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Augmented Reality for operator assistance (#630)

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Introduction

Augmented Reality is an emerging technology for backing of industrial service and maintenance operations. The potentiality includes a hands-free support for complicated procedures with updated assistance to perform a specific maintenance task, e.g. replacement of a faulty component. The AR technology might also present advantages to the meat industry, exceeding the service application mentioned above: an assistance tool for the production and quality inspection crew.

A range of platforms (channels) are available for the AR technology to communicate the augmented information to the user, including tablets, smart phones, video monitors, smart glasses and projectors. A range that provides different aspects of the potentialities: Interactive, updated information, concealed details, hands-free assistance and dynamic updated data.

Quality inspection often includes identification of even very small, even disclosed defects, delicate details and corrective measures. Application of AR for such tasks has been benchmarked in a simulated trial environment and the most promising channel has been demonstrated in a meat

Methods

Four different candidates for an AR channel have been benchmarked for speed/capacity and precision and the best channel has been validated in a meat production tasks including contaminant detection and cutting recipe support.

The benchmark has been made with a simulated piece of meat where submerged contaminants were inserted to mimic bone fragments in meat. The tested channels include a tablet, a set of smart glasses, a video projector and a video monitor. The operator performance is measured with a HTC VIVE based tracking system with a pointer attached to the controller. From the controller the 3D position of the pointer is recorded together with the time consumed for the task, leading to a capacity and quality measure for the 3D operation of pointing out the submerged contamination.

48 operators (Novices to the specific task) young volunteers were recruited. A statistical balanced experiment was set up with four groups, each assisted by: a tablet, a video monitor, a video projector and a set of AR glasses (EPSON Moverio200). The pointer was tracked to give the position accuracy for pointing out the submerged target contamination. The time consumed for the entire pointing procedure was recorded to give an estimated efficiency for each operator in performing the task. Detailed results from the benchmark will be presented elsewhere

A setup was built with a projector as the preferred channel to illustrate the potentiality in a real operation from a meat production. The setup includes a vision sensor to determine the size of product (length and width) and the position of eventually surface contamination (DynaCQ; DMRI, DK). The results from the vision sensor is communicated to the operator using a proprietary tracking software for recognition and tracking of each product. Finally, the reviled cutting instruction and position of the detected surface contamination (e.g. polymer fragments from wrapping films or carrier trays) is shown through a video projector to an operator. Input to the tracking/identification software is a standard RGB camera placed in a fixed position relative to the projecting device, see Fig. 2.

Results

The potential of using AR technology is demonstrated here using a pilot scale production setup. The vision DynaCQ sensor gives the absolute size (length and width) of the meat products and detects any surface contamination. The product in the pilot experiment has to meet specific size requirements. By comparing to the actual measured size, a cutting recipe in form of a set of cutting lines can be calculated for each product.

The calculated cutting lines are projected on the meat surface to guide the operator in performing the optimized cutting operation. The sequential order of the two cutting procedures leaves a significant volume of meat on either of the two trimmings: the caudal (hip) or ventral (belly) part. Actual price differences between the two parts may influence the yield of a specific cutting sequence. In our pilot setup, the sequential order of cutting is communicated to the operator using color codes, see Fig. 3. The sequential order of cutting leaves the lower left-hand cutoff either on the ventral or the caudal part. As these by-products often are priced differently, an optimization potential is available for the operator by selecting a specific cutting sequential order.

Conclusion

Despite the simplicity of the simulated meat product the results seems to be relevant for the meat industry as capacity and precision are parameters with direct impact of the bottom line.

The benchmark of four AR channels is also relevant for the meat industry as all components of the best performing system are off the shelf commercial available products. Even tracking software platforms are available from different vendors and the potential indicated in this experiment aligns with previous demonstrated yield improvement of fresh meat production. The

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commercial benefit will be demonstrated in a specific experimental setup in close collaboration with a meat producer. Further results will be included in the actual poster session.

Figure 3 Figure 3. The pilot setup assists the operator in producing an optimized yield of the raw material (right) and performing a corrective action by removing surface contamination (left). Videos will be presented at the conference.

Figure 2 Figure 2. The pilot setup including DynaCQ sensor, projector and RGB camera

Figure 1 Figure 1. The simulated meat object for the benchmark of four different AR channels. Please, find a detailed description in https://link.springer.com/chapter/10.1007/978-3-030-05297-3_7

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