Internet of Things and Food: ITaaU/FSA programme	
Project title:	Into The Garden
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Co-investigators/partners	University of Nottingham (Ben Bedwell, Sarah Martindale, Michael Brown); Royal College of Art (Sharon Baurley, Rob Philips); Barracks Lane; Brighton and Hove Allotment Federation; Community Composting Network; The Guardian; Hammersmith Community Gardens; Royal Botanic Gardens, Kew; St. Anns Allotments; Wireless Things; The National Allotment Society; Plumpton College; Incredible Edible Todmorden; The Victoria and Albert Museum; Writtle College
Description	This project brings together a range of partners interested in the transformative power of Internet of Things (IoT) data sharing as a utility for local communities of food producers. The project supports FSA's remit to uphold food safety within local growing communities, and to gather evidence on growing environments. Specifically the project will fund 1) ideation workshops to focus the expertise of interdisciplinary researchers, IoT manufacturers and growing organisations on socio-technical solutions to realize this transformative power, and 2) resources to develop a technology demonstrator based on the outputs of the workshop.
Keywords	Internet of Things, Growing, User Centred Design, Human Computer Interaction
Project timeframe	24/11/15 – 23/03/16
Report date	Final 04/04/16

Executive summary

The “Into the Garden” project explored what value IoT might provide as a utility to local food growing communities. In the early stages of the project, we brought together project researchers and non-academic partners in two ideation workshops – one in London, and one in Nottingham – where we presented examples of existing products marketed at “connected growing”. Critique of these products gave us insights into what could rapidly be developed and deployed “in the wild” at a local test site to provoke reflection on a future generation of value-adding IoT products for allotments, community gardens and small-scale commercial growers. The project proceeded to produce the technology demonstrator - an array of outdoor environmental sensors networked via portable waterproofed cellular hotspots, pushing data to a cloud data store and on to a web-based “community” visualization – and deployed it at a local large allotment, along with “probe” packs allowing allotment tenants to check out sensors, contribute and explore the resulting data, and log their expectations of the technology. At the time of this report, the demonstrator is being used on a daily basis and we are working with the allotment association to coordinate a feedback session with tenants who have used (and avoided using) the technology. Early informal responses suggest that tenants are conducting simple communal experiments to understand how growing conditions vary across the allotment, and that the communal “equipment bank” model of temporary loans is an effective way to get technology out into the allotment.

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Aims, objectives and methods

Project Aims

This project brings together a range of partners interested in the transformative power of Internet of Things (IoT) data sharing as a utility for local communities of food producers. The project supports FSA's remit to uphold food safety within local growing communities, and to gather evidence on growing environments. Specifically the project sought to enable 1) ideation workshops to focus the expertise of interdisciplinary researchers, IoT manufacturers and growing organisations on socio-technical solutions to realize this transformative power, and 2) resources to develop a technology demonstrator based on the outputs of the workshop.

Extracting Understanding from Data

Although the volume and variety of data sources within society is increasing year on year, methods for sharing and making decisions from that data remain limited. Indeed, growth of data occludes meaning. This project addresses lack of understanding about how IoT can be interacted with to extract human-actionable meaning – and so transition to Intelligent Information Infrastructure (I3) [1] - across ad hoc data sharing communities. Gaining such understanding is crucial for directing ongoing IoT/I3 developments towards human-usable outputs that can help address key societal challenges, such as food security, biodiversity, and climate change.

To identify IoT opportunities within the FSA remit we will work with local food growers from across the UK and key network partners including educators, regulators and press.

This project provides seed-funding to enable a substantial programme of research (see Impact). Within the scope of this seed funding, we aim to co-design and prototype a provocative IoT demonstrator for local food production. By bringing together an extensive and diverse set of partners and facilitating development of a demonstrator, this project will enable us to access further funding to evaluate the scalable, longitudinal potential of such technology infrastructures on the production of community actionable understandings (such as for environmental and crop indicators) from continuous, ubiquitous, environmental sensing technologies.

This project produces capacity to understand IoT/I3 in new ways, as well as demonstrate transformational potential of such technologies on local, regional and national scales.

Why local food production?

We aim to understand new modalities of interacting with IoT/I3, and the extraction of understanding from such data, through the use of case studies involving local food production in gardens, allotments and smallholdings. While sensing technologies are becoming a part of major food supply chains, there is a lack of test beds for IoT/I3 in ad-hoc local food production. Technology advances mean the time is right to develop an asset-rich approach that sees, in the words of Perry [2] "communities not as culture-deficient, but as agents to be empowered to build and develop local capacity to address [a number of issues such as] food austerity". To this end, IoT/I3 has the potential to be a value-adding utility for local food growing communities.

Our focus is on food production as a theme is influenced by various factors including: (i) there is a large target population with people exhibiting a wide set of existing knowledge (from beginners to experts) (ii) that are already engaging in forms of data collection, (iii) that may benefit considerably from additional digital services for data harvesting and meaning extraction, and (iv) have a history involving the vibrant repurposing of items in their environment. Communities of growers such as allotmenteers and window box growers will provide insights into generalisable data-rich IoT/I3 decision interactions between people and their environments.

The Food Standards Agency (FSA) is responsible for ensuring that local food producers meet food safety and hygiene standards – governing whether local growers are able to distribute and/or sell their produce – and for exploring the impact of local production on health (e.g. highlighting the benefits of local food growing for those on low incomes [3]). The introduction of IoT/I3 into local growing scenarios will have a significant impact on that relationship. IoT/I3 will enable growers both to share evidence and best practice across communities, and to exert greater control over their growing environments. Combining greater degrees of control and evidence-gathering encourages the production of accountable food – more likely to meet standards on health and safety, and labeling, and thus more likely to be tradable. The project allows the research team to consider how IoT/I3 can introduce greater accountability into growing practices in a manner that encourages greater distribution of locally-produced food, while increasing food safety. More broadly, pervasive environmental monitoring will also benefit national decision-makers such as the FSA by providing greater insights into the build-up of pollutants in local growing ecosystems, as well as the effects of climate change and changes in biodiversity patterns. Through IoT/I3, growers will have the opportunity to share data with regional and national agencies through ethical data sharing practices.

This project brings together a research team with an excellent track record of high-impact and ground-breaking interdisciplinary research. Collectively, team members from University of Nottingham and Royal College of Art have expertise in design and interaction, user engagement and evaluation, sense making, and technical expertise in sensor data collection, sharing, and response. As such, this collaboration is capable of gathering requirements for socio-technical solutions, and developing and evaluating the impact of these solutions 'in the wild'.

The methodology leverages the power of open design by enabling growers to configure IoT technology kits and infrastructures to meet the needs of their community; and as a consequence the community will have the capacity to engage in citizen science, gathering and sharing data that improves the accountability of local-produced food. The approach was developed and tested in previous Horizon project 'Conversations with Bees' [4]

Activity 1: Ideation Workshops

The project is supported by an extensive consortium of high profile end-user partners representing a range of growing organisations (incl. allotments, small-holdings and horticultural institutions) and a technology partner (a UK based IoT manufacturer). In the first stage of the project, we bring these partners together with researchers in facilitated ideation workshops to scope out appropriate, feasible technologies to create an IoT/I3-enabled garden demonstrator. The first workshop, hosted by the Digital Catapult, and the second workshop, hosted by St Anns Allotments, explored the possible roles of IoT in local production and distribution of food. Additional stakeholders were invited by the research team and partners to join the events, including representatives from FSA, the Centre for Urban Agriculture and the Global Food Security programme. As a result, a benefit of these workshops was the strengthening of the existing research network.

In advance of workshops, the research team and technology partner produced a set of case studies envisioning future IoT/I3 enabled gardening scenarios. These cases were put forward for critique at the ideation workshops, and were deliberately provocative to make salient the key (entangled) informatics and Human Computer Interaction challenges of IoT/I3 including:

- How IoT/I3 technologies can scale within and across grower communities. How would communities respond to diversity and complexity of data, links, and the volume of data?
- How can human and plant behaviour/interactions be captured by IoT/I3 systems?
- How can data from growers and associated ecosystems be turned into understandable and actionable information?
- Is there value in using IoT/I3 technologies to enable cooperative/collaborative initiatives within and across growing communities?
- Is it feasible to use IoT/I3 technologies for collaborative intelligence between humans and infrastructure in support of augmenting actionable decision making?

In addition to critique of the case studies, the ideation workshops shared some characteristics of hack-days, involving paper-prototyping around a set of existing IoT technologies procured and presented by the research team (see Figure 1 and Appendix A: technology review). This paper prototyping allows us to illustrate and quickly "sense check" ideas emerging from the group.

Figure 1 Critiquing existing "connected growing" products (left) and brainstorming during a site walkaround (right) during STAA ideation workshop

The intended output of this activity was the specification of a demonstrator, including:

- A technology kit containing components, e.g. for environmental condition monitoring (eg. soil moisture levels, soil temperature, light intensity, ambient temperature, air quality, weather), actuation (eg. automated watering), IoT object tracking (eg. RFID & NFC enabled tools), and ruggedised devices
- A data infrastructure – based on existing, appropriate open-source products – to enable the collection and storage of data generated by the technology kits
- Information visualisation(s) to enable end-users to better understand the growing environment and take action to improve their production
- Use case(s) for the test-bed

Activity 2: Development, deployment and evaluation of demonstrator

Following the ideation workshops, our aim was to construct a low-fi demonstrator including the kit (or subset of), basic data infrastructure and infovis, and conduct a short deployment on an appropriate growing location with a post-hoc focus group to capture initial reactions to the technology in situ.

Here we drew on the support of our end-user partners to identify a suitable demonstrator site, engage appropriate end-users on the site, and investigate how those end-users approach the demonstrator. As a result of the energetic ideation workshop held at St Ann's Allotment, STAA were keen to host the demonstrator and act as gatekeeper to the allotment tenants as testers of the technology.

A period of development, drawing on concepts emerging from the ideation workshops (particularly interest around community mapping of growing conditions across large allotment sites and community gardens), resulted in the Into the Garden demonstrator. The demonstrator consists of:

- An array of six "sensor packs" (see Figure 2), each consisting of a Koubachi environmental sensor (which collects data on light levels, air and soil temperatures, and soil moisture) a high-capacity USB power pack, and a portable 3G-wifi hotspot. These sensor packs can be taken by a user and left "planted" for up to 7 days to gather a week of data from one location, moved around various locations by the user, or passed around between users.
- Accompanying "feedback packs" (see Figure 3), each consisting of evaluation postcards (which ask users questions about their expectations and use of the sensor packs, in addition to asking them to plot the locations where they used the pack), and a digital camera (to allow the user to photograph where/how they used the sensors)
- A cloud data store (which harvests data uploaded by the Koubachi sensors) and web-based information visualization, available via http://j.mp/intothegarden
- A community hub (hosted in the visitor centre at St Ann's Allotment) consisting of a kiosked tablet showing the information visualization (see Figure 4) and a place to check-in/out and recharge the sensor packs

Figure 2. Sensor pack

Figure 3. Feedback pack

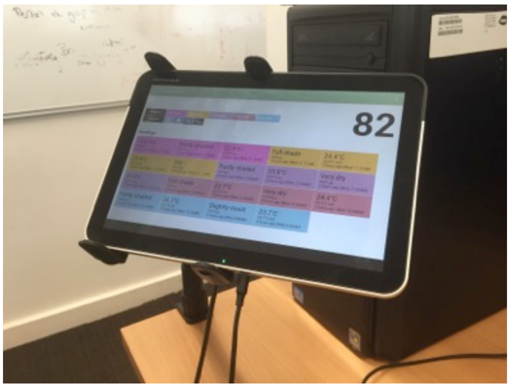

Figure 4. Information visualisation tablet

With support of STAA, the research team demonstrated the technologies to the end-users, and deployed the demonstrator on St Ann's Allotment to allow the end-users to check sensor kits in and out over a 2-week period. The aim is to return after this period, gather paper-based feedback and photographs of equipment use, and facilitate a focus group to allow the end-users to feed back on their appropriation over that period.

As a semi-structured activity, the researchers have three targets in activity 2:

- To learn whether the end-users were able to gain new insights into their growing practices and make actionable decisions (e.g. ecologically sustainable and high yield plant selection) based on high volume, varied, complex, linked datasets from the test bed
- To evaluate whether the ideation workshop enabled us to frame advanced IoT/I3 technologies appropriately for the local growing scenario: as identified by Dourish & Bell [5]: "Problems of cultural context [...] are ones that arise not in the deployment of technologies but in the imagining of them – an imagining that arises before design"
- To reveal infrastructural issues in the prototype that emerge in sustained real-world use: IoT/I3 infrastructures to support growing will need to be robust enough to perform over seasons, not weeks, yet potential issues will emerge even over a relatively short deployment

Together the two activities test the feasibility of the design methodology and IoT technologies developed, as a precursor to longer deployments at larger scales.

Key findings

In line with the project plan, the project team ran two ideation workshops – one at the Digital Catapult (London) on 22/1/16 and one at St Ann's Allotments Visitor Centre (Nottingham) on 29/1/16 – and deployed a technology demonstrator in St Ann's Allotments from 11/3/16 onwards, leaving it in place for tenants to continue to use. Rather than a one-off focus group to gather feedback from tenants, we have visited occasionally to discuss the ongoing use of the technology with both tenants and our gatekeeper at the Visitor Centre, who has been central to the process of helping tenants check out kits for the first time, ensuring that batteries remain charged, and that the community tablet remains switched on.

Our findings relate to responses to the demonstrator - as observed through the data generated by the sensors, feedback directly from users, and feedback from our gatekeeper – and implications for growing IoT based on our reflection on the ideation workshops and the demonstrator responses.

Responses to the demonstrator

As of 1/4/16, all of the probe packs have been checked out by tenants, and have been used for nine distinct sessions of data collection. These sessions have been **characterized** by the tenants as "experiments" to:

- Determine what the sensor packs do (e.g. *"what does data from the sensors tell me?"*)
- Challenge a hypothesis about their growing environment (e.g. *"does using fleece regulate the soil temperature on my plot effectively?"*).

Sessions have varied significantly in **length**, some lasting for only one instantaneous reading, most lasting for an extended period of time, ranging from several hours over the course of a day (i.e. one visit to the allotment) to multiple days. Generally speaking, tenants expressed the general sentiment that they expect to use the kits for *"more than a 'stick it in and see the moisture, job done'"*, tending towards *"comparing or watching changes [over a] period of time"*. The longest continuous session lasted 20 days, during which time the tenant switched out the battery pack themselves to continue collecting data.

Preconceptions about the technology have stopped some tenants from using the kits. General attitudes towards the kits' value have varied widely, summarized by our gatekeeper as *"some gardeners have found the idea [of sensing growing conditions] laughable, others have been right on it"*, with attitudes seemingly unrelated to the expertise of the tenants. Those who have been uninterested in the technology have most often not seen the value in technology that tells you what you can see for yourself, e.g. *"why do you need to know that [from the sensor] when you're going there yourself"*.

Those who have used or intend to use the kits most often believe that the **value** is in better understanding soil conditions. On one hand this includes knowing more accurately what areas of a plot require watering (and so reduce time spent on *"the least enjoyable aspect of allotment growing"*, as well as water waste and the risk of overwatering), and how soil temperature varied – tasks that tenants believed the kit could perform. On the other, tenants suggested that they were particularly interested in better understanding the composition of soil (e.g. pH and nutrients), as well as the presence or risk of soil-based disease: tenants were disappointed that the kits could not provide these insights.

Our aim is to continue to monitor the deployment, gathering feedback as the tenants continue to experiment with and become familiar with the technology.

Implications

There are opportunities to *share* technologies in allotments, but current products are not designed to support this

It is clear that the business models of current "connected growing" products target individual, private consumers, and suggest that the products are long-term investments: this doesn't tally with expectations of experienced growers, who want to conduct distinct, temporary experiments and have expectations that modern technology has a short lifespan. The model that we are exploring with our demonstrator – an equipment "bank" that a community of growers check kits in and out of – aligns more closely with the spirit of allotments and community growers, and increases the chance of knowledge transfer around the technology.

Equally, the design of back end systems that collect and visualize data from existing products focus on individuals reflecting on their own data, not on sharing data across communities. In addition, the provision of data APIs is patchy, and APIs are poorly advertised. Our "community tablet" is one attempt to bring data from multiple users together in one place to allow communal reflection, but there is plenty of work to do here to explore how community visualisations can promote better community growing.

Some aspects of growing should not be 'interfered with' by technology

Many of our workshop participants and demonstrator users – even those open to the potential value of the demonstrator technology – were very clear that new technologies and the core "enjoyable" growing practices should be kept apart. Some took part in community or individual growing precisely to escape the distractions of modern technologies such as mobile phones and computers. Others saw the role of technology as eliminating or ameliorating the "chores" in growing (esp. watering and disease prevention), thus maximising the potential to enjoy the inviolable practices that attract them to growing.

Growing data has different value at different scales

We see three different resolutions at which the data generated by our demonstrator has value:

- Data captured by *individual growers* can help the individual streamline their growing practice, and experiment. We saw various examples of this individual experimentation, and have gathered suggestions for other experiments that growers wish to conduct but cannot do with the existing technology
- When brought together *across a local site*, a growing community can strategise collectively about how to better use/redesign their site. We have begun to observe some communal responses to our "community tablet", but have also had interesting feedback from our gatekeeper about how data could begin to inform their longer term strategy around management of their allotment
- A *national dataset* of growing conditions and good grow would be of interest to many parties, but capturing such information at scale is

expensive without substantial support from the growing communities around the country, and raises issues of standardization of collection practices and data structures

Key issues

Existing products are not aimed at community/experienced growers

- Existing products marketed at local growers are prohibitively expensive (particularly in comparison to investments in improving other aspects of growing, e.g. better seeds, better physical tools), e.g. the Koubachi sensor used in our demonstrator exists in several versions, with only the most expensive version (> £150 per unit) offering the features considered useful by demonstrator users, as well as the ability to be configured (e.g. for more frequent sampling)
- Existing products seem to be marketed at indoor growing, and so are not typically of interest to experienced growers or community growers

Existing products do not readily allow technical experimentation

- When "intelligent" growing products are genuinely "connected", they exist in vertical infrastructures that tie users into data stores and interfaces, rather than offering opportunities to repurpose data or connect multiple products

Existing products focus on data collection rather than automation

- While there is a range of products that enable environmental sensing, there is a lack of products that enable *actuation* in growing scenarios; experienced growers seem to want help with "what they can't (physically) do, not what they don't know"

Intervening in growing scenarios with novel (digital) technologies is difficult

- Allotments, community gardens and farms are seen as "places to escape technology": engaging people in these places requires an approach that is sensitive to this

Additional value in growing data may emerge in the longer term

- Understanding *seasonality* through data is of interest to growers, but short term deployments/evaluation (e.g. in the scope of this short project) do not allow us to assess this

Existing products are difficult to connect!

- Like many IoT products, the connected growing products we tested were difficult to pair with network infrastructures: in ideation workshops our participants struggled to understand how to pair all products, and suggested that most pairing procedures would be *"too much effort for not enough end product"*
- All products appeared to assume that reliable network infrastructures existed nearby. The most reliable sensor in our selection – Koubachi – relied on wifi connectivity, which is unlikely to exist in many growing

scenarios (solved in our case using mobile 3G-wifi hotspots); other sensors, e.g. Flower Power, relied on the user connecting via Bluetooth to gather data, meaning that the data could not be accessed remotely

Next steps

We will pursue two strands of activity from this pilot project going forward:

1. Maximising the value of the data, relationships, technology and findings generated in the course of the work.
2. Planning further research that expands the foundational understanding that has been developed.

To address the first point we will continue to disseminate the findings of the project, as set out in sections 8 and 9 below. We will also remain in contact with the network of partners that we've built through the project and can make technology available to them if they would like to continue exploring its usefulness within their communities. The conversations we've started with colleagues in biological sciences and mental health will feed into our strategy for further funding, enriching our established interdisciplinary collaboration.

The focus of our thinking on the second point, about further research activity, will be on the potential for actuation based on real-time data collected from networked sensors in gardens. Actuation was identified at the ITaaU/FSA workshop in March as an area that was not addressed by the pilot projects and that warrants further investigation, and we hope to respond to this point. We will seek additional funding to support this work according to the strategy outlined below. We will keep FSA and ITaaU informed as our plans develop and invite their input.

Engagement and impact

Co-design Workshops

As detailed above, a wide range of stakeholders took part in our ideation workshops. In addition to the direct input at the workshops from community growing groups, the involvement of the Garden to Plate Network also put us in contact with other groups who were unable to attend the events but expressed interest in contributing to research in this area. These are links that we hope to develop in future work. One of the participants in the London workshop is part of a collaborative programme at the University of Nottingham for artists working with interactive technologies; so we were able to connect these strands of work through the project.

Technology Demonstrator Deployment

We were delighted that the St Anns Allotments Association was able to host both an ideation workshop and the technology deployment at their Visitor Centre. We have developed a particularly strong relationship with the Partnership Manager at STAA, who has managed the deployment on site, allowing the research to reach out into the wider community there.

Additional outputs

The findings from this project are currently being written up into a paper for ACM CHI 2017, the world leading human computer interaction conference. This paper explores how internet of things technologies can be designed, developed and deployed to support activities, such as growing, that are fundamentally human and resistant to technological interference.

Dissemination activities

ITaaU dissemination event

Sarah Martindale (University of Nottingham) and Rob Philips (Royal College of Art) represented the project at the IoT and Food workshop event on 7-8 March in Westminster.

Victoria and Albert Museum, Design Weekend

We are in contact with the organisers of the Digital Design Weekend, an event that will run at the V&A Museum on 24 & 25 September 2016. The theme this year is Engineering, as part of a season dedicated to the topic at the museum. The focus is on the human and social side of engineering (design/making for social change). We will present our research about gardening technologies in some form (exhibit, talk and/or workshop), as environment/climate is an area that they want to include. There will also be a publication, supported by the AHRC, arising from the event, to which we will contribute.

DHRA 2016, University of Brighton

We also plan to make a submission to the call for the annual conference Digital Research in the Humanities and Arts, hosted by the University of Brighton, 4-7 September 2016. This event is explicitly interdisciplinary in its aims and is structured around the central theme of Place, Ecology and the Digital. Consequently we think that our research will be of interest to the programme committee. Accepted work can be published in conference proceedings. There are also opportunities to create/install work to be displayed alongside the academic programme, which we will investigate.

Funding strategy for future activity

Working with our academic and industrial funders we are currently exploring three options for further funding:

- EPSRC responsive mode funding, to expand the project to a longitudinal data capture across the country
- Innovate UK funding to design, develop and test bespoke 'sharable garden sensor kits' with key partners

- Various funding mechanisms within Horizon to enable agile research to scale up engagement with partners (e.g. to maintain the technology demonstrator in its current location at St Ann's Allotment) and widen research participation in the project

Key references

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Appendix A: technology review

Technology	Description	Evaluation	Used in project?	Verdict
Click and Grow	'Zero effort' growing. Self-contained system with LED and water reservoir.	Used as provocative artefact for ideation workshops	Activity 1	Expensive; seemed purposeless to experienced growers; has potential for controlled experimentation/as a base for hacking
Parrot Flower Power	Wireless (Bluetooth) plant monitor	Used as provocative artefact for ideation workshops	Activity 1	Some scepticism over targeted feedback provided by Flower Power app; developed fault very quickly
Koubachi Wi-Fi Plant Sensor	Wireless (wifi) plant monitor	Used as provocative artefact for ideation workshops and as environmental sensor in technology demonstrator	Activity 1 + 2	Expensive; reliance on wifi for data transmission means use in large gardens, allotments, etc. requires use of portable wifi hotspots/deployment of additional wifi infrastructure. Useful data API. Configuration API is only available for the most expensive version of the sensor.
Plantlink	Wireless Moisture sensor	Not readily available for purchase in UK, so not used in project.		
Thirsty Plant Kit	Soil moisture monitor kit (hackable, construction required).	Used as provocative artefact for ideation workshops	Activity 1	A novelty aimed at education; looks like a good tool to introduce hacking/experimentation to non-technical users
Edyn – Smart Garden System	Wireless plant monitor	Not readily available for purchase in UK, so not used in project.		
3Dponics Hydroponics Gardening System	3d printed hydroponics systems	Not used in project.		
Droplet – Smart Irrigation System	Smart targeted water sprinkler	Not readily available for purchase in UK, so not used in project.		
Flower Power H20	Flower Power with watering	Not readily available for purchase in UK, so not used in project.		
Green IQ Smart Garden Hub	Smart gardening hub, links to other stuff.	Not readily available for purchase in UK, so not used in project.		
Netatmo Weather Station	Indoor and outdoor weather station	Used as provocative artefact for ideation workshops	Activity 1	"Public weather map" generated from contributions by owners is interesting; a data API is provided
Wunderbar	IoT developer kit	Used as provocative artefact for ideation workshops	Activity 1	Expensive and BLE pairing mechanism is temperamental; probably most useful for lo-fi prototyping
Miracle-Gro AeroGarden	Soil-free LED indoor gardening system	Used as provocative artefact for ideation workshops	Activity 1	As Click and Grow, but "more trusted" (from experienced growers' PoV) alternative; has programmable options for LEDs

Appendix B: literature review

- See “key references” above.

Appendix C: Data sets (project output)

The significant data sets produced by the project are:

1. Recordings of the ideation workshops (activity 1)
    - Both workshops were audio recorded to allow the project researchers to recall specific parts of discussions, if necessary. As per the ethics policies of the University of Nottingham, these recordings are stored internally on servers accessible only by the UoN project researchers and will not be made available outside the project team.
2. Data generated by the technology demonstrator
    - Most recent readings from the demonstrator can be viewed at http://j.mp/intothegarden while historical representations of the data generated by individual sensors can be accessed via the “More readings” links at that address. A full data set is available on request via Benjamin.bedwell@nottingham.ac.uk