Remote Monitoring of Livestock Wireless and the Wii – Improving Livestock Welfare

Ian McCauley
Greg Cronin
Michelle Watt
Samantha Borg

Future Farming Systems Research, DPI Vic
Outline

Wireless Technologies
Active Sensing of Animal Welfare
Passive Sensing of Animal Welfare
Wireless Technologies

Good Features

• ease of deployment
• ease of use
• real or near-real time
• rapidly evolving

Disadvantages

• cost
• range and interference
• rapidly evolving
Types of Wireless Technologies

Short Range (cm - 1 km)
- Low power, moderate to high data flow
- WiFi, bluetooth, Zigbee/Mesh

Long Range (1 km to 20+ km)
- High power, low data flow
- UHF cell call, UHF digital

Global
- Satellite - no data, restricted
- Mobile phone network
- Really a network of Short Range
- Moderate power, high data flow
Outline

Wireless Technologies
Active Sensing of Animal Welfare
Passive Sensing of Animal Welfare
Active Sensing of Animal Welfare

Sensor actively measures something
Sensor actively transmits data wirelessly
Sensor Node

Requires wireless and sensors that are:

- *cheap*
- *small*
- *low power*

eg DOT™

- *computing, wireless, ID, sensing on a chip*
- *requires battery and antenna*

eg Temperature (thermistors)

- *fever, chilling*
- *some problems with attachment*
The Problem of Power

It requires power to collect information
It requires lots of power to transmit information
Power COSTS - and affects
  • size
  • complexity
  • robustness
  • cost

Profound limitations on livestock applications
  • duration
  • range
  • species

As yet, no commercial systems with wireless sensor on the animal
TekVet

US startup approaching commercialisation
Wii on a sheep

Movement (accelerometers)
- very low power
- small
- easy to attach

Measures
- acceleration in three dimensions
- orientation
- activity
- gait
Wii on a sheep

Can we monitor sheep behaviour using accelerometers?

• Initial version uses “off the shelf” components
• Simple modifications would reduce size by 10
• Accelerometer unit and separate wireless unit
• Range about 50 m
• Just deploying prototypes
Can we monitor sheep behaviour using accelerometers?

- Initial version uses "off the shelf" components
- Simple modifications would reduce size by 10
- Accelerometer unit and separate wireless unit
- Range about 50 m
- Just deploying prototypes
Can we monitor sheep behaviour using accelerometers?

- Initial version uses “off the shelf” components
- Simple modifications would reduce size by 10
- Accelerometer unit and separate wireless unit
- Range about 50 m
- Just deploying prototypes
Outline

Wireless Technologies
Active Sensing of Animal Welfare
Passive Sensing of Animal Welfare
Passive Sensing of Animal Welfare

Active sensing
- high cost, power, complexity

Passive sensing (ID only)
- low cost, power, complexity
Passive Sensing of Animal Welfare

Active sensing
- high cost, power, complexity

Passive sensing
- ‘measures’ ID only
- does not initiate wireless
Measurement of Feeding Behaviour

Funded by the Pork CRC
Directed to measuring feed consumption Welfare?

- feeding behaviour a leading health indicator

Use Radio Frequency IDentification technology

Measures ‘presence’ of pig at feeder

- duration of feeding
- pattern of feeding
Feeder Design

Modified feeder with RFID Antenna

Pigs have ID tag attached to the ear
Visual and RFID Measurements

Ten pigs, ten week study, RFID monitoring every 2 sec

**Automatic Monitoring**

<table>
<thead>
<tr>
<th>Pig ID</th>
<th>Time [April 24 2008]</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

**Visual Observations**

<table>
<thead>
<tr>
<th>Pig ID</th>
<th>Time [April 24 2008]</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
Changes in Feeding Behaviour

Ultimate aim is to categorise behaviour
Identify normal patterns
Alarm on outliers
Growsafe

US company, target is cattle feedlots
RFID read at waterpoints
Weight taken at waterpoints
Growth and drinking behaviour monitored
Medium-term Industry Prospects

Intensive industries
  • *reasonable prospects*
  • *infrastructure being created*
  • *significant investment and education*
  • *cost:benefit productivity drivers exist*

Extensive industries
  • *significant technological hurdles*
  • *highly variable production systems*
  • *cost:benefit productivity drivers weak*