Vitirover and Trimble combine to Develop the Vitirover Autonomous Industrial Robotic Mower for Managing Vegetation on Large Surfaces

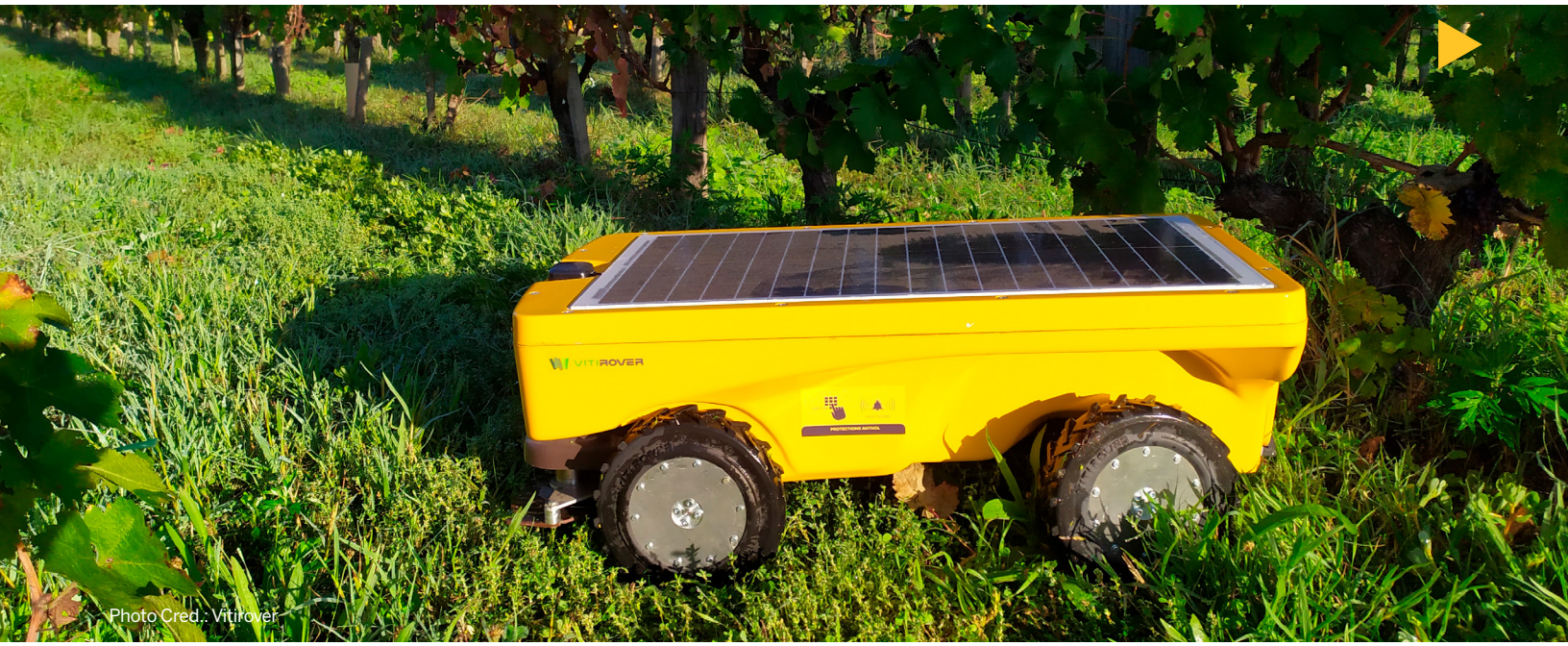
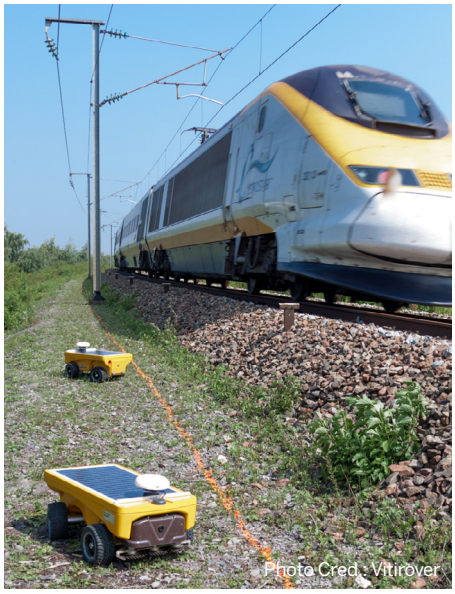


Photo Cred.: Vitirover

The Vitirover robot mower offers autonomy and flexibility in agricultural spaces including vineyards, and industrial spaces such as photovoltaic farms.

The Vitirover is an industrial and agricultural maintenance machine built to adapt and manage vegetation and grassing on all large surfaces. The navigational heart of the robot includes an Trimble MB-Two high performance, dual-frequency receiver with a RTK/PPP positioning engine. Available as a subscription service, the Vitirover robot is managed by a shepherd, an individual charged with tracking all robots at work.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Solution

Precise Autonomous Robot solution for industrial vegetation and grass control

- Trimble MB-Two high performance, dual-frequency receiver
- RTK/PPP positioning engine
- Provides centimeter-level accuracy in less time

Overview

Vitirover was founded in 2010 to develop high-precision robotic solutions for industrial vegetation and grass control. The first robots were developed to mow in sensitive areas around vineyard vines, which typically have 7,000-12,000 obstacles per hectare. This makes mowing a complex task that requires precision to prevent damage to vines and speed to complete mowing tasks across slopes and counterslopes of many acres. By 2018, the Vitirover industrial mower robot had gone through several iterations. Applications expanded beyond vineyards to arboriculture farms, photovoltaic farms, railways, electricity transmission network, high voltage power plants, and along roads and highways. At the heart of the solution is a motorized 4-wheel drive robot equipped with solar panels and a Trimble MB-Two high performance, dual-frequency receiver with an RTK/PPP positioning engine.

Today, the industrial grass maintenance robot is an effective alternative to glyphosate, a common possibly carcinogenic herbicide used to kill unwanted plants. Vitirover robots are offered as a service, monitored by the company's trained technicians (called shepherds).

Location
SAINT-EMILION, FRANCE

NEED

Automated mowers are not new to the industry. However, most are bound by wired space and plugged into a power source. The Vitirover team sought to develop a solution with more autonomy and flexibility in terms of power and application. A key impetus for development at the time was growing public concerns about the toxicity of the herbicide glyphosate, commonly used in agriculture, forestry, lawns and gardens to kill weeds and manage unwanted plant growth. As more countries ban or limit the use of the pesticide, owners of large properties need a way to manage large grass areas, such as along highways, railways, industrial areas and farms. A fully autonomous rugged mower robot could be the solution.

CHALLENGE

The development of the Vitirover robot emerged with an idea to eliminate the limitations in functionality of other automated mowers. For instance, automated mowers typically have mechanical limits, operating within a wired space that must be installed and must be plugged in to collect energy for operation. These systems are typically designed for smooth grass and clean backyards.

"This type of solution will work in agricultural spaces, such as vineyards, or industrial sectors such as photovoltaic farms," said Arnaud de la Fouchardière. "The Vitirover is designed to operate in challenging natural environments, with no mechanical limits."

SOLUTION

Key in eliminating the operational limitations of an autonomous mower was to combine powerful solar panels and GNSS for navigation and security. The solar panels 'fuel' the robot movement and the GNSS board. When asked about the choice of GNSS, Vitirover's Chief Technology Officer Xavier David-Beaulieu points to precision and reliability as essential elements. "We knew we needed high-precision. Our first thought was to use a camera, but grass and debris on a vision-based system would quickly cover the camera. GNSS was the answer."

David-Beaulieu was already familiar with GNSS solutions from Ashtech S.A.S., a French-based GNSS developer. "I've used Ashtech boards for a long time and trust them. As part of Trimble, the choice was straightforward."

When asked about precision, David-Beaulieu noted that standard GNSS have around 1 meter precision, which won't work for applications such as along a high speed railway or around electrical fields transformers. "We needed a solution that was very accurate, in the centimeter range," he confirmed. "Autonomous operation near a railway, for instance, requires the robot to operate very accurately between the tracks and the sidewalk."

The technical team selected the Trimble MB-Two that incorporates the MB-Two Z-Blade technology, which is able to drive the GNSS agnostic engine and acquire over-the-air satellite corrections for RTX through its embedded L-band hardware or get correction from a NTRIP Server for centimeter-level accuracy.

"We needed two GNSS antennas to ensure accurate heading measurements even in areas with magnetic charge, such as railways. On average, the Vitirover achieves 5cm accuracy," said David-Beaulieu.

The robot is also built with security features including a rechargeable battery and a second GPS system, making the units difficult, if not impossible, to steal. Each Vitirover robot is even tracked in real-time by a shepherd or the human interface, even when the power supply is down.

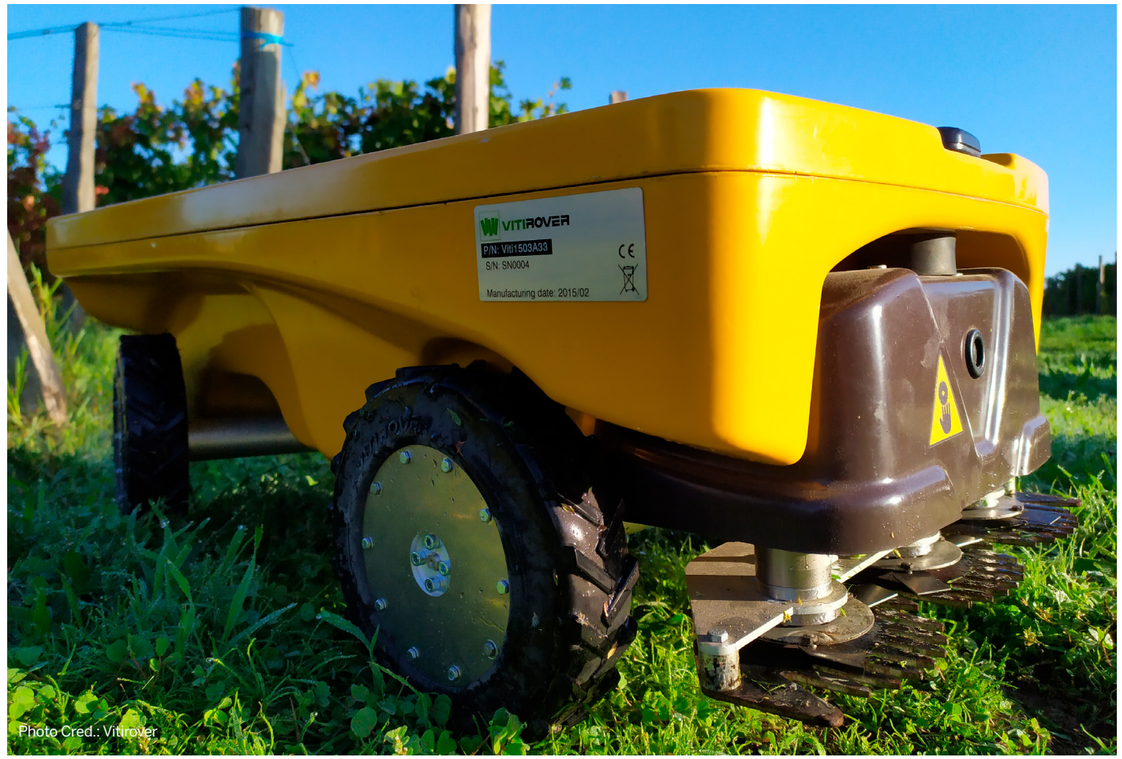

Photo Cred.: Vitirover

RESULTS

One operator (called a shepherd) can manage up to 50 robots using a website available on a PC or phone. The shepherd tracks the robots' work in real-time and remotely monitors energy consumption, rotation speed of each motor for each robot, the battery level, and charge level of the solar panel. The shepherd can also access the history of the last 24 hours of operation, including details like scheduling, working hours, recorded issues, mowers' self-cleaning operations, completed journeys, and quantity of cut grass.

The robots are able to move in varying patterns:

- **Standard** – from place to place depending on the job. Especially suitable for plots with a great density of obstacles (up to 10,000 obstacles per hectare) such as vineyards or photovoltaic fields.
- **Methodic** – operates in parallel lane. Ideal for free space environments such as gardens.
- **Trip** – plot-to-plot scenarios as defined by the shepherd.
- **Tracks** – operates in a straight lane. Suitable for railways and sidewalks where clear lanes are defined (the ideal lane is less than 0.10m apart)

The first step to begin a job is to define the application limits. The Vitirover team has a special tool that collects the points to define the polygon limits. This custom tool uses a Trimble MB-Two with RTK options. Once gathered, the points are uploaded to the cloud.

When a Vitirover robot is placed in the area to be mowed, it connects to the cloud to download the defined plot to work, as well as the located and time stamped jobs made before by other robots. It is able now to automatically run an algorithm to determine the optimal route to unmowed places. The number of robots used to complete a job is dependent on the surface to work and is determined by the shepherd.

During any operation, each robot continuously collects data, comparing the quantity of electricity consumed to the amount of grass to be cut, automatically calculating where it's going and how much work is still needed to be done. It can recharge itself with sun power or the shepherd can change the battery each day. If a robot needs help, it automatically sends a text to the shepherd. The most recent applications have been along high-speed train tracks, airport tarmacs and highways.

Vitirover developers continue to add new features to the Vitirover mower robot. For instance, the Ground Robot for vineyArd monitoring and ProtEction (GRAPE) includes a robotic arm that can automatically dispense pheromones traps creating sexual confusion for the grape worms and the Vineyard Vigilant & INNovative Ecological Rover (VVINNER) includes cameras and weather sensors to track insect population cycles, predict harvest productivity and measure vineyard strength.

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