Nowadays, 3D technologies are becoming a tool almost indispensable for every industry, technical company, museums, or scientific units. An example of an interesting application of 3D optical technology is research carried out by the Department of Food Technology at the Warsaw University of Life Sciences. The unit under the leadership of dr hab. Lech Adamczaka uses the SMARTTECH 3D scanner to test the composition and quality of meat. The obtained data is used to analyze the volume and color of the tested meat sample, which are important variables describing its technological properties.
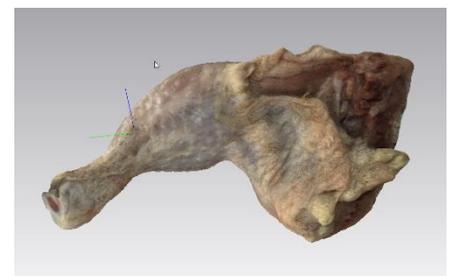
Consumers are placing ever greater demands on the quality of foodstuffs, judging their freshness, and deciding to buy based on their appearance. For this reason, the color of the meat becomes one of the most important selection criteria. It depends on many factors, such as sex, age, and the way the animal is reared, as well as the way the product is stored or the food additives used during its processing.

3D scanning process using SMARTTECH3D UNIVERSE scanner

During laboratory tests, the assessment of the technological value of meat is taken into account, which includes: the ability to absorb water, the pH value, color, and nutritional values, e.g. protein or fat content. In most meat processing plants, a given product is classified only through visual inspection by an employee. This is largely a subjective method and prevents the entire process from being archived reliably. Tests carried out in specialized laboratories offer more possibilities, but the process is labor-intensive and inaccurate, e.g. when it comes to measuring density, volume, or color.
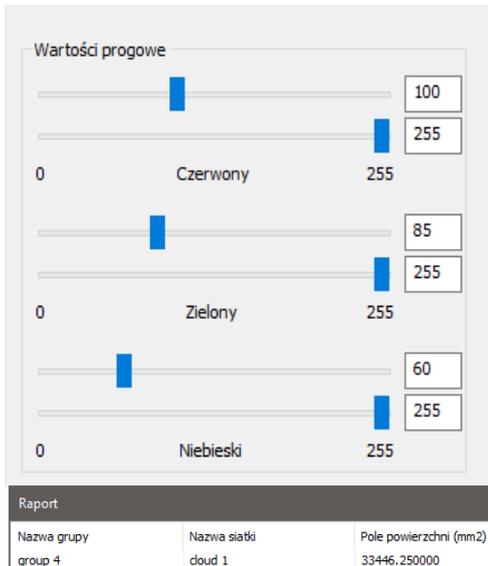
There are many methods of assessing the color of meat, the most popular of which are: sensory, based on visual examination, and instrumental - colorimetric or spectrophotometric. Currently, the most commonly used measurements are the color of the product in the CIE LAB (L * a * b *) system, which allows us to distinguish good meat from defective PSE (pale, soft, watery) and DFD (dark, hard, dry) meat. Thanks to the use of 3D scanners, scientists receive tools that significantly expand their comparative possibilities.

The view of a triangle with texture in SMARTTECH3Dmeasure

Wartości progowe

| | | 100 |
| | | 255 |

0   Czerwony   255

| | | 85 |
| | | 255 |

0   Zielony   255

| | | 60 |
| | | 255 |

0   Niebieski   255

Raport

Nazwa grupy	Nazwa siatki	Pole powierzchni (mm2)
group 4	cloud 1	33446.250000

Calculation of the selected surface

Benefits of using 3D optical scanning technology

We would like to highlight the possibilities offered by the use of a 3D scanner in relation to previously used methods, for example, examining a chicken thigh. Warsaw University of Life Sciences in its project used a scanner SMARTTECH3D UNIVERSE 10MPix with the possibility of the full-color reproduction and measuring volume of 400x300x210mm. The scanning head was integrated with an automatic shadeless lighting system, which allows us to obtain the best quality of the reproduced color.

3D scanning allows you to obtain information about the shape and geometry of a given object and to create a virtual copy of it. As a result of scanning, you get a cloud of points that reflect the scanned item. They are described through three coordinates: X, Y, Z, and three color components: R, G, B. Consequently, a triangle mesh is created from the points obtained as a result of the measurement.

Thanks to the use of an optical 3D scanner, it is possible to easily determine important parameters, such as the volume and density of meat. Additionally, by the usage of white structured light technology, we can easily obtain a realistic texture of the scanned object, which gives information about the color and condition of the product. These elements are crucial at the stage of assessing the technological properties of meat. Measurement with the use of an optical 3D scanner greatly facilitates most of the research stages. The eternal archiving of the virtual model also allows for objective comparisons at a later time.

Measurement of the density and classification

The use of 3D scanning enables an innovative process of estimating the share of the most valuable part of the entire chicken carcass, i.e. the breast before it is sent for cutting. Due to size differences, it is important to divide the carcass according to the size of the breasts. Smaller breasted carcasses should be cut or sold whole, and oversized carcasses that may need to be trimmed to a certain weight can result in multiple trimmings that diminish the market value.

Carcasses are currently classified according to their weight. Due to the differences in the size and proportion of individual muscles, it is important to develop a new way of assigning carcasses to categories. This will result in the use of the raw material and selection of appropriate parameters for production processes. 3D scanners significantly simplify the measurement of breast size and also helps to determine their dimensions based on the cross-sections made.

Odległość

d: 106.008726 mm
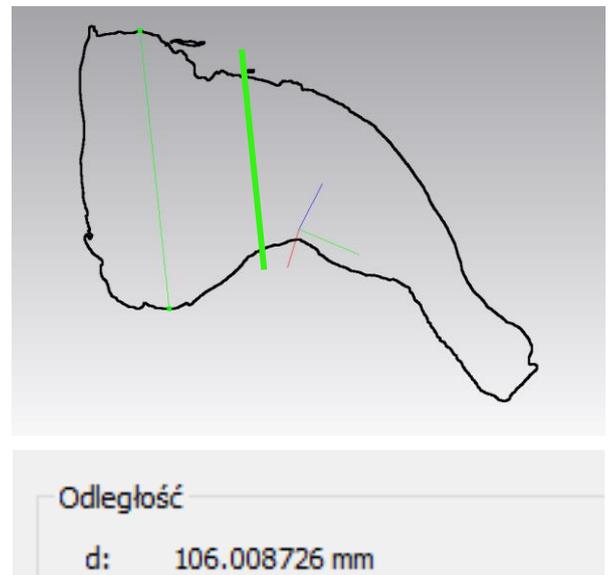
Calculation of the selected length

The three-dimensional measurement technology allows for accurate, non-invasive, hygienic measurement of samples. Additionally, the determination of the sample volume is influenced by the mean measurement error of less than 2%. Measured samples can then be used in the production process or for other research purposes.

Usually, checking the volume involved placing an object in the water and determining the change in the height of the liquid column. In the case on the left, the volume of the thigh is approximately 315 cm³. Currently, it is enough to click one button in the SMARTTECH3Dmeasure software to obtain a precise measurement result of the volume of the measuring element.

Determining the volume of an object based on changes in the height of the liquid column

In the SMARTTECH3Dmeasure software, it is possible to select the points by its RGB color. It enables selective measurement of the surface of the same color. Consequently, we can select the color of the skin on the object and determine its surface area.

Cross-section and distance measurement is another very useful tool. It enables precise dimensioning of the analyzed sample.

After the success in described measurements, the Department of Meat Technology plans to implement its scanner for measuring other food products, hoping to further optimize the research.
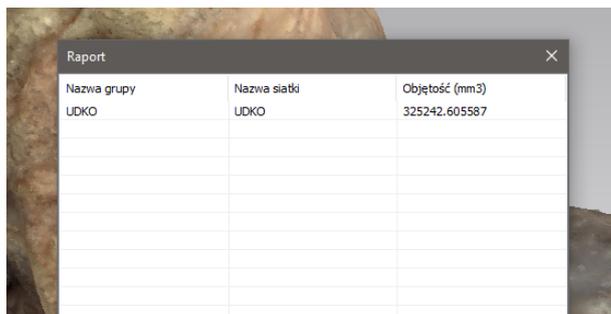
Calculation of volume based on the 3D scan

Warsaw University of Life Sciences

Faculty of Food Technology, Department of Food Technology, Department of Meat Technology

Warsaw University of Life Sciences is one of the largest and most prestigious universities in the country. It educates nearly 18 thousand students in 38 fields of study. The Faculty of Food Sciences conducts research and expertise in the field of microbiology and food biotechnology, the technology of processing plant and animal raw materials, and food engineering. It was here that the Polish Standard PN-A-82109 "Meat and meat products.

SMARTTECH Sp. z o.o.

SMARTTECH3D is a world-renowned Polish manufacturer of optical 3D scanners, founded in 2000. The company's offer includes a full range of professional contactless measuring devices for various applications, as well as quality control and reverse engineering software. SMARTTECH3D provides design and implementation services for advanced optical measuring systems and 3D measurement services around the world. The satisfied customers include NASA, Boeing, Lufthansa, Orlen, Military Police, KRONES, Central Office of Measures as well as many educational units.

Read more at www.smarttech3dscanner.com