



LMI TECHNOLOGIES

FactorySmart® Inspection

POTATO SORTING AND INSPECTION

3D MACHINE VISION IN THE AGRO-FOOD INDUSTRY

INTRODUCTION

3D machine vision technology adds speed, precision and cost-effectiveness to the potato sorting and inspection process.

Potato Power

The potato is a staple food product in every continent around the world. It's importance as a food source is perhaps best emphasized in French, where the potato is known as "pomme de terre", or apple of the earth. This is primarily because potatoes are such a highly versatile vegetable, and can be used for a wide range of purposes. With a high yield per hectare and low water requirements, potatoes are also a more sustainable food product than other staple crops such as grain or rice.

Automated Potato Sorting & Quality Control

Potatoes, like all agro-food produce, grow in a wide variety of shapes and sizes. Before processing and packaging they must be sorted into categories by shape. For example, large and long potatoes are used in the production of french fries, large and wide potatoes in potato chips, while smaller potatoes are sold to be mashed or used in side dishes. In addition to shape and size, potatoes also have to be inspected for blemishes and other surface defects.



Potato processing is a major agro-food application requiring an automated quality control solution that can handle **high-volume, high-speed** throughput requirements.

APPLICATION CHALLENGES

Traditional processing methods fail to achieve maximum level throughput.

Processing Conditions

In a packaging plant, potatoes are first washed clean of dirt and then singulated onto a grooved conveyor system so that they can be individually inspected. Factors influencing the sorting decision typically depend on the variety of potato, the intended use of the potatoes in production, the grading rules currently in effect and the daily price list of the different sizes and grades.

The Challenge: High-Volume, High-Speed

Sheer volume of potato shapes, sizes, and quality makes manual inspection costly, time-consuming, inefficient and error-prone. As a result, factories must implement a solution that can automate this process and meet throughput demands with a high degree of accuracy.

Other approaches to sorting and inspection, such as automatic mechanical systems using weigh scales, are slow and require ongoing maintenance. Systems using traditional 2D vision require on-site calibration, external light sources and a multitude of hardware components and cabling.



If manual inspection and 2D scanning systems can't achieve the required results, what solution can?

**The answer:
3D smart sensors.**

SOLUTION INSIGHTS

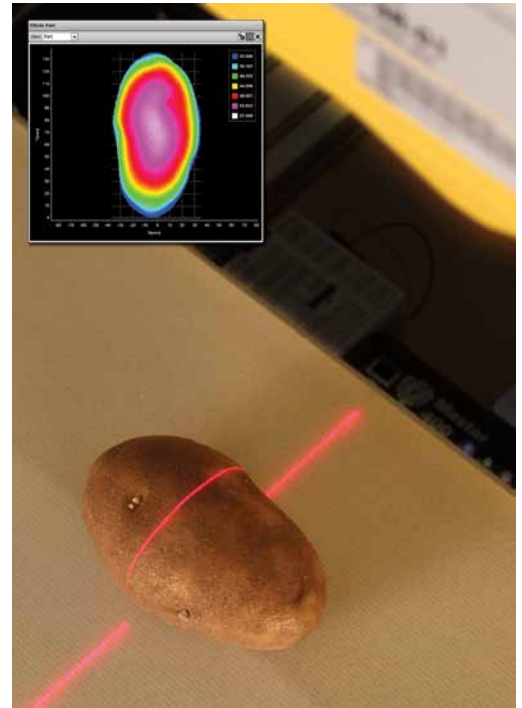
3D smart sensors deliver rapid volumetric measurement for potato sizing and full 3D point cloud surface profiles for high-precision surface defect detection—all at production speed.

Volumetric Measurement

Potato sorting is ideally suited for laser-line based 3D machine vision solutions. Specifically, compact and pre-calibrated laser-line solutions use only a single light source and can acquire full 3D volumetric measurements of each potato that passes on the conveyor, then process that data in real-time without the need for an external PLC (controller).

Surface Defect Inspection

In systems that also require inspection for defects on the potato's surface, a 3D smart sensor can deliver pixel-by-pixel matched 3D and 2D data in a single scan—with very high accuracy. Blemishes, defects and other irregularities are easily visualized using these complete surface profiles.



THE CASE FOR 3D MACHINE VISION:

- Contrast invariant, ideal for inspecting low contrast objects
- Volumetric measurement provides shape and position related parameters
- Immunity to ambient light means it performs in variable lighting conditions
- Pre-calibrated to deliver measurements in standard units

IMPLEMENTATION INSIGHTS

Networking, built-in measurement tools and rapidly customizable algorithms make 3D smart sensors ideal for achieving high-volume, high-speed throughput requirements.

3D Machine Vision in the Factory

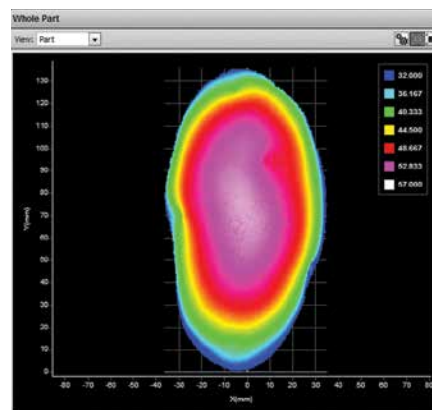
In potato sorting, a 3D machine vision sensor is mounted above the conveyor belt, scanning the top surface of the potato as it is transported under the sensor. For strict sizing applications, factories will use a 3D solution with built-in measurement tools that can sort potatoes quickly and efficiently based on their organization's unique tolerances, without the need for custom software programming.

Built-In Measurement Tools

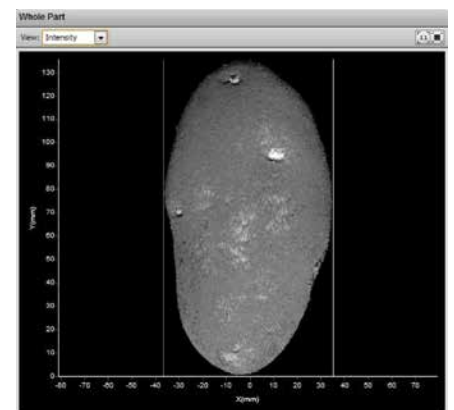
Built-in measurement tools are configured through a standard web browser and the 3D smart sensor supports several industrial PLC protocols to deliver measurements such as length, width, height and volume directly to the factory control system.

Rapidly Adjustable Sorting Functionality

3D machine vision based sorting can be altered “on-the-fly” to accommodate fluctuations in commodity pricing. For example, when potato chips are in higher demand, technicians can modify the sorting algorithm to direct a greater volume of potatoes toward that market.



3D W Height Map



Matching 2D Intensity Image

ADDITIONAL CAPABILITIES

The ability to tag and track parts makes today's 3D smart sensors highly effective in inspection processes that require automated downstream control decisions.

The Downstream Inspection Process

Every time a potato is inspected, both a measurement and control decision are created. For example, at the time the potato is scanned its position is noted by an encoder. Since potatoes are ultimately sorted or rejected by downstream hardware (e.g. a deflection gate), the control decision for each potato has to be tagged and tracked until it arrives at the gate—at which point the 3D smart sensor must activate the gate to sort or reject each potato according to spec.

Automated Control Decisions:

Part Tagging and Tracking

The best 3D smart sensors will calculate the sorting decision and control the timing of deflectors downstream from the scanning zone in order to direct the potatoes into the correct bins. This requires that each potato is tagged with a decision and tracked by its encoder position until the appropriate sorting bin is reached, where the sensor then activates a deflection gate at the precise time. There could be hundreds of potatoes queued into the sensors tracking control logic at any one time. Built-in control logic such as tagging and tracking avoid the unnecessary cost of adding PLC systems.

A 3D SMART SENSOR'S POWERFUL HIDDEN ABILITIES:

- More than just factory communication protocols
- Real-time part tracking for high-volume downstream processes
- Discrete I/O activation for highly accurate control decisions

THE POWER OF MACHINES THAT SEE

3D smart sensors provide a faster, more precise and cost-effective solution to traditional methods of agro-food sorting and quality control.

Easy-to-Use

Features such as web-browser driven point-and-click environment for rapid configuration, built-in measurement tools and rich I/O for communicating results make it easy for factory technicians to get the results they need.

Low Latency

Real-time measurement capabilities minimize lag between data acquisition and visualization, which means factories can consistently meet their throughput targets.

Connected

Today's 3D smart sensors connect seamlessly with factory infrastructure to report results, web browsers for diagnostics and monitoring, the Internet for upgrades, and with other network devices to exchange or combine data.

Flexible

Quickly and easily customize sorting algorithms to achieve maximum throughput in specific product markets based on changes in commodity pricing.

Built-In Tools

Built-in application-specific tools provide maximum ease and control over the sorting and inspection process.

3D BOOSTS THROUGHPUT AND MINIMIZES SYSTEM COST AND COMPLEXITY:

- Increases volume throughput with rapid scan rates
- Automates potato sizing without the need for a PC
- Automates potato grading with a single solution delivering both 3D and 2D data
- Automates potato tracking and deflection gate logic for sorting into multiple bins

IT'S BETTER TO BE SMART
contact@lmi3d.com

ABOUT LMI TECHNOLOGIES

ADVANCING 3D MEASUREMENT WITH SMART SENSOR TECHNOLOGY

At LMI Technologies we work to advance 3D measurement with smart sensor technology. Our award-winning, FactorySmart® sensors improve the quality and efficiency of factory production by providing fast, accurate, reliable inspection solutions that leverage smart 3D technologies. Unlike contact based measurement or 2D vision, our products remove complexity and dramatically reduce implementation cost.

To learn more about how LMI's inspection solutions can benefit your business, we invite you to contact us at contact@lmi3d.com or visit us at www.lmi3d.com to explore the possibilities of smart 3D technology.

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