Integrated system to assist producers meet market specifications

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The BeefSpecs drafting tool (Walmsley *et al.*, 2014; http://beefspecs.agriculture.nsw.gov.au/drafting) has been developed to assist producers manage cumulative risks associated with meeting market specifications [final P8 fat (mm) and hot standard carcass weight (kg)] and the enhanced BeefSpecs to predict lean meat yield, Meat Standards Australia (MSA) marbling and MSA index to assist producers make informed marketing decisions for emerging markets on live cattle before slaughter (McPhee *et al.* 2020). The critical inputs for these BeefSpecs tools are frame score, P8 fat and muscle score (MS). Visual assessments of frame score, P8 fat and MS have large variations when compared to gold standards. To reduce this variation a real-time system using off-the-shelf 3 dimensional (3D) Red Green Blue-Depth (RGB-D) structured light cameras (McPhee *et al.* 2017) has been developed and integrated with radio-frequency identification (RFID), weight and the BeefSpecs tools (Figure 1). This abstract describes an overview of the integrated system and why it has been developed.

Failure to meet market specification is worth well over $51M to southern beef producers in Australia and even more when feeding costs are taken into consideration. The integrated system has been developed to assist producers meet market specifications and improve compliance rates. The BeefSpecs tools have also been developed to assist producers and managers make feeding, breeding and meat quality decisions on live cattle between 225 and 50 days before slaughter. 3D real-time values of hip height (HH, cm), P8 fat and MS are reported within 60 seconds. Frame score, initial P8 fat and MS along with weight and BeefSpecs inputs (e.g., growth rate) and equations (Walmsley *et al.*, 2014) predict final P8 fat. It has been demonstrated that 3D cameras estimate HH for cows and steers with 0.75 and 0.90 correlation, respectively. The root mean square error of P8 fat was 1.54 and 1.00 mm for cows and steers, respectively and the supervised machine learning and global optimization approach correctly classified MS (mean ± SD) 80 ± 4.7%; and 83 ± 6.6%, for cows and steers, respectively (McPhee *et al.* 2017).

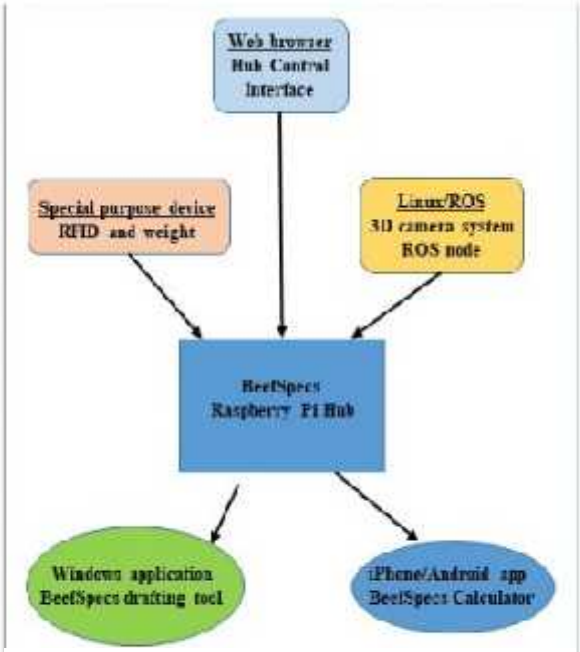

Figure 1. Schematic of integrated system; radio-frequency identification (RFID); Robot Operating System (ROS).

In conclusion, objectively assessing cattle in real-time with 3D cameras is not invasive and will assist the beef industry make informed management decisions on live cattle before slaughter. Real-time objective assessment can also be integrated with the BeefSpecs calculator on iPhones and androids. The BeefSpecs optimization tools for both large pastoral companies and feedlots can also be used to allocate cattle to paddocks and pens, respectively and reduce feeding costs. The BeefSpecs tools currently can assess Angus cattle between 2 and 11 mm of P8 fat. Additional research is being undertaken to extend the range and expand the 3D system into other breeds.

References

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