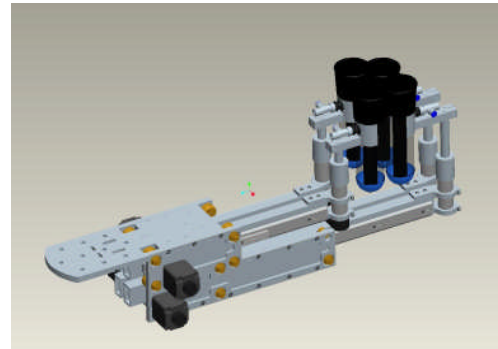Project number: **5497**
Funding source: **Teagasc / DCU**

Date: **Sep 2012**
Project dates: **Sep 2004 - May 2012**

Development of a robotic milking system for use in rotary parlours

Key external stakeholders:

Pasture based dairy farmers, Milking system manufacturers, Academic staff working in the area of milking technology.

Practical implications for stakeholders:

The outcome/technology is a robotic milking cup applicator suited to operation on a rotary milking parlour

- Reduced labour costs for large scale dairy farming.
- State of the art milking technology.
- Contribution to the state of the art in the area of teat identification and robotic cup application.

Main results:

A robotic milking cup applicator has been developed which is capable of simultaneously applying milking cups to the udder of an animal. A teat sensing system has also been developed integrating thermal and optical vision systems which is suited to the rapid determination of the teat position on an animal in the milking parlour.

Opportunity / Benefit:

This technology is ideally suited for licensing to a third party such as a manufacturer of automated milking machines. Thereafter the milking system could be used on rotary milking parlours which are ideally suited for large pasture based dairy herds.

Collaborating Institutions:

School of Mechanical Engineering, DCU.

Teagasc project team: Mr. John Upton (Project Leader/PL)
Dr. Padraig French,
Dr Pat Dillon,
Dr. Eddie O'Callaghan

External collaborators: Dr. Harry Esmonde (Dairymaster)
Dr. Brian Corcoran (DCU)

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1. Project background:

The challenge for Irish dairy farmers is to increase productivity without incurring additional costs chief among which is labour. A modern automated milking parlour can allow efficient throughput of animals thereby facilitating increased animal head count and improved labour efficiency. Increasingly the rotary parlour is being adopted as an optimal solution, where herds in excess of two hundred animals are easily handled. Much of the milking process has been automated except for milking cup application. This project addresses that problem by developing a robotic milking cup applicator suitable for use on a rotary parlour.

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2. Questions addressed by the project:

- Can a robotic milking cup applicator be developed for integration in a rotary milking parlour?
- Can the new system be retrofitted to existing parlours with minimal adaptation to the parlour?

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3. The experimental studies:

The project was split into two aspects. Cup application and teat sensing. New techniques and devices were developed to deal with each aspect.

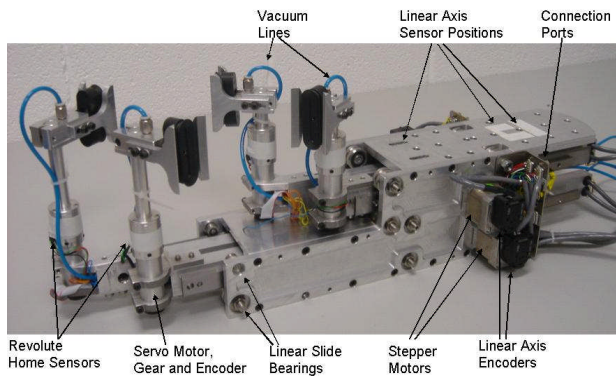
4. Main results:

Robotic applicator.

Figure 1

A multilinked robotic applicator shown In Figure 1 was designed and built at DCU. This was coupled to a six axis industrial robot arm and tested by applying milking cups simulatneously to four phantom teats. The teats were placed in arbitrary positions corresponding to typical udder configurations. The system was capable of simultaneously and independently manipulating all four cups so that they were succesfully applied to the teats in a short time frame.

Contact   John Upton   Email: john.upton@teagasc.ie.

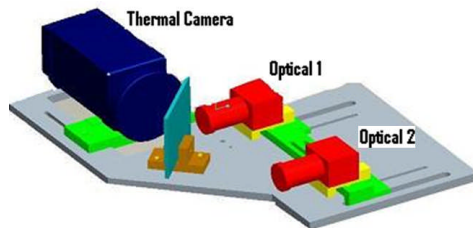http://www.teagasc.ie/publications/

Teat Sensing

Figure 2

A hybrid sensing system incorporating a thermal camera and two optical cameras was developed to identify and then measure teat position, see Figure 2. The thermal camera was used to identify the teats from background objects. High precision optical cameras use this information so that accurate teat position values could then be determined using sereo triangulation.

5.   Opportunity/Benefit:

While the project was ultimately aimed at allowing pasture based dairy farmers to benefit from the use of automation, the immediate goal was to license the technology to a manufacturer of milking systems. One major milking machine manufacturer initially expressed an interest in the technology but later declined to get involved. Due to limited funding on the part of Teagasc and DCU, further work in this area has been put on hold.

6.   Dissemination:

Six papers as described below

Main publications:

Ben Azouz A., Hunt Duffy A., Corcoran B., Esmonde H., O'Callaghan E., "Development of a Teat Sensing System for Robotic Milking" 11th Mechatronics Forum Biennial International Conference, Limerick, Ireland, June 23rd-25th, 2008.

D. Christie D., White J., Corcoran B., Esmonde H., O'Callaghan E., "Design and Control of an End-Effector for Application of Milking Cups" 11th Mechatronics Forum Biennial International Conference, Limerick, Ireland, June 23rd-25th, 2008

Esmonde H., See H., "Spectral Identification of Smart Fluids", 11th Mechatronics Forum Biennial International Conference, Limerick, Ireland, June 23rd-25th, 2008.

Popular publications:

7.   Compiled by: John Upton