Snapshot Report

Snapshot

AI/ML Modular (and relocatable) Computer Vision and Sensing Cell

Project Code	Prepared by	Date Submitted
2021-1273	MEQ Probe	29/03/2022

Project Description

The purpose of this project is to develop a modular camera system that is capable of capturing multiple images simultaneously at chain speed in an abattoir. The project involved the design, selection and prototyping of hardware for a modular camera system, including a centralised workstation and several cameras. This construction extended to an advanced design of a system capable of remaining within the boning room environment of project partner Gundagai Meat Processors (GMP) for several months while collecting data across every production day. Software development of a graphical user interface (GUI) occurred to ensure information could be displayed in real time to the user. The outlined objectives of the project were:

- Remain in the abattoir for an extended period of time (meaning it is suitable for use in an abattoir)
- Take 1-6 photographs of primal's in lamb abattoir upon an operators command
- Save the photographs to a centralised workstation
- Display any required instructions/menu's to the user through a GUI

Project Content

Hardware Selection and Design

Initial design of the modular camera system considered the harsh environment within an abattoir, including the need to withstand high pressure cleaning. All components were IP67 rated, and the complete system watertight. This criteria guided the selection and design for the centralised computer workstation and the modular cameras. The hardware prototype was tested in a controlled environment and within the abattoir. Camera placement was the primary focus, experimenting with placement on conveyor belt, camera angle, focal length, exposure and saturation of the image. Two locations were chosen - one for data capture of lamb primals and another for bagged cuts. The camera mounting system progressed through several developmental designs, with a final robust design that withstands an abattoir environment.

The advanced hardware design consists of a moveable centralised computer workstation, several mountable cameras with interchangeable lenses to allow usage in a range of positions. The system was proven to be watertight, and the system remained installed and operational in the GMP boning room with no issues for five months.

Software Development

Software development required the selection of frameworks and algorithms, and implementation of several software components. The prototype software is able to process data from up to six cameras in real-time, allows a frontend user to monitor and override the system using a touchscreen-optimized GUI, and is able to record data and store images to local and cloud storage in response to manual or automated triggers. It is reliable in operation within an abattoir environment for an extended period of time while producing accurate identifications of lamb primals at chain speed.

Project Outcome

There were four outcomes of the project were achieved successfully, and were outlined as follows:

- The modular system hardware remained permanently in the abattoir for five months, with no complications. The system is suitable for use in an abattoir.
- The system was able to capture video data in real-time from up to six cameras, and record still images to data storage, upon an operator's command.
- Images recorded either manually by an operator or automatically by the camera system software are saved to the local file system on the centralised workstation.
- The modular camera system includes a robust touchscreen GUI capable of displaying real-time information to the user about the operation of the system, including video feeds and machine learning model outputs.

Benefit for Industry

It is recommended that further research and development be undertaken to further develop these technologies which have direct and specific benefits to the red meat industry. The MEQ Team is of the opinion that there is immediate value in the following areas:

- Automatic Sorting: a machine learning/computer vision system could be developed to control mechanical systems such as belt diverters to enable automated sorting of meat cuts in certain situations.
- Supply Chain Traceability: with some expansion of scope, potentially including more cameras and processing nodes, the technologies used in this project could be applied to the problem of boning room traceability to track an individual carcase as it is transformed into primals and individual cuts.
- Quality Assurance: a machine learning/computer vision system could be developed to identify and count objects once boxed, and alert users to the presence of foreign objects

Useful resources

Not applicable.