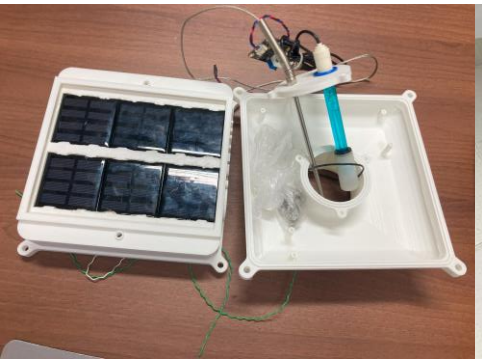
Ground Segment for Space IoT :

Gases and Water quality ,
Earth Observation,
MultiGNSS





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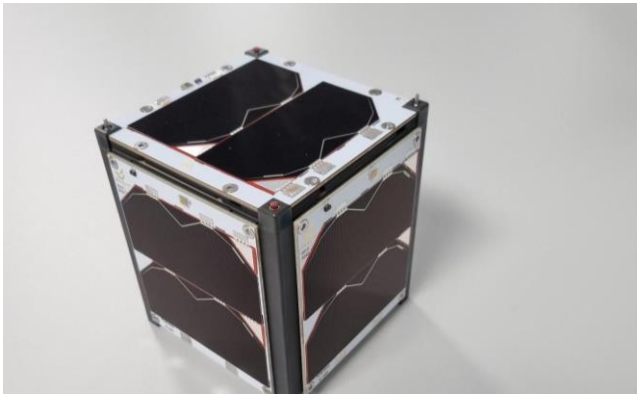

CubeSat final platform

Final cubesat development :	The 1U platform includes:	Payloads:
Under test and acceptance Ready for programming To be launched	Aluminum Structure Onboard-Computer Electrical Power System (Solar panels, batteries, and power distribution) Attitude Determination and Control System UHF Communication System (435MHz to 436MHz)	SDR based communication system Gaz sensors … Patch antenna

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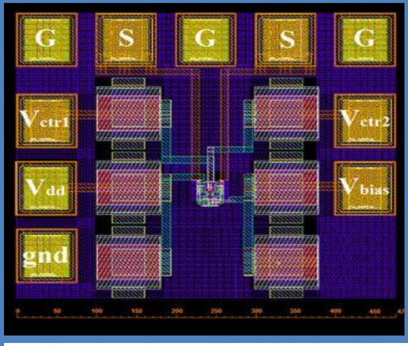

Journal of Circuits, Systems and Computers | Vol. 26, No. 04, 1750055 (2017)

An Enhanced Design of Multi-Band RF Band Pass Filter Based on Tunable High-Q Active Inductor for Nano-Satellite Applications

Aymen Ben Hammadi, Mongia Mhiri, Fayrouz Haddad, Sehmi Saad and Kamel Besbes

DOI: 10.1109/IDT.2016.7843051 • Corpus ID: 23242997

An L, S and S2 bands, compliant LC-based DCO for amateur Nano-satellite applications

S. Saad, M. Mhiri, +1 author K. Besbes • Published 2016 • Materials Science, Computer Science • 2016 11th International Design & Test Symposium (IDT)

This paper presents a LC-based digitally controlled oscillator (DCO) with an enhanced frequency resolution and an extended linear frequency tuning range. It generates frequencies between 1.22 and 3.52 GHz that covers three main bands defined for amateur Nano-satellite applications (L, S and S2). The DCO exploits a new tunable active inductor (TAI) that achieves a high Q-factor with a maximum value of 98 over a frequency range of 1770 MHz. It tunes from 3.55 nH to 15.2 nH. Furthermore, a tuning circuitry based on a capacitive degeneration network formed by a capacitance with an additional resistance, is employed to achieve a low frequency resolution without any dithering. The achieved frequency resolution is approximately between 3 and 16 kHz. The DCO exhibits a phase noise of −105.8 dBc/Hz at 1MHz frequency offset and an FoM of −175 dBc/Hz. Finally, the circuit consumes 5.2 mA current when is designed in a 90-nm nine-metal CMOS technology with an operating supply voltage of 1.0 V.

A 160-µW, Ring Digitally Controlled Oscillator for UHF/VHF Nano-satellites Broadcasting Tuners in 90nm CMOS Process

Authors: Sehmi Saad, Mongia Mhiri, Aymen Ben Hammadi, Kamel Besbes
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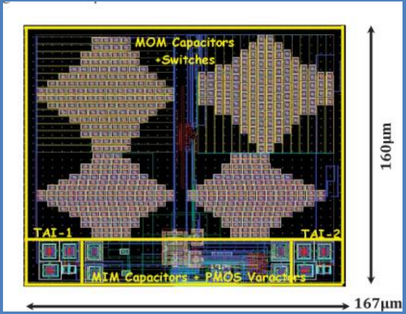
Emails: Sehmi.Saad@fsm.rnu.tn, Mongia.Mhiri@fsm.rnu.tn, Aymen.Benhammadi@fsm.rnu.tn, Kamel.Besbes@fsm.rnu.tn



2016 11th International Design & Test Symposium (IDT)

An L, S and S2 bands, compliant LC-based DCO for Amateur Nano-Satellite Applications

Sehmi Saad[1], Mongia Mhiri[1], Aymen Ben Hammadi[1] and Kamel Besbes[1,2]
[1]Microelectronic and Instrumentation Laboratory, LR-13ES12, University of Monastir, Tunisia
[2]Center for Research in Microelectronics and Nanotechnology (CRMN), Techno-park of Sousse, Tunisia
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Constellation of Pico-Satellites for 3D Earth observation

NissenLAZREG[1], Kamel BESBES[1,2]
[1]Microelectronics & Instrumentation Lab; Faculty of Sciences of Monastir; University of Monastir, Tunisia
[2]Centre for Research in Microelectronic & Nanotechnology (CRMN), Technopark Sousse, Tunisia
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ELSEVIER
Advances in Space Research
Volume 61, Issue 4, 15 February 2018, Pages 1017-1024

Analysis and design of Cubesat constellation for the Mediterranean south costal monitoring against illegal immigration

Nissen Lazreg [a], Omar Ben Bahri [a], Kamel Besbes [a, b]

Small Satellite and Multi-Sensor Network for Real Time Control and Analysis of Lakes Surface Waters

Nader Gallah
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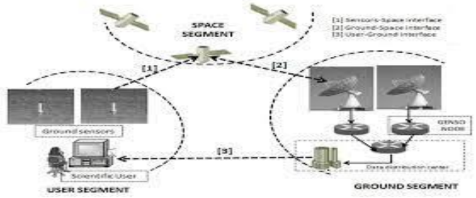

(IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 8, No. 3, 2017

Water Quality Monitoring based on Small Satellite Technology

N. Gallah[1], O. b. Bahri[1], N. Lazreg[1], A. Chaouch[1]
[1]Microelectronic and Instrumentation Lab
[1]Faculty of sciences, University of Monastir
Monastir, Tunisia

Kamel Besbes[1,2]
[2]Center for Research on Microelectronics and Nanotechnology, CRMN
Sousse, Tunisia

Prototype of the system with microcontroller board, sensors and SDR module

Fig. 1. Satellite earth observation. (a) NASA project (Courtesy of NASA). (b) ESA project (image by ESA/ATG medialab)

However, the satellite earth observation systems present always gaps. The earth observation methods used for water quality monitoring are based on sensors resolution. Indeed,

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Advances in Space Research
Volume 61, Issue 6, 15 March 2018, Pages 1501-1511

Didactic satellite based on Android platform for space operation demonstration and development

Omar Ben Bahri [a], Kamel Besbes [a, b]

Smartphone-Based Telemedicine Supported by Pico-Satellite Constellation

Omar Ben Bahri, Nissen Lazreg & Kamel Besbes

Pages 726-735 | Published online: 20 Mar 2018
Download citation https://doi.org/10.1080/03772063.2018.1438212 Check for updates

Full Article | Figures & data | References | Citations | Metrics | Reprints & Permissions | Get access

ABSTRACT

Many people in developing countries are required to travel for several hours to see a doctor. The concept of so called telemedicine accompanied with developments in the field of wireless communications may improve the health care. Here presented telemedicine system is for a distance consultation. It is based on a pocket smartphone using its camera to develop a video broadcasting mission for a real-time consultation. However, developing countries in the Middle East and North Africa suffer network coverage in most areas. To overcome this issue, the system includes a software defined radio in order to integrate the small satellite technology in the telemedicine routine. The proposed pico-satellite constellation can provide an interesting solution for near real-time transmission, which will significantly improve the health care in remote areas.

KEYWORDS: Constellation MENA Pico-satellite SDR Smart system Telemedicine

ICEMIS2017, Monastir, Tunisia

Registration and correction techniques in Cubesat remote sensing images

Nissen Lazreg[1], Rochdi bouchiha[1], Kamel Besbes[1,2]
[1]Microelectronics & Instrumentation Lab, Faculty of Sciences of Monastir, University of Monastir, Tunisia
[2]Centre for Research in Microelectronics & Nanotechnology (CRMN), Technopark Sousse, Tunisia
lazreg.nissen@yahoo.fr, rochdi.bouchiha@gmail.com, kamel.besbes@fsm.rnu.tn

Autonomous and In-situ Water Quality Monitoring System for Real-World Applications

Nader Gallah, Omar Ben Bahri, Zied Gafsi and Kamel Besbes
Microelectronics & instrumentation Labs, University of Monastir, Monastir, Tunisia
Email: kamel.besbes@fsm.rnu.tn

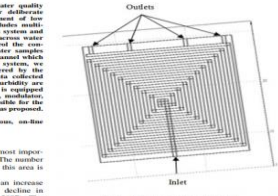

Fig. 1. Schematic of the channel designed

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MICST : Maghreb International Cources on Space Technology 2012

THE 1ST MAGHREB INTERNATIONAL COURSES IN SPATIAL TECHNOLOGY

1st MIC-ST - April, 10-11-12, 2012

Program. The overall objective of MIC-ST is to give the participants recent knowledge of the potential of space technology for sustainable economic development and to prepare Maghreb Regional participation in the 2nd Mission Idea Contest of Micro/Nano-Satellite Utilization (MIC), sponsored by the Univ. of Tokyo and Univ. Space Engineering Consortium in Japan.

- Presentation of: Nano-satellite Mission Idea Contest
- Courses on: Miniature Spacecraft System Design
- Workshop: MIC Project guideline

History of Spaceflight, Space Mission Design: Celestial Mechanics, Keplerian Orbits, Orbit Perturbations, Mission Analysis, Contact periods, sun incidence, Miniature Spacecraft System Design: Satellite System, System Design, Subsystems, Structure& Mechanisms, On Board data handling, Attitude and Orbit Control, Telecommunications, Power, Thermal control, Spacecraft Tests, Launch Vehicles, Spacecraft operations

Ground stations, Formations of Pico-Satellites for Telecommunications and Earth Observation, Exemplary Missions, Pico-Satellites UWE-1, UWE-2, Small Satellites Abrixas, Envsat, Interplanetary satellites Cassini/Huygens

The course curriculum will be implemented through a mixture of theory and practical examples, by using state of the art hardware, software and instrumentation facilities.

This course will be conducted jointly by ICS-Wurzburg University and uEi lab-FSM-Monastir University.

Language. All lecture, course materials and medium of instruction are in ENGLISH

Event Setting. Monastir –Tunisia

Public. Graduated students/researchers/engineers/business persons

Maghreb only : Mauritania-Morocco-Algeria- Tunisia-Libya

Maximum Available seats : 20

MICST

March, 17, 2012. End MICST Registration

March 28, 2012 Last date of regularization of registration fees

April, 10-12, 2012. Regional Seminar

Space-MIC

- May 1, 2012. Abstract Deadline
- June 15, 2012. Evaluation Deadline
- July 1, 2012. Announcement of finalist
- September 2012. Final paper deadline
- October 10-13, 2012. Final Pres. at the 4th nano-satellite symposium in Japan

About Monastir City. Monastir was founded on the ruins of the Punic–Roman city of Ruspina. The city features a well preserved the first Ribat that was used to scan the sea for hostile ships in Islamic expansion period. Several scientists came to stay in the Ribat of this peaceful city for contemplation. The Ribat was also one of the filming locations for Monty Python's Life Of Brian.

Monastir (from Latin monasterium), is situated at 20 km south of Sousse; 162 km south of Tunis. It is a city on the central shore of Tunisia, in the Sahel area. Traditionally a commerce and fishing port, Monastir is now a major university, agriculture and tourist resort district. The city population is 100,000. It has an international airport with flights from most Western European countries. Monastir's north-eastern territories lead into a place called Skanes which is 6 miles from Monastir's town center. Skanes is a holiday resort known mostly for its professional golf courses, never-ending strips of white, sandy beaches, clear blue sea and hotels that fuse Moorish architecture with modern designs, and is frequented throughout the summer by tourists from around the World. As well as the relaxation (thalassotherapy) and sports on offer they also come for the medina, where it is possible to sample fresh Tunisian cooking as well as bargaining for local goods.

EdMDM Ecole doctorale Matériaux Dispositifs et Microsystèmes — µEi — UNIVERSITÄT WÜRZBURG — The 2nd Mission Idea Contest for Micro/Nano-satellite Utilization

The 2nd Maghreb International Courses in Spatial Technology: Nano-Satellites Design

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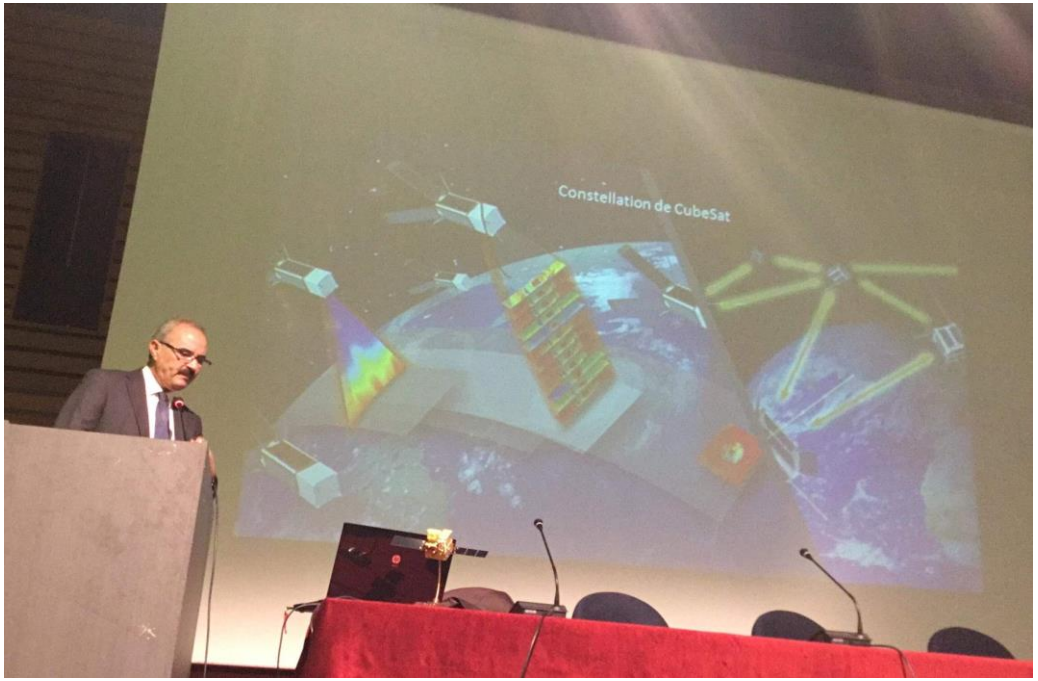
MICST 2014 *Hotel El Habib – Monastir*
27-28 Mars 2014

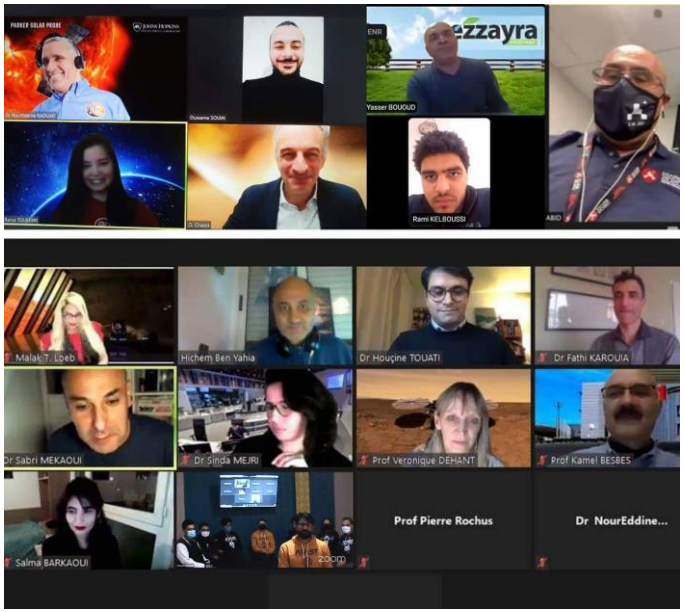
JASMINA SPACE DAY 2016

Conference Special session on space



Space talks on University clubs

Webinars on space developments and trends



National Space Strategy Conference – March 2018

UNISEC-Global Activities in 2022-23

**Number of
- Member Universities: 10
- Students: 40
- Professors ;15
- Others（ Corporative members, etc.): 5

UNISEC-Global activities in 2022-2023

- *Space star 2022 and 2023*
- *FACT project advancements until March 2024*
- *Master class on space technology*
- *Space events at engineering schools*
- *Ticad 8 : side event August 2022*

Side event TICAD 8, August 2022

TICAD Tokyo International Conference on African Development Tunisia 2022

RÉPUBLIQUE TUNISIENNE MESRS

Workshop:

Space Activities in Africa: Challenges & Opportunities

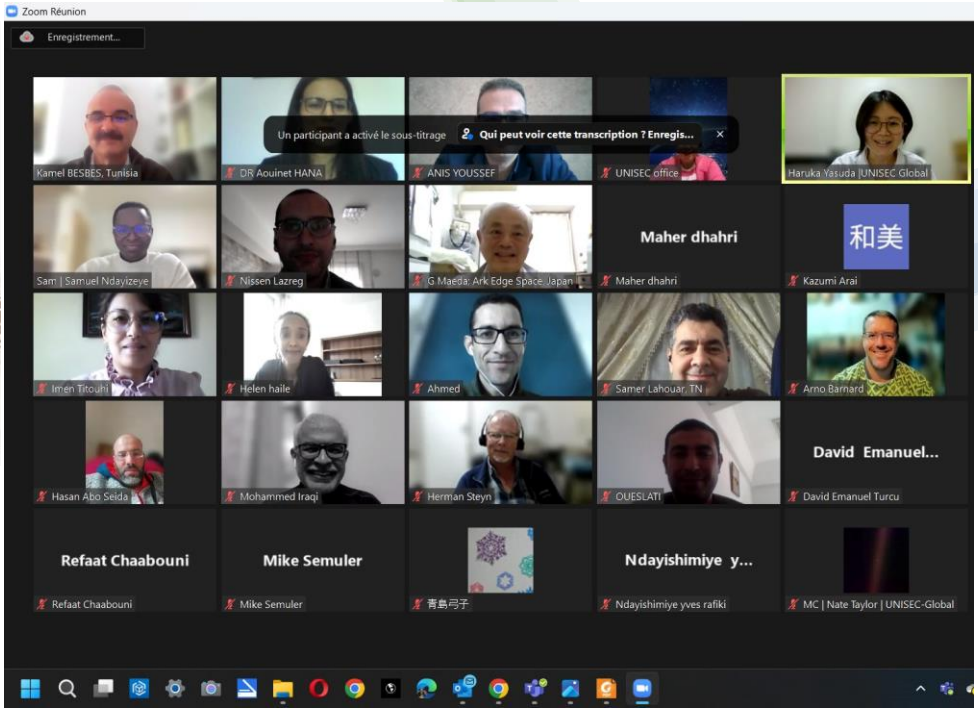
Space Activities: Tunisia's Case

08h30 – 09h00	Welcoming of participants	
09h00 – 09h10	Opening Remarks	**M. Nizar Ben Neji** : Minister of Communication Technologies
09h10 – 09h20	Remarks	**M. Moncef Boukthir** : Minister of Higher Education and Scientific Research & President of National Outer Space Commission
09h20 – 09h35	Challenges and Opportunities in Space Development ~ from the Case of Japan	**M. Ishii** : VP JAXA, Japan
09h35 – 09h50	Satellite activities to fight against climate change in Africa	**Dr. Amel Makhlouf** : Senior Expert, International Aerospatial and Climate, Italie
09h50 – 10H05	Opportunities and Challenges of IoT in Space for Digital Applications in Africa	**M. Mohamed Frikha** : DG, Telnet
10h05 – 10h20	Space activities for African countries : use cases	**Pr. Mohamed Yahia** : NARSS Egypt
10h20 - 10h35	Nanosatellite Constellation for Africa	**M. Charles Mwangi** : Director, Kenya Space Agency.
10h35 – 10h50	Governance of extra-atmospheric space activities in Tunisia	**Dr. Kamel Besbes** : National Commission for Outer Space
10h50 - 11h10	**Coffee Break**	
11h10 -11h30	Space for Youth and Women's Empowerment in Africa	**M. Ahmed El Fadhel** : DG, Tunisian Space Association, TUNSA
11h30 – 11h40	Launch of Tunisian IoT satellite Ifriqya1 Project	**M. Chaouki Chibi** : DG, Ministry of Communication Technologies
11h40 - 11h50	CERT'Labs laboratories: A pillar for the development of aerospace activities	**Mrs Ines AYARI** : Research and Studies Telecommunications Center
11h50 – 12h00	Satellite Communication: Used Frequency Band	**Mme Olfa Jammeli** : DG, National Frequency Agency
12h00 – 12h15	Challenges and Opportunities of Space Activities in Tunisia	**Dr. Mohamed Abid** : Engeneer at NASA
12-15 - 12h30	Open debate and Wrap-up	M. Kamel Saadaoui : Chief of Staff to the Minister, MTC, Moderator

August 25, 2022

Cite des sciences, Tunis

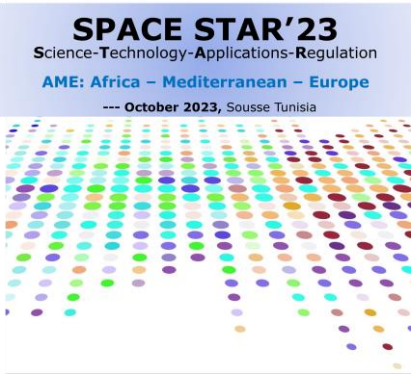
Workshop organized



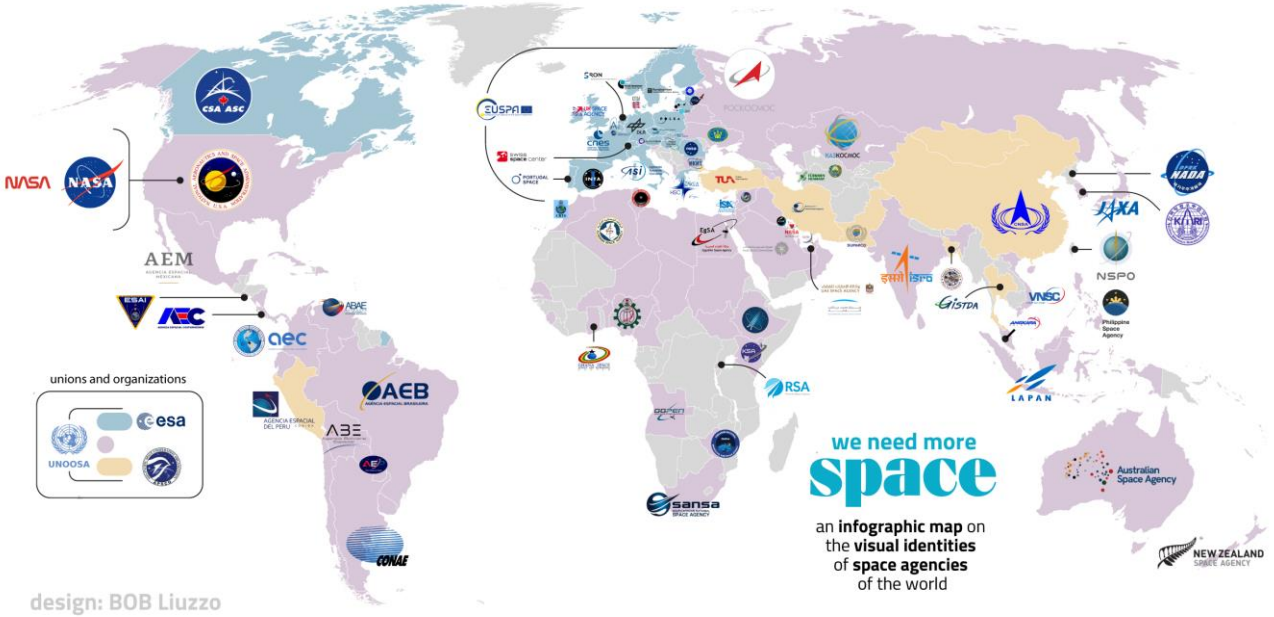
Space Star 2022

SPACE STAR'22
Science-Technology-Applications-Regulation
27-29 October 2022
Sousse Tunisia

Space Star 2023



SPACE DIPLOMACY



University Space Engineering Consortium TUNISIA
UNISEC

Unisec Tunisia is driving a mobilizing strategy

2010 …
UNOOSA (Graz 10-11)
training Symposium

Japan MIC
Nagoya 2012, Tokyo 13,..)

Jan 2012
1st Courses on Space Tech

UNISEC Tunisia
Nov 2013

Oct 2015
CNEEA, Experts committee

TN-TK project
Oct 2016

Apr 2016
NCP TN-H2020 Space

Conf :Tunisian Space Strategy
mars 2018

Oct 2018
FACT Project
360KDT

CP H2020 et HE SPACE
mars 2019

Apr. 2020
RNT SAMA Tunisia

Oct 2023

Oct 2022

Actions; Governance, Networking, Events, Exhibitions, Conferences, Studies, Training, Research, Startups, Legislation, Major Projects, International Cooperation, Resources, ...
Network of Tunisian partners: CNEEA, CRM, CNCT, Enova robotics, Avionav, INAT,
Network of International Partners: HE, CAST, JAXA, ISRO, UNOOSA, Samar Univ., ITU Turkey, Wursburg U., UVSQ, Vigo U.

Plan for 2024 and beyond

SPACE STAR 2024 13-15 November 2024

Launching Tunisian cubesat
Training more and more students
Participation to next Unisec events virtually or in person
Reform national law about space