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Vale uses robots to remove employees from risky situations and increase the safety of its operations

The company adopts models developed by the Vale Technological Institute – Mining or purchased from the market

The dream of science fiction writers to see robots working side by side with men is becoming a reality in Vale's operations in Brazil. The company has been investing in different models of robots to assist employees in maintenance tasks, helping to remove them from risky situations and contributing to the company's objective of becoming benchmark in mining safety. Currently, Vale works with three main robot models: two developed by the Vale Institute of Technology (ITV - Mining), which resemble "carts", and one acquired from an international supplier, Anymal, nicknamed by the company as "puppy".

[Click here](#) to watch a video showing how the robots work

Created in 2010, ITV keeps a robotics cell, which has been developing robots, drones and artificial intelligence (AI) solutions for operations. In 2015, Vale's Speleology area started the SpeleoRobot project, which the following year was taken over by ITV in partnership with the Federal University of Minas Gerais (UFMG). The remotely operated robotic device, with cameras and a lighting system, capable of moving over rough terrain, was initially designed to help speleologists working for Vale by mapping caves close to operations.

As of 2017, the SpeleoRobot began to be tested in other operational functions, such as inspections in confined environments, which are difficult for people to access. Inspections have already been carried out in pipes, galleries and drains, in addition to services in plant equipment, such as mapping of ball mills and inspection of crusher teeth. The SpeleoRobot has already been used in more than 15 different services in the operations in the Brazilian states of Minas Gerais, Espírito Santo and Pará. Its interchangeable locomotion system allows the robot to move using wheels, tires, treads or legs, providing mobility conditions on different types of terrain, and its sensing system allows for high resolution inspection, generation of three-dimensional maps, in addition to other modular capabilities.



Speleo Robot, developed by ITV, getting ready for an inspection (ITV)

Recently, some of the robot perception modules developed by ITV were exchanged with NASA, the US space agency. “These modules are being validated for use in an international underground robotics challenge”, comments researcher Maira Saboia, from ITV.

ITV is producing three more units of this robot, which will be leased to copper operations in Pará and iron ore operations in Vitória (Espírito Santo) and Itabira (Minas Gerais), where they will be used in inspections of mills, pipelines and other confined environments.

The Robot for Inspection Services (ROSI) is also being developed by ITV, in partnership with the Federal University of Rio de Janeiro (UFRJ). Designed since the beginning of the project as an inspection tool in Vale's operational areas, ROSI focuses on conveyor belts, a critical piece of equipment for mining. For this, ROSI carries a robotic arm capable of acting with dexterity in the operational environment, being able to reposition sensors and collect samples in places with difficult access. The robot began to be developed in 2017 and is currently in the testing phase

“These robots were created within Vale by the employees themselves and are a constantly evolving technology,” explains researcher Gustavo Pessin, from ITV. “Development is open-source, completely open from hardware to software, and its structure is modular. Everything that is developed can be used in other robots and equipment and adapted to new situations or functionalities using resources within Vale”.

Anymal

In addition to developing equipment at home, Vale is also acquiring Anymal, a quadruped robot created by Anybotics, a Swiss company. Already used in other industries, the robot was adapted for mining operations with the support of a team

from Vale. This year, a proof of concept was completed at the Cauê plant, in Itabira (Minas Gerais). The success of the tests convinced Vale that it should purchase a unit of the robot.



Anymal robot standing next to analyst Rayner Teixeira in Itabira (Raphael Portilho/ Vale)

During the proof of concept, the robot maneuvered around the platform and overcame obstacles such as going up and down stairs. It created and displayed a digitized map of the area under inspection, executed route planning and defined the way forward, focused on specific objects and instruments, transmitted images, recorded thermal images with temperature measurements, among other functions.

Using the robot minimizes human exposure in hazardous locations, in addition to allowing remote asset inspection and data collection so that more effective decisions can be made. “With the robot, we eliminate risks pertaining to inspection activities, such as rotating equipment parts, noise and dust,” explains Rayner Teixeira, operational analyst responsible for developing Anymal at Vale. “We also eliminate activities that have ergonomic risk, where the employee would need to perform a task in an uncomfortable position. The robot also gives us access to confined spaces, like the inside of a mill.”

The robot will be used to carry out inspections of the grinding unit and the three-dimensional map of the Cauê mine. In addition to the gains in employee safety, a reduction in the number of stops and maintenance costs is expected, as well as greater reliability in inspection and the collection of parameters to control the performance of assets in real time.

Vale Institute of Technology

Created in 2010, the Vale Institute of Technology (ITV) is a non-profit institution, with the objective of developing technological and scientific solutions to the challenges of the mining and sustainability chain in the territories in which Vale is present. The pillars of action are research, training and entrepreneurship.

It operates through ITV Sustainable Development, in Belém (Pará), and ITV Mining, in Ouro Preto (Minas Gerais), with the purpose of creating options for the future through scientific research and the development of technologies, expanding knowledge and frontier of business in a sustainable way. In addition to applied research initiatives for Vale, ITV conducts master's and specialization-level training programs.

Innovation in safety

Innovation is key for Vale to improve people's lives and transform the future together with society. In its strategy, the company prioritizes safety, reliability, low carbon agenda and generation of shared value. Ongoing safety innovation initiatives aim to remove employees from risk or reduce their exposure through the use of technologies such as autonomous vehicles, among others; identify and resolve causes of accidents with motor vehicles and energy equipment through operator fatigue detection systems and proximity alerts, for example; and elimination of risk scenarios.

More information



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