

EUROPEAN SMES ROBOTICS APPLICATIONS

SECOND OPEN CALL EXPERIMENTS (ESMERA-SOCE)

www.esmera-project.eu



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About ESMERA

ESMERA (European SMEs Robotics Applications) is a starting point for European SMEs designing and developing robotic solutions.

To unlock the innovation potential of these SMEs, ESMERA promotes applied robotics technology developed for industrial challenges set by key European companies. Thereby the SMEs get a chance to bring new technologies that address real life problems to an existing market.

ESMERA offers direct financial support to the solution-providing SMEs, through a cascade funding mechanism. On top of that, the core partners of ESMERA provide the beneficiaries with an environment for developing, evaluating, testing and demonstrating novel robotic technologies, alongside with non-technical business mentoring and support.



Agriculture



Construction



Healthcare



Manufacturing



Food Processing



Energy



Emergency Response



Retail

Project: Aerowind

Helvetis SA (Switzerland) & LARICS (Croatia)



TRL 8



Energy

Autonomous inspection of wind turbine blades.

SME Profile

Helvetis is a UAV pioneer of technologies for inspection, focused on the wind industry. LARICS is a robotics and intelligent control systems research group at University of Zagreb.

Challenge

Current visual inspection methods are slow, inaccurate, costly and require complex coordination and logistics. The addressed challenge is the development of an autonomous vision system using Unmanned Aerial Vehicles (UAVs) that will enable inspection of wind turbine blades without stopping the turbine and thus disrupting energy production.

Solution

The technological advances of UAVs enable the AeroWind system to prove the proposed concept of autonomous inspection of stopped blades. The required hardware is mounted on the UAV to implement localization and motion planning software modules on-board the vehicle. This project aims to improve on the level of autonomous turbine blade inspection that can be performed while the turbine is still operating, using the implementation of the blade capture module, development of a safety system for emergency detection and autonomous recovery.



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Project: AMESON

FERON TECHNOLOGIES P.C. KEFALAIOUCHIKI ETAIREIA
(Greece)

Open hardware & software bundle for maintaining communication in complex structures

SME Profile

Feron is an experienced technology provider, specialized in cutting-edge ICT systems development and integration for the global telecom and IoT markets.

Challenge

The challenge is to build an affordable communication system suitable for extreme conditions. A robot/system operates in a fire environment and should be able to maintain sufficient communication in a complex structure such as an underground car park or tunnel, based on a simple and quickly deployed solution that should represent significant progress compared to current technology.

Solution

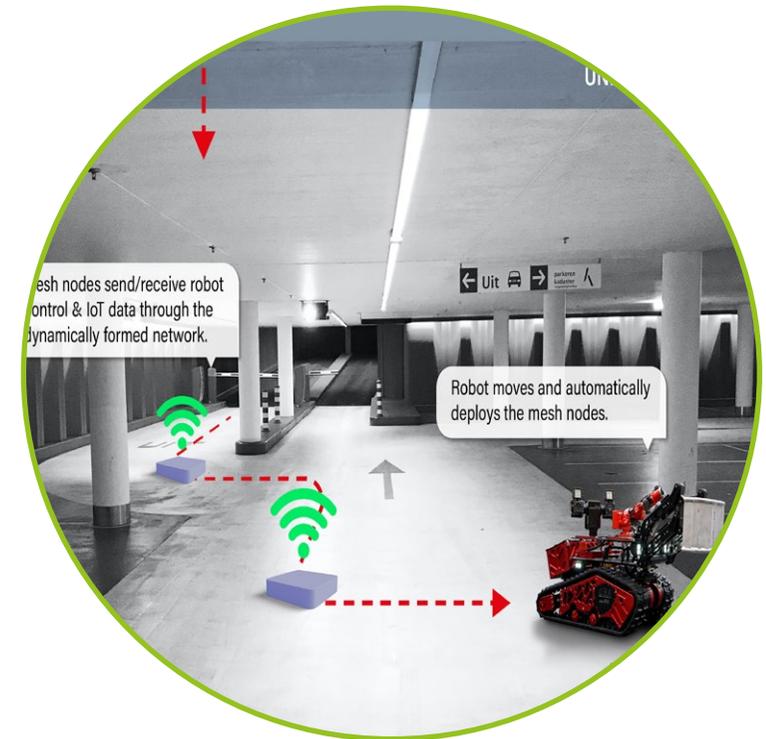
The project introduced and demonstrated a new disruptive solution that reliably supports the deployment of novel robotic technological solutions during emergency situations. The solution establishes an on-demand network that may transmit different types of information – from sensor data to video feed – and enable the full control of a robot remotely in challenging environments. It can be deployed in a fully automated and smooth manner, without human intervention during configuration, and with a target cost of a few thousand euros.



TRL 7



Emergency Response



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Project: FLOX-rover

Flox Limited (UK)



TRL 7



Agriculture

FLOXRover is an autonomous robot system improving litter quality, welfare and performance in broiler sheds.

SME Profile

FLOX is a livestock welfare and performance company with initial applications in the broiler industry – using AI and robotics to improve the lives of chickens.

Challenge

Bird welfare and flock performance suffer when chickens cannot be monitored or managed granularly. Shed/flock size (100m long, with 50000+ birds) means farmers take 1-2 walks daily, in ammonia and allergen-rich environments; performing key tasks manually and without the aid of data. This human/bird interaction increases the risk of zoonosis, and is not sufficient for optimising the shed environment or providing care to each individual bird.

Solution

FLOXRover improves key welfare and performance outcomes via the automation of previously manual tasks, the collection of key environmental and behavioural data, and the improvement of litter quality and chicken spread.

The rover detects issues requiring corrective action via onboard sensors and cameras, and performs high-value management tasks via attached implements.



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Project: iRTA

Agriultural & Environmental Solutions Private Company (Greece),
National Centre for Scientific Research „Demokritos“ (Greece),
Agricultural University of Athens (Greece),
SCiO Private Company (Greece)

Flexible and modular autonomous robotic platform for vineyard treatment

SME Profile

AGENSO (Agricultural and Environmental Solutions) is an innovative agriculture and environment company. NCSR-D is the largest self-governing research organization under the supervision of the General Secretariat for Research and Technology of the Greek Government. AUA is the third oldest University in Greece. It contributes to European primary sector development by conducting basic and applied research in agricultural related sciences. SCiO specializes in different facets of data analysis from multi-parameter Descriptive Analytics to complex Predictive Analytics over large data volumes.

Challenge

iRTA targets the treatment application in steep slope vineyards. The key requirements of this challenge are autonomous access of all areas of a steep slope vineyard; efficient application of treatments; operational capacity of 4-6 hours; safe operation in the presence of people and obstacles; and auto-refill capability or operator notification.

Solution

iRTA is a modular robotic platform with respective sensing devices and a precision spraying component, as well as software for (a) analysing sensor inputs, navigating the unit, and monitoring its operation and (b) automatically detecting leafage/canopy and spraying accordingly. It is developed using Arduino microcontrollers and low-cost sensors and actuators. It has three different operation modes: manual, remote, or autonomous. Its payload capacity is over 100kg and it is able to move in rough and sloppy terrains.



TRL 5



Agriculture



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Project: MoCAAS

Spin Robotics Aps (Denmark) &
Pehama Production A/S (Denmark)



TRL 8



Manufacturing

A novel flexible mobile cobot assembly workstation.

SME Profile

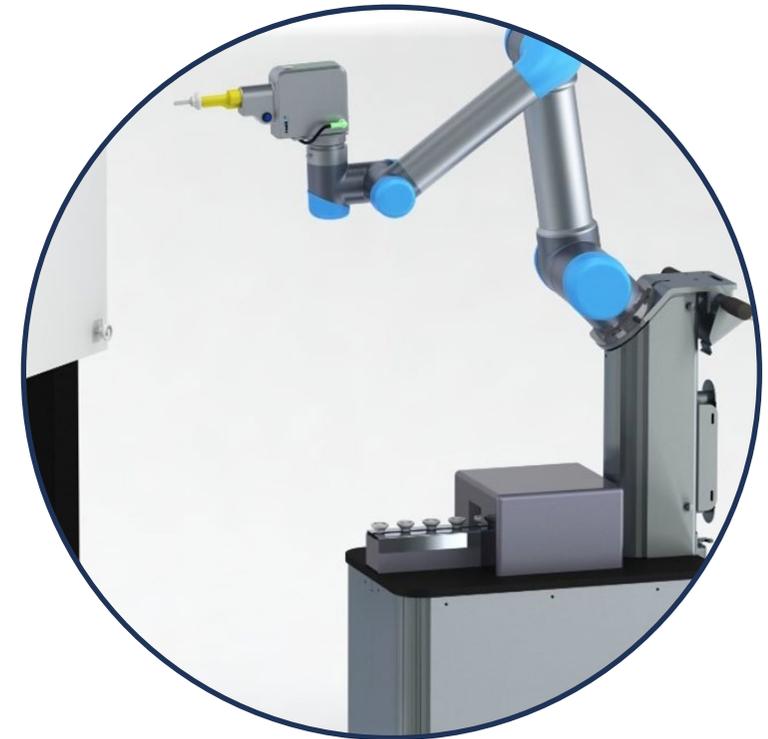
Spin Robotics is a Danish end-of-arm tool manufacturer specialized in assembly applications involving Cobots. Pehama Productions A/S is a systems integrator which since 1965 has produced advanced production equipment, special machines, and automation solutions for the Danish industry.

Challenge

The main objective of the ESMERA demonstrator is to showcase how to increase the flexibility and decrease programming time for assembly tasks with collaborative robots running assembly tasks that involve inserting threaded objects. The focus is to provide fast and easy teach-in while ensuring high insertion process quality.

Solution

The MoCAAS workstation minimizes the integration effort and enables fast changeover via introducing intelligent insertion by utilizing force control. Additionally, the self-calibration system is an easy-to-use automated Hand-to-Eye, with a GUI-based calibration system directly integrated at the platform teach pendant via the URCap framework. Last but not least, the safe tool design combined with a new safety sensor at the tip of the tool makes the solution fully collaborative and safe, and ensures that the workstation can run at full speed (250mm/s).



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Project: NeRo

Cyber Surgery, SL (Spain)



TRL 7



Healthcare

Robotic assistant for spine surgery, which increases surgery safety and optimizes cost-effectiveness

SME Profile

Cyber Surgery is a startup result of deep research in robot spine surgery techniques. The company consists of 25 motivated and highly qualified people, at the stage of preclinical trials in animal and human corpses.

Challenge

Spinal fusion is a very complex and risky surgery and it requires inserting pedicle screws that are fixed with a rod into the targeted vertebrae. When the intervention is performed freehand, there is a risk of malposition up to 15%, and 4.2% risk of re-intervention due to neurological damage. The challenge of the robot is to improve the accuracy of these surgeries.

Solution

The novelty of the proposed solution resides in the patient tracking system which is based on an innovative and patented system. The main advantages of the solution are as follows: i) a tracking system which is six times more accurate than current optical tracking systems; ii) the calibration of the system in the beginning of the surgery is almost instantaneous, reducing surgery time and costs; and iii) the tracking system drastically minimizes occlusion risks and the footprint in the operating room



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Project: PLUTO

WPWEB (Italy)



TRL 6



Construction

A drone for the autonomous inspection of railway tunnels.

SME Profile

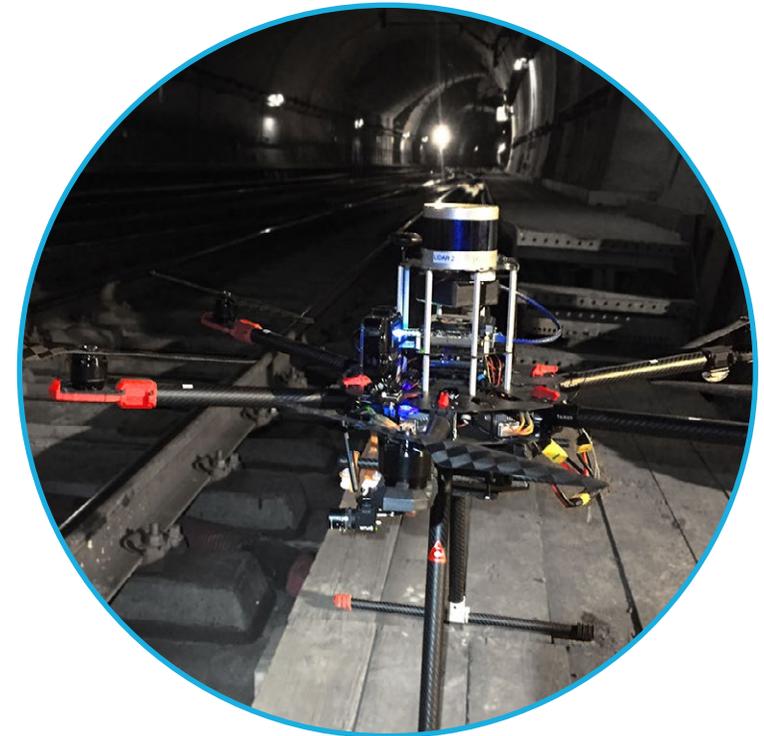
WPWEB is an Italian innovative SME experimenting with robotic solutions for infrastructure inspections. The focus is on the implementation of autonomous systems.

Challenge

Interventions of maintenance people inside tunnels of subways and raw inspections after infrastructure incidents are dangerous and time-consuming operations. The key task for the robot is to autonomously travel to the Point of Intervention and to inspect the complete volume of the tunnel. The robot should not cause interrupt traffic.

Solution

The system inspects confined spaces where communication with the outside is not possible. It also creates a 3D mapping to be used for monitoring the explored environment and automatically detects deteriorations through a neural network. The autonomous navigation software uses laser inertial technologies to navigate in environments where a GNSS signal is not available.



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Project: PRySM

Pulverizadores Rocha (Portugal) &
INESC TEC Tecnologia e Ciência (Portugal)



TRL 7



Agriculture

High precision spraying robot for steep slope vineyards.

SME Profile

Rocha Pulverizadores is a symbol of quality in the sprayer trade, providing a range of low-volume, highly efficient and ecological first-class equipment. INESC TEC is an institution created to act as an interface between the academic world, the world of industry and services, and the public administration, in the framework of Robotics, Artificial Intelligence, Information Technologies, Telecommunications and Electronics (ITT&E).

Challenge

Steep slope vineyards account for 12% of European viticulture land area and produce some of the highest value wines. Row sizes are quite narrow, typically 90 cm - 150 cm. Treatments are currently applied from a small tractor-based system where water and pesticides losses are high. Smarter systems are required that can selectively apply treatments according to individual plant needs.

Solution

Precision Robotic Sprayer (PRySM) is a modular and precise terrestrial sprayer robot, capable of operating autonomously on rugged terrain with steep slopes and under the most diverse ground conditions. PRySM robot has advanced algorithms for self-localization that are reliable under GNSS failures/absence, and has advanced perception systems to support precision spraying tasks. PRySM is fully electrical and is designed to work with low volume spraying (less than 120 liters per hectare).



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Project: RAIL-O-BOT

Ingeniarius Ltd (Portugal)

Disruptive autonomous compact loaders for vegetation management in railways.

SME Profile

Ingeniarius provides R&D services in the domain of mobile robotics, focusing on the development of robots for challenging field applications including agriculture, forestry and others.

Challenge

For environmental and health reasons, it is necessary to find a non-chemical solution to remove or to cut back vegetation near railway infrastructures. An autonomous robot capable of navigating, identifying and mechanically removing undesirable vegetation without damaging the railway systems and endangering the safety of trains is of the utmost importance. Furthermore, the robot needs to withstand the suction effect of fast-moving trains.

Solution

The robotic solution is an automated off-the-shelf compact loader, known as Ranger. The Ranger has been initially designed by Ingeniarius to autonomously remove forest debris. RAIL-O-BOT goes beyond these initial requirements with a decision-making architecture to fulfil pre-planned railway vegetation management missions, a perception architecture to monitor the state of vegetation along railways, and a human-machine interaction architecture for human oversight.



TRL 6



Construction



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Project: ROMERO

MDM TEAM SRL (Italy), Università degli Studi di Firenze –
Centro per la Protezione Civile (Italy)

Multi-domain distributed monitoring system for safety and environment assessment

SME Profile

MDM Team is an Italian SME established in 2012 focusing on underwater robotics and autonomous systems. They are partnering with the ROMERO team to provide a robust solution to monitor extreme environments.

Challenge

In extreme scenarios, the capability to assess the situation becomes a hard task to be solved in a very short time to enable possible counter-measures, evacuation or alternative actions. The challenge is the adoption of an automatic system based on a swarm of heterogeneous drones, collecting data from the sea-bed, very shallow water and aerial areas to provide a quick and effective response to the problem of situational awareness even during the occurrences of these natural events.

Solution

ROMERO is a unique distributed system, ready to be deployed in an extreme environment to gather data from distributed sensors in order to support safe monitoring of volcanic activities. ROMERO includes an environmental data system that will continuously collect information about the surface and submerged area through a weather station and a sea buoy, and a web portal to support decision making process by giving access to aerial and underwater drones for field data collection.



TRL 6



Emergency
Response



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Project: Rover4RT

ZeniaLabs Automation Intelligence S.L. (Spain), Electronics and Opto-Mechanics Engineering EXOM S.L. (Spain), Alpha Laser GmbH (Germany) & Tecnalía Research & Innovation (Spain)

An alternative to glyphosate for rail maintenance without stopping the rail traffic.

SME Profile

ZeniaLabs is a Spanish SME producing solutions based on Artificial Intelligence, deployment of complex algorithms into hardware-accelerated (FPGA/DSP) proprietary and off-the-shelf platforms, and integration of sensing/communication capabilities into robotics and automation platforms.

EXOM S.L. is a business initiative with a wide experience on research and development, focused on advanced manufacturing, and especially on the design of new processes and machine-tool equipment.

ALPHA LASER GmbH is an owner-operated medium-sized company specializing in the development and manufacture of laser systems for welding, cutting, and hardening metals. TECNALIA is the leading private research and technology organization in Spain and the fifth largest in Europe.

Challenge

Currently, the herbicide glyphosate is used to prevent plant growth between the railway tracks. This clean-up service is crucial for trains to operate properly, but concerns against the usage of herbicides are constantly growing due to environmental and health reasons.

The EU has prohibited glyphosate usage by the end of 2022. Hence, new non-chemical solutions are required as the weed and vegetation removal pose a recurring maintenance problem for all railway operators.

Solution

Rover4RT is a novel solution for robotic vegetation management and automated inspection between the railway tracks. It performs maintenance activities in a clean and efficient manner, as an alternative to herbicide glyphosate. Implementation leads to a cost-effective and environmentally-friendly solution that can co-exist with rail traffic. It also enables smart inspection and monitoring thanks to intelligent detections through computer vision and AI, GNSS geolocation, and data streaming to a control center.



TRL 6



Construction



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EXOM

ZeniaLabs Automation Intelligence

tecnalia Inspiring Business

ALPHALASER

ESMERA BOOSTING ROBOTICS INNOVATION

Project: SA3IR

MetraLabs GmbH Neue Technologien und Systeme (Germany),
 Universidad de Extremadura (UEX)- QSEG Research Group (Spain),
 Universidad de Málaga (UMA) - ISIS and GISUM Research Groups (Spain)



TRL 6



Retail

Robot that can deliver goods in real-world retail scenarios

SME Profile

MetraLabs, founded in 2001, provides robotic solutions for retailers. UEX - QSEG Research Group has extensive experience in software engineering, model-driven engineering, component-based software development, autonomic computing, context-awareness, and ambient intelligence. UMA- ISIS and GISUM are research groups at UMA where ISIS is focused on Robotics, and GISUM is focused on software engineering.

Challenge

Rather than requiring „structured“ factories, robots for warehouses or in-house logistics need to dynamically adapt their behaviour to constantly changing set-ups, where human workers and all kinds of unexpected objects may appear as obstacles. The robots must also be able to autonomously identify the trolleys they must pick up, move and deliver at the designated location. Finally, the robots must be linked to the order management system to allow for delivery on demand.

Solution

The SA3IR project proposes to transfer their solution for intralogistics from the scenario of factories, designed to favor the use of robots, to the complex scenario of retail. The aim is the design and development of the whole framework needed to endow a fleet of small autonomous low-lift pallet trucks with runtime adaptability to the dynamics of real stores and distribution centers.



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SA³IR



UNIVERSIDAD
DE MÁLAGA



METRA
Metralabs
mobile robots



ESMEERA

BOOSTING ROBOTICS INNOVATION

Project: SARA

SVMAC INGENIERIA SISTEMAS Y VEHICULOS SL (Spain),
CTIC FOUNDATION TECHNOLOGY CENTER (Spain)



TRL 6



Agriculture

Smart Autonomous Robotic platform for treatment Application in steep slope vineyards.

SME Profile

SVMAC is a technology-based company whose technological activity primarily focuses on the agriculture industry.

CTIC is a private non-profit research and technology organization.

Challenge

Steep slope vineyards account for 12% of European viticulture land area and produce some of the highest value wines. Row sizes are quite narrow, typically 90 cm - 150 cm. Currently treatments are applied from a small tractor-based system where water & pesticides losses are high. Smarter systems that can selectively apply treatments according to individual plant needs are required.

Solution

The solution is an intelligent robot equipped with an actuator with articulated arms, capable of applying treatments in a precise and localized way, both in conventional vineyards and in steep slope viticulture vineyards. Additionally, it has an intelligent system for leaf detection and density estimation, and an intelligent system for the obstacle detection, which analyzes the surface on which the vehicle is moving.



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Project: SARAF

Hidropar Hareket Kontrol Teknolojileri Merkezi Sanayi ve Ticaret Anonim Şirketi (Turkey)



TRL 5



Manufacturing

Smart solution for the assembly of the adjustable feet.

SME Profile

HKTM started the journey in 1998 to provide the integration of engineering with art; industry with nature; plant with environment; and technology with life.

Challenge

The main challenge is the development of a compact mechatronic solution for the assembly of adjustable refrigerator feet.

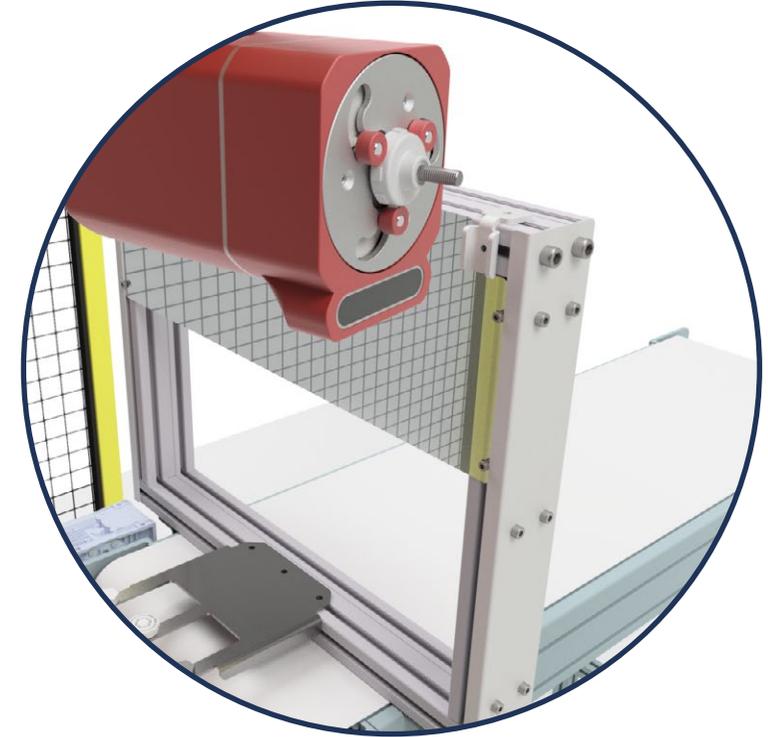
The developed solution should be able to perform the functions of holding and screwing products of different sizes and shapes in an integrated manner without the need for extra adjustment time during operations.

Solution

The SARAF system includes a gripping & foot-running tool, a vision system, and a foot feeder.

The adjustable feet are taken from the feeder with the specially designed gripper. In order to assemble the adjustable feet to the refrigerator, a nutrunner-like system is developed and attached to the tool.

The exact locations of the screw holes are determined with a vision system after the tool arrives at a pre-defined point. Adjustable feet are collected into a feeder and taken by the gripper one at a time.



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Project: SPIWI

IT + Robotics srl (Italy) & University of Padova (Italy)



TRL 5



Food Processing

An autonomous robotic system for fresh fish manipulation.

SME Profile

IT+Robotics designs, develops and assembles advanced solutions for robotics and industrial automation. The University of Padova a multi-disciplinary institute of higher education, aims to contribute to science and humanity with professional training and a solid cultural background.

Challenge

The challenge is to transfer fresh fish that arrive in large trays to smaller ones ensuring that the total weight of the packed second tray is kept within specified limits. The task involves localizing suitable fish to pick, establishing good grasp points, and achieving a stable grasp that does not damage the fish. The likely weight of the fish has to be assessed in order to minimize any trial-and-error adjustments of weight.

Solution

The SPIWI project provides a robotic solution to the picking and placing of fresh fish. Classic bin-picking applications require a CAD model of the objects and use their shape for localization. The SPIWI project uses a model-less approach that allows localizing objects without a reference model, such as for fish. The system uses an RGB-D camera combined with AI-based software for the localization and manipulation of fish. This approach allows operators to set up a pick-and-place application with minimal effort.



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Project: SUSPICION

Fraunhofer Austria Research GmbH (FhA) (Austria),
Joanneum Research Forschungsgesellschaft mbH (Austria),
craftworks GmbH (Austria)



TRL 6



Manufacturing

The AI tool that balances the cost of maintenance while minimizing potential downtimes

SME Profile

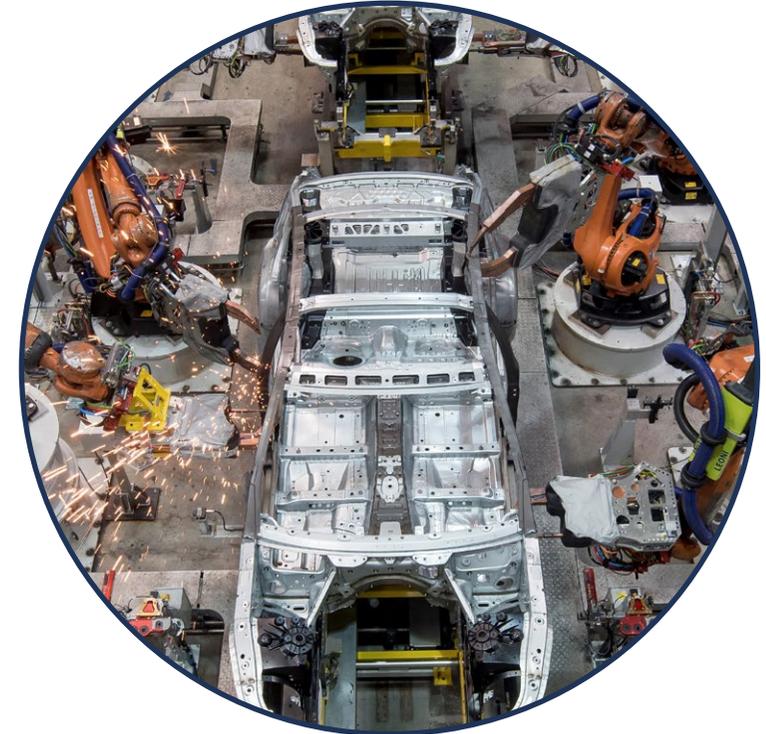
FhA conducts application-oriented research towards crossing the gap between basic scientific findings and their practical application in predictive and prescriptive maintenance of production systems with focus on robotics. Joanneum Research is a non-profit organization concentrating on applied research with a highly qualified staff of more than 450 people working in seven research units in various sectors of innovation. Craftworks develops industrial artificial intelligence solutions for predictive maintenance and predictive quality.

Challenge

In automotive manufacturing, many robots are used in body shops, especially on spot welding processes. During the operation of robots, two pieces of data are continuously recorded: i) the robot's error log, and ii) real-time component data (torque, current, temperature etc). In this challenge we're looking for systems that can detect problems and failures based on the real-time data collected from robots and inform the user about possible problems before they happen.

Solution

An AI tool is developed to identify characteristic patterns in robotized spot-welding applications so as to predict system errors and thus standstills. As a result, machine maintenance is supported, and downtimes of the machines can be further reduced by behaviour prediction and dynamically identifying new correlations and patterns within relevant data sets. The model is defined in a way that it can also be applied to other scenarios after defining application-specific features.



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https://www.fraunhofer.at/de/forschung/cyber-physical_production_and_assembly_systems/suspicion.html

Project: SWTS-FE

sewts GmbH (Germany)



TRL 5



Manufacturing

Robot for taping air balloon foil to the fragile front door of a refrigerator.

SME Profile

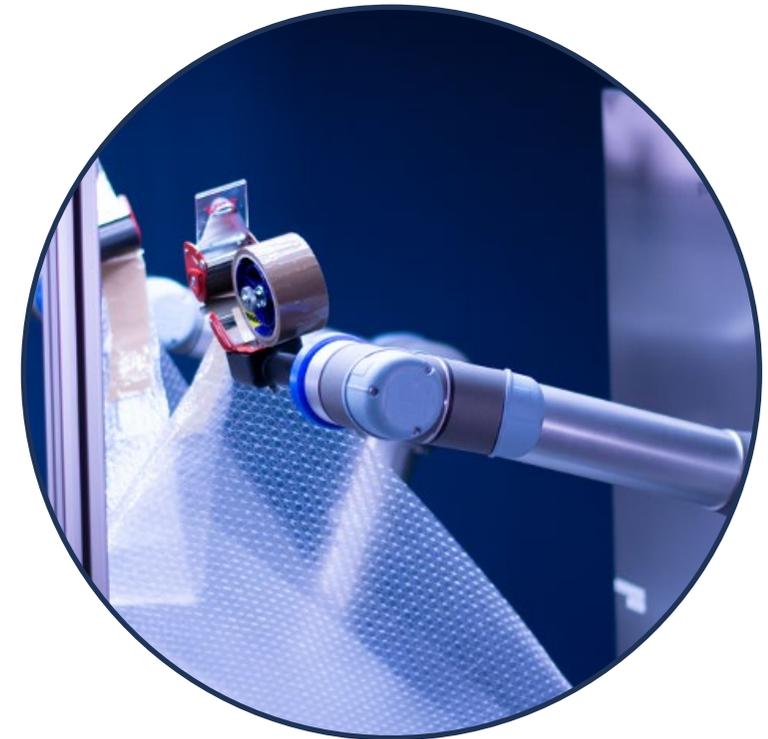
sewts provides cutting-edge perception software, pushing the boundaries of robotics in the processing of easily deformable materials. The intelligent software solution enables countless applications in industrial automation like the handling of textiles, foils, cables, and more.

Challenge

To robots, the handling and processing of limp or easily deformable materials like textiles, foils or leather, constitutes an extraordinary challenge. This is due to the lack of human-like abilities, such as motor sensitivity and visual thinking, and the complexity of the material properties of foils and textiles themselves. The aim of the experiment is to completely automate the currently manual process step of sticking the air balloon foil onto the door of a refrigerator. The special challenges here are the complex material properties of the film and the variety of refrigerators to be processed. The system must be able to process up to 50 different sizes and shapes.

Solution

The robotic solution SWTS-FE is intelligent, flexible and reliable while using simple mechanical components to ensure easy maintenance. By adapting a standard tape roller that can be found at any logistics center with a 3D-printed connection part, a low-cost gripping system was designed. Combined with off the shelf robotic arms, cameras and sensors, sewts was able to create a system that offers a high return on investment and can cut labor costs significantly.



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Project: TOGETHER

Munckhof Fruit Tech Innovators B.V. (Netherlands) & Riwo Engineering B.V. (Netherlands)



TRL 5



Agriculture

Apple-picking robot using deep learning and vision technology in orchards

SME Profile

Munckhof is a global leading company in harvesting and spraying systems for the fruit sector. Riwo is the specialist in controls and software for the Pluk-O-Trak Harvesting Systems running in more than 50 countries worldwide.

Challenge

Due to huge problems in finding personnel and resources for harvesting apple and pear fruits, robotic systems are strongly needed to guarantee sufficient supply of healthy food in the near future. The ARHA Apple Picking Robot is the first step for the fruit growers to meet the increasing demand for fresh and healthy fruits, necessary for the growing worldwide population to >9 billion people.

Solution

The ARHA is an autonomous robotic system designed for robust and reliable apple picking and moving, with bin filling designed to minimize apple damage and optimize efficiency. The goal is to autonomously harvest more than 85% of the available and good quality fresh fruits in the orchard in the next 3-5 years. This must be done in all applicable weather conditions, running outside on a Pluk-O-Trak platform with new features for harvest registration and Smart Agro tools. A new AI vision system and a new gripper design (patent pending) are also implemented. ARHA is able to exhibit high detection, picking and deposition performance indicators in the near future.



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Project: Web2print

Kilt Oy (Finland) & Enekos Oy (Finland)



TRL 7



Manufacturing

Robotized garment laser cutting and piece handling solution for textile industry.

SME Profile

KILT Oy is a dedicated team of industrial laser and software specialists providing solutions to industry. Enekos Oy is an automation specialist company focusing on advanced automation. Together we are creating unique high-tech solutions.

Challenge

In the garment industry the process of labelling and sorting laser-cut garment parts is a bottleneck in the production line. A robotic system is required to take over these tasks from the human operators. The challenge is the design of robotic perception systems that label and sort pieces of laser-cut garment and move the group of textile pieces to different sections on the production line unit.

Solution

The Web2Print solution consists of a modern laser cutter with conveyor and robotic piece handling. The art of the solution is in our in-house developed software that handles the whole production flow from order intake, efficient layout design and production prioritization to stacking up orders in preferred way. Overall production efficiency is more than double compared to current systems.



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Project: WGL

Follow Inspiration S.A. (Portugal)



TRL 7



Retail

Mobile robot for transporting goods in warehouses

SME Profile

Follow Inspiration is a technological company founded in 2012, focused on software and hardware development.

Challenge

The challenge is the design of an automated robot that will pass through several picking locations where human pickers, or the robot itself, will load the cart carried by the robot. Each of these can manage different orders (multiple boxes or compartments). The robot will need to operate in a human-robot collaboration scenario in a typical warehouse environment with level floors (mimicking a supermarket store with 2-metre wide aisles), avoiding pillars and shelves.

Solution

The robot moves autonomously throughout the working facilities, improving efficiency and maintaining safety in the picking process while avoiding all obstacles that might block its way.

Moreover, it can manage different orders and transport multiple types of goods in different compartments, increasing operational uptime. The technology of this solution recognizes the user via image processing algorithms and uses machine learning and artificial intelligence, combined with VSLAM.



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