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Automatic measurement of the body condition of dairy cows with three-dimensional picture processing

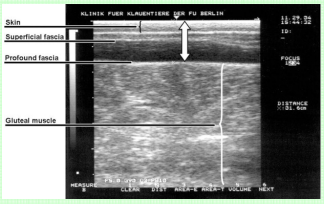
AGRARTECHNIK

U. Bergfeld[1], S. Pache[1], R. Hölscher[2], I. Steinhöfel[1], R. Fischer[1]
[1]Saxon State Office for Environment, Agriculture and Geology, Am Park 3, D-04886 Köllitsch
[2]Hölscher + Leuschner GmbH & Co. KG, Siemensstraße 15, D-48488 Emsbüren

Introduction

- Assessing the body condition is one of the key parameters for herd management, feeding and health control in dairy herds.
- EDMONSON et al. [1] developed a visual method - Body Condition Score (BCS).
- SCHRÖDER and STAUFENBIEL [2] developed a method to determine body fat reserves based on a ultrasonographic measurement of back fat thickness (BFT).
- Both methods deliver only a rough approximation of body condition and need additional effort.

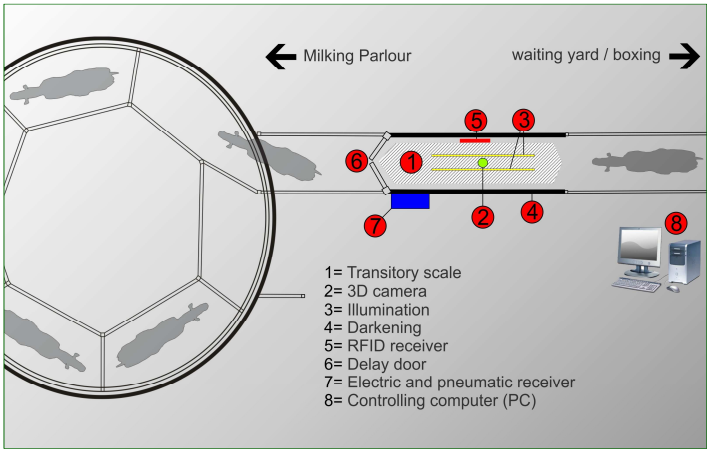
Cows in different body condition



Picture of SCHRÖDER and STAUFENBIEL [2]

Technical Solution

- A infrared (IR-) projector deliver structured light matrix with a laser class 1 (λ = 830 nm) projected on top of the cow.
- A IR-camera with 640 x 480 Pixel and a frequency of 30 Hz records the projected light matrix.
- The camera calculates by triangulation for every pixel a space depth with an exactness of about 1.4 mm in a field of 1400 mm x 1000 mm.
- The 3D-BCS value is calculated from more then 50 body points measured.

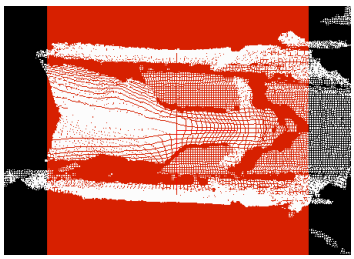


Objective

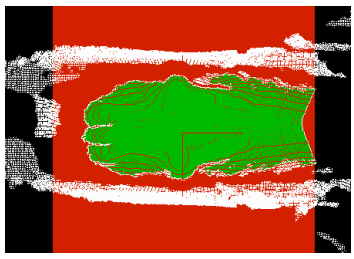
- Development and evaluation of a new sensor system (optiCOW) for the automatic measurement of body condition in dairy herds.
- The system should be solid for practical conditions and should analyze the three-dimensional (3D) data continuously, especially before or after visiting the parlour.
- Analyze the relationship between the estimated body condition based on the optiCOW-system compared with BCS and BFT.

Investigation and Results

- Body condition was contemporary assessed with 3D-BCS (N= 9.151), traditional BCS (N=438) and with BFT (N=438) for 129 cows in a research farm for 118 days (traditional BCS and BFT with one measurement per month).
- Daily correlation between 3D-BCS in the morning and the evening: **r = 0,78 to 0,98**.
- Correlation between morning 3D-BCS and the corresponding traditional BCS: **r = 0,70** / respectively BFT: **r = 0,53**.
- Correlation between evening 3D-BCS and the corresponding traditional BCS: **r = 0,67** / respectively BFT: **r = 0,52**.



Cow A steps at the moment x in the focus.



After 1 second a valid 3D-model was recognised for cow A.

Conclusions

- optiCOW is applicable under practical conditions and allows the evaluation of body condition continuously.
- The results show a high repeatability and a good correlation to traditional procedures.
- The procedure allows the observation of the fat mobilization dynamism during the whole lactation.
- The system can support management, feeding and health control especially in large dairy farms.

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Innovationsförderung. PT PROJEKTTRÄGER IN DER BLE