Regional Program STIC-AmSud
2016 Project Proposal (Research – Innovation)

Basic Form

➢ This form, and the associated CVs, must be filled in English. Before filling the form, please read carefully the bases published in the STIC-AmSud site (http://sticmathamsud.org/).

➢ This form must be sent in **.pdf** by email to the STIC-AmSud Secretariat (contacto@sticmathamsud.org) by the project's International Coordinator.

A. General Information

A1	Project title
	Object Geo-Localization with External Devices

A2	Acronym
	OGLED

A3	Research domain
	Information and Communications Technology (ICT)

A4	Project goals
	The main objective of this project is to offer a service of geo-localization of an object **without the need** to equip the object with a GPS receiver. In more details, collaboration between international partners will jointly: ● Validate the signal processing framework to extract sensor positions offline from raw experimental measurements (given through GLORIA-IOT project). ● Implement, in real time, the geo-localization service through hardware and software development. ● Apply the proposed geo-localization service in two applications, the first one linked to the need of tracking and monitoring south american camelid (vicuñas and alpacas), the second for auto-exploration and characterization of caves by drones.

A5	Abstract
	In the context of internet of things, Low-Power Wide-Area Network (LPWAN), faces a

very fast development. A LPWAN is a network composed of wireless sensors spread in a given area, each sensor sending few octets per day to the base stations of the LPWAN. In the context of LPWAN, geo-localization of the sensors open the road of many new applications, services and business opportunities. The straightforward technological solution to offer such a geo-localization service is to add a GPS receiver to the wireless sensor. The sensors can thus transmit directly their position to the base stations. Nevertheless, when cost, volume and power supply is a strong constraint, this solution is no more feasible and alternative solution should be imagined.

The aim of the OGLED project is to offer the same service by removing GPS receiver at the wireless sensor level, and shift then at the base station level. The idea is to synchronize all the base stations with the same time reference thanks to the received signal of a single GPS satellite. From this common time reference, the base stations can make accurate measurement of the time of arrivals of the signal emitted by a wireless sensor, and thus, compute the position of the sensor. In 2017, the CNRS PEPS project GLORIA-IOT will fund hardware to make real measurement of joint received signals from several LPWAN protocols (LORA, SIGFOX and a new proposed modulation named CCSK-NB-LDPC). OGLED project, in collaboration with different partners, will start at the offline signal processing using the raw experimental measurements (given through GLORIA-IOT project) to validate algorithms that determine sensor positions. After that, real time processing will be performed using hardware and software implementations that will then be applied into two applications, the first one linked to the need of tracking and monitoring south american camelids (vicuñas and alpacas), the second for auto-exploration and characterization of caves by drones. OGLED will be also an opportunity to re-enforced links between the partners of the project and start or continue a long term collaboration.

A6	Scientific coordinators at each institution			
	South America A		**South America B**	
	Institution	University of São Paulo - Instituto de Ciências Matemáticas e de Computação	Institution	Federal University of São Carlos
	Project coordinator	Kalinka R. L. J. Castelo Branco	Project coordinator	Diana Pamela Moya Osorio
	Address	Av. Trabalhador São Carlense, 400. São Carlos – SP. Brazil	Address	Rodovia Washington Luís, km 235 - SP-310 São Carlos - SP - Brasil CEP 13565-905
	Phone/Fax	+55 16 3373-8623	Phone/Fax	+55 16 3509-1575
	Email	kalinka@icmc.usp.br	Email	dianamoya@ufscar.br
	South America C		**South America D**	
	Institution	Instituto Nacional de Investigación y Capacitación de Telecomunicaciones INICTEL-UNI	Institution	
	Project coordinator	Jinmi Gregory Lezama Calvo	Project coordinator	
	Address	Av. San Luis 1771, San Borja, Lima - Perú	Address	

	Tel/Fax		Tel/Fax	
		+51 346 1808		
	Email	jlezama@inictel-uni.edu.pe	Email	
	France A		**France B**	
	Institution	Université de Bretagne Sud	Institution	**ISAE-SUPAERO**
	Project coordinator	Emmanuel Boutillon	Project coordinator	Arnaud Dion
	Address	Lab-STICC, Centre de recherche. Université de Bretagne Sud BP 92100 56321 Cedex France	Address	Supaero Campus, building 7, 1st floor, office 07.1114 10, avenue Édouard-Belin BP 54032 - 31055 Toulouse CEDEX 4 France
	Tel/Fax	+33(0)2 98 87 44 66	Tel/Fax	+33(0)5.61.33.83.78
	Email	emmanuel.boutillon@univ-ubs.fr	Email	arnaud.dion@isae-supaero.fr

	Other participating institutions	
A7		
	In South America	**In France**

A8	**List of expected participants (name and affiliation and status : junior, senior)**
	1. Emmanuel Boutillon (UBS) 2. Christian Roland (USB) 3. Arnaud Dion (ISAE) 4. Kalinka Regina Lucas Jaquie Castelo Branco (USP-ICMC) 5. Diana Pamela Moya Osorio (UFSCar) 6. Héctor Alejandro Miyashiro Asato (INICTEL-UNI) 7. Jinmi Gregory Lezama Calvo (INICTEL-UNI) 8. Milton Ríos Julcapoma (INICTEL-UNI)

A9	**International Project Coordinator (to be chosen among the Scientific Coordinators mentioned in A6)**
	Emmanuel Boutillon, Université de Bretagne - Sud (UBS, France)

B. Project Details

B1. Project guidelines

The objectives of OGLED are:

- Development of a disruptive geo-localization service in the context of Internet of Things.
- Test a new communication protocol for future IoT communication.
- Make two experiments in the context of South America needs.
- Reinforce collaborations between partners.

B2. Project description

Motivations

The LORA [1] or SIGFOX [2] protocols are used in Low Power Wide Area Network (LPWAN) to send few octets per day in the industrial, scientific and medical (ISM) radio bands (a free licence radio band). In the context of the growth of Internet of Things (IoT), those two protocols have a very fast industrial development. They are used in LPWAN as a cheaper, smaller and less energy-hungry solution than the Narrowband IoT LTE [3], a special use case of the classical 3GPP cellular standard. One side advantage of LORA or SIGFOX protocols is that they can be deployed in remote areas (high mountains, amazonian forest, caves) where classical cellular service is not available.

Geo-localization of wireless sensors can offer a large brand of new applications and services. The straight solution is to equip the sensor with a GPS receiver. A sensor can thus simply transmit its position to the base station. Nevertheless, when cost, volume and power supply is a strong constraint, this solution is no more feasible and alternative solution should be imagined. The alternative solution is to use "geo-localization" techniques based on the time of arrival of the signal emitted by the sensor at several based station. In fact, since the speed of electromagnetic wave is known, time of arrival translates to the distance between the emitter and the base station. With at least 3 base stations and specific mathematical computation, position of the emitter can be derived. Nevertheless, the 3 base stations need imperatively to share the same absolute time reference, and here the trouble starts.

In fact, since the speed of light is $3x10^8$ m/s, an estimation of distance with a precision of a 1 meter requires a time of arrival measurement with a precision of 10 ns, 5 times less than the precision of the top signal that a GPS receiver deliver every second (this signal has an accuracy of 50 ns, which is well enough for most of the standard application). It is thus necessary to consider the GPS receiver not as an external device that deliver a time service, but to go up-stream, directly on the signal processing at the output of the Analog-Digital Converter of the GPS to process in an interleaved way GPS signal processing and received sensor signal. The mandatory condition to do that is that both analog digital converter are **controlled by the same clock**, as shown in Figure 1. In this way, clock jitter (unavoidable random variation of the clock period around its mean value) impact identically the time estimation of arrival of GPS and sensors signal: in other words, clock jitter can be almost masked since it is shared by the two receiver. In fact, the base station has only to measure the **difference of time of arrival** between a given GPS satellite signal and the sensor signal, and not the absolute time of arrival.
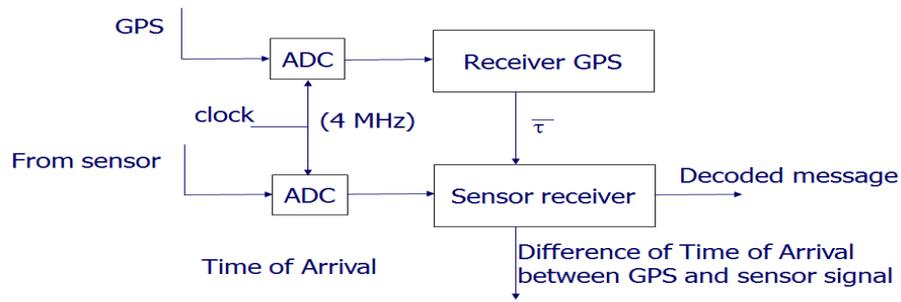
Figure 1. Principle of accurate estimation of differential time of arrival.

In 2017, UBS and ISAE are granted with a CNRS PEPS project [4] called GLORIA-IoT (Géo-Localisation Objet par Réseau Installé Avancé-Internet Of Thing). The duration of GLORIA-IoT is one year and will finish end of 2017. The objective of this project is to set up the platform shown in figure 2 and make several experimentations.
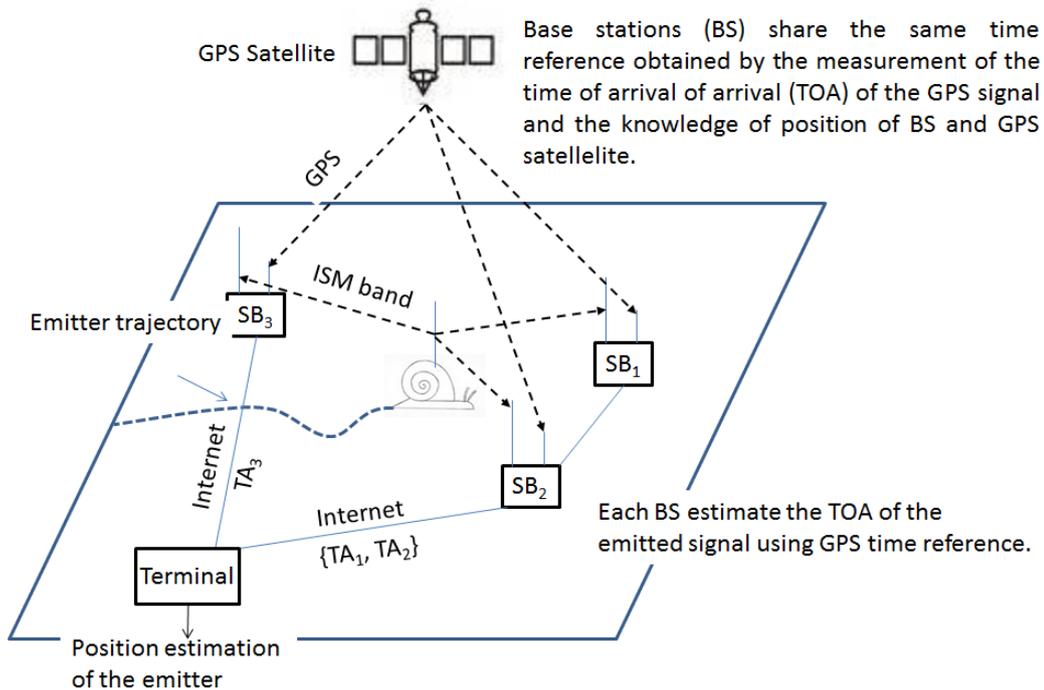

Figure 2. The geo-localization principle explored in OGLED.

To be more specific, in this experimentation, two type of base station will be developed. The first one is base on ETTUS hardware (2 RF daughter boards [5] for the two channels, and a mother board USPR X310 [6], as shown in Figure 3).

2 x SBX 400-4400 MHz Rx/Tx
(120 MHz, X Series only)

USRP X310

Figure 3. Hardware used for the base station.

This solution is effective but it cost (7000 euros) is very high. Thus, a second set of base station with a much lower price is currently under development.

The emitter (the snail in Figure 2) will be placed in a car equipped with a GPS and an avionic inertial central in order to be able to track exactly the vehicle position in time and be able to have a reference position. Then, experimentations will be done to record the received signal in hard disk drive (hundred of Gbits will be generated during those experimentation). Measurement will be done with 3 types of communication waveforms: the already existing LORA and SIGFOX protocols as well as an innovative single carrier waveform named CCSK-NB-LDPC (Cyclic Code-Shift Keying Non-Binary Low-Density Parity-Check Code) that jointly associate modulation and an error correction code in a very efficient way [7], [8]. Note that the CCSK-NB-LDPC waveform is patented by UBS [9] and that this patent is licensed to France-Brevet (https://francebrevets.com/). In the GLORIA-IoT project, it is specified that the data will be open freely to the scientific and industrial community in 2019. The OGLED project will start in 2018, just in time to jointly exploit the data in a one year exclusive period and generates knowledge, publications and to deploy real field applications.

[1] https://www.lora-alliance.org/
[2] https://www.sigfox.com/en
[3] https://en.wikipedia.org/wiki/NarrowBand_IOT
[4] http://www.cnrs.fr/ins2i/IMG/pdf/peps_2017_oca3.pdf
[5] https://www.ettus.com/product/details/X310-KIT
[6] https://www.ettus.com/product/details/SBX120
[7] Oussama Abassi, Laura Conde-Canencia, Mohammad Mansour, Emmanuel Boutillon. Non-Binary Coded CCSK and Frequency-Domain Equalization with Simplified LLR Generation. *24th Annual IEEE international symposium on personal, indoor and mobile radio communications (PIMRC'2013)*, Sep 2013, London, United Kingdom. Pp.1-6,
[8] O. Abassi, L. Conde-Canencia, M. Mansour and E. Boutillon, "Non-Binary Low-Density Parity-Check coded Cyclic Code-Shift Keying," 2013 IEEE Wireless Communications and Networking Conference (WCNC), Shanghai, 2013, pp. 3890-3894
[9] Method for transmitting non binary error correcting code words with CCSK modulation, and corresponding signal and device, E Boutillon, L Conde-Canencia, O Abassi - US Patent 9,438,305, 2016.

Project scope

The objectives of the OGLED project are thus to create an international collaboration between Peru, Brazil and France to develop this technology. The first step is to exploit those results and develop the algorithms required to extract wireless sensor position from the raw measurements and assess the quality of the position given by the GLORIA-IoT system. The algorithms will be developed in a high level signal processing language, like MATLAB typically. To do so, the expertise of INICTEL-UNI, UBS, University of São Carlos and University of São Paulo will be required, since those 4 organizations have already this competence. INICTEL-UNI and UBS have worked on different projects such as satellite communications and the study of algorithms and architectures for digital communication. Also, University of São Carlos has worked on modeling and simulation of cooperative relaying protocols at the physical layer, and on the processing of wireless signals. The next step of the project is to replace experimental measurement and offline computation with a real time operational system. It requires the following:

- Development of the hardware and the software of base station to perform real time joint signal processing of GPS signal and sensor signal to estimate time of arrival.
- Development of the communication structure to connect the base stations to the terminal.
- Development of the user interface at the terminal level to monitor the whole system. Moreover, the terminal should synchronize the base stations on the same GPS satellite (a given GPS satellite stay in the sky for around 4 hours).

The final step of the project is to deploy OGLED system in real applications that correspond to the needs of the partner's countries.

Expected results

The expected results of the project are listed below. For clarity, each objective is associated to a task, in order to be able, in the next section, to show the dependencies/time table of objectives.

Objective 1: Exploitation of the database obtained in the GLORIA-IOT project. With the objective to develop the offline algorithms to extract sensor position. Also, with this task, the precision of the method, in several types of environment (urban, half urban, country-side) will be tested.

Objective 2: Software development on base stations for performing real time joint signal processing of GPS signal and sensor signal to estimate time of arrival.

- 2.1 Develop software on base station to perform real time joint signal processing of GPS signal and sensor signal to estimate time of arrival.
- 2.2 Develop the communication structure to connect the base stations to the terminal.
- 2.3 Develop the user interface at the terminal level to monitor the whole system. Moreover, the terminal should synchronise the base stations on the same GPS satellite (a given GPS satellite stay in the sky for around 4 hours).

Objective 3: Deployment of the OGLED system for two applications.

3.1 Cave exploration
3.2 Vicuñas and alpacas monitoring

If objectives 1 and 2 are clear by themselves, it is worth to describe in details objectives 3.1 and 3.2.

Objective 3.1: Cave exploration Drones, GPSs and base stations will be used to realize a mission inside a cave, providing a real implementation of the proposed service to geo-localization of a target agent. In this application we will focused in the geo-localization of a drone inside a cave that needs to be mapped. The drone to take off needs the information of its localization, so inside the cave we will need to provide three base stations (BS1, BS2 and BS3) that will receive the signal of the GPS located outside of the base through a relay node in the entrance of the cave. This relay node will be responsible to retransmit the GPS information to the base stations via an amplify-and-forward cooperative relaying protocol. This base station will combine the information obtained from the relay node with the data obtained from the drone (the target agent in this case) to determine the geo-localization of it. The drone will be a quadrotor with a modem implementing the LPWLAN capable of sending information based in LORA protocol (this specific modem will need to change information with the autopilot of the drone). A Terminal will be responsible to calculate the geo-localization based on the combined information coming from the base station and the target agent. This scenario is illustrated in Figure 4.
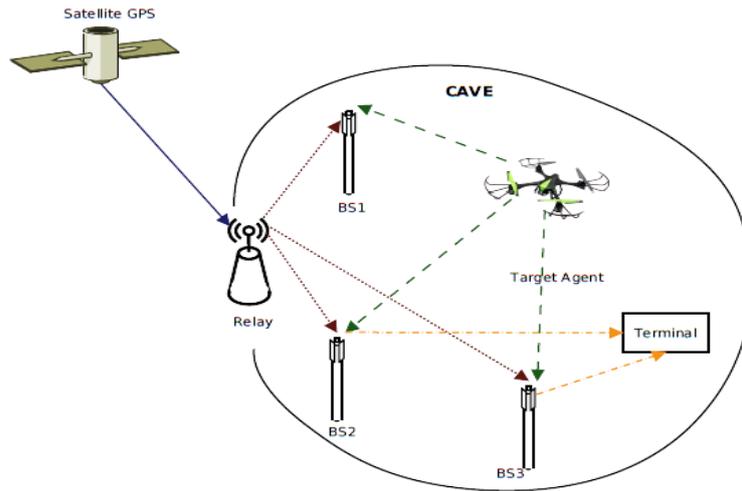
Figure 4. Cooperative geo-localization of drones inside caves.

Objective 3.2: Vicuñas and alpacas monitoring

The National University of Huancavelica Peru and the Direction of production of Regional Government of Cusco need a device to tracking and monitoring vicuñas and alpacas (south American camelid) in their wild environment (over 4000 m of altitude). The geo-localization service offered by OGLED fits exactly those needs: the sensors will be placed once on the vicuñas and the alpacas in the sierra of Perú (Huancavelica and Cusco) and a set of base stations can be spread in the mountains to track precisely the movement of the animals (see Figure 5). The low power transmitter system allow an autonomy of several years, and thus, minimize the interactions with the wild animals.
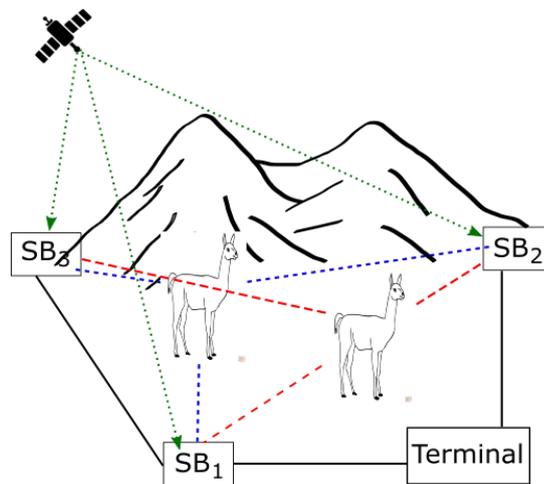

Figure 5. South American camelid geo-localization in Peruvian mountain.

Objective 4: Diffusion. The OGLED consortium is willing to publish the results obtained in high quality conferences (ICC, PIMRC, LATINCOM) and journals (IEEE Transactions). In the project, we will emphasize the participation of students in publications, conferences and short internships.

B3. Schedule, with main execution stages

The schedule of the tasks is shown in table I. The affectation of task is given in table II.

Table I: Organization of the whole project

10

	Title	2018				2019			
		1	2	3	4	1	2	3	4
Task 0	Monitoring of OGLED Project	■	■	■	■	■	■	■	■
Task 1	Offline algorithm developpment	■	■						
Task 2.1	Real time base station			■	■				
Task 2.2	Backbone infrastructure				■	■	■		
Task 2.3	Terminal developpemnt					■			
Task 3.1	Cave exploration							■	■
Task 3.2	Camelide monitoring						■	■	■
Task 4	Dissemination	■	■	■	■	■	■	■	■

Table II: Affectation of tasks to the partners.

	UBS	ISAE	USP	UFSCar	INICTEL-UNI
Task 0	100%				
Task 1	25%	25%		25%	25%
Task 2.1	25%	25%			50%
Task 2.2				75%	25%
Task 2.3				50%	50%
Task 3.1	5%		75%	20%	
Task 3.2	5%				95%
Task 4	20%	20%	20%	20%	20%

To perform the project, 4 workshop meetings with the whole consortium are scheduled.

April 2018, Lorient (France).

October 2018 : São Carlos (Brazil).

April 2019 : Lima (Peru).

October 2019, Lorient (France).

B4. Contributions

Present contributions so as to highlight the role of each partner and the integration among partners.

Université de Bretagne sud has experience in joint design of algorithm and architecture for signal and communication applications. In particular, UBS has developed the hardware of an hardware error resilient GPS receiver (an ASIC is currently under design and will go to foundry in october 2017) in the frame of the RELIASIC project. UBS has also developed an expertise in the demodulation of single carrier communication system for satellite in the frame of contracts with a Korean research institution. Finally, UBS has also proposed an original solution for very low power high efficiency modulation by combining CCSK modulation with NB-LDPC codes. By is background, UBS will be technically mainly involved in task 1 and 2. Since UBS leads the project, it is involved also in tasks related to applications (task 3.1 and 3.2), the monitoring of the project (task 0), and of course, in the dissemination of the results of the project (task 4).

ISAE-SUPAERO. ISAE have the deep knowledge on GPS signal processing and Radio Frequency hardware. In 2017, ISAE and UBS will work together in the frame of GLORIA-IoT.

OGLED is a natural continuation of this collaboration in 2018 and 2019 to exploit the results and publish it. The main contribution of ISAE in OGLED is thus in task 1 (offline algorithm development) and task 2.1 (real time base station). ISAE is also involved in task 4 for dissemination of the project's results.

University de São Paulo (ICMC-USP) and Federal University of São Carlos (UFSCAR) USP and UFSCAR have expertise in protocol simulation required to develop task 2.2 (backbone infrastructure) and the task 2. will evaluation cooperative protocols in MATLAB and OMNET++. The research groups have expertise in protocol simulation. They will do the development of a testbed using drones in a cave to evaluate the geo-localization service. The researchers at ICMC-USP have the expertise in Drones and in the implementation of real testbeds; In the same way, the researchers of UFSCAR have the expertise in the cooperative localization protocols used in the testbed. USP and UFSCAR are also involved in task 4 for dissemination of the project's results.

National University of Engineering – INICTEL-UNI Research group, Embedded Systems and Sensor in Internet of Things, has expertise in the development of embedded systems, electronic instrumentation, algorithms and architectures for digital communication, signal processing and analysis required to develop task 2.1 (Realtime base station) and 2.3 (Terminal development). The project of wireless sensor network developed by the research group, has been implemented in Peruvian amazon for environmental and health application, this expertise is required to develop the task 3.2 (tracking and monitoring south american camelids). INICTEL-UNI is the research institute of National University of Engineering (UNI), hence each year receive undergraduate and master's students to guide and develop their research projects that lead to thesis, articles, conferences. For OGLED project, we consider to work with two thesis of undergraduate students and also to promote internships of this students with UBS and USP universities. INICTEL-UNI is also involved in task 4 for dissemination of the project's results.

B5. Regional Aspects

First of all, we will expose the existing links between the partners, then we will explain how OGLED will reinforce/construct links between partners.

Past and present collaborations

Links between Brazil and France: Since 2014 the research groups of Brazil and France have been developing and interesting and complementary work. In 2016 prof. Jean-Philippe Diguet spent 45 days in São Carlos (paid by University of São Paulo and France Embassy in a program named "Cátedras Francesas") to develop research together the Brazilian team. In this same year, prof. Catherine Dezan also spent 7 days doing research together the Brazilian team. This interaction results in a submission of projects to funding agencies (Services on demanding in IoMoT) and publication of a paper in a conference [1]. Prof. Catherine Dezan, from Lab-STICC, also sent a proposal to spend part of her sabbatical year here with the Brazilian team. Currently we are planning to continue with this project in the Service on Demand with IoMoT (we already applied for funding).

Links between Peru and France: Since 2011 INICTEL-UNI, Peru and Lab-STICC (CNRS Laboratory, UMR 6285), France are working together developing satellite communications projects. This all happened thanks to the stay in Peru for a whole year (2011) of Professor Emmanuel Boutillon (with a CRCT obtained through the CNU, the National Council of France's Universities). Thanks to this, many researchers from INICTEL-UNI have done an internship in France. They were invited by the University of Bretagne Sud, by the own funds of Lab-STICC, for a duration from 3 to 6 month. In 2012, for 6 month: Bach. José Luis Sánchez (UNI), in 2013,

for 6 month : Mg. Joel Vilca (UNMSM), in 2015, for 3 months: Bach. Franklin Cochachin (UNI). In 2016, for 3 months : Bach. Héctor Miyashiro (UNI). These internships have resulted in many publications [11-14]. Mr. Franklin Cochachin is actually a PhD student in an ANR project and Mr. Emmanuel Boutillon is his advisor. Finally, for this year Mr. Emmanuel Boutillon has obtained financing, from French embassy in Lima-Peru, to visit Peru in July. The objective of this trip is to coordinate research and training activities between INICTEL-UNI and UBS. The training component concerns the involvement of Lab-STICC in a Telecom Master at UNI.

Links between Peru and Brazil: So far, there is no links between INICTEL-UNI and Federal University of São Carlos (UFSCar) and between INICTEL-UNI and University of São Paulo (USP) while UFSCar and USP have already a long record of joint collaborations.

Links between UBS and ISEA: UBS and ISEA has a long story of collaboration on GPS receiver. Recently, they obtained the CNRS PEPS grant (project GLORIA-IoT) to develop the technology of OGLED project.

Reinforcement of collaborations with OGLED's project.

The cooperation through a coordinated program of exchange of researchers, taking as context a common research problem, which provides the framework for the project scientifica activities is one of the goals and benefit provided by OGLED project.

OGLED will be an additional project that will strengthen PERU-FRANCE and BRAZIL-FRANCE once the OGLED project includes joint research activities via international mobility, focused scientific and testbed activities, designed to exploit complementary expertise and to create synergies among the partners, establishing the basis for sustainable future cooperation at different levels, including: co-advising of PhD students, joint organization of international events (workshops, conferences, summer schools, etc.), participation in bilateral project proposals, participation in large-scale international project proposals, etc. OGLED will create a new partnership between Brazil and Péru with a lot of potential. Exchange of students is an important dimension of the project, so it can be seen as a seed for future long terms collaboration between countries.

An important aspect, in particular for experienced researchers, is the possibility opened by OGLED to expand their contacts in a different continent and reinforce the networking opportunities. Researchers exchanges make it possible to deepen the existing contacts and to raise new ones, not only within the visiting institutions, but through contacting people that interacts with those institutions. The participant institutions are involved in other projects and have a recognised track of activity and excellence, which makes them adequate vehicles for the establishment of fruitful contacts and networking.

Joint publications between partners

[10] Mariana Rodrigues, Daniel Fernando Pigatto, João V. C. Fontes, Alex S. R. Pinto, Jean-Philippe Diguet and Kalinka R. L. J. C. Branco. UAV Integration Into IoIT: Opportunities and Challenges. In The Thirteenth International Conference on Autonomic and Autonomous Systems (ICAS 2017). (accepted for publication)

[11] H. Miyashiro, E. Boutillon, C. Roland, J. Vilca and D. Díaz, "Improved Multiplierless Architecture for Header Detection in DVB-S2 Standard," 2016 IEEE International Workshop on Signal Processing Systems (SiPS), Dallas, TX, 2016, pp. 248-253

[12] E. Boutillon, J. L. Sánchez-Rojas and C. Marchand, "Simplified Compression of Redundancy Free Trellis Sections in Turbo Decoder," in *IEEE Communications Letters*, vol. 18, no. 6, pp. 941-944, June 2014.

[13] Emmanuel Boutillon; José-Luis Sanchez-Rojas; Cédric Marchand, « Compression of redundancy free trellis stages in Turbo-Decoder », Electronics Letters, 2013, 49 (7), pp. 460 – 462.

[14] Anthony Barré; Emmanuel Boutillon; Neysser Blas; Daniel Diaz, « A POLAR-BASED DEMAPPER OF 8PSK DEMODULATION FOR DVB-S2 SYSTEMS », International workshop on Signal Processing Systems (SISP'2013), Sep 2013, Taipei, Taiwan.

[15] A. Dion, L.V. Calmettes, E. Boutillon, E. Liegeon, " Fast Acquisition Unit for GPS/GALILEO Receivers in Space Environment", ION GNSS 2008, San Diego, Jan., 2008.

[16] A. Dion, E. Boutillon, L.V. Calmettes, "Reconfigurable GPS-Galileo Receiver for Satellite-based Applications", ION GNSS 2007, Fort Worth, Texas, Sept., 2007.

[17] A. Dion, E. Boutillon et al. "A flexible implementation of a global navigation satellite system (gnss) receiver for on-board satellite navigation". IEEE DASIP, Conference, pages 48–53, Oct 2010.

B6. Institutions and CVs of coordinators

Description of each participating institution, and curriculum vitae of each participant (maximum 2 pages per participant).

<u>Description of institutions</u>

Bretagne-Sud University (UBS) The Bretagne-Sud University (UBS), is a public modern university (founded on February 7, 1995), which has 721 employees, including 427 teachers and teacher-researchers , that hosts more than 8578 students and currently offers 93 doctoral diplomas and licenses. Established in three places: Lorient, Vannes and Pontivy, it currently has 91,723 m² of built-up areas. The Lab- STICC is a Joint Research Unit CNRS (UMR 6285) conducting research in the domain of ICT. The laboratory contains 178 researchers and teacher-researchers, and more than 350 taking into account PhD students, engineers and technicians. The Lab-STICC is a laboratory which groups several research centers in Bretagne: Université de Bretagne Occidentale, Université de Bretagne-Sud, Télécom Bretagne, ENIB and ENSTA Bretagne. The laboratory is organized into three divisions: MOM (Micro -Waves and Materials) division, CACS (Communications architectures and circuits and systems, led by E. Boutillon) division and the division CID (Knowledge , Information, Decision). Part of the project will be developed in the CACS division at the Université de Bretagne Sud.

ISAE-SUPAERO is a research and innovation-driven institution of higher education for aerospace engineering. Since 1909, SUPAERO has been educating students to have the most advanced scientific and engineering skills. With its extensive range of over 33 degree and educational programs, backed by research-driven teaching and close collaboration with industry, ISAE-SUPAERO hosts over 1700 students, among them 225 doctoral students. Around 30 % of our students are from 45 nationalities. Within ISAE-SUPAERO, the DEOS (Department of Electronic, Optronic and Signal processing) hosts 3 research group that cover 5 scientific domain. The SCAN group (Signal-Communication-Antennas-Navigation) is comprised of around twelve associate professors, professors and research engineers, who have extensive expertise in signal processing: adaptive antennas, radar processing, receiver architectures and communication techniques and networks applied to telecommunications, satellite constellation-based positioning and navigation (GNSS), GNSS receiver architecture based on FPGA. The focus of SSPA group (Space systems for planetology and its Applications) is to develop associated missions and technologies for geophysical exploration of the solar system. The CIMI group (Microelectronic image sensors) focuses on two main goals: to improve the performance of CMOS imagers (mainly for space application) and to propose new architectures aimed at the development of new dedicated applications. The project will be conducted in the SCAN group.

University of São Paulo (USP). The University de São Paulo (USP) is the largest and most prestigious university in the Latin America. USP, as the major institution of higher learning and research in Brazil, is responsible for educating a large part of Brazilian Masters and Ph.D's. The University of São Paulo offers undergraduate courses in all areas of knowledge, with 300 courses and more than 59.000 students. USP has also graduate programs in all fields of knowledge, with 222 programs and more than 30.000 Masters and PhD students. It is present in numerous academic networks all over the world. The Instituto de Ciências Matemáticas e de Computação (ICMC) is one of the USP's units. It is located in city of São Carlos and is responsible for undergraduate and graduate course the areas of Computer Science, Computer Engineering, Mathematics and Statistics. ICMC as well has a vast network of international cooperation and is one of the nation's leading institutions in its fields. LSEC is a research laboratory of ICMC at University of São Paulo (USP) - São Carlos. USP, the major institution of higher learning and research in Brazil, is responsible for educating a large part of Brazilian Masters and Ph.D's. LSEC - ICMC/USP has been conducting research on aerial robotics and autonomous systems for over 10 years, is also partner of the INCT-SEC (National Institute of Science and Technology in Critical Embedded Systems), and includes 4 professors and 8 Ph.D. students. LSEC collaborates with several other national and international institutions and possesses a number of platforms for the experiments in this project, including unmanned aerial vehicles (fixed and rotate wing), drive-by-wire robotic cars, and state-of-the-art sensors. LSEC is located in the Institute of Mathematics and Computer Science São Carlos, owned by the University de São Paulo. LSEC has participated in important projects as INCT-SEC (573963/2008-9 and 2008/57870-9); E-Science Project "Attitude and Heading Reference System based on recursive robust Kalman filter implemented in FPGA" (2014/08432-0); S-Truck: Smart, Safe & Secure Scania Trucks (with Scania).

Federal University of São Carlos (UFSCar) The Federal University of São Carlos (UFSCar) was created in 1968, and it was the first federal institution of higher education founded in the countryside of São Paulo State. The University has four campuses: São Carlos, Araras, Sorocaba and Lagoa do Sino. The 48 academic departments of the University are divided in eight centers: Agrarian Sciences, Biological and Health Sciences, Management and Technology Sciences, Science and Technology for Sustainability, Exact and Technology Sciences, Humanities and Biological Sciences, Education and Human Sciences and Natural Sciences. UFSCar offers 62 undergraduate courses and 47 graduate programs. There are a total of 24.825 students registered at the University: 12.338 in undergraduate courses; 1.584 in distance education; 369 are students of professional Master's Programs; 1.915 of academic Master's Programs; 1.690 Doctoral Programs; and 6.929 of Specialization Courses. In 2014, UFSCar obtained the 18th place among 300 Latin American universities included in the ranking prepared by Quacquarelli Symonds (QS). The institution obtained 82 points in the overall assessment and is, therefore, considered the 10th best Brazilian institution. The Department of Electrical Engineering (DEE) is one of the 13 departments that integrates the Center for Exact Sciences and Technology (CCET). The DEE was created in 2008 with the REUNI program of the Ministry of Education. Currently, the department has 21 professors, which participate, actively, with national and international collaborations and research projects in the areas of: Telecommunications, Power Systems, Electrical Generation and Distribution, Microelectronic, Biomedical Engineering, Bioinformatics, Control and Automation, and Robotics. The research group of Communication Systems and Optoelectronics Devices of the DEE develops research projects in: wireless communication networks, 5G technologies for wireless communications, optical properties of semiconductor materials and devices, optoelectronics components, and photonics.

National University of Engineering (UNI) and INICTEL-UNI The National University of Engineering (UNI) was founded in 1876 in Lima, Perú. Today the university is organized into eleven faculties with 27 academic departments. These departments are specialized in economic, civil, industrial, mechanic, mechatronic, electronic engineering and the physics, chemical and

mathematical sciences. UNI is one of the best national universities of Peru. The post grade school has eleven departments with different Master and PhD programs. The university has also four researches institutes in Sciences, economic and electronic engineering. The National Institute of Research and training of telecommunication (INICTEL-UNI) was integrated to the National University of Engineering in 2006, however INICTEL was founded by the Peruvian government in 1971. The main research topics are based in telecommunications field. Today, the researches focus in the areas of: embedded systems and sensor in internet of things with applications in the environment monitoring and health monitoring, antennas and radars design for application in archeology, antennas for small satellites, 5G mobile communications, drone and satellite image processing and analyze for agriculture applications, technology for emergency warning system and bioengineering. Some of these projects were financed by the "Consejo nacional de ciencia y tecnología" (CONCYTEC) and Innovate Perú. Actually, different projects are developed in collaboration with entities such as University of Bretagne-Sud from France, University of Sao Paulo from Brazil and the Instituto de Investigaciones de la Amazonía Peruana (IIAP) from Peru.

 CV of participants

Note that the extended CV of coordinators are given in the annex. This section presents a short CV of all OGLED participants.

Emmanuel BOUTILLON: He is a professor at the University of Bretagne-Sud (UBS, Lorient-France). He was the head of the LESTER laboratory from 2005 to 2007 and, since 2008, in charge of the CACS (Communication, Architecture, Circuits and Systems) department of the Lab-STICC. His current research interests are on the interactions between algorithms and architectures in the field of wireless communications. He published more than 22 journals and 53 international conferences papers and 8 licenced patents. He is senior IEEE member and was a member of the IEEE DISPS committee from 2004 to 2012. He was also a member of the CoNRS (National French Committee for Scientific Research) from september 2012 to august 2016. He has been involved in several industrial projects related to communication and signal processing applications. http://www-labsticc.univ-ubs.fr/~boutillon/anglais.html

Christian Roland: After 20 years as an engineer in Telecom Industry, Christian Roland joined UBS as an associate professor. He is a member of the IAS team at Lab-STICC working on the efficient implementation of digital communication algorithm. During four years (2007-2012), he was the vice-director of the faculty of science (UBS). Over the last twenty years he has worked in the field of radio-communications and used to collaborate with implementation teams. He also has strong experience in Software Defined Radio and Cognitive Radio [ALA09] [PAL03] [ROL02]. He was involved in successful projects such as DVB-RC and ANR PRIMO. Christian Roland has a global view of radio aspects, digital communications and computer architecture, which is perfectly suitable to participate at the OGLED project.

Arnaud Dion: He has first worked as a development engineer on digital electronics in a small company. In 2004, he joined ISAE, the French Aerospace Engineering Institute of Higher Education in Toulouse (formerly SUPAERO), as a research engineer. While working as an engineer, he obtained his Ph.D in 2014 from ISAE. His projects include electronic architecture design, hardware-software codesign. He specialized on satellite navigation algorithms and systems. He also teaches electronic and system design. http://personnel.isae.fr/arnaud-dion/

Kalinka R. Lucas J. CASTELO BRANCO. She has Master in Computer Science from University of São Paulo (1999) and PhD in Computer Science from University of São Paulo (2004). She is currently an Associate Professor at the Institute of Mathematics and Computer Science (ICMC-

USP), working in the department of Computer Systems. From January 2015 to January 2016 she has been doing her sabbatical research with Professor Salah Sukkarieh at Australian Centre for Field Robotics. She was the coordinator of the project "Service Oriented Architecture for Complex Critical Embedded Systems" funded by FAPESP. She was Administrative and Operational director of the National Institute of Science and Technology in Critical Embedded Systems (INCT-SEC) from 2008 to 2014. She has been involved in many research projects focused in autonomous vehicles funded by private (for example Scania) and public agencies (CNPq, CAPES and FAPESP). She has experience in Computer Science, with emphasis on Computer Networks, Security, Safety, Embedded Systems, Internet of Things, and Distributed Computing. http://lattes.cnpq.br/3559042497669898

Diana Pamela MOYA OSORIO. She received the B.Sc. degree in Electrical and Telecommunications Engineering from the Armed Forces University (ESPE), Sangolquí, Ecuador (2008), and the M.Sc. and D.Sc. degrees in Electrical Engineering with emphasis in Telecommunications and Telematics from the University of Campinas (UNICAMP), Campinas, SP, Brazil, (2011 and 2015, respectively). During the Doctorate, she worked together with the Wireless Technology Laboratory (WissTek) at UNICAMP, and she participated as a visiting researcher at the Centre for Wireless Communication, University of Oulu, Finland. Currently, she is an Assistant Professor at the Department of Electrical Engineering at the Federal University of São Carlos, São Carlos, SP, Brazil. Her research interests include: modeling and analysis of wireless communication networks and technologies for future 5G mobile networks. Also, she is the coordinator of the research project entitled "Security for 5G Wireless Communication Systems: new approaches from the physical layer perspective" with cooperation of CWC and the São Paulo State University (UNESP), which is funded by the National Counsel of Technological and Scientific Development (CNPq). http://lattes.cnpq.br/5374423182568583

Jinmi Gregory LEZAMA CALVO. He is a PhD in Electronics Systems from University of Lorraine, France (2014), Master in Electronic Embedded Systems from University of Henri Poincaré, France (2010) and Engineer from National university of San Antonio Abad del Cusco, Peru (2005). He is a researcher at the National Institute of Research INICTEL-UNI in the department of research and technology development. He is chair of research group "Embedded Systems and Sensors in Internet of Things". He has worked in research projects focused in Wireless Sensor Network to water quality monitoring in Peruvian amazon (2016), Signal analysis and processing to develop electrical arc fault detection algorithms (Hager group – Jean Lamour Laboratory in France) from 2011 to 2014, Hardware implementation of high efficient video coding based in standard H.264 (2010). He has experience in signal analysis, electrical fault detection, embedded systems and Internet of Things.

https://dina.concytec.gob.pe/appDirectorioCTI/VerDatosInvestigador.do?id_investigador=15304

Hector Alejandro MIYASHIRO ASATO. He received the B.Sc. degree in Telecommunications Engineering from National University of Engineering (UNI), Lima, Peru (2014). Since then, he has been working as a researcher, at INICTEL-UNI in the department of research and technology development, in projects related to: algorithms and parallel hardware architectures, for DVB-S2 standard decoders (2014), hardware design and implementation of a wireless portable ECG monitor (2015), and since 2016, development of a platform based on Software Defined Radio (SDR) for IOT protocols. He has participated as a visiting researcher at CACS department of the Lab-STICC, France. His research interests include: IOT, 5G, MIMO systems, OFDM, cognitive Radio, embedded systems. http://dina.concytec.gob.pe/appDirectorioCTI/VerDatosInvestigador.do?id_investigador=24571

Milton RIOS JULCAPOMA: He is an associated professor at the department of Electric and Electronic Engineering of National University of San Marcos (UNMSM, Lima-Peru). He received the B.Sc. degree in Electronic Engineering from National University of San Marcos (UNMSM), Lima, Peru (1982). He has participated in a digital signal processing research project at Machinenbau Fachbereich department of the University of Kassel, Federal Germany from 1988 to 1990. He has achieved many awards: best paper in postgraduate category, with "Red de sensores inalámbricos para la medición de parámetros del agua para crianza de peces amazónicos" in 2014, 2nd place in XII Premio de Investigación AHCIET (1995). He is concluding M.Sc. studies on Telecommunications with a data compression for network sensors project at Ricardo Palma University. http://dina.concytec.gob.pe/appDirectorioCTI/VerDatosInvestigador.do?id_investigador=280

B7. Additional information

Intellectual property

It is intended that pre-existing know-how will be used "royalty-free" within the consortium for **OGLED** project purposes and for possible usage after the project completion. To enable a trustful and reliable cooperation, the partners of the consortium will define their project background in a Consortium Agreement. They will make it accessible according to the needs in the consortium for successful completion of the envisioned tasks. Existing tools of the partners will maintain the ownership and copyrights, internal licensing might however be worked out between the partners if necessary (limited licenses might be provided for free).

List all the complementary fundings expected or already obtained.

In 2017, the funding already acquired are:

- Travel grant from french embassy of Lima for a trip of Emmanuel Boutillon (july 2017).
- CNRS PEPS GLORIA-IoT (11 Keuros) to make experimental measurement (2017).

The researchers in Brazil will apply for a regular project in FAPESP (State of São Paulo Funding Agency) to obtain funding for trips. The laboratories in Brazil already have UAVs to perform the experimentos (two 3DR Solos and 2 Parrots that can be used inside the cave).

INICTEL-UNI is a research institute with research and finance autonomy. In case of proposal acceptance, INICTEL-UNI can assign, by including OGLED into its projects agenda, researchers and funds for materials, during the years 2018 and 2019. Also INICTEL-UNI in collaboration with the National University of Huancavelica researchers will apply to CONCYTEC and Innovate Peru funds to develop projects complementaries.

In 2017, UBS will ask complementary funding to the french Labex CominLab for 12 months of engineer to develop task 1 and 2.1. In fact, the idea of OGLED has emerged as a spinoff result of the RELIASIC project (hardware error resilient GPS receiver), and CominLab has some funding for this type of disruptive idea.

Experience of the coordinators in similar projects.

Emmanuel BOUTILLON: He is currently the responsible of an ANR project (Project NAND [1]) and the labex project RELIASIC [2]. He his also involved in a USTAR project of Utah State (USA) related to error correction algorithm. In april 2017, he was invited two weeks in Utah State University in the frame of this project. In the past, E. Boutillon has also been involved in many project of different types, to cite few, he was involved as a Work Package leader in two european project, he was responsible of a joint CNRS-NSF grant, he also was implied in the co-supervision of a PhD funded by the Franco-Italian University with Politecnico di Torino.

Kalinka Castelo Branco: She is currently a participant of an Attitude and Heading Reference System based on recursive robust Kalman filter implemented in FPGA. She has been involved in many research projects focused in autonomous vehicles funded by private (for example Scania) and public agencies (CNPq, CAPES and FAPESP).

Diana Pamela Moya Osorio: she is currently the coordinator of the research project entitled "Security for 5G Wireless Communication Systems: new approaches from the physical layer perspective" with cooperation of CWC and the São Paulo State University (UNESP), which is funded by the National Counsel of Technological and Scientific Development of Brazil (CNPq).

Jinmi Gregory Lezama Calvo, he is currently the coordinator of research group Embedded Systems and Sensor in Internet of Things, with the project entitled "Research and development of low power wireless sensor network". He has been involved in the project of Signal detection and development of algorithms to arc fault detection funded by private contract with Hager Group (France) and the Laboratory Jean Lamour of the University of Lorraine (France).

Arnaud Dion is involved in two projects funded by DGA and Occitanie region.

Perspectives of continuing collaboration after project financing is over.

Since 2011 INICTEL-UNI, Peru and Lab-STICC (CNRS Laboratory, UMR 6285) of University of Bretagne-Sud, France are working together developing satellite communications and algorithms for digital communications projects. In this 5 years, different internships and papers were developed. At the present time, we work in the research topic algorithm and architecture for digital communication and to extend the cooperation accord.

Since 2014 USP/UFSCAR, Brazil and Lab-STICC (CNRS Laboratory) of the University of Bretagne-Sud, France are working together developing Internet of Things, Drones and hardware implementation algorithms. In this 3 years, different research visitings, projects and papers were developed. At the present time, we work to extend the cooperation accord (umbrella project) and in the IoMoT project.

OGLED will offer a disruptive service in the growing area of Internet of Things opening new challenges. Many research, and eventually, commercial opportunities will arise from the project. It will give many opportunities to the consortium to continue the collaboration in several forms.

B8. International referees

Suggest names of at least 3 international referees to evaluate the project. These researchers should not be connected to people in the project.

1-   Dr. Julio Urbina (United States, Pennsylvania State University, jvu1@psu.edu)

2-   Dr. Antonio Alfredo Ferreira Loureiro (Federal University of Minas Gerais - UFMG, loureiro@dcc.ufmg.br)

3-   Dr. Pedro Henrique Juliano Nardelli (University of Oulu, Finland, nardelli@ee.oulu.fi)

4-   Dr. Olivier Sentieys (INRIA, Rennes, olivier.sentieys@inria.fr)

B9. Public and private support obtained related to the project:
Previous project STIC AMSUD / MATH AMSUD?
 NO

Other public support in the past (ECOS, COFECUB, CNRS, European Union, etc.):

PEPS CNRS GLORIA-IoT (2017, 11 Keuros).

Prospects for public or private support in the future:

In Peru, CONCYTEC and Innovate Peru fund can be obtained in the future to make the implementation of geo-localization service for tracking and monitoring south American camelids in Huancavelica and Cusco in Collaboration with the National University of Huancavelica.

In France, contact with Orange Labs Rennes and Kerlink (http://kerlink.fr/fr/) companies will be taken.

C. Project Budget

Project title: **Object Geo-Localization with External Devices (OGLED)**

Participating institutions:
Université de Bretagne Sud
ISAE-SUPAREO
University of São Paulo -Instituto de Ciências Matemáticas e de Computação
Federal University of São Carlos
National University of Engineering - INICTEL-UNI

The STIC-AmSud program **funds travel expenses** (air tickets and *per diem*) to researchers in research missions and workshops.

C1. First year (2018)

Planned missions – Year 1

Researcher	Status (student, junior, senior)	Institution	Origin	Destination	Planned date	Duration (max. 30 days)	Estimated cost of the trip (€)	Estimate of total *per diem* (€)	Trip and Mission funding institution[1]	Mission objectives
Hector Miyashiro		INICTEL-UNI	Lima	Lorient	April	10	1500	1200	CONCYTEC	Meeting
Jinmi Lezama		INICTEL-UNI	Lima	Lorient	April	10	1500	1200	CONCYTEC	Meeting
Hector Miyashiro		INICTEL-UNI	Lima	Sao Paulo	October	10	800	1200	CONCYTEC	Meeting
Jinmi Lezama		INICTEL-UNI	Lima	Sao Paulo	October	10	800	1200	CONCYTEC	Meeting

---

[1] **Each institution will pay for the trip and per diem of its own researchers.**

Emmanuel Boutillon		UBS	Lorient	Sao Paulo	October	10	1400	1400	MAEID	Meeting
Kalinka Branco		USP - ICMC	São Paulo	Lorient	April	10	1500	1200	CAPES	Meeting
Diana Osorio		UFSCar	São Paulo	Lorient	April	10	1500	1200	CAPES	Meeting
Arnaud Dion		ISAE	Toulouse	Sao Paulo	October	10	1400	1400	MAEID	Meeting
Student	Student	UBS	Lorient	Lima	Mai	30	1400	1400	MAEID	Trainee

CONSOLIDATED BUDGET: Year 1

Funding requested to the STIC-AmSud Program
Estimated costs (€)

	A. Travel costs (air tickets)	B- Maintenance costs (*per diem)*	TOTAL
MAEDI France	4200,00	4200,00	8400,00
CNRS France			
INRIA France			
Institut Mines-Télecom France			
MINCYT Argentina			
CAPES Brazil	3000,00	2400,00	5400,00
CONICYT Chile			
CONACYT Paraguay			
CONCYTEC Peru	4600.00	4800.00	9400.00
ANII Uruguay			
MPPEUCT Venezuela			
SENESCYT Ecuador			
COLCIENCIAS Colombia			
Total requested funding to STIC-AmSud	11800,00	11400,00	23200,00
Other funding[2]			
TOTAL	11800,00	11400,00	23200,00

Do you have additional funding sources for this project[3]? (if so please specify the amount and source (s)).

---

[2] Specify in additional page.
[3] Reserved for CNRS researchers

C2. Second year (2019)

Second year funding depends on approval of intermediate progress report.

Planned missions – Year 2

Researcher	Status (student, junior, senior)	Institution	Origin	Destination	Planned date	Duration (max. 30 days)	Estimated cost of the trip (€)	Estimate of total *per diem* (€)	Trip and Mission funding institution[4]	Mission objectives
Milton Ríos		INICTEL-UNI	Lima	Lorient	October	10	1500	1200	CONCYTEC	Meeting
Hector Miyashiro		INICTEL-UNI	Lima	Lorient	October	10	1500	1200	CONCYTEC	Meeting
Jinmi Lezama		INICTEL-UNI	Lima	Lorient	November	10	1500	1200	CONCYTEC	Meeting
Kalinka Branco		USP	São Paulo	Lima	April	10	1000	1200	CAPES	Meeting
Diana Osorio		UFSCar	São Paulo	Lima	April	10	1000	1200	CAPES	Meeting
Kalinka		USP	São Paulo	Lorient	October	10	1500	1200	CAPES	Meeting
Diana Osorio		UFSCar	São Paulo	Lorient	October	10	1500	1200	CAPES	Meeting
Emmanuel Boutillon		UBS	Paris	Lima	April	10	1400	1400	MAEDI	Meeting
Christian Roland		UBS	Lorient	Lima	April	10	1400	1400	MAEDI	Meeting

---

[4] **Each institution will pay for the trip and per diem of its own researchers.**

Student	Student	UBS	Lorient	Sao Paulo	Mai	30	1400	1400	MAEID	Trainee

CONSOLIDATED BUDGET: Year 2

Funding requested to the STIC-AmSud Program
Estimated costs (€)

	A. Travel costs (air tickets)	B- Maintenance costs (*per diem*)	TOTAL
MAEDI France	4200,00	4200,00	8400,00
CNRS France			
INRIA France			
Institut Mines-Télecom France			
MINCYT Argentina			
CAPES Brazil	5000,00	4800,00	9800,00
CONICYT Chile			
CONACYT Paraguay			
CONCYTEC Peru	4500.00	3600.00	8100.00
ANII Uruguay			
MPPEUCT Venezuela			
SENESCYT Ecuador			
COLCIENCIAS Colombia			
Total requested funding to STIC-AmSud	13700	12600	26300
Other funding[5]			
TOTAL			

Do you have additional funding sources for this project[6]? (if so please specify the amount and source (s)).

---

[5] Specify in additional page.
[6] Reserved for CNRS researchers

C3. BUDGET TOTALS

	Year 1	Year 2	Total
Funding requested to MAEDI (France)	8400	8400	**16800**
Funding requested to INRIA (France)			
Funding requested to CNRS (France)			
Funding requested to Institut Mines-Telecom (France)			
Funding requested to MINCYT (Argentina)			
Funding requested to CAPES (Brazil)	5400	9800	**15200**
Funding requested to CONICYT (Chile)			
Funding requested to CONACYT (Paraguay)			
Funding requested to CONCYTEC (Peru)	9400	8100.00	**17500**
Funding requested to ANII (Uruguay)			
Funding requested to SENESCYT (Ecuador)			
Funding requested to MPPEUCT (Venezuela)			
Funding requested to COLCIENCIAS (Colombia)			
Matching funds from the partners			
Other sources			
TOTAL	**23200**	**18200**	**49500**

ANNEX

This annex is composed of the 5 CV of the coordinators, i.e.,

Emmanuel Boutillon, UBS, OGLED coordinator.

Kalinka Regina Lucas Jaquie Castelo Branco, USP coordinator

Diana Pamela Moya Osorio, UFSCar Coordinator

Arnaud Dion, ISAE coordinator

Jinmi Gregory Lezama Calvo, INICTEL-UNI Coordinator

Emmanuel Boutillon, UBS coordinator, OGLED Project coordinator

1/ Personal data

Name: Emmanuel Boutillon

Birth date: November 2nd, 1966

Professional address (with telephone and e-mail):

Lab-STICC, UMR CNRS 6285, Centre de Recherche, Université de Bretagne Sud BP 92116, 56100 Lorient

Telephone: 02 97 87 45 66

E-mail: emmanuel.boutillon@univ-ubs.fr

Current job title and size of the research group:

Professor at the University of Bretagne Sud (UBS).

2/ Highest obtained degree (with indication of place and date)

2000: Habilitation à Diriger des Recherches, Université Pierre et Marie Curie.

3/ Professional activity in the last 5 years

2011 Sabbatical year at the Peruvian National Center of Research in Telecommunications (INICTEL), UNI (National University of Engineering), Lima-Peru.

Jan. 2008-2016 Head of the CACS department (160 peoples) of Lab-STICC (UMR 6285)

Since Sept 2000 Full Professor, Université de Bretagne Sud (UBS)

4/ Other duties/ positions

Labex CominLab Member of the administration council of the Labex CominLab
CNRS Member of the section 7 of CoNRS up to august 2016.
IEEE Member of IEEE DISPS (2005-2013).

5/ Awards, fellowships and external recognition

IEEE senior Member since 2013..

Special session chair SIPS'2017, Co-chair special session on Polar coding, WCNC'2017, on 5G,

ICC'2017 (Paris) General Co-chair of International Symposium on Turbo-Code Brest 2016.

6/ Ongoing funded research projects with dates, titles, sources of funding

1) RELIASIC (2015-2018): Labex CominLabs project (PI of the project): Reliable ASIC design
2) NAND (2016-2018) : French ANR agency project (PI of the project) Noise Against Noise Decoder.
3) France-Brevet contract (2015-2017) : Valorisation of patent linked to Non-Binary LDPC code.
4) PEPS GLORIA-IoT from CNRS
5) SYMPADEC (2017): high level synthesis of error control code (funded by GDR ISIS, CNRS).

7/ Projects approved in the least 5 years

1) Decoding architecture for Cortex code (2011-2014), private contract with Orange Labs (France).
2) High speed demodulation for DVB-S2X receiver (2013), ETRI (south Korea).
3) GIGADEC (2011-2013), public project funded by Brittany Region to develop Gigabit/s error control codes.

8/ Publications

8.1 – Highlight the most important publications related to the project theme

30 journal papers, 59 conferences papers, 13 patents, 2 book chapters, 18 PHD students.

H-index of 22., cited more than 2000 times

(see http://www-labsticc.univ-ubs.fr/~boutillon/anglais.html).

O. Abassi, …, E. Boutillon, "A Novel Architecture For Elementary Check Node ….", *IEEE Trans. on Circuits and Systems II: Express Briefs*, 2016.
Cédric Marchand, E. Boutillon "Before convergence…", *Elec. Letters*, 2015, 51 (1), pp.114 - 116.
L. Conde-Canencia, E Boutillon, "Application of the Bubble…", *Elec. Letters*, 2014, 50 (25), pp 1937-38.
E. Boutillon et al. « Simplified Compression…", IEEE Communications Letters, Accepted 2014.
E. Boutillon et al. "Design of a GF(64)-LDPC…", IEEE TCAS-I, Oct. 2013
E. Boutillon et al. "Compression of redundancy…", Electronics Letters, 2013, 49 (7), pp. 460 - 462.
In the frame of a contract with France-Brevet, 5 patents have been filled and licenced in the period 2013-2017.

8.2 – Publications in cooperation with the project partners

3 communs publication with ISAE.

4 publications with INICTEL.

See section Joint publications between partners page 17. for details.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

Oussama Abassi (june 2014), "Etude des décodeurs LDPC non-binaires",
Yangyang Tang (january 2013), "Computation on Unreliable Architecture"

9.2 – Ongoing

Hassan Hard, "hardware implementation of Non-Binary LDPC codes", PhD started in february 2016 (with prof. A. Al Ghouwayel, University Libanaise)
Franklin Cochachin, "Noised enhanced LDPC and Turbo decoder", PhD started in february 2016 (with prof. D. Declercq, University of Cergy Pontoise)   Mourad Hafidi, "GPS on stochastic architecture", PhD started in october 2014.
Ahmed Ahmed Abdmoulah, "Non-binary LDPC codes associated to high-order modulations", PhD started in october 2013.

Kalinka Regina Lucas Jaquie Castelo Branco, USP coordinator

1/ Personal data

Name: Kalinka Regina Lucas Jaquie Castelo Branco

Birth date: March 28th, 1975

Professional address (with telephone and e-mail):

Instituto de Ciências Matemática e de Computação. University of São Paulo. Av. Trabalhador São Carlense, 400 - Centro. Cep. 13.566-590 - São Carlos-SP Brazil.

Telephone: +55 16 3373-8626

E-mail: kalinka@icmc.usp.br

Current job title and size of the research group: Associate Professor at University of São Paulo

2/ Highest obtained degree (with indication of place and date)

2012 - Associate professor by University of São Paulo

3/ Professional activity in the last 5 years

2015 - Sabbatical year at University of Sydney (Australian Centre for Field Robotics)

2012 - Associate Professor

4/ Other duties/ positions

2008-2014 - Administrative and Operational director of the National Institute of Science and Technology in Critical Embedded Systems (INCT-SEC).

5/ Awards, fellowships and external recognition

6/ Ongoing funded research projects with dates, titles, sources of funding

1. Attitude and Heading Reference System based on recursive robust Kalman filter implemented in FPGA (2015-2017) - FAPESP
2. Recuperação ambiental de bacia hidrográfica: estratégias de proteção de recursos hídricos, restauração ecológica de matas ciliares e de consolidação do novo Código Florestal Brasileiro (2014-2017) (as participant) - CNPq

7/ Projects approved in the least 5 years

1. Self-Adaptive Embedded Computing for UAVs (2016-2016) (as coordinator)
2. Attitude and Heading Reference System based on recursive robust Kalman filter implemented in FPGA (2015-2017) (as participant)

3. Study and improvement of control algorithms using data sensor estimation (2015 - 2016) (as coordinator)

4. Service Oriented Architecture for Critical Embedded Systems (2012-2014) (as coordinator)

8/ Publications

8.1 – Highlight the most important publications related to the project theme

1. Pigatto, D. F. ; Gonçalves, L. ; Guilherme Freire Roberto ; Rodrigues Filho, J. F. ; Silva, N. B. F. ; Pinto, A.R. ; Branco, K. R. J. C. . The HAMSTER Data Communication Architecture for Unmanned Aerial, Ground and Aquatic Systems Aims, Scope and Definitions. Journal of Intelligent & Robotic Systems, 2016.

2. Rodrigues, D.; Pires, R. M.; Marconato, E. A.; Areias, C.; Cunha, J.; Branco, K. R. L. J. C., Vieira, M. . Service-Oriented Architectures for a Flexible and Safe Use of Unmanned Aerial Vehicles. IEEE ITS MAGAZINE, p. 97-109, 2017.

3. Ribeiro, A. C. ; Pinto, A. S. R. ; Zafalon, G. F. D. ; Pigatto, D. F. ; Branco, K. R. L. J. C. ; Cansian, A. M.. An Approach To Mitigate Denial of Service Attacks in IEEE 802.11 Networks. Journal of Computer Sciences, v. 10, p. 128-137, 2013.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

1. Emerson Alberto Marconato (2016) - Layered architecture model for interconnection of systems in UAS.

2. Daniel Fernando Pigatto (2017) - HAMSTER -- healthy, mobility and security-based data communication architecture for unmanned systems.

9.2 – Ongoing

1. Natássya Balarte Floro da Silva (2012), Desenvolvimento de um Veículo Aéreo Não Tripulado Completamente Autônomo – especificação de um VTOL com asas fixas. – FAPESP

2. Rodolfo Barros Chiaramonte (2013), Desvio de Obstáculos em Tempo Real para Veículos Aéreos Autônomos.

3. Luiz Carlos Querino Filho(2014), Sistema de controle descentralizado para veículos aéreos não tripulados de asa fixa em formação utilizando controlador robusto H∞ com saltos Markovianos.

4. Rayner de Mello Pires (2014), Análise de difusão de dados em redes FANET. CNPq

5. Mariana Rodrigues (2016), Cloud-Sphere - A security approach for Unmanned Aerial Vehicles. CNPq.

Diana Pamela Moya Osorio, UFSCar Coordinator

1/ Personal data

Name: Diana Pamela Moya Osorio

Birth date: December 14th, 1985

Professional address (with telephone and e-mail):

Departamento de Engenharia Elétrica, Centro de Ciências Exatas e de Tecnologia, Universidade Federal de São Carlos, Rodovia Washington Luís, km 235 - SP-310, São Carlos - SP - Brasil, CEP 13565-905.

Telephone: +55 16 3509-1575.

E-mail: dianamoya@ufscar.br

Current job title and size of the research group:

Assistant Professor at Federal University of São Carlos.

2/ Highest obtained degree (with indication of place and date)

2015 - Assistant Professor by Federal University of São Carlos

3/ Professional activity in the last 5 years

2014 - Visiting researcher at the Centre for Wireless Communications, University of Oulu, Finland.

2015 - Doctor in Electrical Engineering, in the area of Telecommunications and Telematics.

2015 - Assistant Professor.

4/ Other duties/ positions

(2016 - current) - Member of the Course Counsel of the Department of Electrical Engineering.

5/ Awards, fellowships and external recognition

6/ Ongoing funded research projects with dates, titles, sources of funding

(2016 - 2019) - Security for 5G Wireless Communication Systems: new approaches from the physical layer perspective (as coordinator) - National Counsel of Technological and Scientific Development (CNPq) .

7/ Projects approved in the least 5 years

8/ Publications

8.1 – Highlight the most important publications related to the project theme

1. D. P. Moya Osorio, E. E. Benítez Olivo, H. Alves, J. C. S. Santos Filho, and M. Latva-aho, "An Adaptive Transmission Scheme for Amplify-and-Forward Relaying Networks," in *IEEE Transactions on Communications*, vol. 65, no. 1, pp. 66--78, Jan. 2017.

2. E. E. Benítez Olivo, D. P. Moya Osorio, H. Alves, J. C. S. Santos Filho, and M. Latva-aho, "An Adaptive Transmission Scheme for Cognitive Decode-and-Forward Relaying Networks: Half Duplex, Full Duplex, or No Cooperation,'" in *IEEE Transactions on Wireless Communications*, vol. 15, no. 8, pp. 5586-5602, Aug. 2016.

3. D. P. Moya Osorio, E. E. Benítez Olivo, D. B. da Costa, and J. C. S. Santos Filho, "Distributed link selection in multirelay multiuser networks," in *Transactions on Emerging Telecommunications Technologies*, vol.27, no.7, pp.939--951, Mar. 2016.

4. D.P. Moya Osorio, E. E. Benítez Olivo, H. Alves, J.C. S. Santos Filho, and M. Latva-aho, "Exploiting the direct link in full-duplex amplify-and-forward relaying networks," in *IEEE Signal Processing Letters*, vol.22, no.10, pp.1766--1770, Oct. 2015.

5. D. P. Moya Osorio, E. E. Benítez Olivo, D. B. da Costa, and J. C. S. Santos Filho, `'"Impact of outdated channel estimates on a distributed link-selection scheme for AF relaying networks,'" in *IEEE Wireless Communications Letters*, vol.4, no.2, pp.185--188, Apr. 2015.

6. E. E. Benítez Olivo, D. P. Moya Osorio, D. B. da Costa, and J. C. S. Santos Filho, "Multiuser incremental decode-and-forward relaying under outdated channel estimates," in *Electronics Letters*, vol.51, no.4, pp.369--371, Feb. 2015.

7. E. E. Benítez Olivo, D. P. Moya Osorio, D. B. da Costa, and J. C. S. Santos Filho, "Outage performance of spectrally efficient schemes for multiuser cognitive relaying networks with underlay spectrum sharing," in *IEEE Transactions on Wireless Communications*, vol.13, no.12, pp.6629--6642, Dec. 2014.

8.2 – Publications in cooperation with the project partners

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

9.2 – Ongoing

Arnaud Dion, ISAE Coordinator

1/   Personal data

Name: Arnaud Dion

Birth date: 21/12/1970

Professional address (with telephone and e-mail):

DRRP/DEOS, ISAE; 10 Avenue Edouard Belin, BP54032 31055 Toulouse cedex 4

Tel : +33 5 61 33 83 78

Mail : arnaud.dion@isae-supaero.fr

Current job title and size of the research group: Research engineer

2/   Highest obtained degree (with indication of place and date)

PhD, Toulouse, 31/09/2014

3/   Professional activity in the last 5 years

Research engineer at ISAE

4/   Other duties/ positions

Design engineer, Multi Video Design

5/   Awards, fellowships and external recognition

URISMIP medal, 2005 (Union Régionale des Ingénieurs et Scientifiques de Midi-Pyrénées).

6/   Ongoing funded research projects with dates, titles, sources of funding

CGNSS, 2016-2018, funded by Occitanie region.

GLORIA-IOT, 2017, funded by CNRS

7/ Projects approved in the least 5 years

REPCO : 2014-2017, funded by DGA

Vector tracking algorithm in degraded environment, 2013, funded by CNES

8/ Publications

8.1 – Highlight the most important publications related to the project theme

E. Chaumette; P. Benoit; F. Vincent; G. Pages; <u>A. Dion</u>, "Minimum Variance Distortionless Response Estimators For Linear Discrete State-Space Models," in IEEE Transactions on Automatic Control , vol.PP, no.99, pp.1-1doi: 10.1109/TAC.2016.2594384.

8.2 – Publications in cooperation with the project partners

<u>A. Dion</u>, <u>E. Boutillon</u>, V. Calmettes, and E. Liegon. A flexible implementation of a global navigation satellite system (gnss) receiver for on-board satellite navigation. In Design and Architectures for Signal and Image Processing (DASIP), 2010 Conference on, pages 48–53, Oct 2010.

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

9.2 – Ongoing

Jinmi Lezama, INICTEL-UNI Coordinator

1/ Personal data

Name: Jinmi Gregory Lezama Calvo

Birth date: July 25th 1983

Professional address (with telephone and e-mail):

INICTEL-UNI Av. San Luis 1771 - San Borja - Lima 41 - Perú

Telephone: (+51) 999 113 362

E-mail: jlezama@inictel-uni.edu.pe

Current job title and size of the research group:

Researcher at the National Institute of Research INICTEL-UNI in research group "Embedded Systems and Sensor in Internet of Things" - ES2IoT (7 researchers)

2/ Highest obtained degree (with indication of place and date)

2014 : Ph.D. in Electronics Systems from University of Lorraine, France

3/ Professional activity in the last 5 years

2016 to Now: Researcher at the National Institute of Research INICTEL-UNI

2016 : Professor at the National University San Antonio Abad del Cusco (UNSAAC)

2015 to 2016: Engineer at Regional Government of Cusco.

2014 to 2015: Research at Laboratory of Jean Lamour in the University of Lorraine, France.

2011 to 2014: Research at Hager Group in the research and development department, Obernai, France.

4/ Other duties/ positions

2017: Chairman of research group "Embedded Systems and Sensor in Internet of Things" - ES2IoT

5/ Awards, fellowships and external recognition

Registered researcher in REGINA of CONCYTEC Peru, 2016-2018

Young investigator Award finalist, The IEEE Holm Conference on Electrical Contacts, New Orleans, LA USA. 2014

6/ Ongoing funded research projects with dates, titles, sources of funding

- Research and development of low power wireless sensor network (2017), funding by INICTEL-UNI

7/ Projects approved in the least 5 years

- Signal detection and development of algorithms to arc fault detection (2011-2014), private contract with Hager Group (France).

- Water monitoring for human consumption in the Peruvian Amazon (July to December 2017) funding by INICTEL-UNI

8/ Publications

- Q. Pan et al. "Discrete wavelet transform optimal parameters estimation for arc fault detection in low voltage power networks". Electric Power Systems Research", 2017.

- S. Jovanovic et al. "Shunt active power filter-based approach for arc fault detection. Electric Power Systems Research", 2016.

- J. Lezama et al. "An embedded system for AC series arc detection by inter-period correlations of current". Electric Power Systems Research, 2015.

- E. Tisserand et al. "Series arcing detection by algebraic derivative of the current", Electric Power Systems Research, 2015.

- J. Lezama et al. "Arc Fault Detection Based on Temporal Analysis", 60th IEEE Holm Conference, 2014.

- J. Lezama et al. "Frequency analysis to arcing detection and prototyping FPGA approach", 59th IEEE Holm Conference, 2013.

- M. Rabla et al, "Arc fault analysis and localization by cross-correlation in 270 V DC", 59th IEEE Holm Conference, 2013.

- J. Lezama et al. "Modeling of a Domestic Electrical Installation to Arc Fault Detection", 58th IEEE Holm Conference, 2012.

8.1 – Publications in cooperation with the project partners

9/ Theses oriented and post-doctoral fellows supervised

9.1 – Finished/defended in the last 5 years

9.2 – Ongoing

- **Undergraduate these:**

Angel Galvez (March 2017), "Adaptive system using error correction algorithms for wireless sensor network".