

AGRICULTURE - FOOD HARVESTING

ROBOTIC ASPARAGUS HARVESTER

Multi-Axis Guided Motion for Automation in High Debris Farming Environment.



HIGH SPEED



DEBRIS RESISTANT



CONTINUOUS AUTOMATION



MULTI-AXIS SOLUTION

Up to this point, asparagus harvesting has largely been an arduous and expensive manual process. The stalks grow at various speeds, so it has been the job of workers to painstakingly cut through each ripe stalk individually. This laborious process makes asparagus one of the most expensive vegetables to produce. With demand on the rise, it has become more important than ever to explore automation solutions to make harvesting sustainable.

The Bremen Centre for Mechatronics (BCM), the packaging machine manufacturer Strauss, and the agricultural company C. Wright & Son have collaborated to develop GARotics, a robotic asparagus-harvesting vehicle that uses image processing to identify and collect green asparagus at its optimal ripeness.

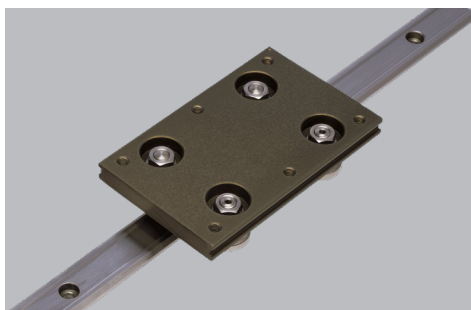
To move the asparagus shearing tools into position requires a robust guided motion system with a high degree of maneuverability to avoid damaging the growing stalks.

CHALLENGE

HIGH THROUGHPUT IN A HARSH ENVIRONMENT

To meet demand, it is critical that the robot have a high throughput. Therefore, the cutting toolhead must have travel speeds above 1 m/s to cover the width of the crop row. Additionally, the system should have the flexibility to maneuver around the stalks that are not ready for harvesting.

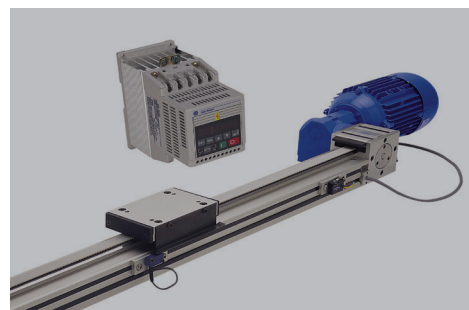
Asparagus is grown in many regions across the world, where environmental conditions can be hot or cold, dusty or wet. The system must be resistant to these harsh conditions and tolerant of debris to run for 24 hours in the fields.



SL2 Stainless Steel Linear Guide



PRT2 Ring and Track System



DLS Belt Driven System with Motor and Controller

SOLUTION

FAST & DURABLE MULTI-AXIS GUIDED MOTION

To maximize throughput, two independent cutting heads are mounted to the underside of the robot harvester and travel across the width of the row of crops on SL2 stainless steel linear guides. The vee guide wheel technology of SL2 wipes away any dirt, dust, and debris, while the stainless steel construction provides corrosion and environmental resistance. Each guide system is driven by AC geared motors and a belt drive (based off HepcoMotion® DLS actuators) for speeds up to 1.4 m/s. With specialized motors it is possible to achieve 5 m/s on such a guide system.

The cutting heads use a secondary pivoting movement to navigate around asparagus stalks, only gripping and cutting those ready for harvesting. The gripper swings into position using a PRT2 ring and track system; stainless steel vee guide wheels and track again provide robust self-cleaning capabilities and high speed for the PRT2. The PRT2 and SL2 systems then reverse the motion, delivering the asparagus to a conveyor belt on the robot's side.

CHALLENGE SOLVED

ROBUST DESIGN PROVIDES 24-HOUR SPEED AND RELIABILITY

With a steady energy supply, this robotic harvester can work in the fields for 24 hours. The robust design of the linear and rotary guided motion elements allows it to work continuously in dust, dirt, wetness, and a range of temperatures with almost zero maintenance (even no need for greasing). The speed and reliability of the SL2, PRT2, and DTS elements available from Bishop-Wisecarver help GARotics achieve a new level of throughput for automated harvesting of this high demand crop.

“ Thanks to the combination of a linear movement and rotation when lowering, it is possible to fit in a small distance between the stalks of two asparagus.”

- LASSE LANGSTÄDTLER, RESEARCH ASSISTANT AT THE BREMAN INSTITUTE