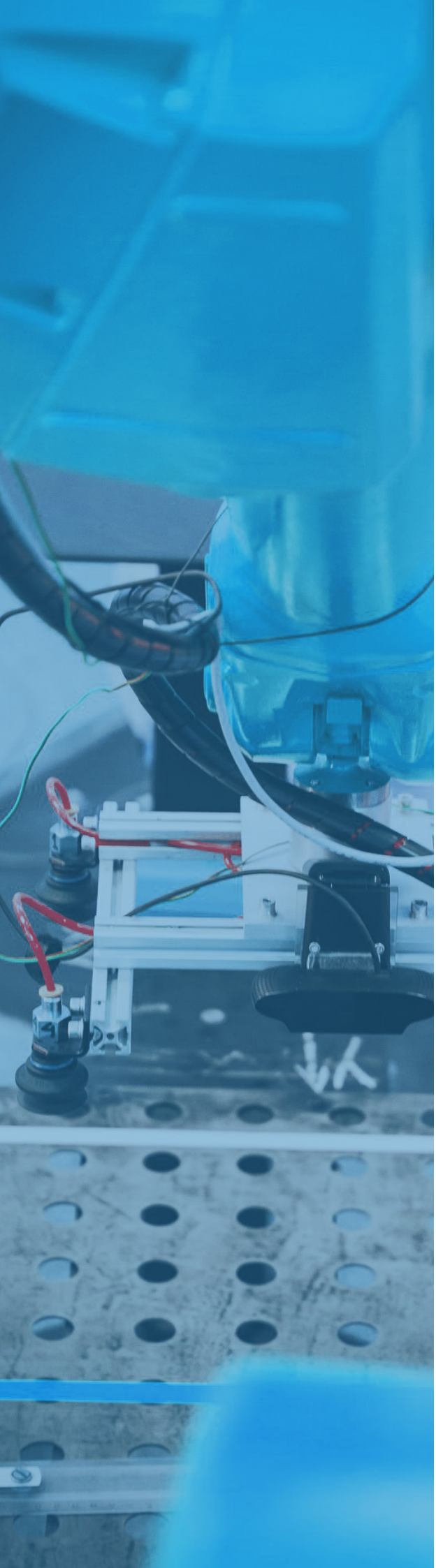

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TRINITY Digital Innovation Hub. Your European one-stop shop for agile manufacturing

By Alessandra Zini, CECIMO EU Policy Officer and Projects Coordinator

As we are approaching the end of the second year of the project TRINITY, funded in the framework of Horizon2020, the European Commission programme for Research and Innovation, we are already collecting a number of success stories. After having evaluated more than 150 applications submitted for our first round of open call, selected SMEs are now in the process of developing their own innovative robotic applications for agile manufacturing and implementing them in the supply chain.

Thanks to a series of online events, we are showcasing robotic applications in different industrial contexts, such as in support of Additive Manufacturing technology, sensors and visions, and human-robot collaboration, just to mention a few.

You can read some of the SMEs success stories in this section of the magazine and visit the TRINITY DIH website at www.trinityrobotics.eu for more information on the project and our next open call. ■

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WAAM CLAMP: Hybrid additive manufacturing to reduce production lead time by MX3D

By René Backx, CCO, MX3D

Short lead times are key for repairing (potential) pipeline leakages in the oil & gas industry, both to prevent downtime/ interruptions and to decrease safety risks. These leakages are primarily solved by metal clamps around the pipeline to enclose it and prevent gas/fluids from escaping. As pipes come in different shapes and sizes, these clamps are frequently custom made. Traditionally, these clamps are manually welded and/ or CNC milled. While specialized welders are becoming scarce and CNC milling has high material waste (on average >80% of original material), additive manufacturing (AM) can provide an attractive solution.

Robotic Wire Arc Additive Manufacturing (WAAM), a large-scale metal 3D print technology that uses an arc welding process to produce metal parts additively, has the potential to shorten the lead time of producing the clamps as the manufacturing can be fully automatic with less material waste. Moreover, WAAM enables new/optimal shapes that cannot be done with traditional manufacturing. Furthermore, the printing production can be done on-site and with multiple robots, decreasing the lead time further. On the other hand, WAAM has two potential disadvantages that could increase the lead time, as both post-processing and part inspection is required afterwards.

This research aims to tackle both disadvantages by creating hybrid manufacturing where additive manufacturing technology prints on pre-produced metal components to prevent these selected parts from being post-processed and inspected afterwards.

As a result, a fully functional pipeline clamp will be built from pre-produced metal components and additive manufacturing for the remainder of the part.

The consortium strives to demonstrate an alternative agile manufacturing technology based on WAAM technology that is potentially faster, cheaper and more flexible than traditional manufacturing. Moreover, WAAM has the benefit of higher production speed and lower costs compared to other 3D metal printing technologies such as Selective Laser Melting (SLM), creating an attractive alternative manufacturing technology.

The Trinity consortium of TEAM Industrial Services, MX3D and TiaT Europe incorporates key value chain partners. TEAM Industrial Services has the application engineering expertise, MX3D advanced WAAM and printing capabilities, and TiaT Europe specialized inspection and testing capabilities. By joining capabilities, the consortium aims to demonstrate this value proposition of hybrid AM while adhering to strict industry standards.

By conducting the research and creating the demonstrator, the consortium aims to accelerate the adoption of large-scale additive manufacturing in the oil & gas industry. Taking into account the industrialization and certification requirements in the sector, this demonstrator will open up new thinking on alternative manufacturing technologies to reduce material waste and lead time. For industries that frequency use complex metal parts (e.g. oil & gas, maritime, mining, utilities, energy) and where fast repair of unplanned downtime is essential, hybrid WAAM will add an alternative, more agile and fast manufacturing technology, in particular at remote locations. ■

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EACHPack Project – A step forward for small-scale logistic facilities

By Nicola Castaman, R&D Developer, IT+Robotics and Ph.D. Candidate, University of Padova

The growth of e-commerce is leading to the explosion of shipments of small postal packages weighing less than 5kg. Besides, shipping companies have to balance between a low cost to their customers and a demand for even faster shipping. This poses a huge problem, and also an opportunity for those who seek to provide innovative solutions in logistics worldwide.

Small parcel sorting is still a manual process that requires to pick up each package from a container, put it under a tracking system that checks the package transit, measures weight and volume, and places them on specific outgoing containers according to its destination. In incoming parcel posts handling, operators are subjected to repetitive 3-4 hours work shifts, in which they arrive to handle up to 400 packages per hour.

Systems based on 2D or 3D vision technologies are widely used in many applications, but they work with objects that have a defined model and a known shape.

Parcels, and in particular envelopes, do not have a reference model for locating them and they are often called model-less objects.

EACHPack (End-to-end Automatic Handling of Small Packages) project proposes a solution able to respond to these challenges, with the support of Trinity funding.

IT+Robotics leads the development of such an ambitious project, combining the academic experience of the Intelligent Autonomous System Lab of the University of Padova and know-how in the logistic field of AgileVision.

EACHPack exploits innovative machine vision algorithms based on Deep Learning to reach this goal, with the aim to potentially provide a complete robotized system to small and medium delivery structures, a system capable of performing the incoming parcel posts sorting process in an end-to-end fashion. Indeed, the proposed solution can recognize, localize, and handle deformable and non-fixed size objects such as the parcel post.

Due to the lack of robotised solutions able to effectively perform the small parcel sorting process, a significant number of small delivery facilities are potentially interested in the proposed system (around 250 only in Italy). Moreover, enabling small delivery facilities to robotise the avoid people to do repetitive tasks without added value.

We feel the market is going to be ready for opportunities in this field of automation and, thanks to Trinity, EACHPack represents a strong proposal that could significantly improve shipping companies' operation. ■

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Automating AM at scale

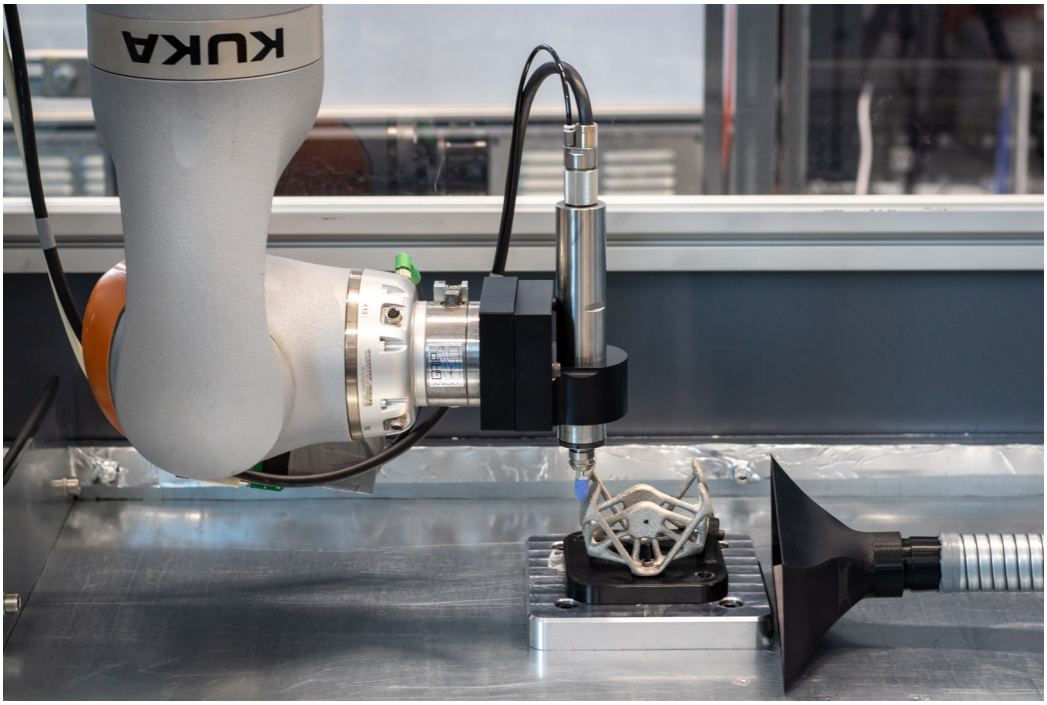
By Robert Bush, Founder Additive Automations

TRINITY has announced a collaboration with Sheffield-based start-up Additive Automations to automate the post-processing step for metal 3D printing and deliver a more cost-effective solution for volume production.

The project, named Separation of Additive-Layer Supports by Automation via 2-way digital twin (or SALSA2d), aims to reduce cost per part by 25% through the use of industrial robots and digital twin technology. The process works using integrated force and vision sensors which collect data to determine part geometry. This data is then analysed by software to determine the location of support structures which are then removed using an end-effector tool.

"Automating support removal and finishing in AM completely changes the economics when scaling up AM, and for the first time makes it feasible for manufacturers around the world to adopt this technology in rapid production," explained Robert Bush, founder of Additive Automations. "The digitalisation of AM also comes with an increase in quality, traceability and repeatability. Given that on average almost two thirds of post-processing costs are from finishing and support structure removal, we believe automation can reduce costs by an average of 25 per cent per part."

Since its founding, Additive Automations has secured funding from TRINITY, Innovate UK, and the National Research Council Canada and collaborated with both Renishaw and the University of Sheffield Advanced Manufacturing Research Centre (AMRC). TRINITY began working with the company in mid-2020 and is helping them to foster relationships with European companies, navigate the coronavirus pandemic and raise Series A investment in 2021. Renishaw says it began working with the company last year and has provided four examples of titanium parts across medical, oil and gas, automotive and mechanical engineering applications to demonstrate its support structure removal process. ■



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RoboBend - World's first standard bending robot

By Thomas Ronlev, CEO and Co-founder, RoboBend ApS

RoboBend - is the World's first standard bending robot that solves the problem of finding qualified machine operators, provides higher capacity on company's present machines, lowers production costs and delivers consistent high quality for your clients.

According to interviews conducted with key metal industry players, today there are 1.5 million press brake machines around the globe in the metal processing industry operated by humans, doing repeatable and dangerous work every day. Monotonous, risky work forced the future generations to look for other jobs and industries rather than take open vacancies in the Metal Industry, that resulted in severe labour shortages – European Commission's market data analytics company Skills Panorama predicts 2.7 million unfilled metal machinery job vacancies in the EU by 2030. Probably the best solution to this challenge is using robots that replace humans in controlling the press brake, solves safety issues and allows workers to work in other parts of production.

RoboBend is designed to make it simple to use at any production environment, for any worker with no special training. First, the operator specifies the piece that needs to be bent through an easy-to-use user interface. This process is repeated only for new pieces since all information is stored and can be accessed from the cloud server. The robot starts operating – it picks up prefabricated pieces from the feeder system with the robot arm and relevant gripper (vacuum, mechanical, electromagnetic), places them in the bending machine, takes them out once bent, and neatly stacks them on a pallet. It operates until all prefabricated pieces are bent and the feeder cartridge needs to be replaced.

An important component in RoboBend is the press brake control interface (RBMI) – the brain, which has embedded the software giving an "intelligent solution" and allows RoboBend to work with any existing press brake on the market. This is a key feature and makes RoboBend easy to implement and to use – providing the robot control over the machine, easy programming interface, quality control and at the same time is based on Industry 4.0 philosophy, making it possible to integrate data from the cloud and from other sources to optimize both the set-up and daily machine performance.

RoboBend ApS has recently participated and successfully received funding from Trinity DIH open call to facilitate and grow advanced robotics for agile production. "Co-operation with Trinity DIH consortium and its network partners opens up many possibilities for growth and solving metal industry challenges. With Trinity DIH funding programme we will be able to create next-generation RoboBend solution that will be able to work with larger pieces (up to 1,5 meters), it will have new software and user interface for faster batch production and a much easier programming process." - states CEO of RoboBend ApS Thomas Ronlev.

All in all, the next generation RoboBend solution will enable smaller batch production and open up more possibilities for companies that work with many different metal pieces and smaller batch orders. This will make RoboBend even a better business case for SME companies and will make their production more efficient and agile.

RoboBend is the world's first standard bending robot that provides an excellent business case for companies that are facing qualified operators shortages and are looking to increase their productivity. Robobend can bend more pieces than the human operator, so companies can increase bending capacity on your existing press brake machines. It works autonomously and delivers consistent high quality every time. ■

Thomas Ronlev
CEO and Co-founder
RoboBend ApS

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ICON:

Improved automation of electric motors manufacture

By Stefano Ellero, Area Manager, STAM

Small manufacturers of electric motors need to stay agile in their offering, in order to face quick changes in requests from customers and be flexible towards great variations in the design of the products they make. Collaborative robotics is the right approach to address this need, because it is more flexible than rigid automation, more suitable to manufacture small, different batches of motors and allows manufacturers to take advantage of automation speed and repeatability and human flexibility.

ICON's objective is to improve a robotic cell for coils winding, developed by the demonstration partners STAM and ICPE, by deploying three TRINITY-originated Human-Robot Collaboration (HRC) and Artificial Intelligence (AI) modules.

In the current setup, automation is covering large part of the process; the only steps performed by the operator are pre - and post- works on the wire (wire routing). Since the cell is based on an industrial robot, during the automatic cycle it is closed by a safety fence. In order to perform the pre and post winding actions, the operator is allowed to enter the robot area only if the cell has come to a complete stop. This results in robot non-operative time and reduces the cell productivity.

Moreover, the cell addresses winding on stators with different sizes and design. Currently, the user inputs the stator parameters on an HMI, which are translated into robot trajectories. If the user input does not match the stator that was physically loaded, there is possibility of collision and failure of the system hardware.

In the ICON demonstration, continued and mistake-proof production will be ensured exploiting the HRC and AI modules developed by TRINITY:

• The operator can work alongside the robot, whose speed is reduced, thus avoiding cycle stop. To reduce the accident risk, we will integrate the module "Safe Human Detection in a Collaborative Work Cell", which uses a safety laser scanner to detect an operator in the robot working area. The controller continuously monitors the sensor input and reduces the robot speed accordingly. This would allow an operator to do the wire routing on a completed stator while the robot starts a new cycle on another stator.

• We will deploy an efficient and flawless HRC process by exploiting the module "Projection-based Interaction Interface for HRC". The module will project command buttons, winding instructions and the real time robot workspace on the operator's work bench. This will also allow non-expert users to operate the system.

• Finally, thanks to the module "Object Classification", we will verify that the user input matches the actual stator geometry. An AI classification algorithm will be integrated to identify the stator, allowing to validate the operator's inputs before starting the process. This will avoid robot collisions with the workpiece and consequent failures. The algorithm will be trained with a set of known stators, to confirm validity of user inputs and reduce the setup time.

ICON will have many positive impacts on electric motors manufacture. Firstly, the robot non-operative time will be reduced, performing the wire routing actions in parallel to the robotic coil winding. Secondly, the overall cycle time will be shortened and winding failures will be avoided, thanks to the AI-based control of input parameters. These productivity impacts will be achieved ensuring the total safety of the operator, that is monitored by safety sensors and informed about the robot operations through the projection system. ■