

## Final Report Summary Investigations into 3D Camera Performance

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The original TTOM project goals were as follows:

- 1) Measure and model the performance of the stereo vision and time of flight 3D-imaging systems currently being applied by IceRobotics in the dairy industry.
- 2) Compare and contrast with the CMOS 3D imaging architectures being developed at Edinburgh University through simulation/modelling
- 3) Propose how the technologies under development at Edinburgh University may be exploited to provide IceRobotics with competitive advantage.

A set of test procedures was defined at the beginning of the project. The tests were designed to provide insight into various imager artefacts which had a bearing on robotic tracking performance. As a result of these experiments, IceRobotics was able to tune the performance of the camera by adjusting various settings to eliminate certain artefacts. Image post-processing steps introduced in software were able to considerably reduce other offsets and non-ideal imaging performance.

From the work done it became clear that future 3-D cameras will need to provide:

- increased resolution
- increased frame-rate
- increased accuracy for distance measurement
- reduced noise and ambient light interference
- decreased power dissipation
- decreased illumination power
- smaller form factor

Two distinct approaches have been identified for achieving the required improvements:

1. Application of state-of-the-art CMOS imaging techniques for removing noise, reducing power and increasing frame-rate.
2. Application of SPAD array sensing methods.

There was insufficient time and resource in the T-TOM programme to investigate the specific details of either and so establish the comparative advantages and disadvantages of these approaches. However, this will be the topic of some research at University of Edinburgh over the next one to three years via M.Eng. and Ph.D., projects. It is envisaged that links with IceRobotics will be continued and strengthened through this work.

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