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A Spanish project tests a quadruped robot in vineyards

Developers say its sensors and AI could turn laborious inspections into standardized data for earlier yield forecasts.

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A Spanish agricultural technology project is testing a quadruped robot fitted with sensors and artificial intelligence to monitor vineyards and fruit crops, in an effort to turn labor-intensive field checks into standardized data that growers can use to make faster decisions.

The project, known as AGRHOUND, includes the National Agri-Food Technology Center of Extremadura, or CTAEX, based in Badajoz. According to CTAEX, the goal is to develop and validate a four-legged robotic system for high-value crops as part of what the group describes as Agriculture 5.0, combining field sensors and intelligent data processing to support autonomous decision-making.

The machine is designed to move through conditions that can be difficult for wheeled equipment, including uneven rows, light slopes and dense vegetation. Cameras and other sensors mounted on the robot collect close-range information as it walks through the crop. That information is then processed with AI models that are being trained to detect patterns linked to plant growth, vigor and physiological condition.

One of the main targets is yield estimation. In vineyards and orchards, that kind of forecast can help growers plan labor, harvest schedules and crop sales before picking begins. Project participants say the robot is not meant to replace farmers or agronomists. Its purpose is to provide more frequent and more consistent observations, so field teams can identify areas that need closer inspection and avoid making decisions for an entire plot based on limited sampling.

Early field validation has already begun in commercial growing conditions. According to the project description, one of the test sites is a vineyard in the Ribera del Duero wine region, while another is a blackberry farm in Huelva operating under a macrotunnel, a protected growing structure large enough for workers to move through standing up. Using two very different crops is intended to show whether the system can adapt to different planting layouts, soil conditions and crop-management systems.

The field data collected at those sites is being used to train the AI so it can better distinguish between leaves, fruit and branches under changing light, across varieties and at different stages of ripeness. The project is also working on navigation and guidance systems that would give the robot greater autonomy, allowing it to identify areas of interest on its own, approach plants and carry out tasks such as visual inspections or sample collection.

For growers, the main advantage of a system like this is repeatability. A robot can follow the same route and record measurements using the same criteria each time, which can make it easier to compare how a block changes from week to week. That could also reduce some of the physical strain and time involved in walking row by row through large plantings to inspect vines or fruit by hand.

The work fits into a broader push in Europe and Spain to bring robotics, computer vision and sensor systems into agriculture. Similar efforts have been tested in olive groves and vineyards, including projects that use LiDAR, satellite imagery and noninvasive sensors to measure terrain, estimate grape production or monitor vine water status. Other autonomous platforms have been built for precision weed control, including laser-based systems that aim to reduce herbicide use.

The practical case for vineyard use is especially clear for the drinks business, where grape growers and wineries depend on reliable crop forecasts and timely field information. If systems like AGRHOUND prove accurate and affordable, they could strengthen precision viticulture by helping producers monitor vine health, estimate yields earlier and target irrigation or other interventions more precisely. That could, in turn, support planning across the wine supply chain, from labor needs in the vineyard to decisions about incoming fruit at the winery.

For now, AGRHOUND remains in the validation stage. Its developers still have to show that the robot can operate reliably outside controlled demonstrations and under the daily pressures of working farms. Battery life, maintenance in the field, rural connectivity and performance in mud, on slopes or in heavy vegetation are among the issues that will shape whether growers adopt the technology for routine use. The project is continuing to train its algorithms with real-world vineyard and fruit-crop data as testing moves forward.