

The Internet of Things Applied to Agriculture

The concept of the “Internet of Things” (IoT) sounds very abstract but simply means a collection of networked physical devices embedded with electronics (often sensors or actuators). You may be familiar with wireless security systems or heating control systems that work in this way. These can communicate with (and be controlled by) smart phones and tablets that are themselves connected to the internet.

There is significant commercial focus on IoT opportunities in agriculture, where there is real scope for improved enterprise management. Recent advances have made wireless sensors that collect data over a wide area much more affordable. The ability to review and control systems from a device in your pocket is a powerful concept for the busy grower/producer. Systems are becoming available that highlight potential plant or animal disease issues before they become serious outbreaks.

IoT can now be viewed in very practical terms and with clear insight into its commercial value. To further this activity a Special Interest Group is being set up as a joint initiative between the Institution of Agricultural Engineers (IAgrE) and the National Centre for Precision Farming (NCPF), hosted by Harper Adams University.

The IOT key imperatives are those of interfacing and interaction with the physical world and the exploitation of object-connected and embedded technologies for sensing and actuation, communications and networking capability, embracing the existing and future Internet and other network of networks development¹.

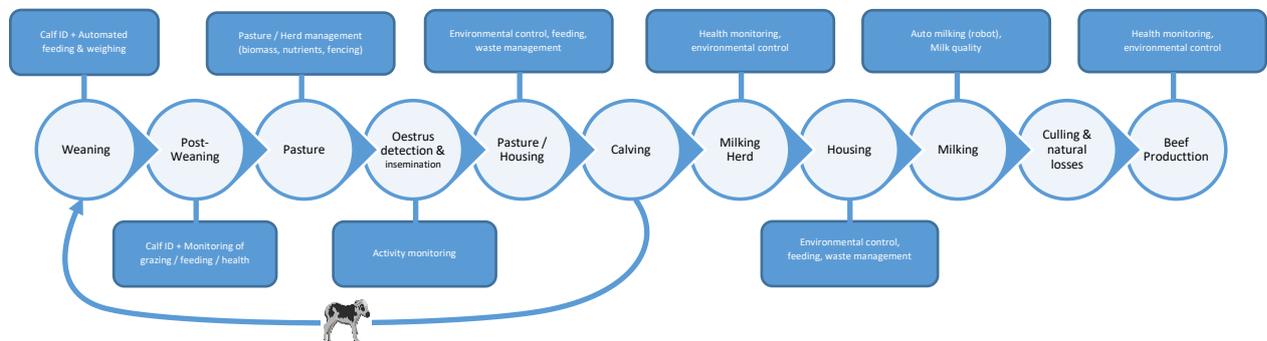
By considering connected processes in virtually any farming activity it is possible to identify applications in which these IoT imperatives can be exploited for commercial advantage. Take for example the processes involved in rearing and producing lactating cows for milk production, as illustrated in schematic below.

Effective oestrus detection is of critical economic importance and governs the artificial insemination activity within these processes. While hormonal synchronisation has become an effective tool for timed artificial insemination (TAI) in many breeding programmes, the search for alternative ways of consistently predicting ovulation and optimising the management of insemination continues². One such IoT approach effectively monitors the activity of cows for oestrus detection. Electronic activity tags, ostensibly pedometers, attached to the legs of the cows provide electronic identifiers for the cows concerned and generate movement activity data. The data can be communicated via a WiFi network, real-time, and to a farm-based or web-based host facility and analysed.

¹ Furness, A (2012) Introduction to the CASAGRAS Inclusive Model, The Internet of Things 2012: new Horizons (Editor: I G Smith, Technical Editors: O Vermesan, P Friess & A Furness), IERC Publication, ISBN 978-0-9553707-9-3

² <http://articles.extension.org/pages/70309/assessment-of-an-activity-monitoring-system-for-detection-of-oestrus-and-timing-of-artificial-insemin>

Potential for IoT in Milk & Beef Production:



With sufficient investment in R&D, pattern recognition can be developed to detect the optimum time for insemination and automatically inform the farmer and associated staff by texting or via a smart phone app. Without going into great detail it can be readily seen that the process support is exploiting the features of sensing, communications networking, Internet access and actuation that characterise the IoT. In this example, the communications aspect includes human participant/s. In other applications IoT principles of machine-to-machine communications may be exploited, together with options on levels of sensing and actuation to satisfy process and system needs.

Even within this basic application, scope exists for further IoT features, such as cloud-based computing and storage for on-going farm related statistics and evidence-based decision support. Similarly, other aspects of the dairy cattle process pathway, such as pasture and housing management, weaning and so forth, may be considered for developments that exploit the IoT capabilities. The guiding principle in this respect, is to establish if the development can provide economic or other benefits that can justify the approach.

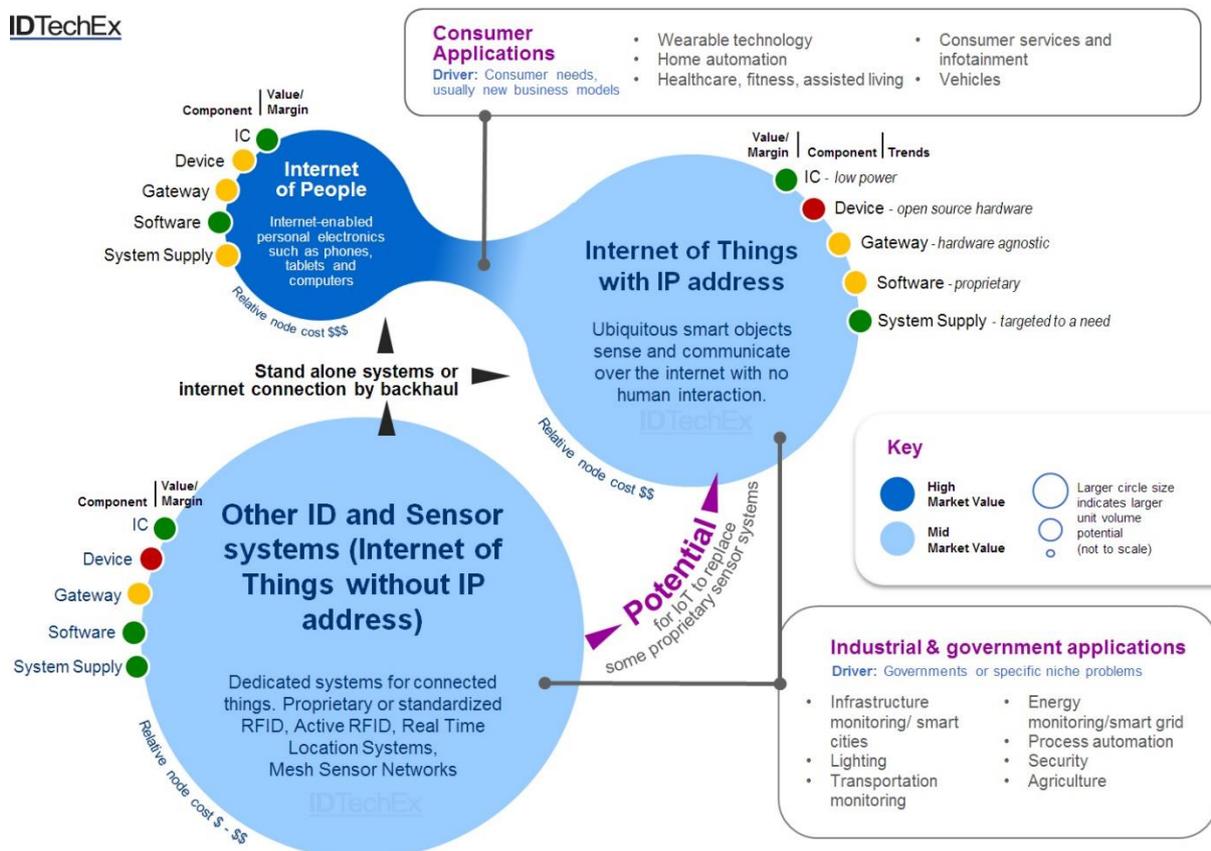
The development of IoT applications that truly add value requires an understanding of the principles and technologies involved, including the technology readiness levels of critical elements and the economics of technology change. The collective wisdom of specialists contributing to a Special Interest Group in IoT applied to agriculture can assist in creating the awareness in capability and opportunities that can benefit the farming and farming support communities, and contribute to the development of an IoT-in-agriculture industry.

The IAgE/NCPF IoT Interest Group will seek to address the needs of various stakeholders covering IoT building blocks and getting started, open and member-specific web-based platforms and applications. The group will also address issues including standards and barriers to development, such as rural broadband, will run events including a launch workshop and provide links to other IoT initiatives and developments as well as networking opportunities.

Many of the technologies associated with IoT are disruptive in the sense that when effectively applied they can yield radical improvement. Collectively they can be seen as an IoT Ecosystem such as the one depicted below by IDTechEx (independent market research, business intelligence and emerging technology analysts). This encapsulates the inclusive potential that the concept of IoT provides.

The IoT Ecosystem:

IDTechEx



To underpin the development of this Interest Group over the coming weeks, a series of web-based introductions will be provided on the foundational imperatives and other key concepts and technologies that contribute to the development of the IoT in agriculture and the associated opportunities for enterprise and product, systems and services innovation in the agricultural sector. An important part of the Interest Group participation is to encourage farmers and other farming stakeholders to identify the problems they encounter and attract assistance in solving them, recognising that inter-disciplinary collaboration can often lead to

innovative solutions. With the IoT as a rapidly emerging platform of technologies and principles, the opportunity is presented for even greater prospects of problem solving and innovation, and of course business development.

Functions identified for the IoT in Agriculture Interest Group include:

1. A forum to address issues concerning the adoption and development of IoT.
2. Monitoring and responding to developments in the IoT “State of the Art”.
3. Networking for integration & collaborative projects.
4. A sandbox for demonstrating IoT devices, toolkits and emerging products.
5. A platform for promoting and celebrating IoT innovation in agriculture and horticulture.
6. A platform for promoting IoT standards and services of benefit to agriculture and horticulture.
7. A platform for identifying skills requirements, training initiatives & research studentships.
8. Influencing education, research and development.

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