Construction site robot ready for outer space

MACHINERY FRAMEWORKS

IN THE BUILDING OF CHIRON, A NEW BREED OF CONSTRUCTION ROBOT, EIGHT MECHANICAL ENGINEERING, TWO ELECTRICAL ENGINEERING AND THREE SYSTEMS ENGINEERING STUDENTS HAVE PUT THEIR THEORETICAL KNOWLEDGE INTO PRACTICE. PROFILES FROM ITEM PROVIDE KEY TO THE PROJECT

Chiron is a construction robot capable of dynamically lifting loads of 30kg, yet it weighs just 74kg. Similar robotic arms are typically four to five times heavier. A variety of tools can be attached to it, and when doing so only the software has to be modified. For example, two team members have already developed a plaster spray tool, complete with a pump and a special application, which enables the construction site robot to move along a wall and distribute plaster.

Due to time constraints, the team decided not to implement the motorisation it had originally planned, opting instead for a modular solution with four wheels. "ETH uses Item profile technology a lot, so it didn't take us long to get in touch with the company," said mechanical engineering student Peter Zhang. "Its technology enables us to react quickly and flexibly. Everything can be extended very easily, which is something we noticed straight away in the project. This is a huge advantage.

The team also added a protective enclosure from Item that provides protection from the tools attached to the robot, such as chainsaws, while also preventing any elements protruding or bursting out if the hydraulics in the robot arm are used improperly.

However, the use of this robot is by no means limited to construction sites. While attending a spectacular event, the team was able to demonstrate what the future could have in store for Chiron. The IGLUNA project took place in the glacier palace of the Matterhorn glacier paradise in Zermatt, where 20 student teams from nine European countries came together at the invitation of the Swiss Space Center and the European Space Agency (ESA). They all arrived with their innovative inventions to investigate how we could make life on the Moon possible for humans.

Towering at a height of 3,883m and extending 15m below the surface, the glacier exhibits extreme conditions similar to those found under the Moon's surface. The temperature there is a steady -4°C. It therefore takes a truly inventive spirit to make the most of these inhospitable conditions. The spectrum of applications presented ranged from architectural designs for a lunar habitat and ideas for efficient food production to artificial intelligence that adapts to the astronaut's preferences.

Chiron, which was specially equipped with a chainsaw, was able to fully play to its strengths at the event: "The aim of our project was to demonstrate that a robot can be sent to the Moon to build a structure that will make it possible to establish safe housing. In concrete terms, this involves Chiron using its chainsaw to cut out blocks of ice and putting them together to form ice walls," Peter explained. Chrion is not yet an autonomous robot. It is operated by humans using a PC interface that offers two options – controlling individual joints to move the robot arm and setting a trajectory for the robot to follow. It then independently calculates how its joints should move. However, there are plans to develop Chiron into an autonomous construction site robot. For example, the team is currently working on software that will enable the robot to detect and pick up stones and assemble them into a structure – all without any human input.

When it comes to their professional futures, the students certainly struck lucky with Chrion: "We can apply a lot of what we've learnt in our studies here on a large scale. And the practical experience is worth its weight in gold," said Peter.

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System for filling cardboard boxes

MK Profile Systems was faced with a request from a cosmetics company to design and provide a comprehensive modular system for loading product into boxes whilst still maintaining hygiene requirements. The design had to account for a box filling machine for different tube formats with a capacity of 200 tubes per minute and 4 boxes per minute.

Chaining of upstream filling stations and integration of the provided scale with NOK out sorting of tubes was also required. Counting of the specified tubes per box was to be implemented via light barriers.

MK's solution was to provide a complete system with inner open profile grooves for maximum flexibility and outer closed grooves for a smooth, clean surface. Material handling of tubes and boxes was enabled with mk belt conveyors. Timing belt stations with timing belt conveyor, supported with pivot bearings for lowering for weighing. A funnel was included to accommodate a complete box fill quantity if there is a fault. In normal operation this would only be pneumatically closed for a box change.

The end result was a optimal solution for the customer, bespoke to their specific requirements.

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