Livestock based Agri-Food production – Challenges, and potential robotics solutions in development

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Leading the way in Agriculture and Rural Research, Education and Consulting
Role of robotics and automation....

- Only some examples...
- And some thoughts on future applications
- There will be lots more!!
The problem...??

Figure 2.3  World population: 1950-2010 and projections (three variants)

Source: FAO WORLD AGRICULTURE TOWARDS 2030/2050
The 2012 Revision
The problem..??

Source: FAO WORLD AGRICULTURE TOWARDS 2030/2050
The 2012 Revision
Livestock projection example..

7.1 PROJECTED NUMBER OF BOVINES TO 2050 IN THE REFERENCE WORLD OF THE IAASTD, BY REGION*

- **CWANA** - Central and West Asia and North Africa
- **ESAP** - East and South Asia and the Pacific
- **LAC** - Latin America and the Caribbean
- **NAE** - North America and Europe
- **SSA** - sub-Saharan Africa

*Regional groupings of countries are as listed in Rosegrant et al. (2009).

Source: adapted from Thornton (2010).
Recent UK trends..

<table>
<thead>
<tr>
<th>Average size of dairy herds in UK (cows)</th>
<th>Average Yield in UK (litres/cow/annum)</th>
<th>Total milk production from UK national dairy herd (billion litres/annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>89</td>
<td>2002-03</td>
</tr>
<tr>
<td>2011</td>
<td>123</td>
<td>2011-12</td>
</tr>
<tr>
<td>2012</td>
<td>125</td>
<td>2012-13</td>
</tr>
</tbody>
</table>

Source: Defra

- Is a common trend..
- Skilled labour/stockmanship applied over more animals
- Can cost-effective automation/sensors/robotics ease the workload?

Food firms fear migrant labour shortfall
By Mike Stones+Michael Stones, 04-Feb-2015
Fears about the availability of migrant labour and any disruption to the key contribution it makes to the food and drink manufacturing sector was one of the hot topics at the Business Leaders’ Forum (BLF) last month.
Imaging system example

Project co-funded by:

Innovate UK
Technology Strategy Board
Imaging to monitor animals

- 3D camera system taking images from above
- Target outputs from this system to the farmer:
  - Liveweight (gain)
  - Carcass weight, fat grade and carcass conformation
  - Primal yield estimation
- Abattoir VIA becoming more commonplace
- Camera technology now cheap enough to sell to farmers
- System payback possible over 1-3 years
Issues addressed

- **Lame Cows (mobility score 2-3):**
  - Lose 200 – 600 litres of milk yield
  - Take 20 – 40 days longer to get in calf
  - Are more likely to be culled.

- **BCS (Body Condition Scoring) is a key measure of cow performance**
  - Indicates if nutrition and herd health are correct
  - BC scoring is time consuming, subjective and not conducted frequently enough

Technology aims

- Automated early lameness detection and BCS system to generate intelligent data and develop predictive modelling

Impact of solution

- Reduced lameness - improved welfare, improved output, lower costs, reduced cow wastage. Value to 300 cow herd >£30,000/yr
- Regular and consistent BCS – improved nutrition management, improved fertility and cow health, lower costs, lower carbon impact. Value to 300 cow herd >£50,000/yr
• 3D imaging of cows to provide BCS, mobility score and cow weight
• Non-intrusive system avoids disturbing the cows or the farms daily routine
• Regular (twice daily) data collection – enables early detection of trends and provides alerts for cow health indicators for individuals, groups and herds

• Reliable and repeatable data collection
• Sensitive to small changes in BCS
• Early predictor of change in mobility
• Monitoring and benchmarking through web-based management tools

A collaboration between:
Kingshay
University of the West of England, Machine vision, Bristol Robotics Lab
Funded by Innovate UK and BBSRC

Project Co-funded by
Reducing Thermal (IR) Imaging cost and accuracy

Health and physiology conditions can be monitored..
Intelligent animal mounted sensors

Animal Electronic Recording Transmission and Synthesis (ALERTS)
Autonomous robotics on-line....
Other future application areas???

- UAV’s (and sensors!) for grassland monitoring
- UAV’s for remote monitoring of outdoor livestock
- Repetitive tasks in primary meat processing
- Robotic animal herding ($<$1M Aus!!)
- “Cobots” – working with people on manual tasks
- Imaging and sensor technology to measure product quality (automatic segregation?)
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Agri-EPI Centre: What is it?

Brand new UK Innovation Centre to deliver:

- Research and development
- Demonstration and training
- Precision agriculture and engineering to... livestock, arable, horticulture and aquaculture sectors
Transformational Technology
EPI Centre – backed by industry

• Industry fully engaged
• over 70 industrial foundation partners
  – Multi-national Agricultural Engineering companies
  – Retail Multiples
  – National and international food product supply chain companies
  – Agri-technology companies
  – Agricultural supplier companies
  – Non-sector technology companies
  – Farmers
Thank You

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