P2-8

Automation in Construction
Projects, Prospects and Development Strategies

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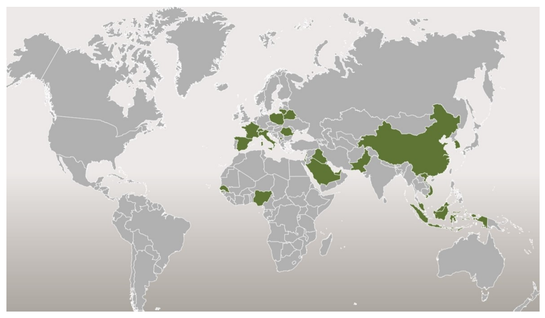
Background

PIAP Institute has been established in 1965. It is in the top five major EOD (Explosive Ordnance Disposal) mobile robot producers, with NATO, ESA, UE certificates & NATO Security Clearance. PIAP is present in 24 countries, with major markets in: Saudi Arabia, United Arab Emirates, South Korea, Nigeria, Vietnam, Indonesia, Pakistan, Senegal, France and Romania. We implement automation in order to push humans away from: threats and painstaking or hard work. (https://www.antiterrorism.eu/)

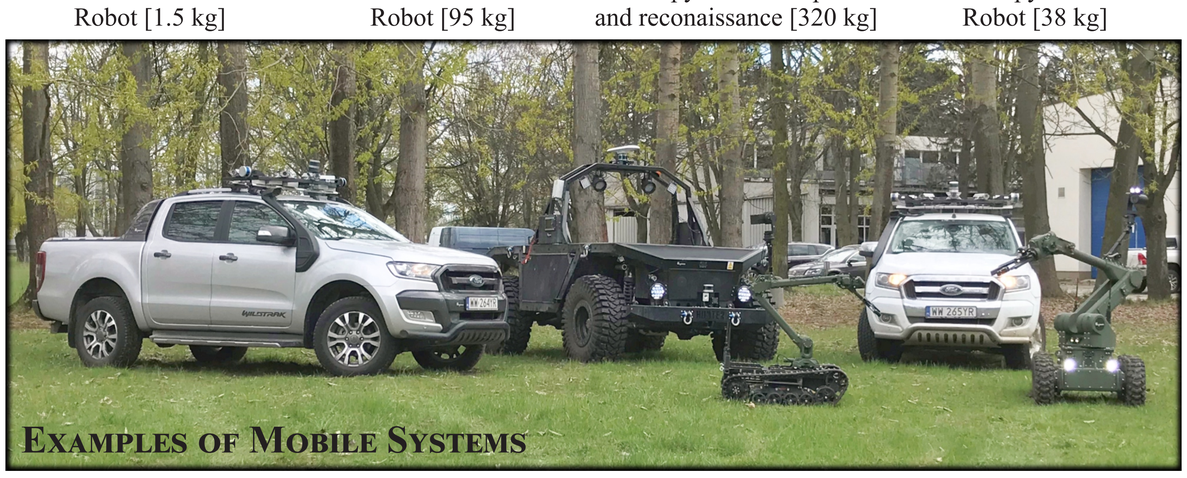


TRM ® 2.0
Tactical Thrown Robot [1.5 kg]

PIAP Patrol
Portable Patrol Robot [95 kg]

IBIS ®
Robot for pyrotechnic operations and reconaissance [320 kg]

PIAP Gryf ®
Mobile pyrotechnic Robot [38 kg]

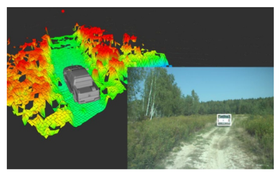


Examples of Mobile Systems

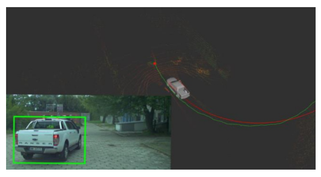
Research Project: ATENA

Modular autonomous system – original drive-by-wire system for FORD Ranger

Autonomous target following without satellite navigation



Following a car or a person based on visual systems



Autonomous off-road driving - route planning based on terrain traversability analysis

Research Project: HUNTeR

Max speed: 50 km/h.
Payload: up to 1000 kg.
Hybrid serial drive :electric motors + battery + diesel generator
Option to drive only by electric or with combustion engine
4x4 drive / 2 steering axles
Weight: 3500 kg

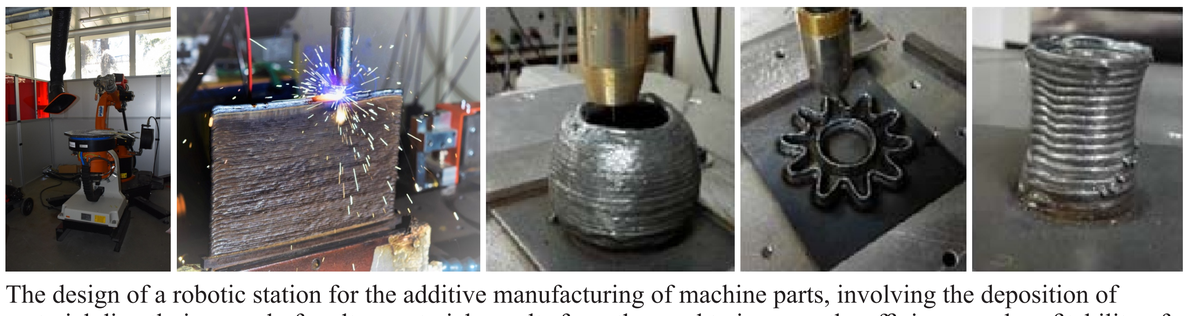
Dimensions: 4.7 m × 2.2 m
Wheelbase: 2.7 m
Power: Li-ion cells: 40 kWh
Drive power: 90kW/220kW
Generator power: 110 kW

Communication range: 800m

Research Project: Space_Adaptors

Mechanical Ground Support Equipment – Ground Handling Adaptor (GHA)

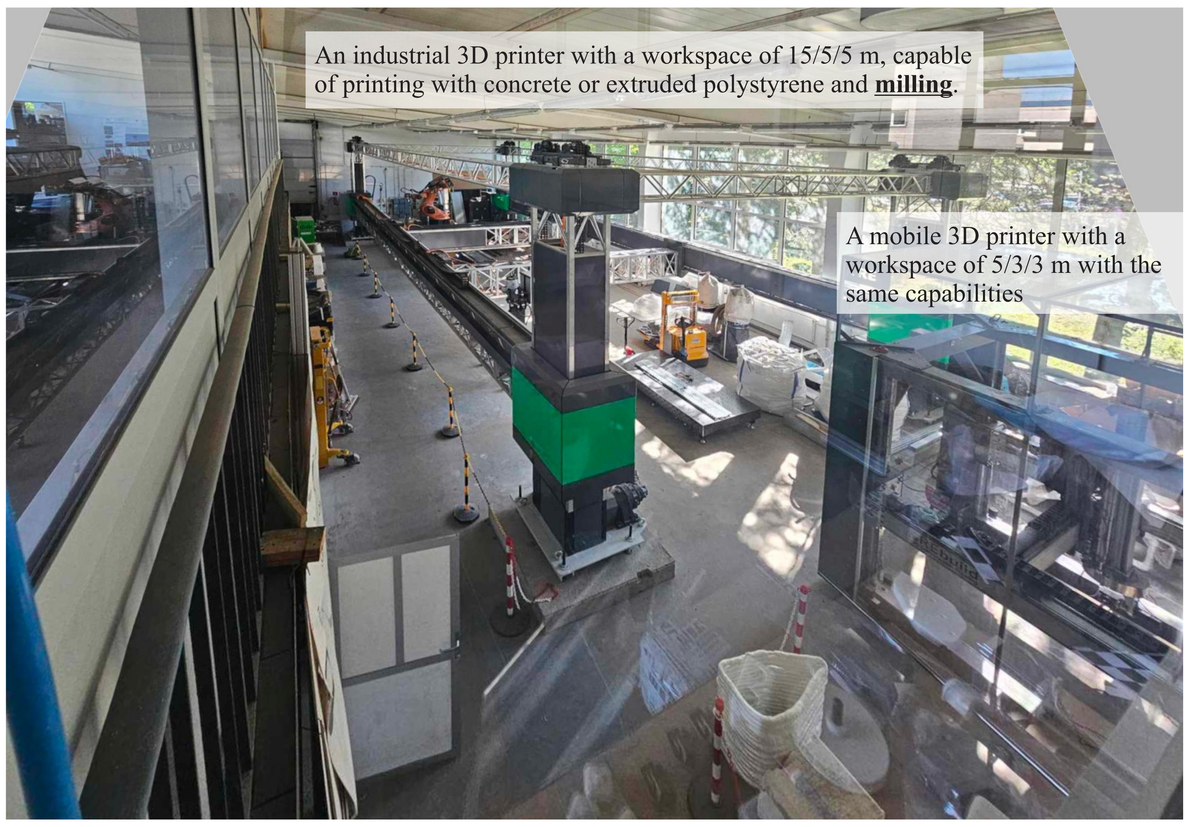
WAAM-based manufacturing (KUKA Kr500)



The design of a robotic station for the additive manufacturing of machine parts, involving the deposition of material directly in a pool of molten material, results from the need to increase the efficiency and profitability of individualized production of engineering structures with various geometries, dimensions and materials (steel, aluminum alloys). The station is based on the operation of a welding machine, the welding pipe of which is embedded in the cluster of a robotic arm of an industrial manipulator **KUKA Kr500** (6 DOF), which ensures the implementation of a wide spectrum of programmed movements in the working space depending on the robotic arm used. This makes it possible to produce (additive manufacturing) machine parts, structural elements, as well as architectural elements, freely scaled. The research station was installed in a room specially adapted for this purpose, which also serves as the station's working chamber, equipped with appropriate infrastructure.

This research is a part of the project titled *Arm-Z: an extremely modular hyper redundant low-cost manipulator – development of control methods and efficiency analysis* and funded by OPUS 17 research grant No. 2019/33/B/ST8/02791 supported by the National Science Centre, Poland

The first on-site 3D printed building in Poland
Printer dimensions: 8×17×5.5 m
Printable area 6×13×3 m

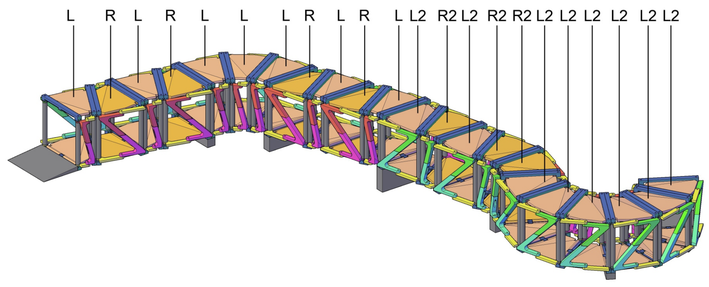


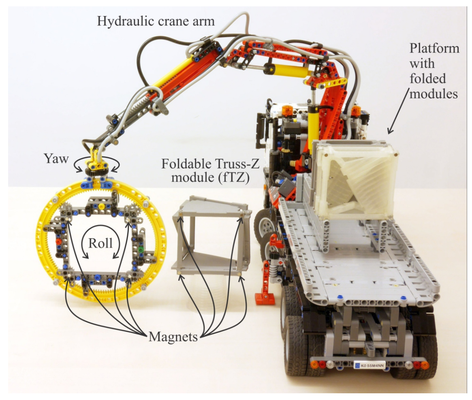
An industrial 3D printer with a workspace of 15/5/5 m, capable of printing with concrete or extruded polystyrene and **milling**.

A mobile 3D printer with a workspace of 5/3/3 m with the same capabilities

Automated Deployment of Modular Free-form Truss-Z

It is designed for creating deployable free-form ramps and overpasses intended for quick and unmanned deployment under strict time constraints or hazardous conditions.





The placement of each module is constrained - the entry and exit faces of each module must be in the vertical plane. This means that the grabber needs only two degrees of freedom, allowing two rotations of a module: roll and yaw (no need for pitch rotation). A special grabber has been designed as shown in the right photograph above. Table below illustrates the robotized assembly of a bridge (shown in the left figure above) made of foldable Truss-Z modules.