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LIAAD
LABORATORY
ARTIFICIAL INTELLIGENCE AND DECISION SUPPORT

13 R&D CENTRES
6 LOCATIONS IN 3 CITIES

745 RESEARCHERS

340 PhDs
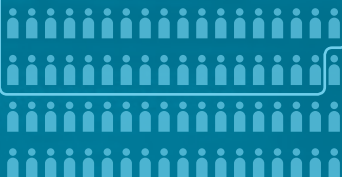
BRAGA U MINHO

VILA REAL UTAD

PORTO ISEP
FEUP
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MORE THAN
190 PROJECTS /YEAR
NATIONAL AND EUROPEAN PROJECTS
R&D AND CONSULTING SERVICES
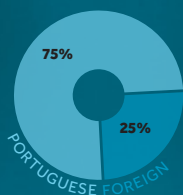
MORE THAN
300 PAPERS /YEAR
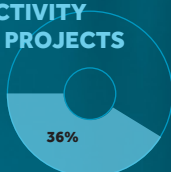INTERNATIONAL SCIENTIFIC JOURNALS

MORE THAN
350 GRANT HOLDERS /YEAR
ENHANCING PERSONAL POTENTIAL THROUGH SCIENCE AND TECHNOLOGY

PhD STUDENTS
75%
25%
PORTUGUESE FOREIGN

INTERNATIONAL ACTIVITY IN PROJECTS
36%

DIRECT CONTRACTS WITH COMPANIES
21%

› **research
and technological development**
› **technology transfer
and valorisation**
› **advanced training**
› **R&D contracts with industry**
› **technology-based business
pre-incubation**

The Institute for Systems and Computer Engineering, Technology and Science — INESC TEC has 35 years of experience in R&D and technology transfer. Present in sites in the cities of Porto, Braga and Vila Real, INESC TEC incorporates 13 R&D Centres with complementary competences, always looking to the international market.

At INESC TEC, the knowledge and results generated as part of fundamental research are typically applied in technology transfer projects, always guaranteeing added and immediate social relevance.

With the launching of INESC P&D BRASIL (in São Paulo, Brazil), INESC TEC has strengthened its presence worldwide, always associating Portugal to international scientific excellence. In Portugal, INESC TEC's capacity for technological innovation has made it possible to modernise national sectors and to launch new exporting companies.

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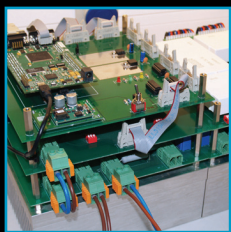
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Portugal

EV SBC
EV SMART BATTERY CHARGER

INESCTEC
TECHNOLOGY & SCIENCE

EV SBC
EV SMART BATTERY CHARGER

The battery charger prototype developed by INESC TEC is a high value device with integrated grid support functions. Based on highly accurate local measurements, voltage and frequency droop control is implemented to reduce the charging rate when there are excessive voltage drops or large frequency changes, and even to reverse the power flow in very critical conditions. Furthermore, if the node where the EV is connected has a light load and an excessive local renewable energy production, the charging rate is slightly increased to maintain the voltage under its upper limit. A battery monitoring system ensures the adequate SOC management during grid support mode of operation.

MAIN FEATURES

- Full-scale bidirectional power flow with low harmonic content
- Wide battery pack voltage range
- BMS Status, SoC, SoH, Highest and lowest cell monitoring
- Galvanic isolation
- Continuous overload and short circuit protection
- Computer diagnosis and monitoring software
- Remote control and monitoring
- Online reconfiguration by micro grid controller
- Power derating according to grid condition, including V2G
- Grid support during disturbances

SPECIFICATIONS

- Maximum power: ±3680W // Max. Charging Current: 10A
- Battery pack voltage range: 350...480V
- Grid voltage: 230V±20% // Grid frequency: 48...52Hz
- Connectivity: RS232, CAN and USB (firmware upload only)
- Switching frequency: ≥20kHz // P.F. (full load) >0.95 // THD (full load) <5%
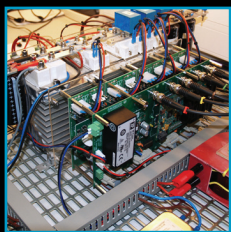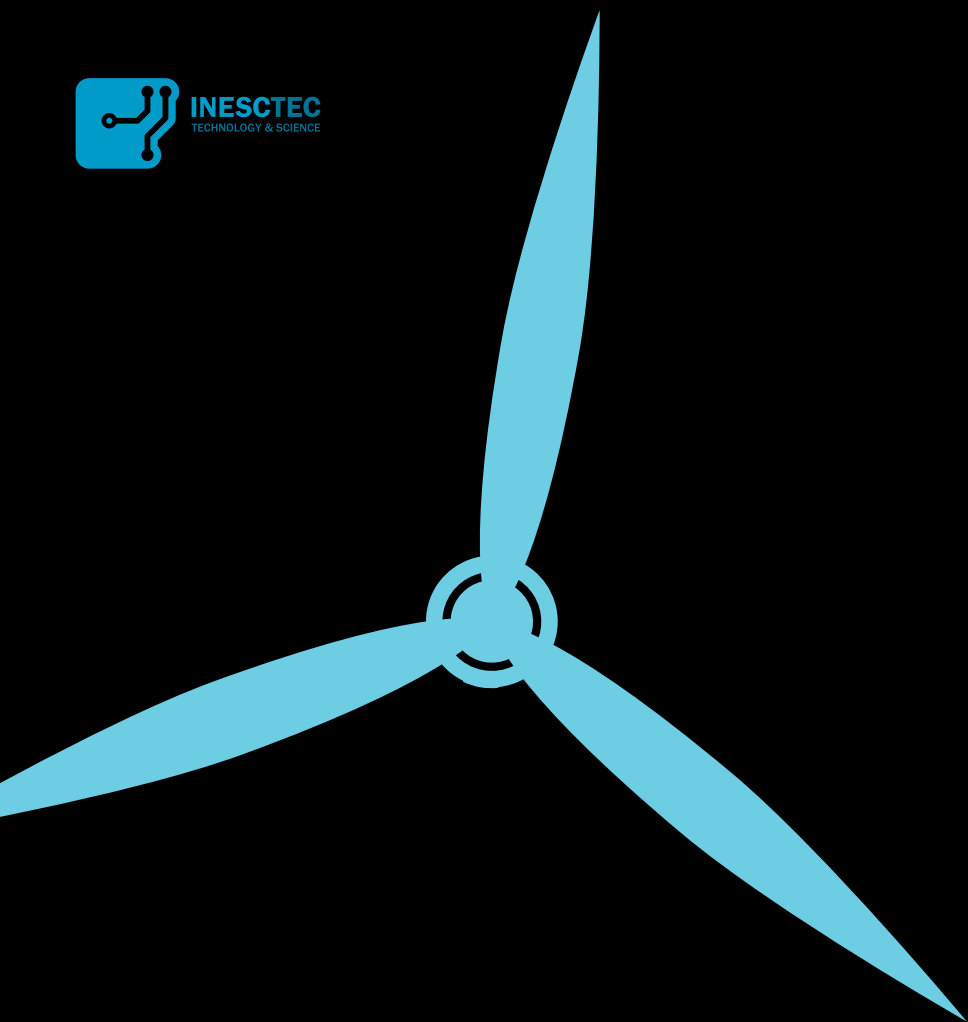- Droop control range: 200...260V, 48...52Hz, -3680...+3680W

WISE

WIND INTEGRATION
IN SMART ENVIRONMENTS

WISE
WIND INTEGRATION
IN SMART ENVIRONMENTS

The micro wind turbine inverter developed by INESC TEC is a high value device with integrated grid support functions. The inverter combines a fast and efficient power vs. speed tracking with an advanced Droop control based on grid voltage and real-time frequency measurements. These characteristics prepare the device for the next step in the expansion of micro producers. Additional features such as fast response to voltage and frequency changes allow the distribution network to easily recover when failures occur.

MAIN FEATURES

- Full-scale controllable power flow with low harmonic content
- Integrated 3kW dump load control
- Real-time grid voltage and frequency monitoring
- Continuous overload and short circuit protection
- Computer diagnosis and monitoring software
- Remote control and monitoring
- Online reconfiguration by micro grid controller
- Power derating according to grid condition
- Grid support during disturbances

SPECIFICATIONS

- Maximum power: ±3680W // Max. Generator current: 20A
- Generator voltage (line-to-line): 210...260V //
  Generator frequency: 10...100Hz
- Grid voltage: 230V±20% // Grid frequency: 48...52Hz
- Connectivity: RS232 and USB (firmware upload only)
- Switching frequency: ≥20kHz // P.F. (full load) >0.95 // THD (full load) <5%
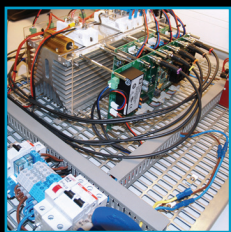- Droop control range: 200...260V, 48...52Hz, -3680...+3680W

SISE
SOLAR INTEGRATION
IN SMART ENVIRONMENTS

INESC**TEC**
TECHNOLOGY & SCIENCE

SISE
SOLAR INTEGRATION
IN SMART ENVIRONMENTS

The solar power inverter developed by INESC TEC is a high value device with integrated grid support functions. The inverter includes a fast and efficient MPP search, combined with advanced Droop control based on real-time grid voltage and frequency measurements. These characteristics prepare the device for the next step in the expansion of micro producers. Additional features such as fast response to voltage and frequency changes allow the distribution network to easily recover when failures occur.

MAIN FEATURES

- Full-scale controllable power flow with low harmonic content
- Wide PV array voltage range
- Real-time grid voltage and frequency monitoring
- Continuous overload and short circuit protection
- Computer diagnosis and monitoring software
- Remote control and monitoring
- Online reconfiguration by micro grid controller
- Power derating according to grid condition
- Grid support during disturbances

SPECIFICATIONS

- Maximum power: ±3680W // Max. PV array current: 10A
- PV array voltage range: 150…450V
- Grid voltage: 230V±20% // Grid frequency: 48…52Hz
- Connectivity: RS232 and USB (firmware upload only)
- Switching frequency: ≥20kHz // P.F. (full load) >0.95 // THD (full load) <5%
- Droop control range: 200…260V, 48…52Hz, -3680…+3680W

ROBVIGIL
SURVEILLANCE
ROBOT

INESCTEC

ROBVIGIL
SURVEILLANCE ROBOT

ROBVIGIL is an indoor surveillance robot equipped with sensors and video cameras that is capable of collecting and sending information in real time. The robot can be remotely operated or instructed to go on rounds autonomously. It operates independently of light conditions and can cooperate with other robots or humans.

FUNCTIONALITIES

- Robust robot localisation
- Intelligent battery charging system
- Transparent management of different communication technologies
- Multiple cameras and sensors
- People detection and tracking
- Visual programming languages for intuitive robot mission configuration and route planning

MAIN FEATURES

- Sensors: floor, water, fire, smoke, temperature, humidity, movement, gas (CH, GPL and CO)
- Supports videoconferencing
- Transparently selects the best wireless technology: WiFi and 3G (more in the future)
- No need for markers for indoor auto-localisation
- Video: 360° Camera, directional HD, Thermal, IR
- Remote Database

SPECIFICATIONS

Dimensions: 120cm height, 60cm diameter
Autonomy: unlimited with 10 to 15-minute charging every 45 minutes (the robot remains fully functional even while charging);
8 to 12 hours without charging
Max speed: 1.4 m/s

TriMARES
AUTONOMOUS
UNDERWATER
VEHICLE

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TECHNOLOGY & SCIENCE

TriMARES
AUTONOMOUS UNDERWATER VEHICLE

TriMARES is an underwater vehicle designed for autonomous inspection, bathymetry, mapping and data collection. TriMARES' modular structure is based on the underwater vehicle MARES (OceanSys) and allows different sensor package configurations. Its increased capacity to transport sensors allows it to carry an on-board high resolution video camera, as well as different types of sonar equipment. It can move smoothly in the water, increasing the quality and georeferencing of the collected data. TriMARES was developed in 6 months by INESC TEC and commissioned by a consortium of Brazilian hydroelectric power companies (CEB Lajeado, EDP). The first unit was exported to Brazil in 2011.

MAIN FEATURES

Modular construction with reconfigurable sections
Spare ports to accommodate additional payload sensors
Robust and safe, with fully shrouded moving parts
Operates in confined spaces - able to ascend/descend on the vertical
Hovering in the water column - station keeping and close inspection
5 degrees of freedom (surge, sway, heave, yaw, pitch)
Autonomous operation with simple mission definition
Rechargeable Li-Ion batteries
Low maintenance
Optional fibre-optic umbilical for real-time video/data transmission
(ROV mode)

SPECIFICATIONS

Length: 1.3 m // Total width: 80 cm // Overall height: 50 cm // Weight: 75 kg
Maximum depth: 100 m
Horizontal speed: 0-2 m/s, variable // Vertical speed: 0-0.3 m/s, variable
Autonomy / Range: 10 hrs / 40 km
Typical sensors: video camera, high sensitivity still camera, multibeam sonar, sidescan sonar, CTD, turbidity, fluorescence
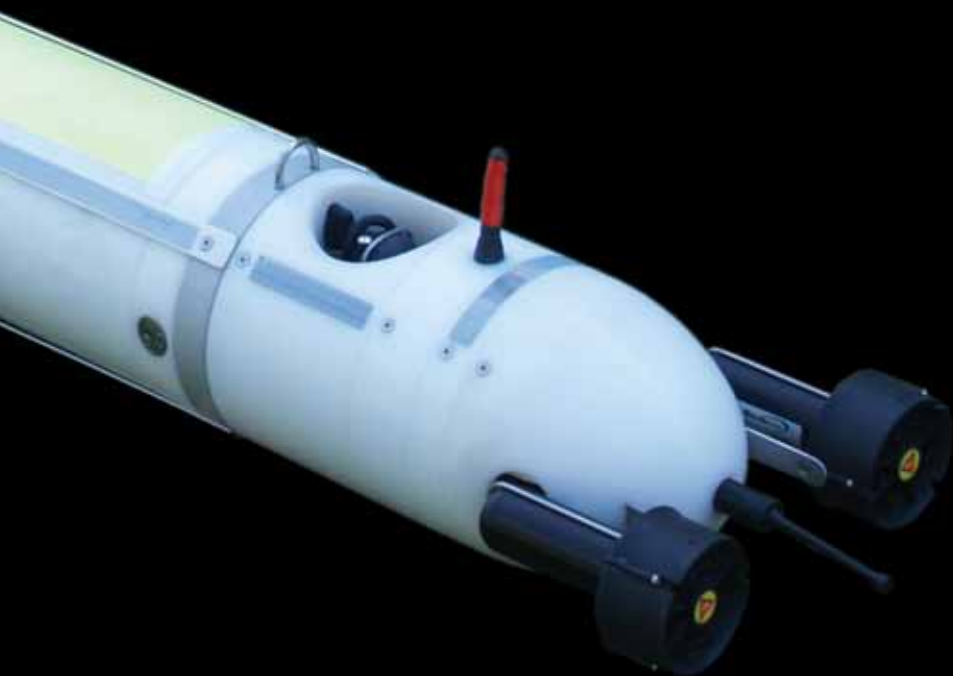
MARES
AUTONOMOUS
UNDERWATER
VEHICLE

INESCTEC
TECHNOLOGY & SCIENCE

MARES
AUTONOMOUS UNDERWATER VEHICLE

Developed by OceanSys (INESC TEC and FEUP), MARES - Modular Autonomous Robot for Environment Sampling is an autonomous vehicle used in underwater operations. This robot can be easily configured and its modular structure allows it to carry a large variety of sensor packages. MARES can be used for different applications such as environment monitoring, underwater inspection and mapping, and surveillance. An acoustic positioning system makes it possible to georeference collected data. This device has been used regularly since 2007 in environmental monitoring operations.

MAIN FEATURES
Modular construction with reconfigurable sections
Spare ports to accommodate additional payload sensors
Robust and safe, with fully shrouded moving parts
Operates in confined spaces - able to ascend/descend on the vertical
Hovering in the water column - station keeping and close inspection
4 degrees of freedom (surge, heave, yaw, pitch)
Autonomous operation with simple mission definition
Rechargeable Li-Ion batteries
Low maintenance
Compact and lightweight - easy transportation and deployment

SPECIFICATIONS
Length: 1.6 m
Diameter: 20 cm
Weight: 32 kg
Maximum depth: 100 m
Horizontal speed: 0-2 m/s, variable
Vertical speed: 0-0.5 m/s, variable
Autonomy/range: 10 hrs / 40 km
Typical sensors: CTD, sonar, turbidity, fluorescence, video camera

ROAZ II
AUTONOMOUS
SURFACE
VEHICLE

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ROAZ II
AUTONOMOUS SURFACE VEHICLE

ROAZ II is an autonomous surface vehicle designed for aquatic environment monitoring, bathymetry, data collection and oceanography, security and search and rescue missions. With on-board sensor processing and high precision navigation it is capable of operating autonomously in the ocean environment. The robot has a wide range of sensors and advanced on-board controls allowing its use in efficient precision environmental modelling (oceanographic, 3D sea floor modelling), automated intrusion detection, target tracking, identification, area patrol, communications relay in multi-vehicle scenarios and surface support to underwater assets.

On-board ROV in coordinated missions makes it a suitable surface platform for underwater inspection and data collection tasks.

This vehicle has already taken part in various operational missions.

MAIN FEATURES

Autonomous operation
GPS with RTK and INS for precise positioning
RADAR for obstacle detection
Infra-red and visible light cameras
On-board image processing
Wireless communication (data/video)
CTD
Multi-beam sonar and side-scan sonar
LiFePO4 Batteries
On-board inspection ROV (remotely operated Vehicle)

SPECIFICATIONS

Length: 4.25 m // Width: 2 m // Weight: 250 kg
Maximum speed: 10 knots
Autonomy: 11 hours
Electric propulsion: 10 HP
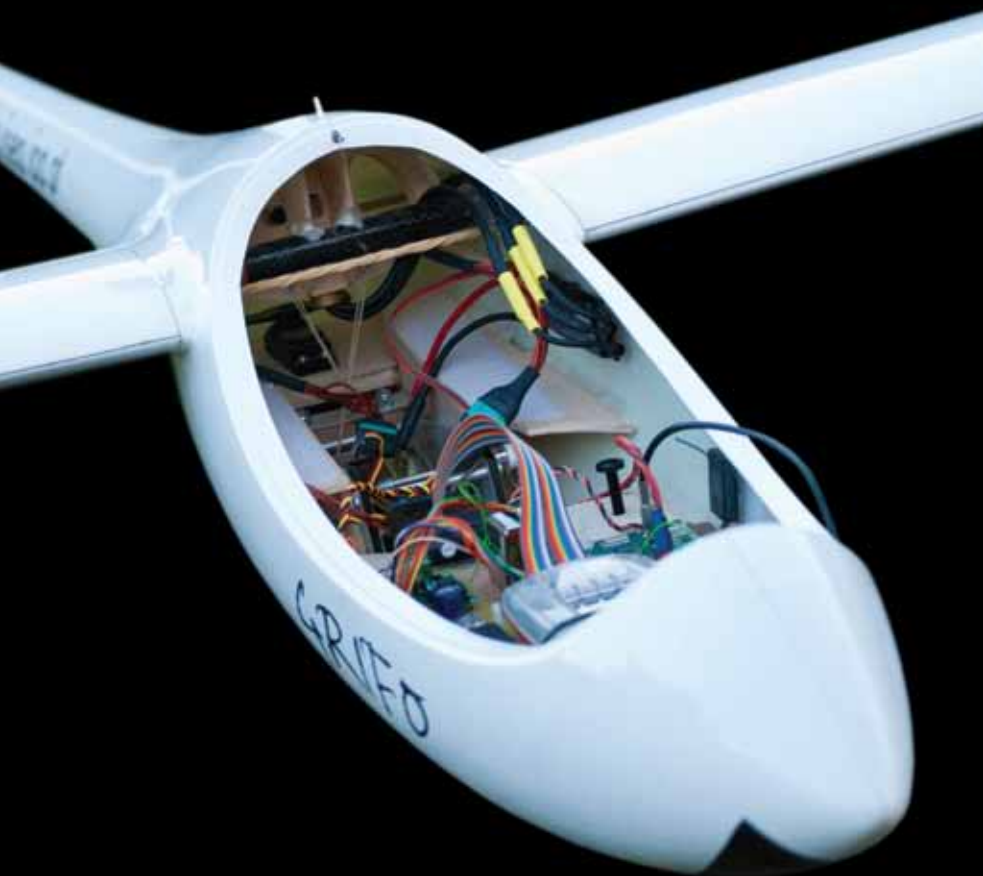Load capacity: 500 kg

GRIFO
AUTONOMOUS
AERIAL
VEHICLE

INESCTEC
TECHNOLOGY & SCIENCE

GRIFO
AUTONOMOUS AERIAL VEHICLE

GRIFO is a small scale, fixed wing autonomous flight vehicle (unmanned aircraft) designed for environmental monitoring, security, forest fire prevention, communications relay and search and rescue missions. Developed by a team with more than 10 years of experience in aerial robots, this vehicle with on-board image processing and autonomous flight control can operate without direct communication with the land station. A custom developed inertial navigation system and autopilot allows the tight integration of additional sensors, a high degree of navigation positioning and sensor in the loop custom manoeuvres for particular applications. Advanced on-board image processing is used not only in application tasks (event detection, target tracking etc.) but also in automatic visual detection of obstacles (land and in flight) in order to endow the UAV with the capability of operating in accordance with VFR (Visual Flight Rules) aerial regulations.

MAIN FEATURES

Electric propulsion
Custom developed autopilot
Custom developed small scale inertial navigation system
Low consumption on-board ARM (Cortex A8) CPU
WiFi communication
Autonomous flight control in gliding mode
On-board imaging processing
Image based sense and avoid
LiPo batteries (Lithium-ion polymer)

SPECIFICATIONS

Wingspan: 4 m
Maximum take-off weight: 10 kg
Cruising speed: 50 km/h
Autonomy: 4 to 6 hours
Fibreglass glider airframe

SmartAGV
SMART AUTOMATED GUIDED VEHICLE

INESCTEC
TECHNOLOGY & SCIENCE

SmartAGV
SMART AUTOMATED GUIDED VEHICLE

The SmartAGV is an Automated Guided Vehicle designed for applications facing challenges which call for a flexible and intelligent flow of materials with an effective cost/benefit ratio. This mobile robot is capable of using different types of localisation systems such as a contour based system, without the need for environment preparation, beacons or magnetic tape. The main objective is to achieve a system that is easily adapted, installed and used.

MAIN FEATURES

- Several Localisation techniques:
  - contours (no environment preparation required)
  - beacons
  - magnetic tape
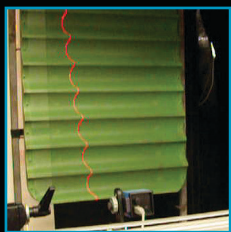- Autonomous management of battery charging

SmartPAINT
SMART ROBOTISED PAINTING CELL

INESCTEC
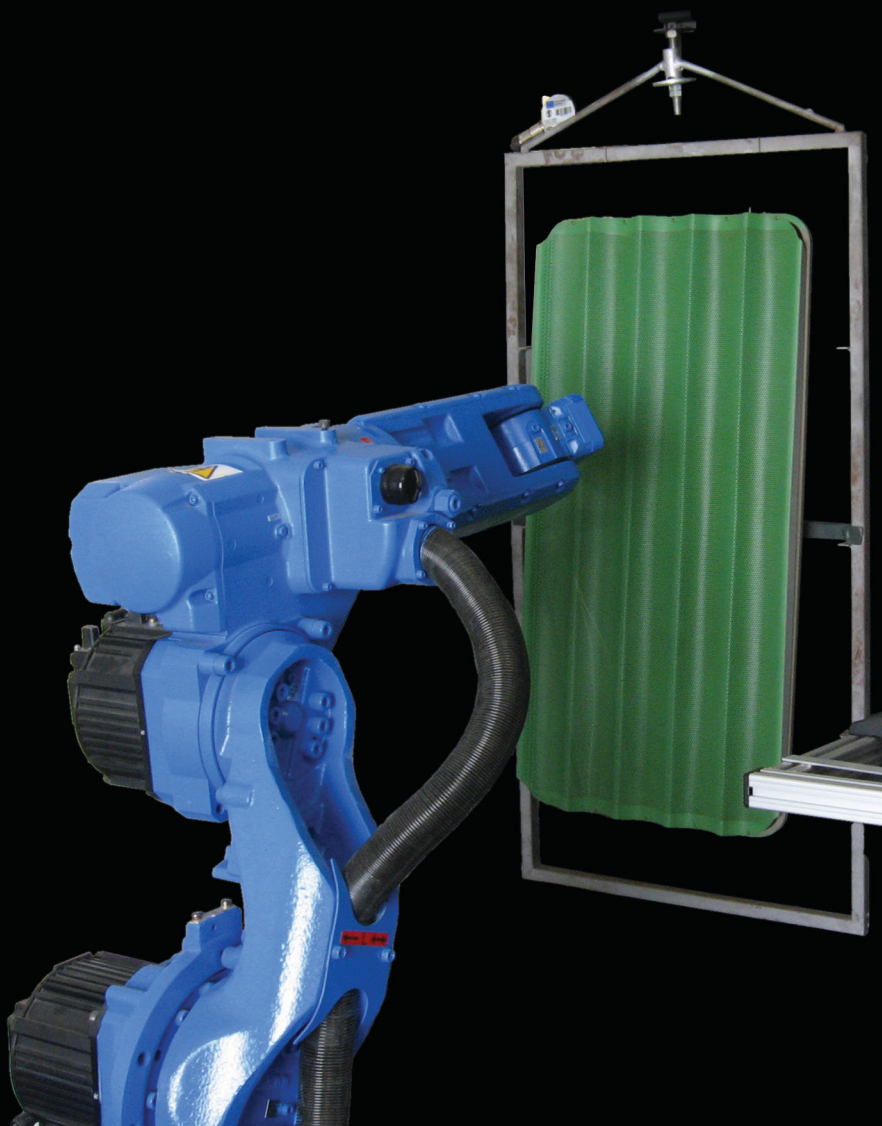
SmartPAINT
SMART ROBOTISED PAINTING CELL

The SmartPaint is a system that may lead to an increase in competitiveness in small series robotised painting. Some of the system's key factors include accumulated know-how which can be recorded and the capacity to increase production at a lower manufacturing cost, as well as the flexibility to rapidly adapt to new products and processes. This system aims at responding to these challenges by developing an intelligent robotised painting cell capable of acquiring, in a fast and intuitive way, the know-how accumulated by specialised technicians and optimised during several years of experience. The acquired trajectories are recorded and automatically translated to the language of the manipulator, which is taught by means of demonstration.

MAIN FEATURES
- Programming of manipulators through demonstration
- Modular and flexible system for automatic recognition of object geometry
- Capable of translating the independent commands of the programming language to the commands supported by the concrete robot installed for production
- Advanced interface for management and control, supporting both local and remote interaction

FLUPOL
SURFACE ENGINEERING

cei
by ZIPOR

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FEUP FACULDADE DE ENGENHARIA
UNIVERSIDADE DO PORTO

COMPETE 2020

PORTUGAL 2020

UNIÃO EUROPEIA
Fundo Europeu de
Desenvolvimento Regional

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

CARLoS
COOPERATIVE ROBOT
FOR LARGE SPACES
MANUFACTURING

INESCTEC
TECHNOLOGY & SCIENCE

CARLoS
COOPERATIVE ROBOT FOR LARGE SPACES MANUFACTURING

CARLoS project applied recent advances in cooperative mobile robotics to a representative industrial scenario in shipyards. The final prototype was demonstrated as a robot co-worker for outfitting operations (stud welding and marking) inside blocks of ship superstructures. Currently, there is no automated solution for these tasks.

FUNCTIONALITIES
- Autonomous stud welding
- Cooperative behaviour under uncertainties
- Semi-autonomous decision-making on the work to be done
- Highly usable and easy controlled by a shipyard worker

MAIN FEATURES
- High mobility inside ship blocks
- Projection mapping augmented reality based interface
- 3DOF and 6 DOF localisation with natural features
- Close to walls path planning for the mobile platform
- Skills-based programming

TECHNICAL SPECIFICATIONS
- Platform absolute localisation accuracy: < 6cm
- Stud placement accuracy: <1cm
- Platform maximum speed: 1.5m/s
- Force application on the wall:>160N
  (depending on the arm configuration)
- Payload of the platform: 100 Kg

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STAMINA
SUSTAINABLE AND RELIABLE ROBOTICS FOR PART HANDLING IN MANUFACTURING AUTOMATION

INESCTEC
TECHNOLOGY & SCIENCE

STAMINA

SUSTAINABLE AND RELIABLE ROBOTICS FOR PART HANDLING IN MANUFACTURING AUTOMATION

The STAMINA Project is focused on building the Factory of the Future with the help of new robotics technologies.

By increasing the flexibility of production facilities, handling an ever increasing customisation of products and production volumes variation, the STAMINA Project aims to find profitable solutions to increase the competitiveness of EU factories. The end result of the STAMINA project is a fleet of mobile manipulators capable of navigating and performing kitting operations on a complex logistic supermarket.

A Vertical Integration solution, aimed at bridging the fleet of mobile manipulators with the production systems is being developed by INESC TEC. A 3D spatial representation of the working environment, allowing a continuous assessment of inconsistencies between reality and the modelled information, is also in development.

PROJECT BENEFITS
- Robotic fleet capable of operating on environments designed for human use.
- Set of sustainable robotic technologies, software and hardware, capable of being transferred to industrial use.
- Robust object recognition and grasping for a large variety of parts.

TECHNOLOGICAL INNOVATION
- 3D Vision for part picking and inconsistency detection.
- Skill / Task based robot programming.
- Navigation without infrastructure.
- Web based Vertical Integration with the factory production system.

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COMPETE 2020

PORTUGAL 2020

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UNMANNED CAPSULE
AUTONOMOUS ROBOT FOR SEARCH AND RESCUE OPERATIONS

UNMANNED CAPSULE
AUTONOMOUS ROBOT FOR SEARCH AND RESCUE OPERATIONS

The Unmanned capsule is a small size autonomous surface vehicle designed for search and rescue operations at sea. This robot carries an uninflated life raft and is capable of inflating it close to survivors in large-scale maritime disasters. It can be remotely controlled or operated autonomously, and can be deployed from shore or from a mother ship.

The capsule was designed to operate in adverse environmental conditions, and is also equipped with a video camera and other sensors to provide information about victims and the disaster to operators on shore. This system was developed as part of project ICARUS (FP7 – Security).

MAIN FEATURES
- Automatic inflation of life raft
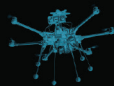- Autonomous navigation
- Live video stream to shore

STRONG
MAR

STRENGTHENING MARITIME
TECHNOLOGY
RESEARCH CENTER

STRONGMAR
STRENGTHENING MARITIME TECHNOLOGY RESEARCH CENTER

AIM INESC TEC is strongly committed to become a center of excellence in maritime technology and, in particular, deep sea technology. The STRONG-MAR project aims at creating solid and productive links in the global field of marine science and technology between INESC TEC and established leading research European institutions, capable of enhancing the scientific and technological capacity of INESC TEC and linked institutions (as well as the capacity of partnering institutions involved in the twinning action), helping raising its staff's research profile and its recognition as a European maritime research center of excellence.

OBJECTIVES The main objectives are: provide services and open access to the European academic and industrial communities; become a recognized maritime research asset; build a well-designed and coherent plan for knowl-edge transfer and exchange of best practices; and enhance the scientific and technological capacity of INESC TEC and linked institutions. These objectives will be fulfilled through a set of measures: summer schools, winter schools, short-term scientific meetings, long-term staff visits, networking meetings, workshops, conferences, technology transfer work-shops with stakeholders, and other dissemination activities.

PARTNERS INESC TEC (PORTUGAL) / CINTAL (PORTUGAL) / HERIOT-WATT UNIVERSITY (UNITED KINGDOM) / NATO SCIENCE & TECHNOLOGY ORGANIZATION (BELGIUM) / UNIVERSITAT DE GIRONA (SPAIN) / UNIVERSITY OF ABERDEEN (UNITED KINGDOM)

START JANUARY 2016 **END** DECEMBER 2018 **BUDGET** ~1 M€

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CRAS
CENTRE FOR ROBOTICS
AND AUTONOMOUS SYSTEMS

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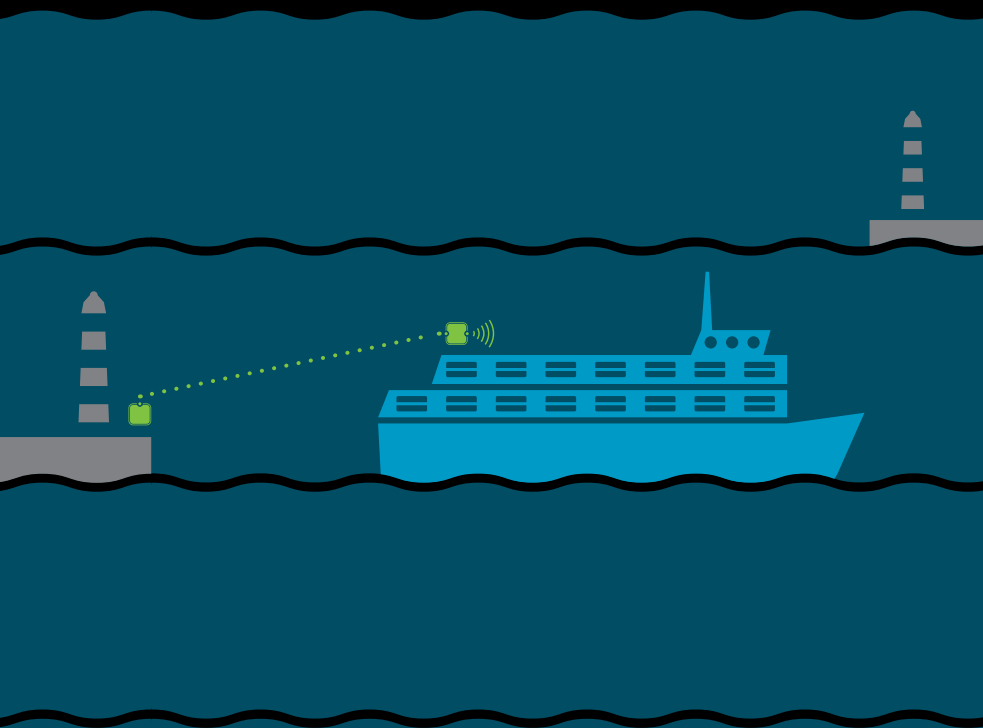PORTUGAL

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HORIZON 2020

JANUS NC

JANUS - NC
MULTI-TECHNOLOGY
MESH ACCESS POINT
FOR NEAR-COAST COVERAGE

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JANUS - NC

MULTI-TECHNOLOGY MESH ACCESS POINT
FOR NEAR-COAST COVERAGE

Network equipment capable of offering Wi-Fi coverage, while connecting to the Internet via multiple heterogeneous links such as 3G, WiMax, and even other Wi-Fi connections. The devices connect to JANUS via a single stable Wi-Fi connection and the box transparently selects the best connection to the infrastructure, depending on temporal conditions. JANUS can form a transparent mesh network that is used to extend a network infrastructure or Internet link to remote locations, via multi-hop wireless links. JANUS can offer Internet connectivity and services (e.g., VoIP) to passengers on boats near the coast or at the dock. Improved Internet connectivity can be achieved using fiber or ADSL as backhaul instead of 3G/WiMax. It can also be used to provide a dedicated network for nodes of the same entity.

FUNCTIONALITIES

Near coast Internet extension
Self configured network
Support for prioritised traffic and QoS
Support for data storage
Remote management
JANUS GPS location - estimated position of network clients

MAIN FEATURES

Support for multi-hop and mobile mesh network mode (Wi-Fi)
Scales to large mesh networks (up to 7000 JANUS boxes)
Multiple link layer technologies: 3G, Wi-Fi, WiMax, etc.
Stable Wi-Fi connection regardless of the Internet link used
Unnecessary network planning: dynamic auto-configuration

TECHNICAL SPECIFICATIONS

Dimensions: 26cm length, 23cm width, 8.8 cm height
Power: DC jack or passive POE, 7-20 V, 5-6 W
Supports renewable energy sources (e.g., solar panels)
Internal Batteries: 12 V, 7.2 Ah
Autonomy: ~10 hours
WRAP-BOX is rated NEMA-67 / IP67

JANUS SR

JANUS-SR
MULTI-TECHNOLOGY
MESH ACCESS POINT
FOR SEARCH-AND-RESCUE
OPERATIONS

INESCTEC
TECHNOLOGY & SCIENCE

JANUS-SR

MULTI-TECHNOLOGY MESH ACCESS POINT FOR SAR OPERATIONS

Network equipment capable of automatically interconnecting with other boxes to form a single broadband mesh network covering a large area for Search-and-Rescue (SAR). JANUS automatically discovers and reconfigures the network topology, providing broadband Wi-Fi connectivity to legacy terminals for local Command and Control. Each terminal, mobile or not, can communicate with any other terminal as if they all belonged to the same LAN, even if they are kilometres apart. Connections to the Internet can also be established if at least one JANUS box has Internet access, through Wi-Fi, 3G, WiMAX or other technology. Integration of drones is supported using the 802.11p wireless technology.

FUNCTIONALITIES
Broadband wireless coverage - JANUS in boats or buoys
Data exchange among equipment of different technologies
VoIP, video, and convey alarm information from sensors
Self configured network
Support for prioritised traffic and QoS
Remote management
Integration of drones - using the 802.11p wireless technology
JANUS GPS location - estimated position of network clients

MAIN FEATURES
Support for multi-hop and mobile mesh network mode (Wi-Fi)
Scales to large mesh networks (up to 7000 JANUS boxes)
Multiple link layer technologies: Wi-Fi, WiMAX, ZigBee, etc.
Stable Wi-Fi connection regardless of the Internet link used
Unnecessary network planning: dynamic auto-configuration
Fast deployment of broadband telecommunications networks

TECHNICAL SPECIFICATIONS
Dimensions: 26cm length, 23cm width, 8.8 cm height
Power: DC jack or passive POE, 7-20 V, 5-6 W
Supports renewable energy sources (e.g., solar panels)
Internal Batteries: 12 V, 7.2 Ah // Autonomy: ~10 hours
WRAP-BOX is rated NEMA-67 / IP67

COMPETE
PROGRAMA OPERACIONAL FACTORES DE COMPETITIVIDADE

QUADRO
DE REFERÊNCIA
ESTRATÉGICO
NACIONAL
PORTUGAL 2007.2013

UNIÃO EUROPEIA
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JANUS-OS

MULTI-TECHNOLOGY MESH ACCESS POINT FOR OFFSHORE FACILITIES

Network equipment capable of automatically interconnecting with other boxes to form a single large area mesh network. At the same time, it offers Wi-Fi connectivity to normal terminals. The terminals connected to a JANUS box may communicate with any other terminals, even if they are kilometres apart, as long as they are connected to this broadband network. Each JANUS box provides a set of interfaces to support the integration of different devices and technologies (e.g., GPS, sensors, BT, ZigBee, etc.) and it is capable of providing QoS.

FUNCTIONALITIES

Broadband network connecting off-shore infrastructures and mobile terminals (e.g., user terminals on boats)
Self configured network
Video, VoIP and data exchange among different equipments
Prioritised traffic and QoS – namely events/alarms
Support for data storage
Remote management
JANUS GPS location – estimated position of network clients

MAIN FEATURES

Support for multi-hop and mobile mesh network mode (Wi-Fi)
Scales to large mesh networks (up to 7000 JANUS boxes)
Multiple link layer technologies: Wi-Fi, WiMAX, ZigBee, etc.
Nodes/Clients connect to a normal Wi-Fi connection
Unnecessary network planning: dynamic auto-configuration

TECHNICAL SPECIFICATIONS

Dimensions: 26cm length, 23cm width, 8.8 cm height
Power: DC jack or passive POE, 7-20 V, 5-6 W
Supports renewable energy sources (e.g., solar panels)
Internal Batteries: 12 V, 7.2 Ah
Autonomy: ~10 hours
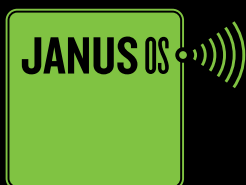WRAP-BOX is rated NEMA-67 / IP67

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CAMPUS DA FEUP
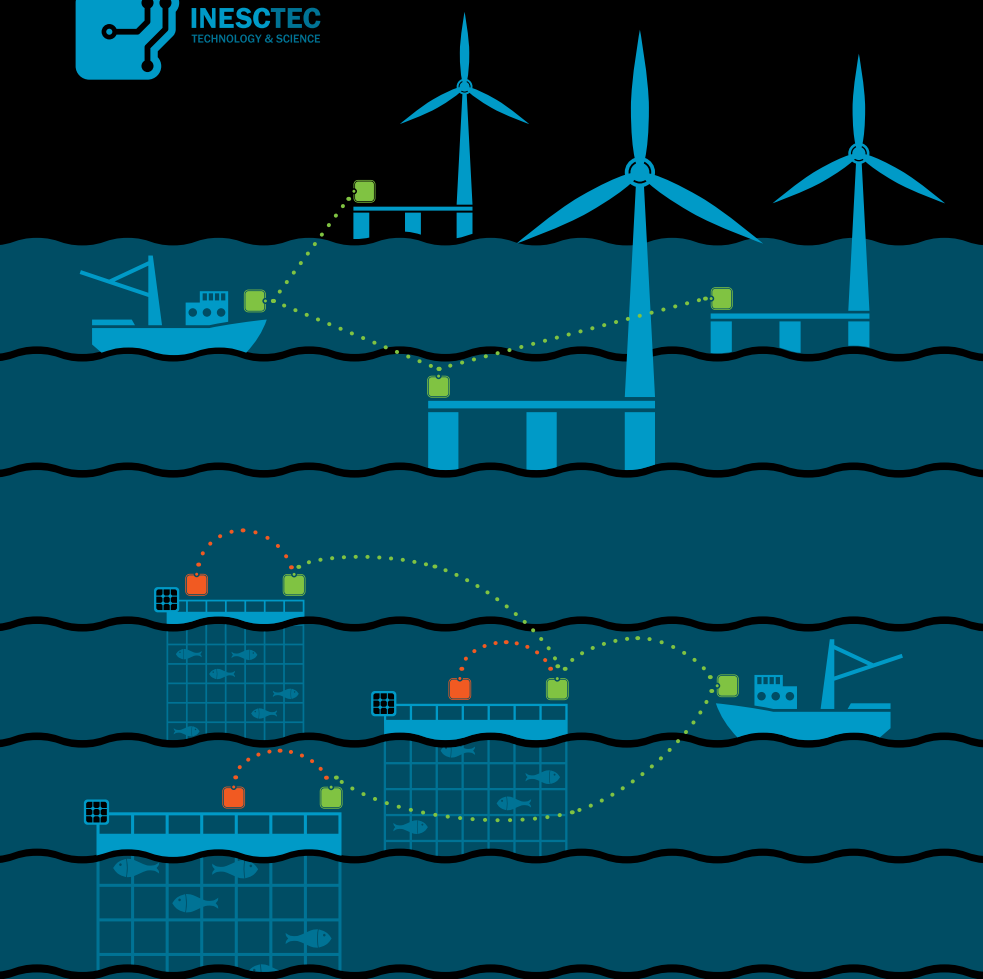R DR. ROBERTO FRIAS 378
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T +351 222 094 000
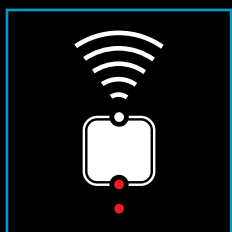F +351 222 094 050
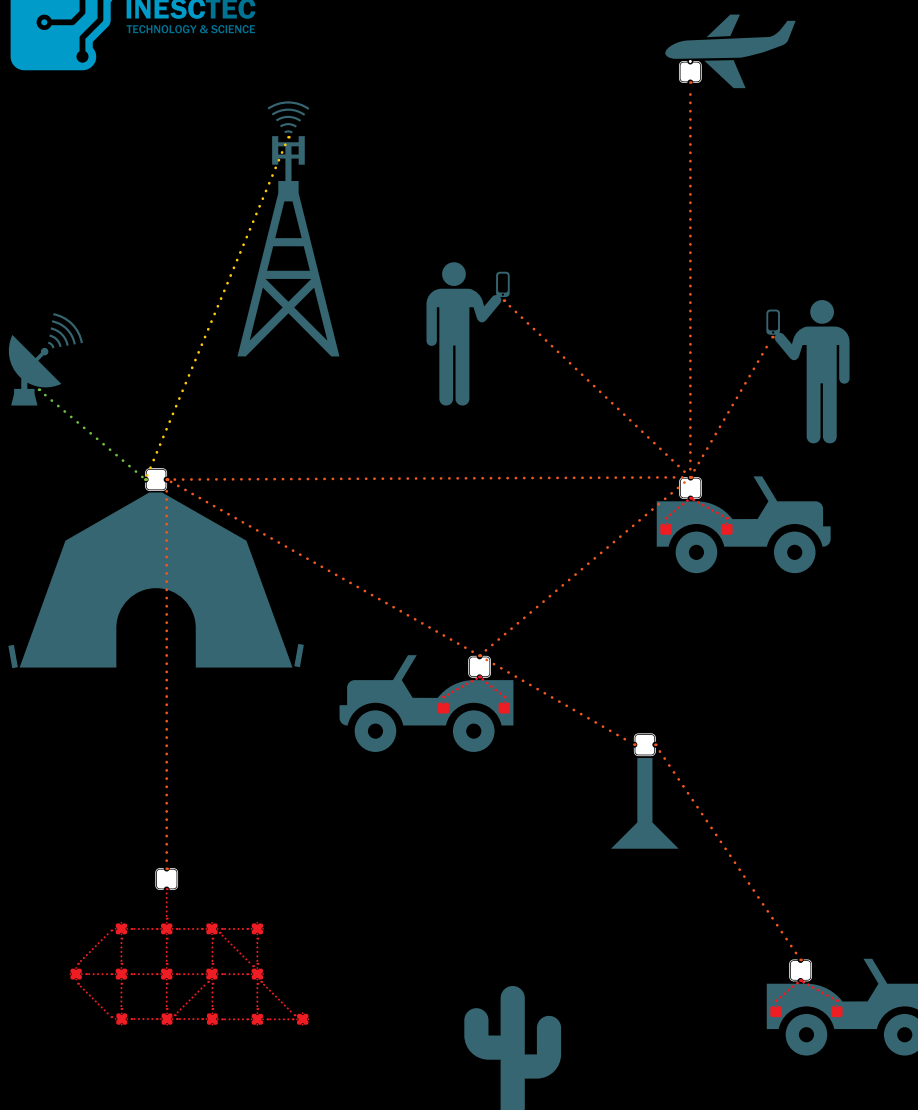www@inescporto.pt
www.inescporto.pt

COTTOS-D

MULTI-TECHNOLOGY EQUIPMENT FOR SECURE BROADBAND SELF-CONFIGURED MESH NETWORK

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COTTOS-D

MULTI-TECHNOLOGY EQUIPMENT FOR SECURE BROADBAND SELF-CONFIGURED MESH NETWORK

COTTOS-D is a versatile network equipment capable of automatically and dynamically interconnecting with other boxes to form a single, private and secure broadband mesh network covering a large area and supporting legacy terminals (Command and Control operations). Connections to out-side the private network can also be established if at least one box acts as a Gateway, using Satellite, 3G/4G or other technology. Integration of Sensors and Wireless Sensor Networks is possible. Drones may be supported by IEEE 802.11p.

FUNCTIONALITIES

Broadband wireless coverage in ad-hoc scenarios
Support for data exchange using different communications technologies
Secure, mobile and private communications
Support for VoIP, video and alarm information from sensors
Support for data storage
Self-configured network
Support for prioritised traffic and QoS
Remote management
Prepared for integration with renewable energy sources
Integration of drones supported by IEEE 802.11p
Data exchange among fast moving nodes using IEEE 802.11p
GPS positioning and estimation of the location of other terminals

MAIN FEATURES

Works in a multi-hop mesh network mode
Scales to large mesh networks (up to 7000 boxes)
Supports multiple link layer technologies, such as Wi-Fi, WiMax, Ethernet, ZigBee
Discovers and reconfigures the topology dynamically
Supports moving boxes and terminals
Works without a telecommunications infrastructure (such as in desert scenarios)

TECHNICAL SPECIFICATIONS

500 MHz AMD Geode, 256 MB RAM // Dimensions: 26cm length, 23cm width, 8.8cm height // Power: DC jack or passive POE, 7-20 V, 5-6 W // Supports renew-able energy sources (solar panels, for instance) // Internal Batteries: 12 // V, 7.2 Ah // Estimated autonomy: 10 hours // WRAP-BOX is rated NEMA-67 / IP67
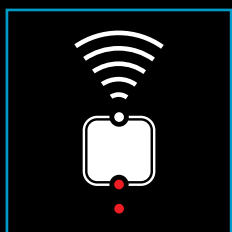
COTTOS-C

MULTI-TECHNOLOGY NETWORK EQUIPMENT FOR SECURE, MOBILE AND PRIVATE COMMUNICATIONS

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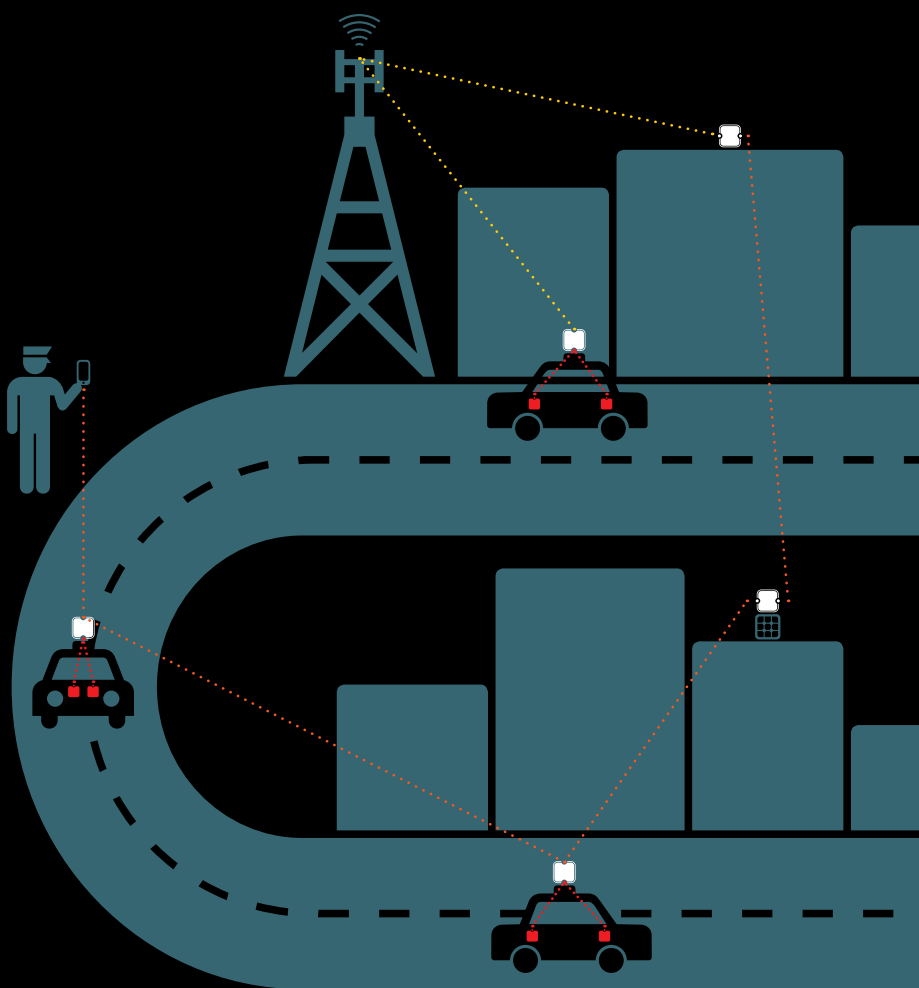
COTTOS-C

MULTI-TECHNOLOGY NETWORK EQUIPMENT FOR SECURE, MOBILE AND PRIVATE COMMUNICATIONS

COTTOS-C is a versatile network equipment capable of offering broadband wireless coverage, acting as a Gateway to an external network / Internet via multiple heterogeneous links, such as 3G/4G, WiMax and Wi-Fi connections. The box dynamically and transparently selects the best connection to the external network. COTTOS-C provides private and secure network connectivity for nodes belonging to the same entity (the police or the army, for example).

FUNCTIONALITIES
- Broadband wireless coverage in infrastructured scenarios
- Support for data exchange using different communication technologies
- Secure, mobile and private communications
- Support for VoIP, video and alarm information from sensors
- Support for data storage
- Self-configured network
- Support for prioritised traffic and QoS
- Remote management
- Integration of drones supported by IEEE 802.11p
- Data exchange among fast moving nodes using IEEE 802.11p
- GPS positioning and estimation of the location of other terminals

MAIN FEATURES
- Works in a multi-hop mesh network mode
- Scales to large networks (up to 7000 boxes)
- Supports multiple link layer technologies, such as Wi-Fi, WiMax, Ethernet, ZigBee
- Nodes/Clients benefit from a stable Wi-Fi connection, regardless of the chosen mesh connection link
- Discovers and reconfigures the topology dynamically
- Supports moving boxes and terminals (for instance, in cars)

TECHNICAL SPECIFICATIONS
- 500 MHz AMD Geode, 256 MB RAM
- Dimensions: 26cm length, 23cm width, 8.8cm height
- Power: DC jack or passive POE, 7-20 V, 5-6 W
- Supports renewable energy sources (for instance, solar panels)
- Internal Batteries: 12 V, 7.2 Ah; Estimated autonomy: 10 hours

BLUECOM+
BROADBAND
COST-EFFECTIVE
INTERNET ACCESS
AT REMOTE
OCEAN AREAS

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HELIKITE

WIND FARM

GPRS/UMTS/LTE
WI-FI

ASV

ROAZ II

BUOY

AUV

MARES
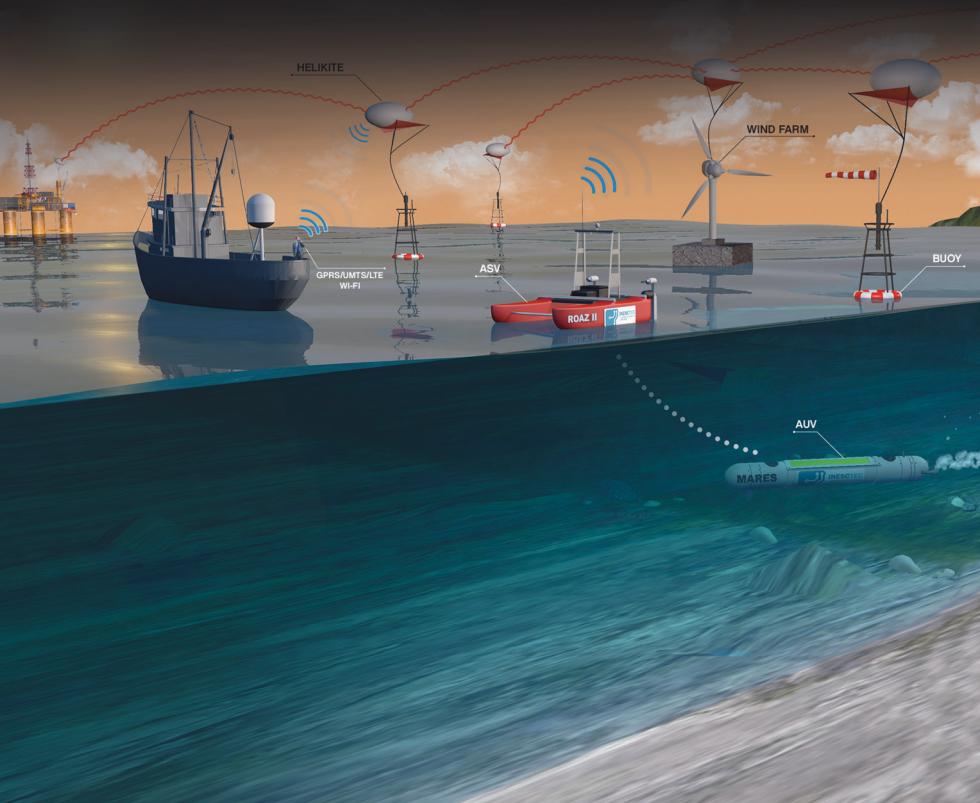
BLUECOM+
AN INNOVATIVE COMMUNICATIONS SOLUTION FOR INTERNET ACCESS AT REMOTE OCEAN AREAS

MOTIVATION

There is no communications solution enabling broadband, cost-effective Internet access at remote ocean areas in alternative to satellite communications.

GOAL

The goal is to develop an innovative communications solution that will enable broadband, affordable Internet access at remote ocean areas for regular devices using standard wireless access technologies, such as Wi-Fi and 4G. The project includes the specification, implementation and laboratory testing of the communication solution, to ultimately create a prototype that will enable broadband Internet access in remote ocean areas, beyond 100km from shore, in alternative to satellite communications.

TARGET GROUPS

THE TARGET GROUPS INCLUDE: MARITIME TRANSPORTATION; FISHERIES, AQUACULTURE AND FISHING INDUSTRY; SCIENTISTS AND RESEARCHERS; COASTAL AND MARINE WATER MANAGEMENT SYSTEM; MARINE BIOTECHNOLOGY, MARINE MINERAL AND ENERGY RESOURCES.

FUNDING

THIS PROJECT IS FUNDED BY NORWAY, ICELAND AND LIECHTENSTEIN THROUGH EEA GRANTS

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PORTUGAL

ICELAND
LIECHTENSTEIN
NORWAY
eea grants

GOVERNO DE PORTUGAL

dgp*m*
Direção-Geral de Política do Mar

VSAT
VERY SMALL APERTURE TERMINAL FOR SATELLITE COMMUNICATIONS

INESCTEC
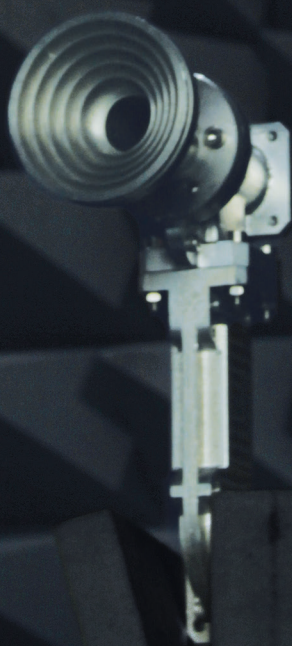
VSAT
VERY SMALL APERTURE TERMINAL FOR SATELLITE COMMUNICATIONS

A Very Small Aperture Terminal (VSAT) is a two-way satellite dish antenna, typically around 1 metre in diameter. VSAT can be used in both terrestrial ground stations and stabilised maritime antennas, providing data rates up to 4 Mbit/s from satellites in geosynchronous orbit.

This technology allows for simultaneous voice and data communication, including Internet connectivity. Therefore, this is a more practical alternative to terrestrial connectivity, especially when terrestrial networks are not available or reliable such as in remote areas.

INESC TEC specialises in designing and characterising waveguide devices for satellite applications, particularly for VSAT communications. The developed VSAT microwave configuration includes a feed, which illuminates the antenna dish, an orthomode transducer (OMT), necessary to isolate the transmitted and received signals, and a Transmit/Receive (TR) filter, which provides further isolation between the signals.

MAIN FEATURES
Ku band
Simple and affordable fabrication
Lightweight

SPECIFICATIONS
Receive Frequency: 10.7-12.75 GHz
Receive Return Loss: <-25 dB
Transmit Frequency: 13.75-14.5 GHz
Transmit Return Loss: <-26 dB
Transmit/Receive Isolation: >50 dB
Dimensions: 62mm x 172mm x 120mm
Feed radiation pattern: 40° (FWHM)
Total Weight: 400 g

COMPETE 2020
PORTUGAL 2020
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OPTOFLUIDIC DEVICES FOR MICROANALYSIS

HYBRID MICROFLUIDIC CHIP FOR SINGLE CELL DIAGNOSIS

INESC**TEC**
TECHNOLOGY & SCIENCE

OPTOFLUIDIC DEVICES FOR MICROANALYSIS
HYBRID MICROFLUIDIC CHIP FOR SINGLE CELL DIAGNOSIS

Miniaturisation and portability, increased automation, minimum reagent consumption, high throughput and reduced manufacturing costs are some of the strong motivations to develop microfluidic sensing platforms.

In this project, partners with complementary expertise (INESC TEC – Optoelectronics, CENIMAT – Material Science, ITQB – Biomolecular diagnosis) joined to develop a new optofluidic chip capable of performing optical and electrical characterisation of biological fluids and single cells.

The technology currently being developed makes it possible to perform multiple simultaneous measurements with extremely reduced sample volumes. As a result, this project guarantees an improved analytical diagnostic tool. In this particular project, the goal is to analyse red blood cells (RBC) simultaneously using impedance spectroscopy and refractive index measurements. The aim is to provide a way to differentiate infected and healthy cells more accurately. Nevertheless, the technology is versatile and will allow a diversity of analytical applications.

POTENTIAL APPLICATIONS

- **Security and defence**: high sensitivity detection of multiple chemical and biological threats using minimal sample amounts.
- **Biomolecular diagnosis**: single cell manipulation and diagnosis (infectious states, cancer).
- **Point of care analysis**: fast and sensitive multiparameter analysis of biological fluids (blood, urine).
- **Quality control**: spectroscopic and refractive index analysis of dye solutions and other fluids (chemical industry, food industry).

SNIFFER

NETWORK OF CHEMICAL AND PHYSICAL SENSORS FOR FOOD SUPPLY CHAIN SECURITY

INESCTEC
TECHNOLOGY & SCIENCE

SNIFFER
NETWORK OF CHEMICAL AND PHYSICAL SENSORS FOR FOOD SUPPLY CHAIN SECURITY

The aim with project SNIFFER is to design and develop a network of distributed devices capable of rapidly detecting on-site multiple kinds of agents and CBR agents which are highly sensitive and specific throughout the most vulnerable stages of the food supply chain (such as farms, large collection centres, wholesalers).

INESC Porto will be responsible for developing sensors based on chemical or physical interactions. These sensors can be used to develop Molecular Imprinted Polymers (MIPs), which are highly selective materials, as well as on Resistive Pulse Experiments using functionalised and non-functionalised nanostructures. Electrical and optical sensors will be developed, extending the applicability of the sensors from single point low-cost sensors to wide area sensor networks.

SNIFFER IS AN FP7 APPROVED PROJECT
IN WHICH THE FOLLOWING INSTITUTIONS PARTICIPATE
TEKEVER ASDS PT
Centro de Investigação da Academia Militar
/ **Laboratório de Bromatologia e de Defesa Biológica** PT
Umeå Universitet SE
Instituto de Engenharia de Sistemas e Computadores do Porto PT
Universidad de Burgos ES
Österreichischen Agentur für Gesundheit und Ernährungssicherheit GmbH AT
Centre Suisse d'Electronique et de Microtechnique CH
Forsvarets forskningsinstitutt NO

FP7-SE C-2012-1: Grant agreement 312411
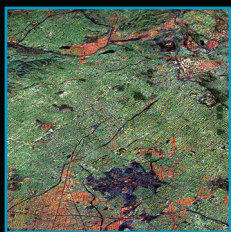
SEE THE UNSEEN
COMPRESSIVE SENSING BASED CAMERAS

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SEE THE UNSEEN
COMPRESSIVE SENSING
BASED CAMERAS

Compressive sensing is an exciting and novel area of research and development that combines concepts from diverse fields, such as mathematics, signal processing, electronics, or optimization.

A camera with a single pixel is perhaps the most representative example of the breakthroughs provided by such technology. For certain scenarios, these cameras may constitute the most attractive solution or even the only available solution.

INESC TEC has recently developed a prototype of a hyperspectral single-pixel camera with a 10 pm spectral resolution, which represents an improvement of two orders of magnitude relatively to the best systems available on the market.

APPLICATIONS

- **Security and defence**: detection of chemical species related with chemical and biological attacks, ability to see through foliage, night vision (InfraRed), Ultra-Violet imaging, Millimeter-Wave imaging, TeraHertz imaging.
- **Quality control**: spectroscopic imaging (detecting contaminations, lesions, defects in agro-food industries), determining the ripeness state and quality of fruits and vegetables.
- **LIDAR imaging**: aerial 3D imaging, unmanned navigation of vehicles.
- **Data encryption/security**: as the measurements depend on a random process, data will resemble noise for a receiver that does not know the originating seed.
- **Pharmaceutics**: detecting and quantifying compounds to uncover counterfeit medication, for example.
- **Remote sensing** ○ **Macro level**: classification of territorial areas (e.g. water, forest, sand);
  ○ **Local level**: mineralogical classification of the terrain (quarry, mining and oil industries).

PARTNERS

ESA EUROPEAN SPACE AGENCY
UM UNIVERSITY OF MINHO (PT)
UNCC UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE (USA)

By now, we believe you are comfortable to say that INESC TEC can be your perfect partner when it comes to developing high-tech imaging systems.

AQUAMONITOR
SENSORS FOR WATER QUALITY MONITORING IN INTENSIVE AQUACULTURE

INESCTEC
TECHNOLOGY & SCIENCE

AQUAMONITOR
SENSORS FOR WATER QUALITY MONITORING IN INTENSIVE AQUACULTURE

INESC TEC is leading a consortium – which includes CIMAR – Centro Interdisciplinar de Investigação Marinha e Ambiental – , the CIQ FCUP – Centro de Investigação em Química at the University of Porto, and the University of Pécs in Hungary – created to develop new sensors for real time water quality monitoring in hyper intensive aquaculture systems. In systems of stackable shallow raceway tanks with water recirculation there are more fish present in less water. Therefore, it is necessary to accurately and constantly monitor parameters, including dissolved CO_2 and O_2, pH, nitrates and phosphates.

Currently used tools do not respond to the industry's needs. However, these types of tools are critical to reducing the investment risk and to increasing fish production and welfare. In order to make these tools capable of responding to these needs, they should be equipped with more effective optical sensors. New optical sensors are being developed by the consortium for this purpose.

In this project, optical fibre interferometric platforms are being combined with sensitive polymeric membranes to enable the detection of different analyte concentrations with the same instruments. The target analyte in the project is dissolved CO_2 but the technology will evolve towards the detection of multiple parameters to determine water quality.
Developed in 2 years (2011-2012)

MAIN FEATURES
Electromagnetic immunity
Based on standard telecom optoelectronics
Miniaturisation and versatility
Multipoint multiparameter detection
High sensitivity
Real time remote operation
Adaptable for different applications

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COMPETE
PROGRAMA OPERACIONAL FACTORES DE COMPETITIVIDADE

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PROTEU
ADVANCED OPTICAL SENSOR FOR MONITORING ESTUARINE AND COASTAL ENVIRONMENTS

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TECHNOLOGY & SCIENCE

PROTEU

ADVANCED OPTICAL SENSOR FOR MONITORING ESTUARINE AND COASTAL ENVIRONMENTS

INESC Porto has developed technology to monitor temperature and salinity in coastal environments using an innovative fully integrated monitoring infrastructure based on optical fibre. As part of the research project PROTEU, an 11 km optical fibre cable, with Bragg sensors placed every 500 meters, was installed that runs from the mouth of the Ria de Aveiro and follows the Espinheiro channel bed to the Vouga river. This made it possible to measure the water temperature at each sensor location in real-time. The results of this project are currently being used in several studies concerning the Ria de Aveiro and the surrounding area and are crucial for continuous environmental assessment and management.

This technology is now being explored further and will be able to measure salinity and other chemical and biological parameters (dissolved CO_2, cyanobacteria) making it an advanced analytical tool for the monitoring and study of marine conditions in estuarine environments.
Developed in 2004

MAIN FEATURES

Electromagnetic immunity
Based on standard telecom optoelectronics
Multipoint detection
High sensitivity
Real-time remote operation
Quasi distributed sensing
Adaptable for the detection of other environmental parameters

SPECIFICATIONS

11 km Optical fibre cable (TON GERE from CABELTE S.A.) with three SMF 28® optical fibres with19 Fibre Bragg grating temperature sensors distributed every 500 m. Cable anchored to the river bed with concrete structures placed every 500 m in the vicinity of the sensors.
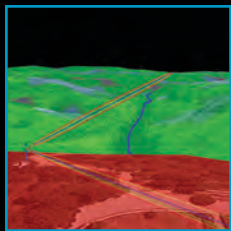
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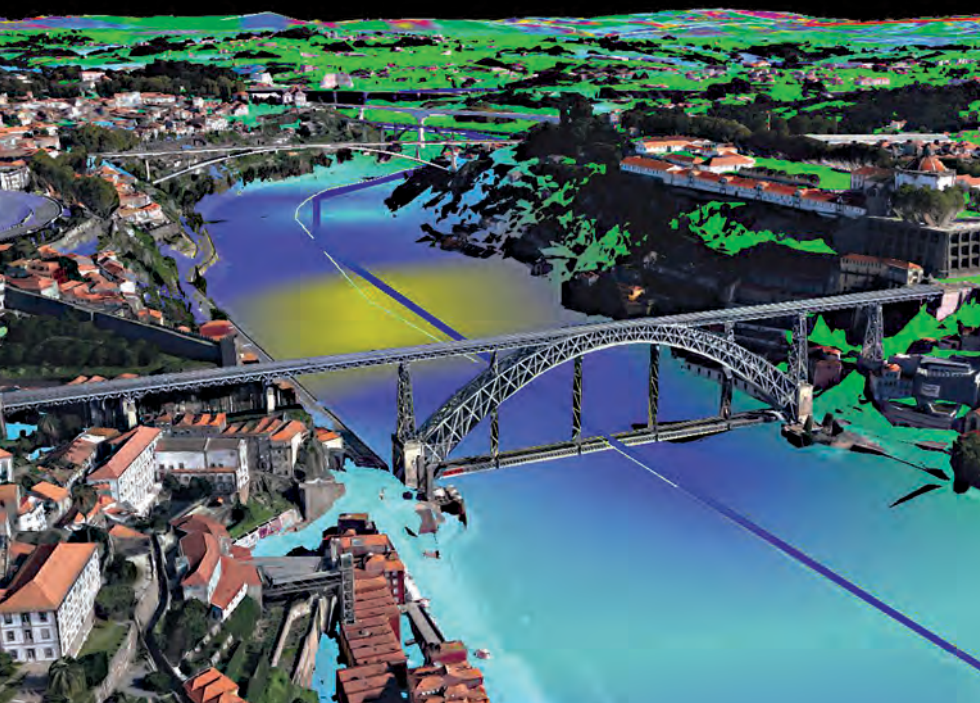F +351 222 094 050
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www.inesctec.pt

DRIW2020
DOURO RIVER
INLAND WATERWAY

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DRIW2020
DOURO RIVER INLAND WATERWAY

AIM

This project aims to upgrade Douro's waterway navigability, assuring an effective cross border link with the "Atlantic Core Network Corridor", through the implementation of River Information Services (RIS), according to Directive 2005/44/EC, such as fairway information, traffic information, traffic management, calamity abatement support, information for transport logistics, law enforcement information, statistics and waterway charges and harbor dues.

The resulting RIS are integrated and supported by APDL's information systems architecture, composed by applications such as JUP (Port Single Window), LSW (Logistics Single Window), 3PORT (GIS) and SAP (Corporate ERP).

INESC TEC MAIN CONTRIBUTION

INESC TEC was contracted by APDL to act as prime contractor, technically coordinating a team of experts who studied RIS implementation, addressing issues like: marine VHF coverage, Automatic Identification System (AIS) provisioning, Differential Global Positioning System (DGPS) signal availability, wide area network data communications, Closed Circuit TV (CCTV), Aids to Navigation (AtoN), meteorology and hydrology sensors, Control Centers design and operation, remote site design, remote site location planning, systems integration, IT security and risk analysis and, finally, evaluation of waterway telecommunications coverage (digital terrestrial TV, mobile networks and emergency network).

Several results were obtained: preliminary studies addressing RIS in Douro's Inland Waterway, two funding submissions addressing its implementation (which were approved), technical specifications for procurement and for required permits and licenses.

START DATE SEPTEMBER 2014
END DATE SEPTEMBER 2015

CLIENT
APDL - Administração dos Portos do Douro, Leixões e Viana do Castelo, S.A.

PARTNERS
DUFINAV, SIGNALRAD, Eng. Gil Coutinho, PBS, SEGURTI, WAVECOM e DOURO AZUL.

FUNDING
This project was co-funded by the European Union/ CEF - Connecting Europe Facility Programme.

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COMPETE 2020   PORTUGAL 2020   UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional   FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

WIDERMOS
WIDE INTEROPERABILITY
AND NEW GOVERNANCE
MODELS FOR FREIGHT
EXCHANGE LINKING REGIONS
THROUGH MULTIMODAL
MARITIME BASED CORRIDORS

INESCTEC
TECHNOLOGY & SCIENCE

WIDERMOS

WIDE INTEROPERABILITY AND NEW GOVERNANCE MODELS FOR FREIGHT EXCHANGE LINKING REGIONS THROUGHMULTIMODAL MARITIME BASED CORRIDORS

AIM

The project aims at facilitating the homogeneous connection between Motorways of the Sea and the TEN-T core network corridors throughout several activities highlighting an IT Corridor Management Platform acting as a Logistic Single Window (LSW). The LSW acts as a network of interoperating platforms, for the integration of sea - based transport services in the logistic chain, considering all types of freight operations, in order to allow a seamless shipment management and communication between all the actors of the supply chain.

INESC TEC MAIN CONTRIBUTION

INESC TEC was responsible for defining the conceptual model, as well as for identifying business scenarios and requirements. Moreover, INESC TEC developed the reference implementation of the interoperable platform for the Logistic Single Window.

START DATE DECEMBER 2014
END DATE DECEMBER 2015

PARTNERS
LA SPEZIA PORT AUTHORITY // LA SPEZIA CONTAINER TERMINAL // INTERPORTOPADOVA CIRCLE // AGENZIA DELLE DOGANE // UNIVERSITÀ DEGLI STUDI DI GENOVA // REGIONE LIGURIA CIMNE // INSTITUTO TECNOLOGICO DE ARAGÓN // CORPORACIÓN MARÍTIMA // A.S.T.A. LOGISTIK PORT OF KIEL // PORT OF ROSTOK // KOMBIVERKEHR // APDL // SOGEMAR

FUNDING
THE PROJECT WAS CO-FINANCED BY THE EUROPEAN UNION//TRANS-EUROPEAN

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COMPETE 2020   PORTUGAL 2020   UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional   FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

3PORT

GEOREFERENCED
MANAGEMENT SYSTEM
FOR PORT BUSINESS
PROCESSES SOFTWARE
LABORATORY

INESCTEC
TECHNOLOGY & SCIENCE

3PORT

...

PCS

AIS

GD

ERP

3PORT

The goal with this project was to develop a state of the art tool for the technical services of Port Authorities that would help them manage and support Port Authority business processes in four major areas: Asset management, Monitoring and maintenance of maritime and land based infrastructures, Navigation safety procedures and Environmental regulation compliance.

GOALS The idea was to create a system that was fully aligned with the business process of the Port Authority so that the system adapts to the processes and not the other way around, a common problem in other solutions. The system was also developed to be an interoperability enabler, providing easy access to information in a georeferenced, integrated and consolidated way, interconnecting strategic areas.

THE MODULES The 3Port is based on eight modules, seven of which are used by the Port – Hydrography (dredging and navigable areas), Port traffic, Domain Management (licenses and concessions), Studies and Construction Work, Security, Environment, Assets Management –, and Live Map used by the general public.

LEADING PARTNER The leading partner was TRIEDE TTI, a company with more than 10 years of experience in the development of Environmental Management and Port Systems. TRIEDE TTI promoted the project and is now commercialising the solution focusing on the Community of Portuguese-Speaking Countries (CPLP) and Latin America.

INESCTEC MAIN CONTRIBUTION INESC TEC was the innovation partner and the booster of the technology transfer triangle. This technology transfer triangle was composed of INESC TEC (producer of the innovation), TRIEDE TTI (producer of the solution, integrating the innovation) and APDL (user of the solution and the one identifying the requirements).

Services provided by INESC TEC were crucial to ensure the integration of state of the art technologies and their alignment with Port Authority business processes. The final result was an innovative solution that will increase TRIEDE TTI's market competitiveness and already made Leixões and Viana do Castelo Ports some of the most innovative worldwide in terms of R&D.

SCOPe
ELECTRONIC PORT COMMUNITY SYSTEM

INESCTEC
TECHNOLOGY & SCIENCE

ACSU 200329 ⑧
22G1

37

MAX.GR. 30.480 KGS
67.200 LBS
TARE 2.185 KGS
4.820 LBS
NET 28.295 KGS
62.380 LBS

CU.CAP 33.2 CU.M.
1.173 CU.FT

SCOPe
ELECTRONIC PORT COMMUNITY SYSTEM

AIM

The project aim was to design and implement an integrated organisational model to manage the processes related to electronic data transfer regarding cargo passing through the Leixões Seaport for the two main business documents: Bill of Lading & Cargo Manifest.

ACTORS

Globally, all Port Community Actors (Port Authority, Customs Administration, Forwarders, Shipping Agents, Customs Agents, Shipping Lines, Original Shippers, Consignors & Consignees and also Software Houses) were involved in this project.

GOALS

The main goal was the conceptual development and validation of a system which needed to be open, critical, inter-operative with heterogeneous environments, flexible, scalable and compatible with UN /CEFACT standards.

The system was also developed to solve the limitations detected in existing solutions, namely intrinsic quality certification, intelligent process monitoring, actor performance measurement and added-value services, such as compensation and certification. This was the innovative domain of this project, with its focus on process innovation (associated to Bill of Lading and Cargo Manifest), enabling product innovation (through associated supporting software applications) and promoting sector modernisation.

START DATE OCTOBER 2002 **END DATE** JULY 2005 **BUDGET** ~3 M€

PARTNERS APDL // ALFÂNDEGA // INESC PORTO // AGEPOR (ASSOCIAÇÃO DOS AGENTES DE NAVEGAÇÃO) // APAT (ASSOCIAÇÃO DOS TRANSITÁRIOS DE PORTUGAL) // TCL // TCGL // BURMESTER // E A MOREIRA // EURONAVE // IBERO LINHAS // NAVEX // GARLAND // SOFRENA // PINTO BASTO // DAVID JOSÉ DE PINHO // PORTOCARGO // RANGEL // TREVOMAR // LAROZE // NASCIMAR // INTERMESUM // SOPORCEL // APIE // ATLANTA // MAEIL // FCR // IBS

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COMPETE
PROGRAMA OPERACIONAL FACTORES DE COMPETITIVIDADE

QUADRO DE REFERÊNCIA ESTRATÉGICO NACIONAL
PORTUGAL 2007.2013

UNIÃO EUROPEIA
Fundo Europeu de Desenvolvimento Regional

FCT
Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

RAIA

IBERIAN COAST OCEANOGRAPHIC OBSERVATORY

INESC TEC
TECHNOLOGY & SCIENCE

Cortegada

Villagarcia

Ons

Vigo

Rande

Cabo Silleiro

Cies IIM

Cies

A Guarda

Viana do Castelo

Leixões

Leixões

Douro
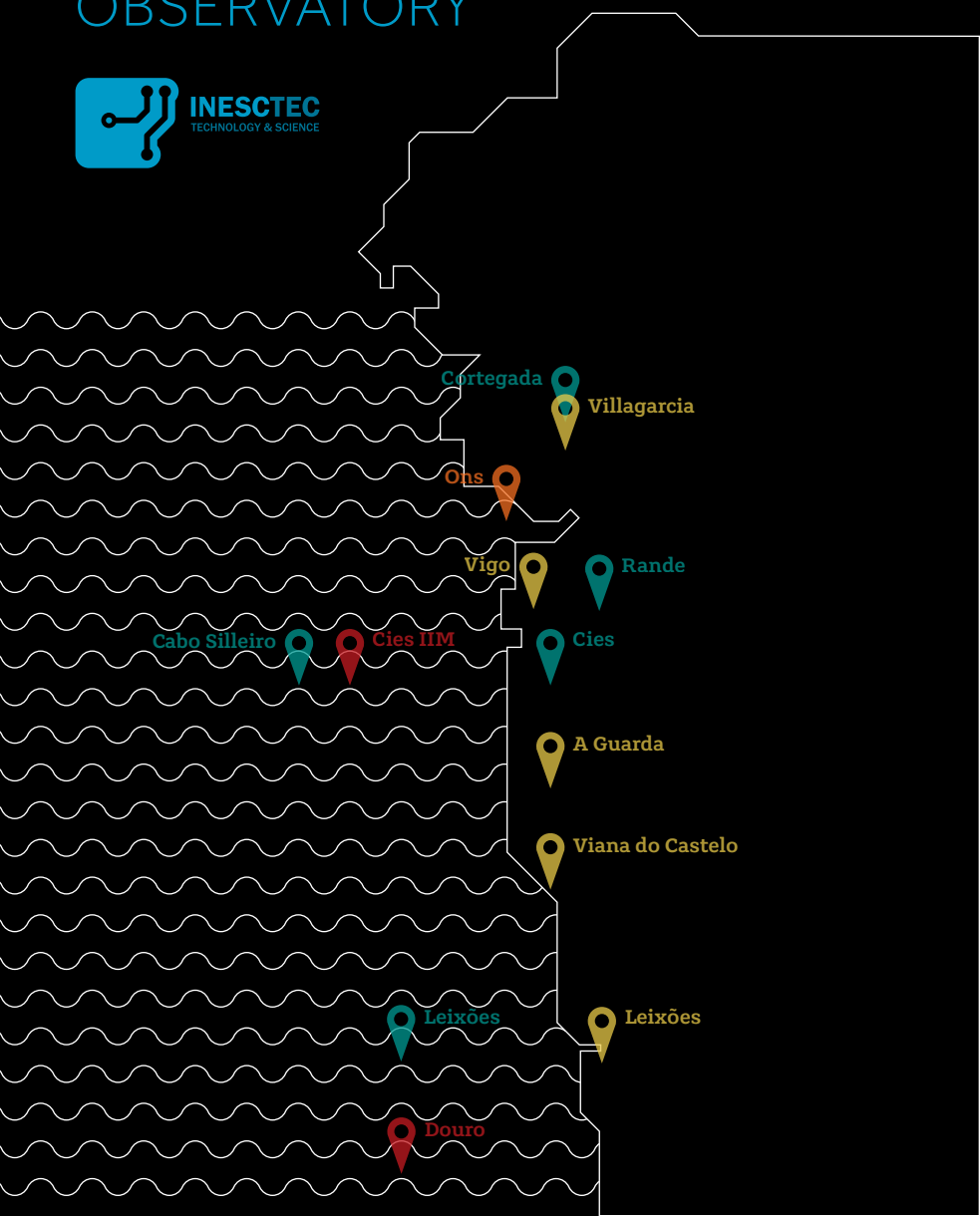
RAIA
IBERIAN COAST OCEANOGRAPHIC OBSERVATORY

AIM

Implementation of a cross-border oceanic observation network to consolidate operational oceanography in the iberian coast and to create new scientific and technological opportunities that would foster the sea economy.

INESC TEC MAIN CONTRIBUTION

Creation of a distributed data services infrastructure, enabling a sensor geographic network for planning and decision support. This data infrastructure uses international standards (ISO19100, OGC) and best practices, and complies with the INSPIRE EC Directive.

START DATE JANUARY 2009
END DATE DECEMBER 2011
BUDGET ~2.5 M€

PARTNERS
METEOGALICIA // INTECMAR // IEO // CSIC-IIM
CETMAR // UNIV. VIGO // CIIMAR // INEGI
FEUP // IH // UNIV. AVEIRO // FCUP

FUNDING
INTERREG IV-A
(NORTE DE PORTUGAL - GALICIA)

BEACONING
BREAKING EDUCATIONAL BARRIERS WITH CONTEXTUALISED, PERVASIVE AND GAMEFUL LEARNING

INESCTEC
TECHNOLOGY & SCIENCE

BEACONING

OVERVIEW

BEACONING sets a forefront in multifaceted education technologies through large-scale piloting of a digital learning platform that blends physical and digital spaces. The BEACONING platform will be a ubiquitous solution that exploits advances in user experience design, mobile communication, location-based and context aware systems, procedural content generation, pedagogy-driven gamification, learning analytics, and cloud technology though innovative integration towards a blended learning space. The BEACONING demonstrator will facilitate, assess and author gamified learning activities, integrating existing educational tools and services of the participating organisations. Large-scale pilots will validate and inform the development of the BEACONING ecosystem that democratises learning across and among fully abled and those with mild to moderate physical and mental impairments (age 15 to 24), undergoing general and vocational training. BEACONING anticipates the benefits of making cross-subject matter more understandable, fostering the application of subject specialism to other domains.

GOALS

1. To integrate technologies, pedagogical and social perspectives of using pervasive, context-aware, and gamified approaches.
2. To develop, implement, and validate the BEACONING platform.
3. To explore and measure the level of engagement, effectiveness, and impact that is enabled by BEACONING platform.

TECHNOLOGY APPLICATION

The project will exploit pervasive, gamified, and context aware technologies to support "anytime anywhere" learning, extending the learning context and experience from the classroom settings to the outdoors and personal spaces. Partners are bringing in expertise and technologies, which will be integrated to provide an infrastructure for pervasive play-learn.

START DATE JANUARY 2016
END DATE DECEMBER 2018

PARTNERS

Coventry University, United Kingdom (Coordinator); Herriot-Watt University, United Kingdom; BIBA Institute, Germany; INESC TEC, Portugal; UCM, Spain; ORT, France; SUCCUBUS, France; ATS, Romania; IMAGINARY, Italy; GEOMOTION, Spain; IFINITY, Poland; PLAYSOFT, France; SEBIT, Turkey; Hands-Free, United Kingdom; SIVECO, Romania.
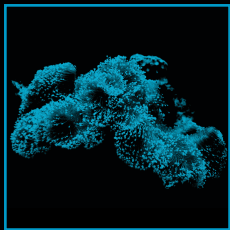
FUNDING

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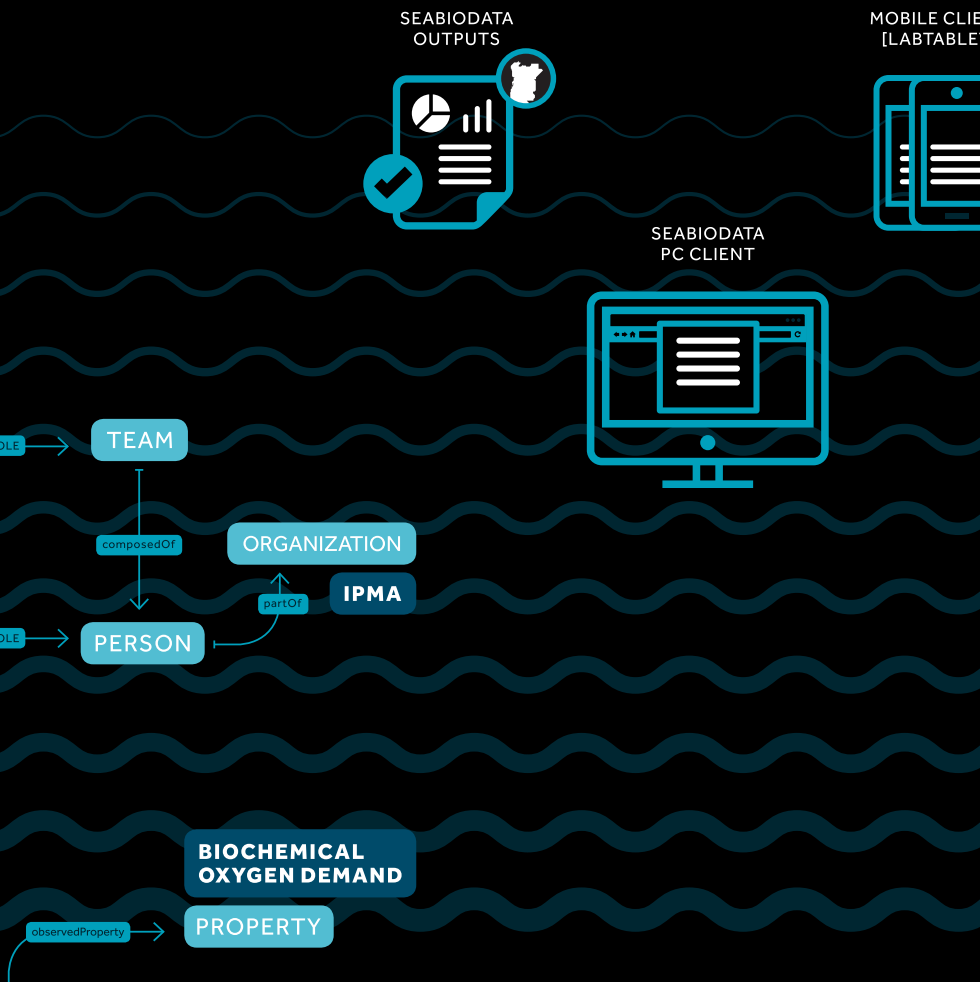F +351 222 094 050
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COMPETE 2020

PORTUGAL 2020

UNIÃO EUROPEIA
Fundo Europeu de
Desenvolvimento Regional

FCT Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

SeaBioData
PORTUGUESE SEAMOUNTS BIODIVERSITY DATA MANAGEMENT

INESCTEC
TECHNOLOGY & SCIENCE

SEABIODATA
OUTPUTS

MOBILE CLIE
[LABTABLET

SEABIODATA
PC CLIENT

ROLE → TEAM

composedOf

ORGANIZATION

partOf → IPMA

ROLE → PERSON

BIOCHEMICAL
OXYGEN DEMAND

observedProperty → PROPERTY

SeaBioData
PORTUGUESE SEAMOUNTS BIODIVERSITY DATA MANAGEMENT

AIM

Development of an adequate technological framework for the effective and efficient monitoring of particular ecosystems such as seamounts, providing adequate and timely information to stakeholders. Thus contributing for the establishment of the Good Environmental Status (GES), the monitoring of resources and the promotion and preservation of Portuguese marine environment and their biodiversity.

INESC TEC MAIN CONTRIBUTION

Conception and development of an adequate technological framework to ensure that the biological material and associated information, collected in the project BIOMETORE (EEAGrants, PT02_Aviso2_0001) about the biodiversity of seamounts and their ecosystems, namely in the Madeira-Tore and Great Meteor, is compiled and fully accessible. The system will ensure the integration, organization and long-term preservation of relevant data for marine information systems, enabling prompt and uniform data access to researchers at a local and national level.

Seabiodata (EEAGrants, PT02_Aviso5_0002) will provide new means to store and access original datasets and a set of interoperable services to disseminate observation data, thus providing baseline information for sustainable management of the Portuguese marine environment, as well as to the development of the marine strategies for the continuous assessment and maintenance of the good environmental status (GES).

START DATE JULY 2015
END DATE APRIL 2017
BUDGET 229K€

PARTNERS
IPMA – INSTITUTO PORTUGUÊS DO MAR E DA ATMOSFERA (PORTUGAL)
IMR – INSTITUTE OF MARINE RESEARCH (NORWAY), AS CONSULTANT

FUNDING
SEABIODATA WAS CO-FINANCED BY EEA GRANTS, EUROPEAN ECONOMIC AREA FINANCIAL MECHANISM, JOINTLY FINANCED BY ICELAND, LIECHTENSTEIN AND NORWAY
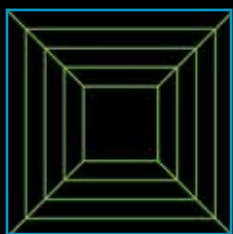
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COMPETE 2020
PORTUGAL 2020
UNIÃO EUROPEIA
Fundo Europeu de Desenvolvimento Regional
FCT Fundação para a Ciência e a Tecnologia
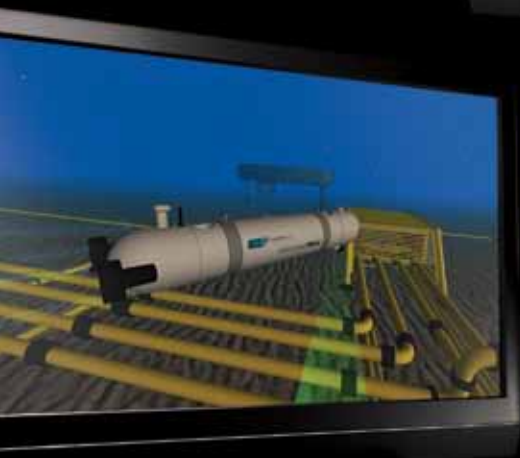MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

SERIOUS GAMES AND VISUAL SIMULATORS

SPECIFICATION AND DEVELOPMENT OF SOLUTIONS FOR EDUCATION, TRAINING AND CERTIFICATION

INESCTEC
TECHNOLOGY & SCIENCE

SERIOUS GAMES AND VISUAL SIMULATORS

SPECIFICATION AND DEVELOPMENT OF SOLUTIONS
FOR EDUCATION, TRAINING AND CERTIFICATION

DESCRIPTION

Specification and development of Serious Games applications and Visual Simulators for Education, Training and Certification, based on 3D virtual environments controlled by rule engines and enabling multiplayer interaction.

ADVANTAGES

- Reduces training and certification costs
- Avoids interaction with costly equipment in early training/certification phases
- Allows the simulation of complex or hazardous situations
- Enables flexible and remote training/certification
- Allows more training hours per trainee
- Increases the interest, the engagement and, therefore, the success of participants

MAIN FEATURES

- 3D virtual environments
- Rule-based engine
- Multiplayer
- Web technologies, enabling remote use

EXAMPLES

- F-16 aircraft engine maintenance simulator for teams
- Sea search and rescue AUV (Autonomous Underwater Vehicle) simulator
- Car driving simulator

POTENTIAL USERS

- Armed Forces
- Civil Protection
- Flight Schools
- Aircraft Maintenance Companies
- Aircraft Industry

SOFTWARE VERIFICATION AND VALIDATION

SOFTWARE VERIFICATION AND VALIDATION FOR THE SOFTWARE INDUSTRY

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SOFTWARE VERIFICATION AND VALIDATION

SOFTWARE VERIFICATION AND VALIDATION FOR THE SOFTWARE INDUSTRY

ACTIVITIES

Model-based testing (automatic test generation from formal models and UML models for API and GUI testing)

Verification & validation process improvement

Software model checking

Static analysis and contract-based verification

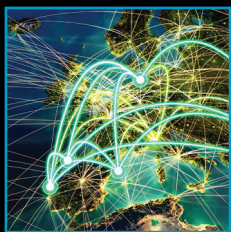### SERVICES

V&V consulting
Test automation

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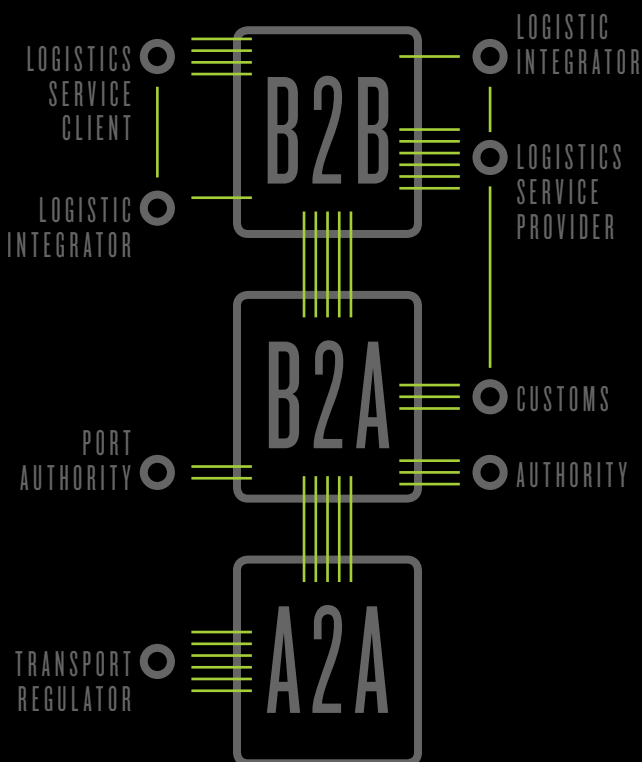R DR. ROBERTO FRIAS 378
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MIELE

MULTIMODAL INTEROPERABILITY E-SERVICES FOR LOGISTICS AND ENVIRONMENT SUSTAINABILITY

INESCTEC
TECHNOLOGY & SCIENCE

LOGISTICS SERVICE CLIENT

LOGISTIC INTEGRATOR

B2B

LOGISTIC INTEGRATOR

LOGISTICS SERVICE PROVIDER

B2A

PORT AUTHORITY

CUSTOMS

AUTHORITY

A2A

TRANSPORT REGULATOR

MIELE
MULTIMODAL INTEROPERABILITY E-SERVICES FOR LOGISTICS AND ENVIRONMENT SUSTAINABILITY

AIM

The goal was to implement a Logistic Single Window as a network of inter-operating platforms, built by different organisations and commercial realities, capable of providing clients with integrated Door-to-Door logistic services with Business-to-Business and Business-to-Administration integrations.

INESC TEC MAIN CONTRIBUTION

INESC TEC was responsible for defining the conceptual model, as well as for identifying business scenarios and requirements. Moreover, INESC TEC created an interoperable platform for the Logistic Single Window and a Mobile Application for transport operators to manage Bookings and Status reports. The systems are supported by the ECoNet – Enterprise Collaborative Network concept and by the GS1 Access Points in order to comply with the new GS1 messages.

START DATE SEPTEMBER 2010
END DATE DECEMBER 2013
BUDGET ~16 M€

PARTNERS
RINA // ITALIAN MINISTRY OF TRANSPORT // GRIMALDI // TSG // IB // CAP
CYPRUS PORT AUTHORITY // JACOBS UNIVERSITY // SIGNALIS // DBH LOG
PORT AUTHORITY OF GIJÓN // CIMNE // COMPASS // PLAZA
IPTM // APL // APDL

FUNDING
THE PROJECT WAS CO-FINANCED BY
THE EUROPEAN UNION // TRANS-EUROPEAN TRANSPORT NETWORK (TEN-T)

ADVANCED PLANNING AND SCHEDULING SYSTEMS

INESC**TEC**
TECHNOLOGY & SCIENCE
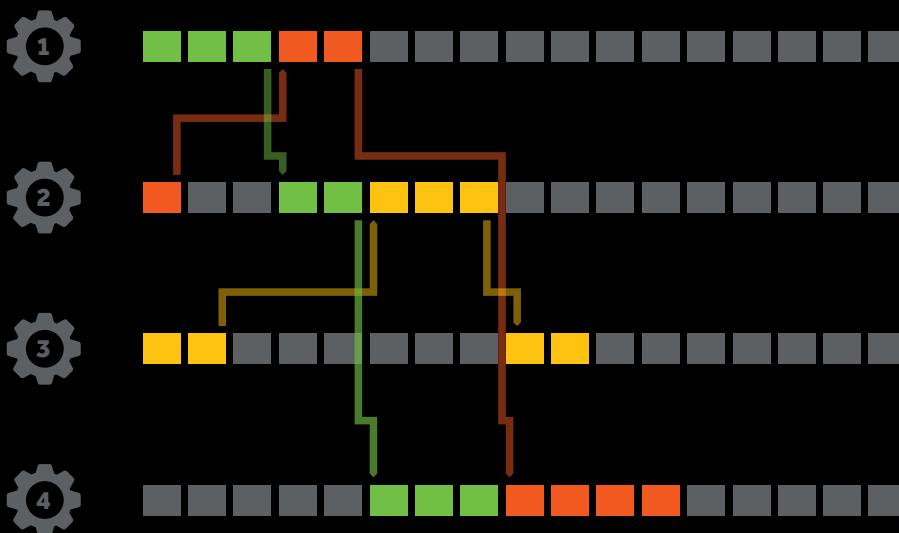
ADVANCED PLANNING AND SCHEDULING SYSTEMS

In a globalised world manufacturing organisations seek to improve their competitive position by increasing operational performance. Production planning and operations scheduling are crucial to this end, representing today one of the most challenging tasks to managers. Furthermore, planners are struggling with the increasing complexity of production processes and with the lack of support planning tools that consider constraints and specific features of real world problems.

INESC TEC has a large experience in designing and developing innovative tools to optimise production planning and operations scheduling, thus contributing to reduce the gap between the practical needs of real production planning and commercially available solutions which are in general very strict and hard to use.

INESC TEC has designed and developed an optimisation engine that can be integrated with standard ERP or scheduling systems to enhance the global quality of schedules. This engine uses state-of-the-art, multi-criteria optimisation procedures and leads to considerable gains in productivity. Criteria such as reduction of delays or increase in resource utilisation can be considered at the same time, by using these procedures.

The benefits of this approach are even more evident in scenarios with a large number of production orders, different types of resources, complex product structures, or bottlenecks. Moreover, in a context where multiple criteria are taken into account, planners are involved in the process and they interact with the system to choose one of the multiple generated scheduling solutions (which correspond to different trade-offs between objectives).

Each solution is shown in a Gantt chart, allowing the planner to assess the quality of the schedule under analysis, in a multiple perspective way.

CUTTING
AND PACKING
OPTIMISATION

INESCTEC
TECHNOLOGY & SCIENCE

CUTTING AND PACKING OPTIMISATION

Cutting and packing problems are at the core of many manufacturing networks and logistic systems. These are complex combinatorial optimisation problems, with a strong economic and environmental impact.

These problems arise in the context of several real-world applications, both in industry and services, whenever one or more large objects or container spaces have to be divided into smaller items in order to minimise waste. Examples include cutting paper rolls into narrower rolls in the paper industry, cutting large boards of wood into smaller rectangular panels in the furniture industry, cutting irregularly shaped components of garments from fabric rolls, and also packing boxes into containers or loading items on pallets in logistics applications.

INESC TEC has a large experience in designing and developing innovative solutions to optimise the cutting of 1D, 2D and 3D figures. This includes, for example, optimising the use of raw materials or truck loading. Industrial solutions have been developed for the textile, paper, wood and metalworking industries.

For the container-loading problem, a set of boxes must be packed inside a container, maximising the use of space. In some cases, some arrangements of boxes will not be loadable as there may not be a sequence to load them in the right positions. Moreover, other arrangements can be unstable during the loading process or during the transportation process. Constraints for each cargo unit (such as this side up or maximum bearing weight) must also be taken into account.

INESC TEC has created new algorithms that generate balanced solutions, considering objectives such as space utilisation, and cargo and worker safety.

The practical impact of these results in the performance of certain industrial sectors can be significant as the use of raw materials and product packing will be optimised, and waste will be reduced.
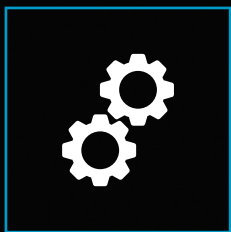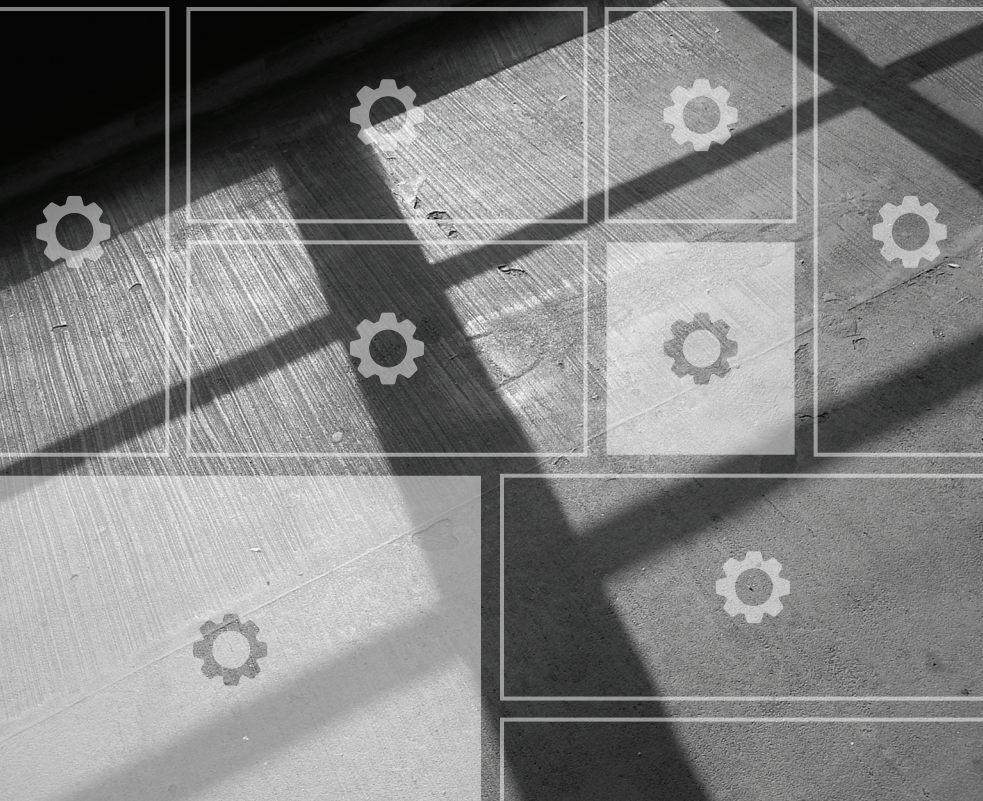
PRODUCTION SYSTEMS ENGINEERING

CONSULTING SERVICES TO SUPPORT PRODUCTION SYSTEMS DESIGN, ANALYSIS AND IMPLEMENTATION

INESCTEC
TECHNOLOGY & SCIENCE

PRODUCTION SYSTEMS ENGINEERING

CONSULTING SERVICES TO SUPPORT PRODUCTION SYSTEMS DESIGN, ANALYSIS AND IMPLEMENTATION

INESC TEC offers a consulting service dedicated to designing the best production system for each manufacturing company, from business model definition to implementation roadmapping. The service is based on a well-proved and extended methodology and supported by a complete toolbox covering the entire lifecycle of the project.

This service can be applied either to greenfield projects or to improve facilities already in operation. The methodology is based on lean concepts and focuses on added value creation throughout the entire process. It can be used in Make-to-Stock, Make-to-Order or Engineering-to-Order environments.

MAIN BENEFITS

- A holistic and integrated approach where Operations and Production Resources Management, Internal Logistics, Quality Management and Information Management are considered simultaneously.

- Easy-to-use concepts supported by self-learning materials and pre-defined templates.

- Multi-scenario business demand analysis and system performance using Key Performance Indicators.

- Possible integration with process simulation software tools.

INTELLIGENT AUTOMATION AND INTERNAL LOGISTICS

INTELLIGENT AUTOMATION AND INTERNAL LOGISTICS

In partnership with logistic systems manufacturers and software houses, INESC TEC designs and develops innovative solutions for transportation, distribution and intermediate warehousing in different industries, such as footwear, furniture and metal working.

These innovative logistic systems are supported by advanced software tools for managing, automating, monitoring, maintaining, balancing and scheduling production. Simulation is used to support the design and operations of these systems.

MAIN RESULTS

- production capacity and throughput is increased
- operations that do not add value to the product are eliminated
- flexibility of production systems is increased
- different products can be produced simultaneously
- work in progress is reduced
- lead time is reduced

The One-Step Production System, Logicstore and LogicTrans are examples of products that were designed and developed in this context.

INESC Porto (the coordinating entity of INESC TEC) holds two patents in this field, the Modular Multi-ring System for Flexible Supply of Workstations, and the Distribution and Provisional Storage System for Transport Units.
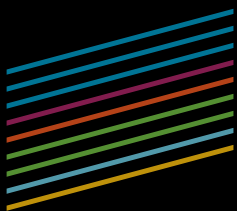
OPTIMAL-IT
CONSULTING SERVICE: FROM BUSINESS MODEL TO IT IMPLEMENTATION

INESCTEC
TECHNOLOGY & SCIENCE

KEY
ACTIVITIES

CUSTOMER
RELATIONSHIPS

CUSTOMER
SEGMENTS

KEY
PARTNERS

VALUE
PROPOSITIONS

CHANNELS

KEY
RESOURCES

REVENUE STREAMS

COST STRUCTURE

OPTIMAL-IT
CONSULTING SERVICE: FROM BUSINESS MODEL TO IT IMPLEMENTATION

OPTIMAL-IT is a consulting service offered by INESC TEC to help organisations improve Business Processes and implement Information Systems in an effective and efficient way. The service starts with a Business Model Assessment and supports Business Processes analysis and improvement, and the implementation of Enterprise Information Systems.

This service can be applied either to greenfield projects or to improve systems already in operation.

These services are based on a coaching consulting approach. Therefore, projects are developed by progressively introducing concepts and by working closely with the Client in order to achieve concrete results. This way it is possible to ensure that after the project is concluded the Client will have the necessary skills to monitor the implementation of the identified improvement opportunities.

APPROACH
- Business Model Assessment
- Business Process Mapping
- Business Process Modelling
- Information System Specification
- Information System Procurement
- Advice during Business Processes and Information Technology Implementation

MAIN BENEFITS
- Reduce implementation risk
- Reduce the total cost of ownership
- Reduce implementation duration
- Advice independent from technological solutions and suppliers
- Multidisciplinary and holistic approach
- Use of world class industry best practices

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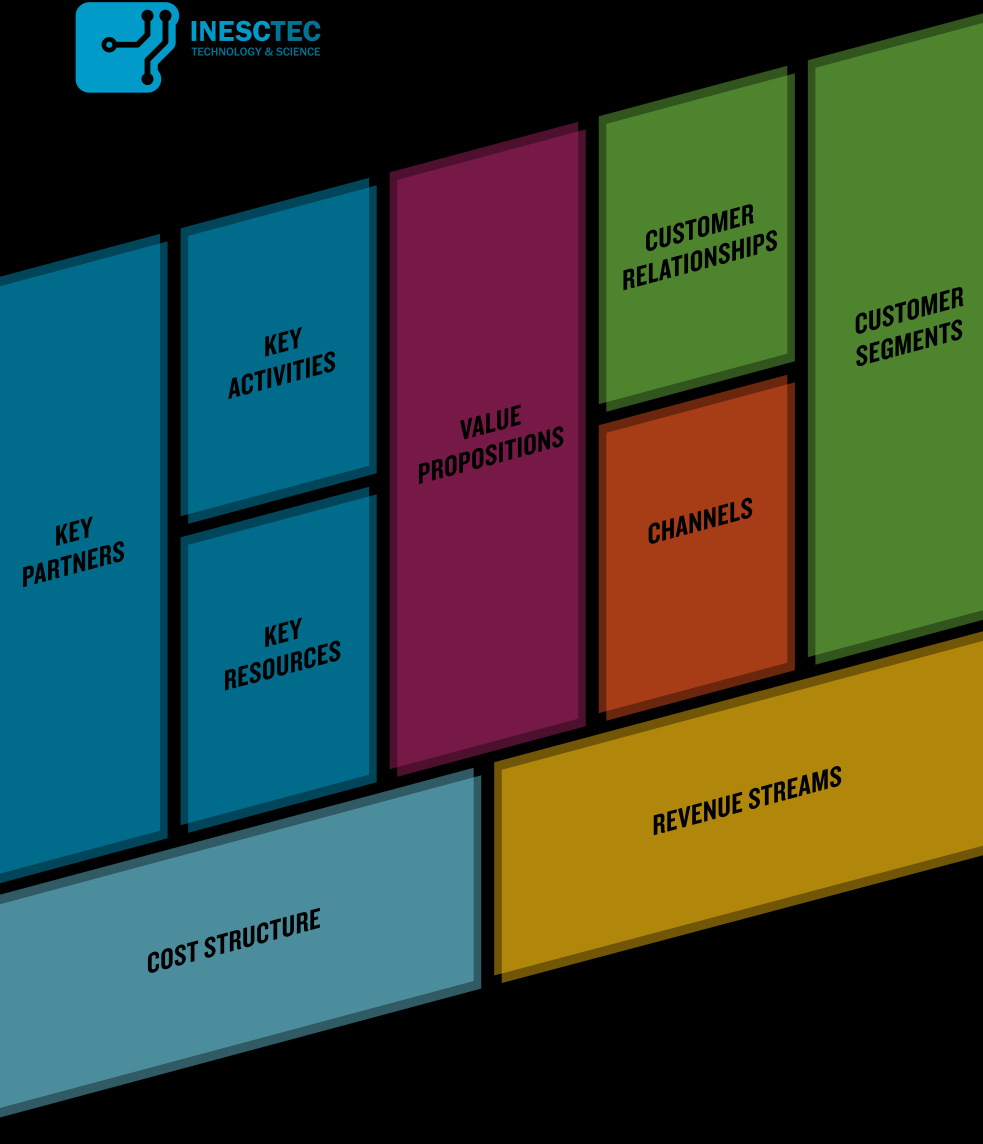F +351 222 094 050
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INESC TEC

TEC4 INDUSTRY©

SMART INDUSTRY VALUE CHAINS

Gain competitiveness with INDUSTRY 4.0

COLLABORATIVE AND SUPPLY NETWORKS AND CHAINS

› New Business Models and Collaborative Networks

› Management of Information, Knowledge and Collaboration

› Flexible and Resilient Systems

LOGISTICS AND MOBILITY

› Automation and Optimisation of Internal Logistics

› Transport and Logistics Systems

OPERATIONS, RESOURCES AND PROCESS MANAGEMENT

› Design and Simulation of Manufacturing Systems

› Integrated Planning, Scheduling and Control Systems

› Asset Management and Predictive Maintenance

ROBOTICS AND INTELLIGENT SYSTEMS

› Collaborative Manipulators and Programming by Demonstration

› Mobile Manipulators

› 2D/3D Artificial Vision and Intelligent Sensors

› Technology Integration and IoT

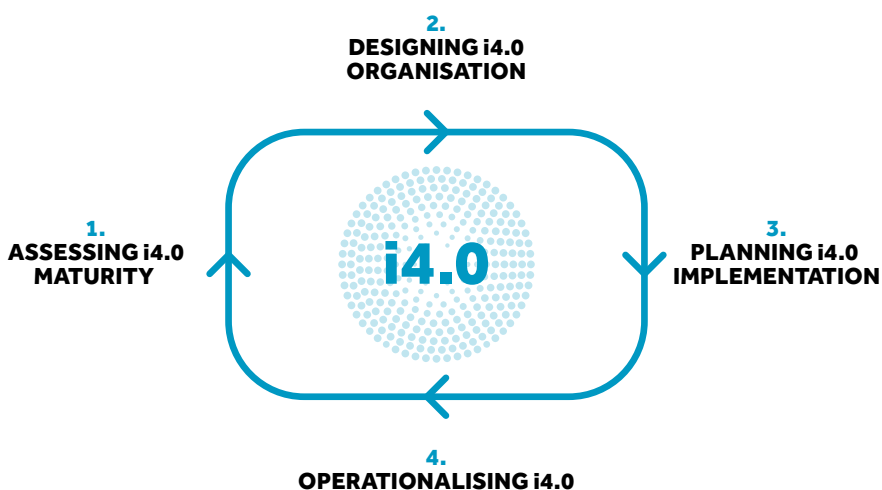### INTERACTION AND CO-CREATION WITH THE CLIENT

› Omni-channel experience (Web, Social Networks, Stores)

› Intelligent Stores

› Product-service Systems

BUSINESS INFORMATION SYSTEMS

› Architecture and Technlogy for Cyber-Physical Systems, IoT and Big Data

› Analysis and Design of Business Information Systems

BUSINESS ANALYSIS AND INTELLIGENCE

› Intelligence in Manufacturing and Business

› Performance Management Systems

› Decision-support Systems and Intelligent Reporting

MEET YOUR R&D PARTNER FOR i4.0 SUCCESS

Manufacturing enterprises are facing important challenges regarding the adoption and development of innovative concepts – technological, business, organisational, social – around Industry 4.0. To overcome uncertainty and to maximize success, it is crucial the definition of suitable strategies and action plans, scoping all complexity and dimensions of the adoption of i4.0 in industrial organisations.

2.
DESIGNING i4.0 ORGANISATION

1.
ASSESSING i4.0 MATURITY

i4.0

3.
PLANNING i4.0 IMPLEMENTATION

4.
OPERATIONALISING i4.0

INESC TEC's research track record, and extensive consultancy experience in developing and deploying solutions for industrial enterprises and value chain management, enabled the offering of high-value services to help companies assess, design, plan and operationalise i4.0 strategies.

INESC TEC i4.0 framework has been developed using a multi-methodological and multi-disciplinary approach including a conceptual modelling and qualitative and quantitative methods for field validation.

INESCTEC

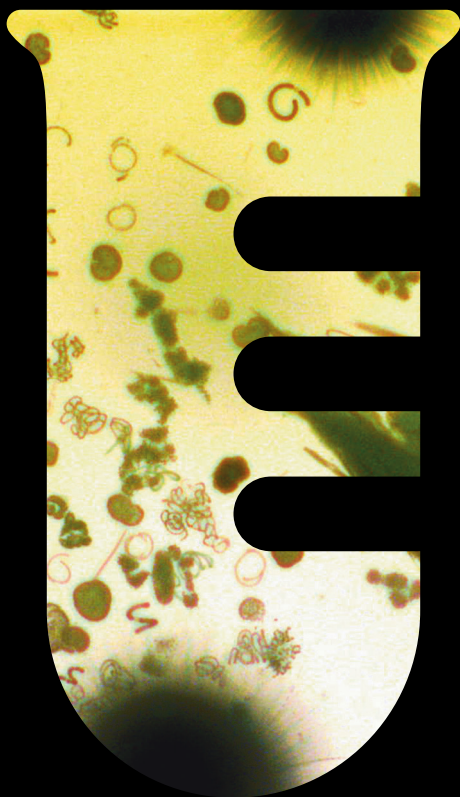CAMPUS DA FEUP
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MODAL
MODELS FOR PREDICTING ALGAE BLOOMS

INESCTEC
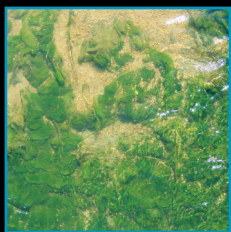
MODAL
MODELS FOR PREDICTING ALGAE BLOOMS

The occurrence of abnormal amounts of certain species of phytoplankton may be associated with eutrophication, which can lead to serious risks in terms of public health, particularly when these phenomena occur in places where drinking water is collected. Forecasting these phenomena in advance is essential for taking preventive actions and thus avoid undesirable consequences.

INESC TEC has applied, compared and adapted several modelling techniques to the problem of predicting harmful algae blooms in the hydrographical bay of river Douro, namely in the reservoir of the Crestuma-Lever dam.

This is a prediction problem with a strong social and economic impact on the metropolitan area of Porto because most of the drinking water in this region comes from this dam.

RESULTS
•Several algorithms developed for forecasting algae blooms
•Software for monitoring and forecasting algae blooms

MORWAQ
MONITORING AND PREDICTING WATER QUALITY PARAMETERS

INESCTEC

MORWAQ
MONITORING AND PREDICTING WATER QUALITY PARAMETERS

INESC TEC has developed models that can be used for monitoring and predicting water quality parameters in the context of water distribution network. These models were developed and tested in the context of the distribution network managed by the company Águas do Douro e Paiva (AdDP), SA. The AdDP conducts regular sampling procedures in different points of the distribution network in order to monitor a set of parameters associated with water quality.

INESC TEC used the data resulting from these sampling procedures conducted for several years. Various models were developed using these data to address two main problems:

- Monitoring the large set of water quality parameters controlled by the AdDP in order to provide early warnings on eventual deviations from the expected "normal" values.
- Predicting the occurrence of extreme values on water quality parameters across the network, with the goal of allowing early preventive actions to be taken to avoid subsequent problems.

MAIN FEATURES
- Predictive models for forecasting water quality parameters supporting preventive actions that can avoid abnormal values.
- Predictive models to estimate the value of several water quality parameters in different points of the network using information obtained at other geographically correlated points, avoiding costly sampling analyses.
- Models for discovering correlations among water quality parameters.

HASLAB
HIGH ASSURANCE
SOFTWARE

INESCTEC
TECHNOLOGY & SCIENCE

HASLAB
HIGH ASSURANCE SOFTWARE

Dependability, **Information Security** and **Formal Methods** are essential pillars supporting the development of **Trustworthy Software Systems**. A trustworthy system is inherently reliable, secure, and available. It must behave as people expect it to, despite environmental disruption, human errors, and attacks by hostile parties. Design and implementation errors must be avoided, eliminated or somehow tolerated. It is not sufficient to address only some of these dimensions, nor is it sufficient simply to assemble components that are themselves trustworthy. Trustworthiness can only be achieved through a global approach to system development.

INESC TEC's **High Assurance Software Laboratory** has been active in both theoretical and applied research, exploring the synergies between these areas for two decades. The highest practical impact of the activity stems from participations in R&D projects (GORDA, CACE, STORK, Cumulo Nimbo, SMART, Minha) aiming at exploring knowledge and technology transfer on the design, implementation and validation of trustworthy software systems with several industrial partners.

The expertise at INESC TEC makes it possible to jointly address several aspects that are central to trustworthy software for today's critical systems:
- Rigorous modelling, and formal specification and verification of software systems' correctness, availability and security
- Dependable and scalable data management protocols, with emphasis on Cloud Computing and infrastructures for big data
- Large scale information dissemination and aggregation protocols such as gossip for handling very large amounts of data
- Technology to implement and integrate the necessary software components to obtain highly-efficient solutions without compromising security

High Assurance Software Laboratory (HASLab) is an R&D Unit of INESC TEC hosted by the University of Minho, Portugal

INDUSTRIAL PARTNERS
PT Inovação // Critical Software // Multicert // SAP // Google // Hewlett- Packard // Nokia // MySQL // Instituto de Aeronáutica e Espaço (Brasil)

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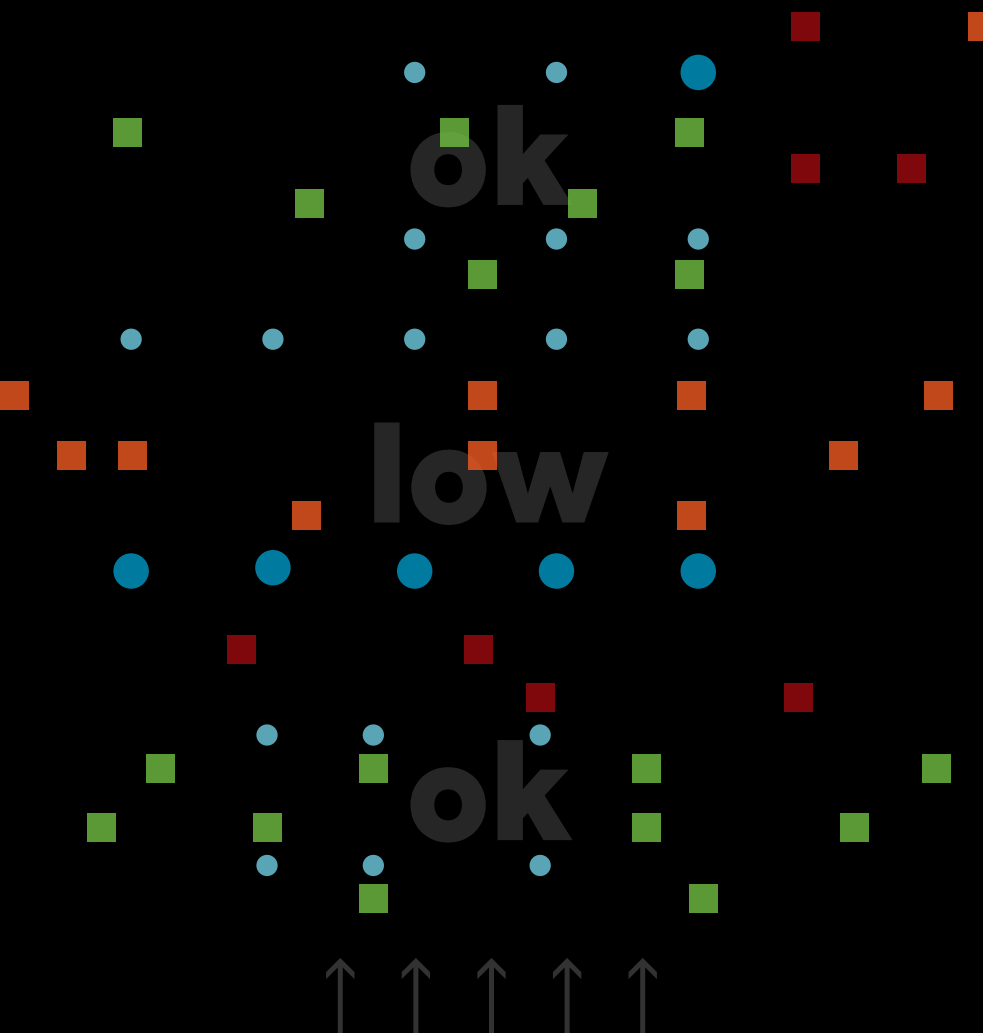
CISTER
RESEARCH CENTRE
IN REAL-TIME & EMBEDDED
COMPUTING SYSTEMS

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RESEARCH CENTRE IN REAL-TIME & EMBEDDED COMPUTING SYSTEMS

Real-time computing systems are those in which correctness depends not only on the logical result of computation, but also on the time at which the results are produced. This implies that, unlike more traditional information and communication systems, where there is a separation between correctness and performance, in real-time computing systems – like those deployed in the aerospace domain -these two aspects are closely related.

INESC TEC's Real-Time Embedded Computing Systems Research Centre has been active in both theoretical and applied research, exploring the synergies between these areas for more than 15 years. The highest practical impact of the activity stems from participations in national and international R&D projects and from the fact that the Centre is a member of the European Networks of Excellence in the area (ArtistDesign, CONET and HiPEAC). The ultimate goal is to explore knowledge and technology transfer on the design, implementation and validation of real-time and embedded computing systems with several industrial partners.

The expertise at INESC TEC makes it possible to jointly address competences that are providing advances and services in architectures for distributed embedded real-time systems, real-time wireless sensor networks, cyber-physical systems, operating systems and quality-of-service distributed computing:

- Wireless Sensor and Actuator Networks
- Embedded Middleware
- Real-time Operating Systems
- Multicore Platforms
- Mission Critical Software
- Adaptive Energy Control
- Avionics

The Real-Time & Embedded Computing Systems Research Centre (CISTER) is an Associate Unit of INESC TEC hosted by the School of Engineering (ISEP) of the Polytechnic Institute of Porto (IPP), PT.

PARTNERS INCLUDE Airbus (FR) // Critical Software (PT) // EADS (DE) // Embraer (BR) // Finmeccanica (IT) // Honeywell (US/CZ) // Space Systems Finland (FI) // SYSGO (DE) // Thales (FR)