CIP-OLIVE Project

ESITIP Program

November, 2020

Unión Europea
Fondo Europeo de Desarrollo Regional
"Una manera de hacer Europa"

CDTI Centro para el Desarrollo Tecnológico Industrial

itida
IT INDUSTRY DEVELOPMENT AGENCY

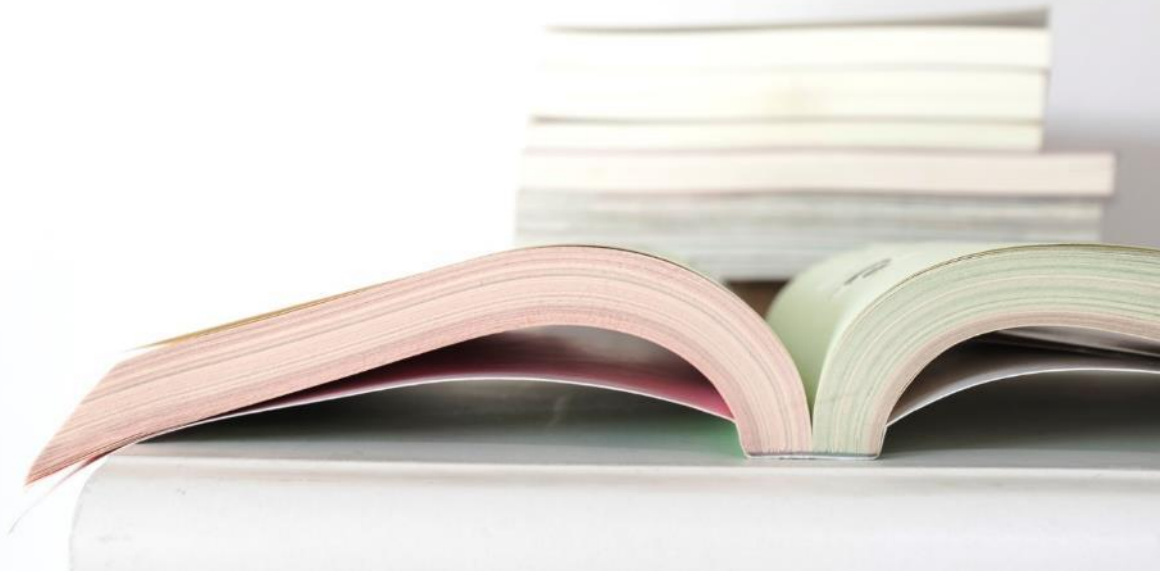
Cairo University

Smartec Systems

1969-2019 ANIVERSARIO 5.0
seresco
NUESTRA HISTORIA, TU FUTURO.

Index

1. Consortium Profile
2. CIP-OLIVE Project
3. Some Practical Tips



SERESCO, S.A.

- Pioneering company at the national level, established in May 1969
- Dedicated to the provision of ICT services and solutions
- Integrated by more than 700 professionals
- Service Centers in four Spanish cities and offices in Portugal, Ecuador, Costa Rica, Colombia and Bolivia

SERESCO S.A. - Activity Areas

Infrastructure, Systems and Services	Payroll and Human Resources	Cartography and Cadastre	Consulting and Software	Digital Transformation Services for SMEs
Strategic IT Consulting	Payroll - Technology outsourcing - Operations outsourcing	Cadastral Management	Software Factory for Maintenance and modernization of applications	Digital Transformation for SMEs
Engineering, Design and Implementation of Solutions		Vectorial and thematic cartography	Data science and analytics	Business Management, Sage X3, Sage XRT and Sage 50 Cloud
Monitoring of Systems, Services and Applications	Human Resources	Geodesy and photogrammetry	Artificial intelligence providing smart services	Digital Talent Sage Partner for Education Training
Operation and Administration of Systems and Communications	Employee Portal	PNOA (National Aerial Ortophotography Plan)	IoT data acquisition	Takson: Intelligent System for online real estate appraisal
Service Desk	ORP	BTA (Harmonized Topographic Base, BCN (National Cartographic Base)	Design of Big data architectures on premises or cloud	Nubia: Cloud Platform for business process management in mobility
Security and Business Continuity Services	Dashboard	Remote sensing		

Spanish Technology Centers

- **AGR-216. The Agroforestry Pathology research group at the University of Cordoba**

  It is a center specially dedicated to the etiology, epidemiology and control of olive and fruit tree diseases.

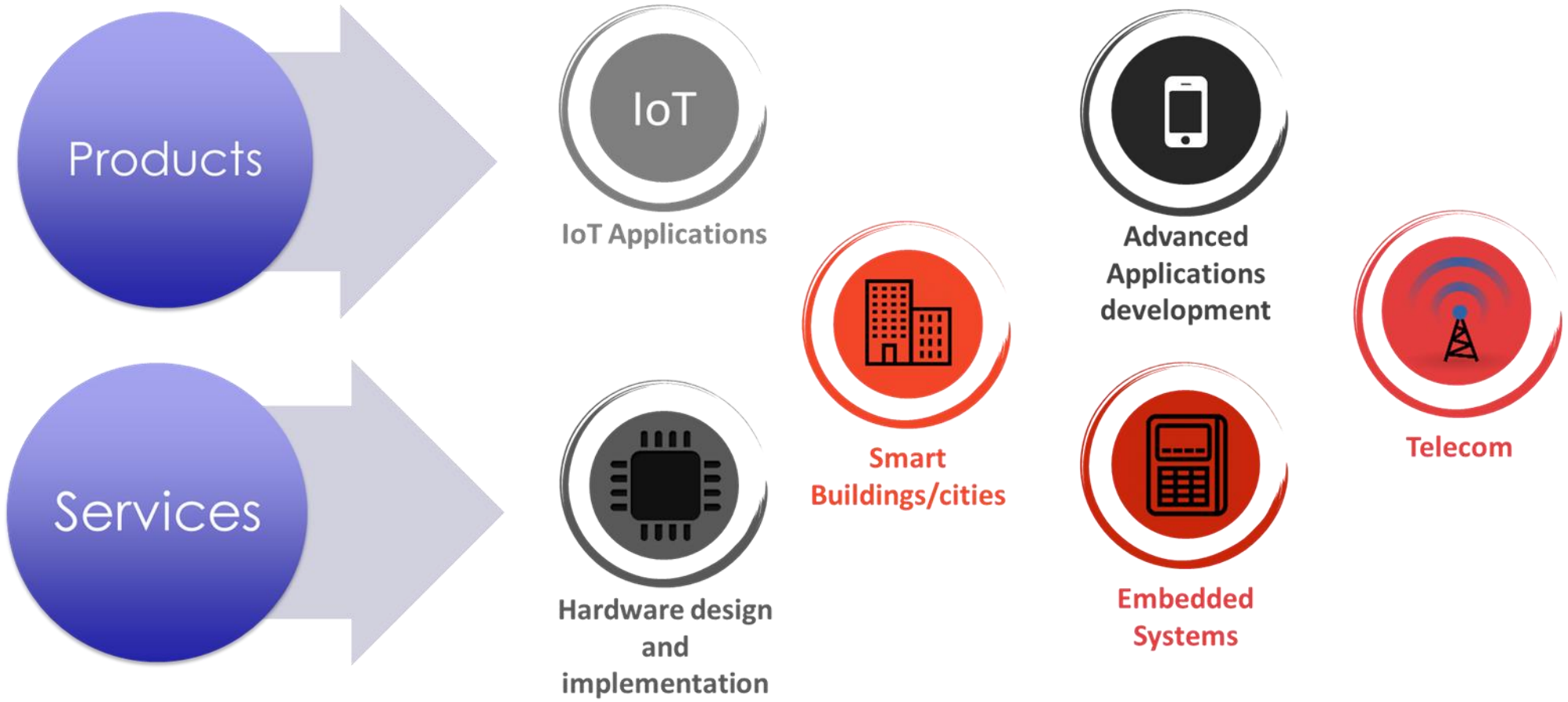
- **State Agency of the Higher Council of Scientific Investigations.**
  Center for Soil Science and Applied Biology of the Segura (CEBAS - CSIC)

  It is a multidisciplinary center that carries out research in three related scientific-technical areas (Agricultural Sciences, Food Science and Technology, and Natural Resources)

Smartec Systems

- Established in 2008 by Dr. Mohamed Khairy, focusing on Embedded systems, software development, and Telecommunications.
- Awarded 10 MLE in R&D funds from national and international funding agencies.
- Member of the international Web of Objects Consortium (WoO) alongside more than 30 organization.
- Fully designed and implemented innovative IoT solutions such as building automation solutions.
- The development arm of Tradelegs and Fidus, US and Canadian companies.
- 70+ employees and consultants, including 4 Ph.D. holders with 160+ man-years hands on experience.
- Providing 3G/LTE network optimization services to Vodafone (since 2012) and Etisalat, through the optimization tool, TEMPO.

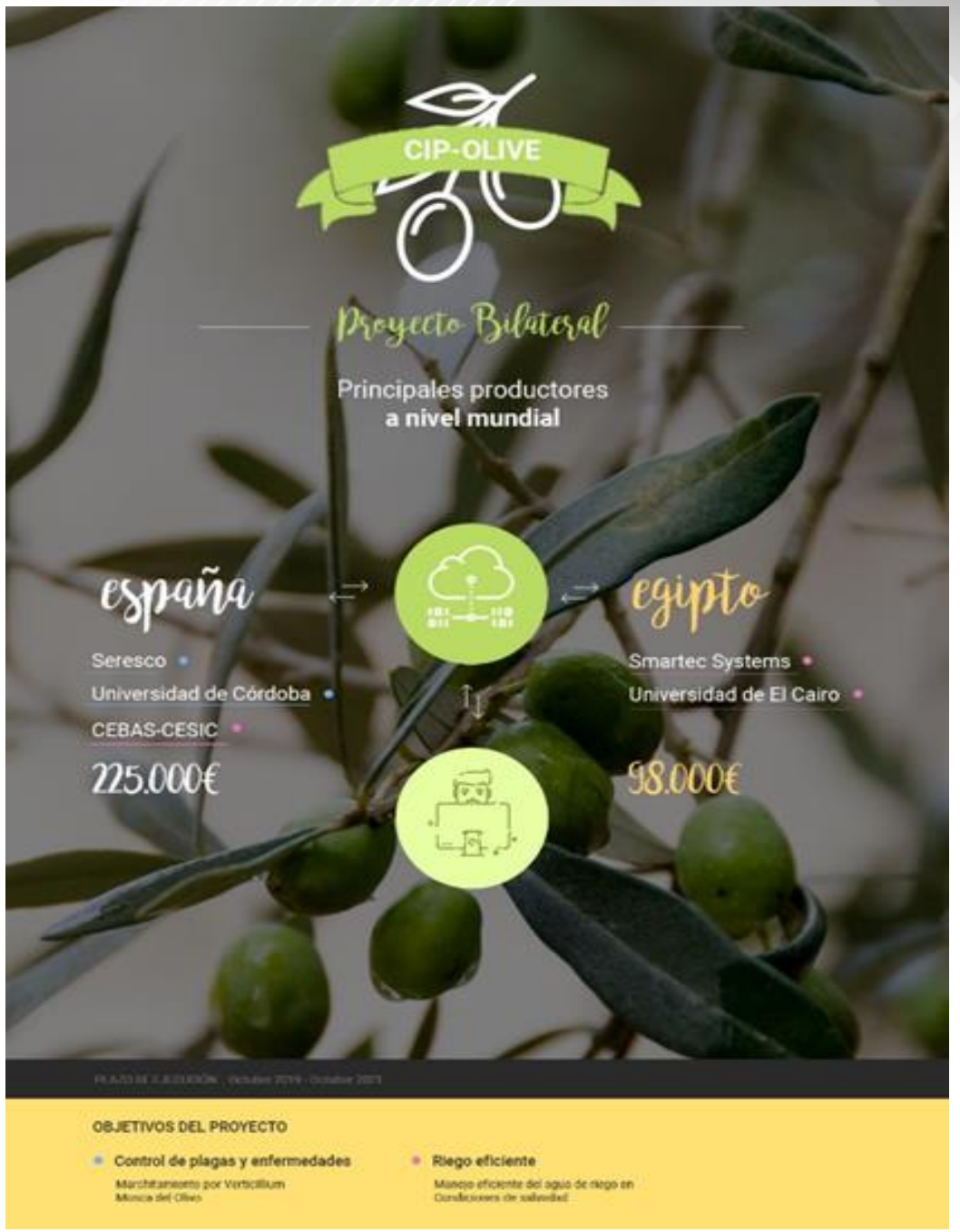
Smartec Systems



Center for Wireless Studies (Cairo University)

- CWS was established in 2008 as a culmination of telecom research efforts within Cairo University
- Research focuses on communication systems, both from theory and implementation points of view
- Funded over 15 MLE from ITIDA, NTRA, STDF, and QNRF
- Partnership with Texas A&M, Univ. of Florida, and KAUST, in addition to Vodafone
- Over 100 papers in reputable journals and conferences.
- 30 Master degrees awarded.
- Most of grads doing Ph.D. in North America.

Cloud-based Integrated Platform for Monitoring Pests, Salinity and Efficient Irrigation in Olive Precision Farming



CIP-OLIVE Project

CIP-OLIVE has a global budget of 323,563 euros, with the support of the Center for Industrial Technological Development (CDTI), through an aid of 123,367 euros for the Spanish entity SERESCO, and the support of ITIDA, through a aid of 1.5 million EGP for the Egyptian partners, within the framework of the Bilateral Hispano-Egyptian Program for Technological Cooperation.

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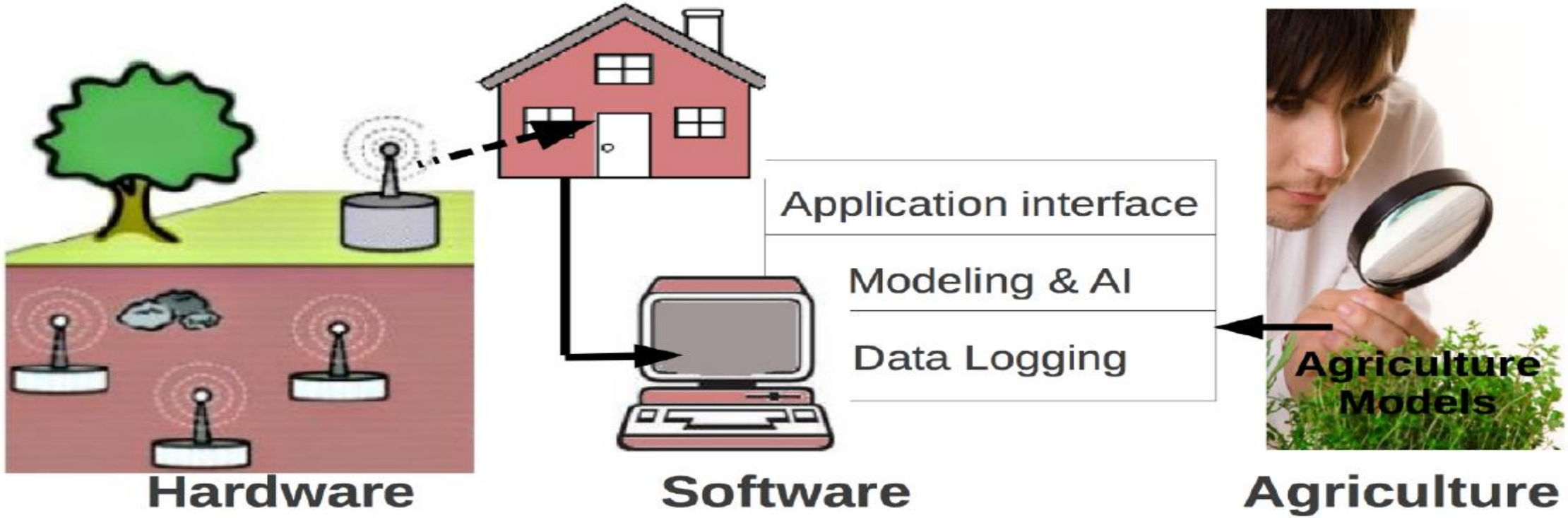
CIP-OLIVE Project - Motivation

- The growing of the olive sector represents an excellent potential market at the agricultural level for Egypt and Spain, being two of the main olive producers worldwide
- Egypt and Spain are the two world's leading table olive producers, with Egypt producing 18% of the world production
- Spain is the largest olive oil producer in the world, with more than 45% of the total world production
- Spain is the first country in cultivated area (Spain had, in 2017, 2.6 million hectares devoted to the cultivation of olives, 23% of the world surface area)

CIP-OLIVE Project - Actions

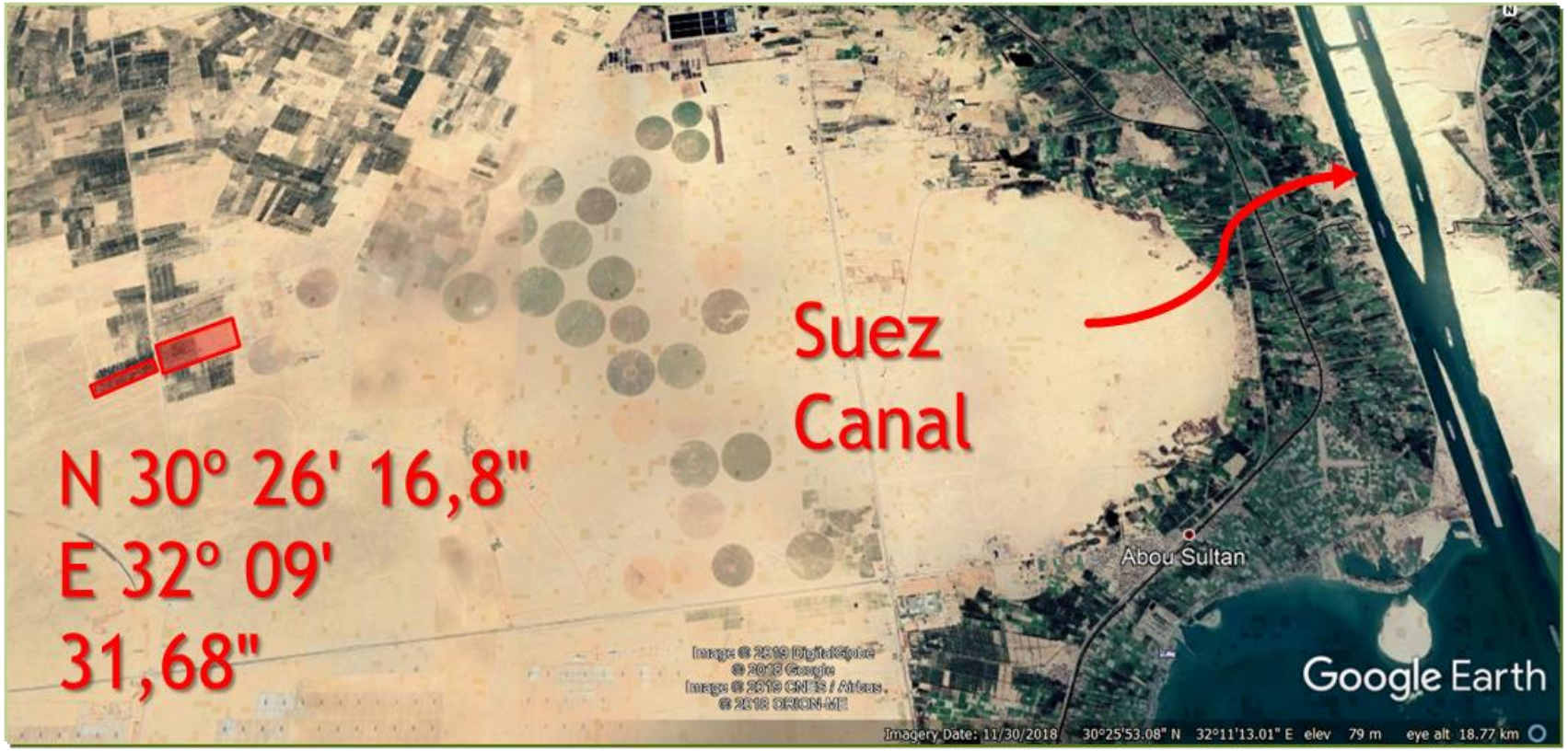
- The project is led by the companies Smartec Systems and SERESCO.
- The planned actions have an estimated duration of 24 months, between October 1, 2019 and September 30, 2021.
- The research components involved in this project include embedded systems, IoT, cloud computing, artificial intelligence, machine learning, and precision agriculture.



CIP-OLIVE Project - Egyptian Test Bed

The grove offers the following researchable advantages:

- **Different types of soil: deep sandy soil, sandy loam soil and shallow clay soil**
- **Irrigation water is highly saline: conductivity 10 to 12 dS/m**
- **14,120 trees of multiple olive varieties: Egyptian, Spanish and Italian**
- **Trees of different ages:**
  - 33 years
  - 21 years
  - 19 years
  - 4 months
- **Arid environment**
- **Drip irrigation**



CIP-OLIVE Project - Spanish Test Bed

- **Pest monitoring**

  Sevilla, Córdoba and Jaén

  - Olive Verticillosis prediction model

- **Management and monitoring irrigation system**

  Valencia

  - Generation and validation of irrigation models

- **Farm selection criteria**

  - New Plantations
  - Signs of *Verticillium dahliae*

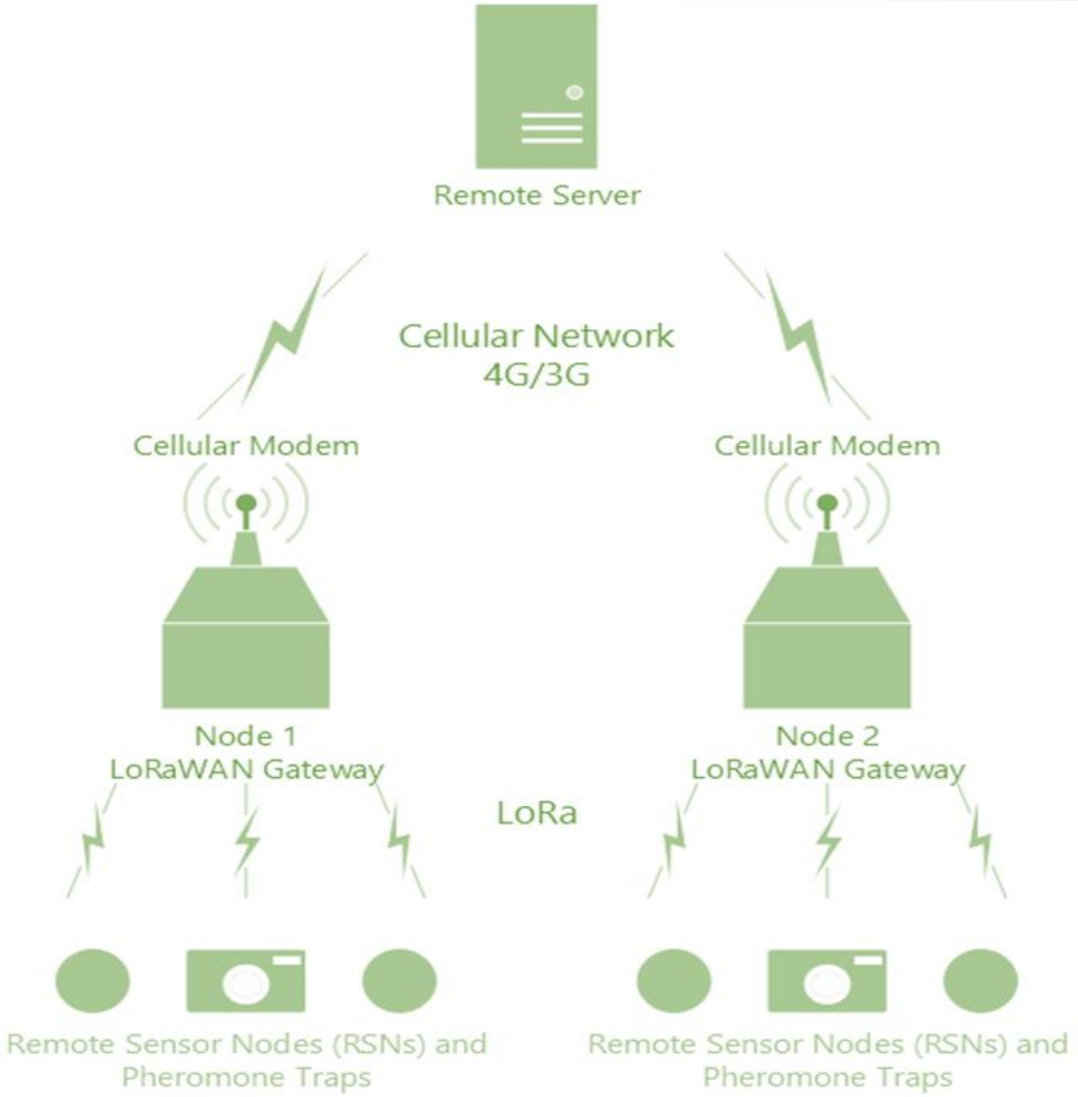
- **56,78 monitored hectares**

CIP-OLIVE Project - Main Objectives

- Develop an integrated hardware/software platform to monitor different olive diseases and pests, while monitoring the irrigation water and salinity; and be able to give recommendations for best agricultural practices
- Early detection of diseases via monitoring weather conditions
- Detection and counting of the Olive Fruit Fly
- Monitoring and management of irrigation water and salinity impact on different olive crops

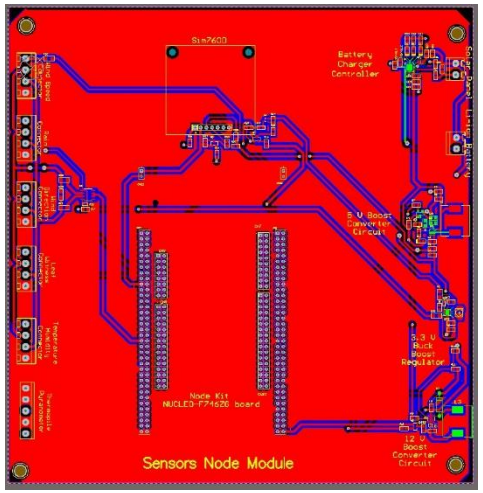
CIP-OLIVE Project - Hardware Architecture

- An integrated control strategy to manage diseases and pests
- Equipped with several monitoring stations that are collecting climate data throughout different sensors (temperature, humidity…)
- Connected to the cloud by means of a reliable wireless network connection



CIP-OLIVE Project – Hardware Implementation

Design of PCBs required for RSN, smart pheromone trap, and gateway.



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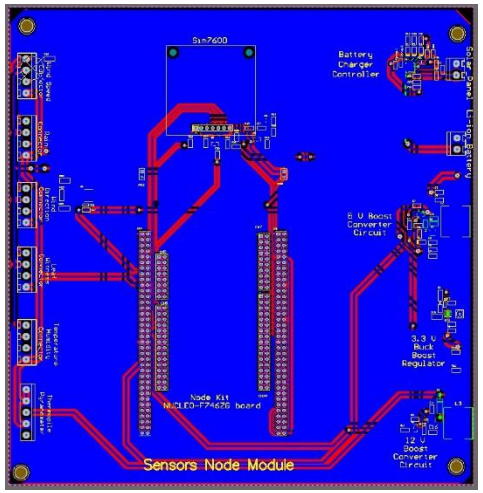

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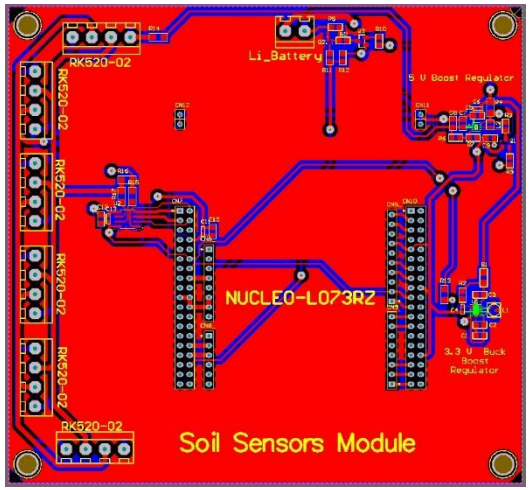
Gateway (Main Node)



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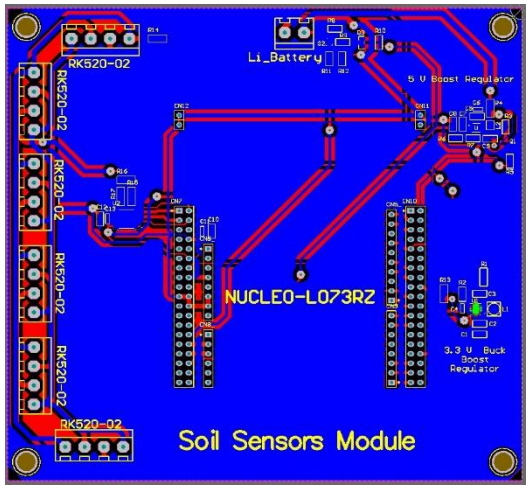

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Remote Sensor Node (RSN)

CIP-OLIVE Project - Hardware Components

CIP-OLIVE Project - Architecture Cultiva Platform

- Georeferencing of zones
- Integration with public and private agrometeorological providers
- Historical information of temperature, humidity, accumulated precipitation...
- Record of field actions: harvests, pruning, irrigation, fertilizers, application of phytosanitary products, machinery, operators...
- Dashboard with predefined indicators: accumulated precipitation and irrigation, ripening components...

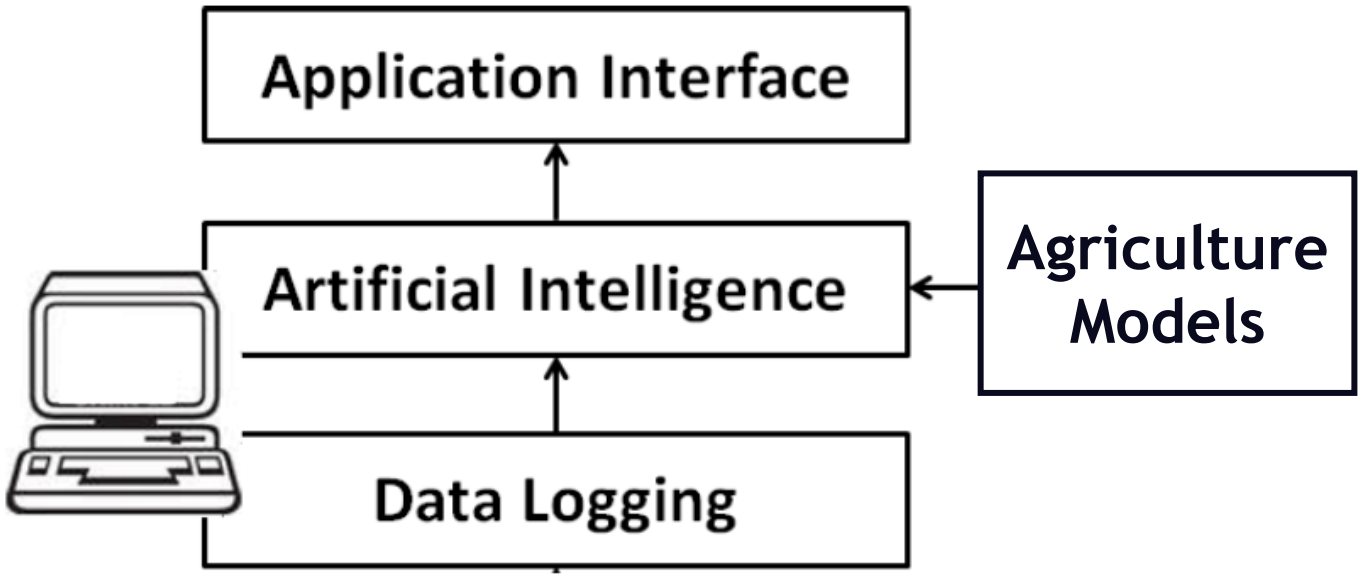
CIP-OLIVE Project - Architecture Artificial Intelligence

The system consists of three layers of software:

a) Recording of data acquired by soil, environmental sensors and pheromone traps

b) Processing them using artificial intelligence techniques in predictive models of pests, diseases and irrigation optimization

c) Application layer provided by the web interface



CIP-OLIVE Project - Olive Fruit Fly Detection

- Add camera that captures the trap photo and send it wirelessly to the software part of the platform
- Exploit the state-of-the-art machine and deep learning techniques (e.g. YOLO) in pest detection and counting
- Effectively remove humans from the loop to achieve a completely automated, real-time pest monitoring system

N. Mamdouh, M. Wael and A. Khattab, “Artificial Intelligence based Detection and Counting of Olive Fruit Flies: A Comprehensive Survey," in R.C. Poonia, V. Singh, and S.R. Nayak, (Eds.), Deep Learning for Sustainable Agriculture, Elsevier, 2021.

CIP-OLIVE Project - Outcomes and Impact

Outcomes

- ✓ A hardware platform for the monitoring station and pheromone trap to collect all the relevant information from the olive plantation farm. (Egyptian Partners)
- ✓ A Decision Support System (DSS) that serves as a single point of access to all the relevant information on the olive plantation farm in order to implement better decision making. (Spanish Partners)

Impact

- ✓ Improve the competitiveness of the farmers, facilitating the adoption of technological innovations.
- ✓ Contribute to achieve a sustainable agricultural development.

CIP-OLIVE Project - Conclusions

- A step forward in the Egyptian and Spanish strategy of using technology to improve agricultural practices

- Develop an integrated cloud-based IoT system that is used to reduce olive crop losses due to airborne pests and disease infections, while monitoring the irrigation water and soil salinity characteristics and how they affect the crop

- Increase the olive production quality and quantity and reduce environmental pollution

Practical Tips

Some Practical Tips

- ✓ **Identification of the strategic needs in R+D+i** of the company/institute.

- ✓ **Choice of partners:** it is key to choose an International Partner that provides guarantees (financial and technical), and that generates added value to the project. Holding several previous meetings is essential, in order to establish the fundamental points of agreement for the proposal.

- ✓ **CDTI & ITIDA:** launch collaboration proposals with international Partners, which are excellent opportunities to find potential partners ("it has been the case for our consortium).

Practical Advice

- ✓ **Design and preparation of the proposal:** justify the added value of the transnational association, the reason for the collaboration, specify the results to be obtained and the plans for its subsequent exploitation.

- ✓ **Define a budget consistent with the capacity of the partners**, with the actions to be undertaken, and balanced among the Partners. It is essential to justify the role of collaborators (technology centers, universities, etc.) in the project.

- ✓ **Support from National Financing Agencies (CDTI & ITIDA):** The support of the CDTI promotion department, through the NCP (National Contact Point), and ITIDA are key in order to: present a preliminary idea of the Project and guide its adaptation to the Bilateral financing line, as well as the resolution of doubts during preparation.

Practical Advice

- **Have enough time to prepare the proposal:** In the international application phase, it will be necessary to have key aspects resolved: specific objectives, work plan, proposed innovation, budget per partner, schedule, exploitation plans and the Consortium Agreement. In the National phase, more specific aspects of the application will be required, as well as additional administrative and economic-financial documentation.

- **Properly define the Consortium Agreement**: clarify the issues of intellectual property and / or commercial rights, as well as procedures for communication and dissemination, etc….

Practical Advice

- **It is convenient to have a technical office** (support consultant) that acts as an interlocutor between the parties, and supports the entire design and preparation phase of the formal application, both in the international and national phases. In the case of SERESCO, we have had the collaboration of the consulting firm Artica+I, and we can say that it has been of great help.

- **It is interesting that different people / profiles** of the participating entities review and contribute to the memory of the proposal (different profiles: technical, commercial, financial...).


Thanks!