MOVING TO MANUFACTURING
DESIGNING KITS
FAQ

1. Explain in detail the process of designing the kits.

- The first step towards selling your idea as a product is to provide it as a kit.
- Many times we underestimate the work and start buying it but we will not be able to select the right component and put together a step-by-step guide.
- Most kits tend to provide only the electronics and software for a particular application rather than any physical housing.
- The reason partly comes down to the difficulty, for a cottage kit building industry, of sourcing custom plastic components.
- The main market for such kits is others in the maker community; these makers will perhaps prefer to combine the kit into a project of their own.
- However, with the growing accessibility of 3D printers and laser-cutters, it is becoming vastly more feasible to provide housing and other physical components even for kits.
- Kits tend to piggyback on existing microcontrollers and often take the form of a standard format plug-on board, for example shields in the Arduino ecosystem or a cape on the Beagle Bone.
- It reduces the support overhead for the kit provider; either user will already be familiar with the platform or if not plenty of assistance will be available elsewhere to cover the basics of getting up and running.
- The kits documentation can then focus on just what is specific in building the project.
- Deciding on what charge your kit will hold is also an important aspect as one has to give out a relevant amount.
- The cost can be decided only after one knows how much he had invested to build that particular kit.
- For documenting this, one should create a spreadsheet (or at least a list) of all the items that make up the product, along with their cost to buy.
- One should list every single electronic component, connector, cable, PCB, case, and so on, in addition to the packing box you'll ship it in and the time taken to put things together.
- This list is called the bill of materials (BOM), and it forms the starting point for all your costing and prices.
- The BOM gives you the marginal cost for your product—that is, how much extra it would cost to make an additional item when you're up and running with production.
- A good starting point for working out your price (how much you will charge consumers) is to take the total cost of the BOM and multiply it by 4 or 5.
- That calculation gives you a margin to cover that item's portion of the fixed costs and also some profit.
- It also provides enough margins for resellers to cover their fixed costs and make some profit.
- However, it can also add to the support overhead, because you will need to deal with remotely debugging your customers' issues, which may be down to their poor soldering rather than defects in your work.
- These problems can all be resolved by moving on a step towards a consumer product and selling fully Assembled PCBs, populated with all the components.

DESIGNING PRINTED CIRCUIT BOARDS

FAQ

1. How are printed circuit boards designed? Explain.

- Soldering things up is a good step towards making your prototype more robust.
- After you've done this, you should have something that will survive being given to an end user.
- You will soon get fed up with soldering each item by hand.
- Moving beyond strip board, designing and etching your own custom PCBs gives you more options on how to lay out the circuit and makes it easier to solder up as the only holes in the board will be those for components.
- Homemade boards will still lack that fully professional finish.
- That's because they won't have the green solder mask or silkscreen layers that a PCB manufacturer will give you.
- Moving to professionally manufactured boards further simplifies the assembly process because the solder mask will make the soldering a bit easier, and, more importantly, the silkscreen provides outlines of where each component should be placed.

MANUFACTURING PRINTED CIRCUIT BOARDS

FAQ

1. Explain common PCB (Printed Circuit Board) making techniques.
2. Explain the steps for manufacturing PCBs.

- If you want only a couple of boards, or you would like to test a couple of boards (a very wise move) before ordering a few hundred or a few thousand, you may decide to make them in-house.

Etching Boards

- The most common PCB-making technique for home use is to etch the board.
- Some readily available kits provide all you need.
- The first step is to get the PCB design onto the board to be etched.
- This process generally involves printing out the design from your PCB design software onto a stencil.
- If you're using a photo-resist board, it will be onto a stencil which masks off the relevant areas when you expose it to UV light.
- Your stencil then needs to be transferred to the board.
- For a photo-resist board, you will expose it under a bright lamp for a few minutes.
- With the board suitably prepared, you can immerse it into the etching solution, where its acidic make-up eats away the exposed copper, leaving the tracks behind.
- After all the unnecessary copper has been etched away, and you've removed the board from the etching bath and cleaned off any remaining etchant, your board is almost ready for use.
- The last step is to drill the holes for any mounting points or through-hole components.

Milling Boards

- In addition to using a CNC mill to drill the holes in your PCB, you can also use it to route out the copper from around the tracks themselves.
- To do this, you need to export the copper layers from your PCB software as Gerber files.
- These were first defined by Gerber Systems Corp., hence the name, and are now the industry standard format used to describe PCBs in manufacture.
- To translate your Gerber file into the G-code that your mill needs requires another piece of software.

- Some CNC mills come with that software already provided, or you can use a third party program such as Line Grinder.
- The mill effectively cuts a path round the perimeter of each track to isolate it from the rest of the copper.
- As a result, PCBs which have been milled look a bit different from those which are etched because any large areas of copper that aren't connected to anything are left on the board.

Third-Party Manufacturing

- If your design has more than two layers, if you want a more professional finish, or if you just don't want to go to the trouble of making the PCBs yourself, many companies can manufacture the boards for you.
- The price for getting the boards made varies based on the complexity and the size of the design but also varies quite a bit from company to company.
- If you need the boards quickly, a local firm is best.
- Either way, the Gerber files are what you need to provide to the manufacturer.
- Make sure you export all the relevant layers from your design, meaning each of the copper layers you're using, plus the solder mask, silkscreen and drill files.

SOFTWARE CHOICES

FAQ

1. What are the different software options for designing PCB? Explain.

There are various softwares which will help you to develop PCBs.

- If you have a contract with a company that develops electronic design, they might use Altium or ORCAD software which are professional and expensive.
- But when we are developing PCBs by ourselves, we use softwares which is cheaper and cost efficient.
- Some of them are:

Softwares	Description
Fritzing	• Fritzing (http://fritzing.org) is a free, open source design package aimed particularly at beginners in PCB design. • It deliberately starts with a design screen resembling a breadboard and lets you map out your circuit by copying whatever you have prototyped in real life. • It then converts that design to a schematic circuit diagram and lets you arrange components and route the traces on the PCB view. • When you are happy with your design, you can export it for manufacture as a PCB. • Fritzing even offers a fabrication service to make it simple to make your design a reality. • You also can export the breadboard design view as an image or a PDF, which has led to Fritzing becoming very popular for people documenting their projects.
KiCad	• KiCad (www.kicad-pcb.org) is another open source offering but with a more traditional workflow. • It has a more comprehensive library of predefined parts and can be used to design boards with up to 16 layers of copper.

Eagle	• It is the most popular PCB layout software for the hobbyist and semi-professional market • The reason for its popularity most likely comes down to its long having a free version for noncommercial use, allowing beginners to get started. • That led to a wealth of how-to guides and other helpful resources for EAGLE being developed and shared by the user community. • The free version is also restricted to two layers and a maximum board size of 100mm × 80mm.
DesignSpark PCB	• DesignSpark PCB does not restrict the size of boards you can design (up to 1m2) or the number of layers (it supports up to 14 layers). • However, it is the only program described here which isn't available for Linux or Mac.

THE DESIGN PROCESS

- Designing a printed circuit board (PCB) involves several steps and considerations to create a functional and reliable electronic circuit.
- Here's an overview of the typical process for designing a PCB:

Schematic Design

- The first step is to create a schematic diagram of the electronic circuit.
- A schematic is a graphical representation of the components in the circuit and their interconnections.
- It helps the designer visualize the circuit's functionality and relationships between components

Component Selection:

- Based on the schematic, appropriate electronic components are selected for the design.
- Factors like performance, availability, cost, and size are considered during component selection.

PCB Layout

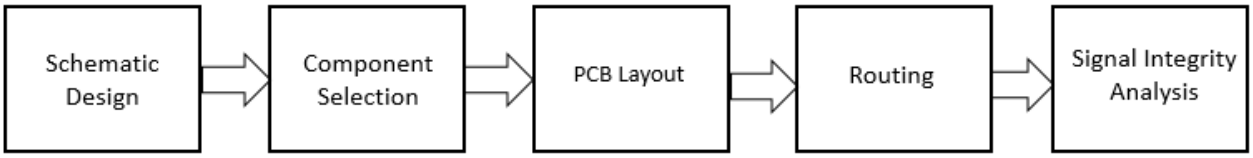
- Using PCB design software, the designer lays out the components on the board, deciding their positions and orientations.
- Components are placed to minimize interference, optimize signal integrity, and facilitate efficient routing.

Routing

- Routing involves connecting the components' pins with copper traces to establish electrical connections according to the schematic.
- The goal is to create a low-impedance and efficient path for current flow while adhering to design rules and minimizing electromagnetic interference.
- Power and Ground Planes
- To ensure stable power distribution and minimize noise, power and ground planes are added to the PCB design.
- These planes provide large areas of copper for power and ground connections, reducing impedance and enhancing signal integrity.

Signal Integrity Analysis:

- Signal integrity analysis is performed to identify potential issues that could affect signal quality, such as signal reflections, crosstalk, and impedance mismatches.
- The designer may use simulation tools to validate the design's high-frequency behavior.



ASSEMBLY

- The process of soldering various components like integrated circuits, resistors, and capacitors onto the PCB is known as assembly.
- The Bare Printed Circuit board after the assembly process is called as Printed Circuit Board Assembly (PCBA).
- There are two types of assembling techniques.
- They are:
    - Through Hole Assembly
    - Surface Mount Assembly
- For through-hole boards, we should use soldering iron.

Surface Mount Assembly

- Surface-mount assembly is a little more involved but quite achievable if you don't have any components with particularly complicated package types.
- For assembling surface-mount boards, you need one more item from your PCB design Gerber collection: the solder paste layer.
- You use it to generate a stencil that allows you to apply the solder.
- You can laser-cut one from a thin sheet of Mylar plastic or have one made for you out of thin steel.
- Obviously, the steel one will last much longer and let you solder up lots more boards before you need to replace it.
- The solder for surface-mount work comes as a paste, supplied in tubs or tubes.
- Using a squeegee and the solder paste stencil, you need to put down an even layer of solder over all the component locations and then carefully lift the stencil off the board.
- Using tweezers and ideally a loupe or magnifying glass, place each component onto the relevant spot on the PCB.
- The paste holds the parts in place to a degree, but take care not to knock the board at this point in case some of the parts get displaced.
- When you have all the components on the board, you need to melt the solder to fix everything in place.
- You can do this with a soldering iron, but doing it by hand is easier if you use a hot-air rework station.
- This station is something akin to a cross between a soldering iron and a blowtorch, and it uses hot air to provide the necessary heat.
- You can solder all the connections at once if you use a reflow oven.
- As the name suggests, this oven heats up the PCB and components evenly until the solder melts.
- Professional reflow ovens allow you to set different temperature profiles, allowing you to match the specification in the manufacturers' datasheets for more exacting components.
- For most uses, however, the temperature profiling isn't crucial.
- For hobbyist and semi-professional use, there is a lot of repurposing of toaster ovens or domestic hot plates to provide a suitable heat source.

Use of Robots for soldering

- After you outgrow hand assembly, you will need some help from robots.
- In this case, you will need robots that can pick up components using a tiny vacuum nozzle, rotate and place them in the right location on the PCB, and then repeat that process at a rate of tens of thousands of components per hour.
- These robots are known as pick-and-place assembly machines.
- The price of such equipment is starting to drop, such that these days desktop models are available for a price similar to laser cutters.
- However, the cost of the machines isn't the only one you need to take into account.
- Because they are geared up for mass manufacturing, the components to feed into the machine are supplied in a form known as tape and reel.
- This is literally a long tape with the components on at regular intervals and a row of holes along one (or both) sides to allow a sprocket on the machine to feed the tape through.
- The tape is then spooled onto a reel, with each reel typically holding a few thousand components.
- Obviously, you need a reel for each of the component types in your circuit design.
- There is also a limit to the number of different reels that can be loaded into the pick-and-place machine at any one time.
- Swapping reels over takes time and adds to the cost.
- Considering all this, if you are running your own pick-and-place machine, having another look at your design may be worthwhile.
- If you can rationalize the number of different types of parts it uses (maybe some of the resistor values aren't critical, for example, and you can swap out some for ones that have the same value as are used elsewhere), you can reduce the number of parts you end up holding in stock, not-yet-used, on reels.
- This complexity might also make it worth your while to offload some of the work to an assembly house, also known as a contract manufacturer.
- Contract manufacturers are firms geared up to helping people produce finished, populated PCBs.
- Often they offer a range of services from PCB design, through dealing with PCB manufacturers, to soldering up the components and even testing the completed boards (which we come to shortly).
- Using an assembly house saves you from buying the expensive machinery yourself.

TESTING

FAQ

1. Discuss the phase of Testing in manufacturing of Internet of Things devices.

- Actually, through the automated assembly process, you might have had some testing steps included already.
- Assembly lines can include automatic optical inspection (AOI).

Automatic optical inspection

- In this process, a high-resolution camera inspects some aspect of the board and its components; for example, it could check that the solder paste is laid properly before the board goes into the pick-and-place machine and compare it to a known good version.
- Any boards which vary from the "golden" reference version by too high a margin are flagged for further checks from a skilled human operator.
- After the boards pass the AOI, the next step is to run them through a functional test.

Functional Test

- This step should be done by all the boards, even with boards that are soldered by hand.

- The functional test involves powering up the board as it will be used in the finished product and ensuring that it does what it is supposed to.
- The focus here is to ensure that the PCB and its components are soldered correctly, that none of the components are faulty, and that there aren't any manufacturing defects in the PCB itself.

Test Jig

- A better approach for the functional test is to build a specific test rig to exercise the different parts of the circuit and measure the voltages at set points on the board.
- These measurements can then be compared against known-good values and a decision made automatically as to whether or not the device under test (DUT) has passed.
- Instead of spending time making individual connections for each test, the normal practice for the test rig is to use the mounting holes for the PCB for alignment and then have it held by some clips against a number of carefully prepositioned, spring loaded pins.
- These pins are known as pogo pins, and the spring means they can make a good connection to the board without any extra work, such as soldering, when the board is placed into the test rig.
- The test program can then run through its tests and measure voltages at different pogo pins at the relevant time in the test to see how the board being tested performs.

MASS-PRODUCING THE CASE AND OTHER FIXTURES

FAQ

1. Write a short note on mass – producing the case and other fixtures.

- Mass-producing cases and other fixtures in IoT refers to the large-scale manufacturing of the physical enclosures and supporting structures used to house IoT devices, sensors, and related components.
- These cases and fixtures play a crucial role in protecting the internal electronics, providing environmental resistance, and facilitating seamless integration of IoT devices into various applications.

3D Printing:

- Additive manufacturing, or 3D printing, is gaining popularity in the production of cases and fixtures, especially for prototyping or small-batch production.
- 3D printing allows for rapid design iterations and customization.

Automation and Assembly:

- Mass production of cases and fixtures often involves automated assembly processes.
- Robots and machines handle repetitive tasks, such as fastening components, ensuring consistency and efficiency.

Quality Control:

- Strict quality control measures are essential to maintain the desired level of precision and consistency in mass production.
- Quality checks are performed at various stages to identify defects and ensure that the final products meet the specified standards.

Scalability:

- Mass production processes are designed to be scalable, enabling manufacturers to produce large quantities of cases and fixtures efficiently and cost-effectively as demand increases.

Customization and Branding:

- Mass production allows for customization options, such as color variations, branding, and labeling, to align the cases and fixtures with specific product lines or customer requirements.
- Environmental Compliance:
- Manufacturers must adhere to environmental regulations and sustainability considerations while mass-producing cases and fixtures.
- Responsible material sourcing and recycling initiatives are increasingly important in the IOT industry

CERTIFICATION

FAQ

1. What is the importance of certification? Why is it required?

- One of the less obvious sides of creating an Internet of Things product is the issue of certification.
- If you forget to make the PCB or write only half of the software for your device, it will be pretty obvious that things aren't finished when it doesn't work as intended.
- If we fail to meet the relevant certification or regulations, the product will be similarly incomplete but it might be realized only after the product is sent to the distributor or has been already sold out to a customer.
- For the main part, these regulations are there for good reason.
  - They make the products you use day in, day out, safer for you to use;
  - They make sure that they work properly with complementary products from other suppliers
  - Ensure that one product doesn't emit lots of unwanted electromagnetic radiation and interfere with the correct operation of other devices nearby.
- The regulations that your device needs to pass vary depending on its exact functionality, target market (consumer, industrial, and so on), and the countries in which you expect to sell it.
- Negotiation is not expected in this, instead one can approach a third party company to perform the test for him based on different standards and also let one know where the product actually falls into and what changes are to be done
- CE is for meeting European standards; FCC for US Federal Communications Commission regulations; UL for independent testing laboratory's UL's test.

COSTS

- As we go further with the development of the product, lots of things get involved in the process.
- In fact, the further you get into the process, the less you will need your hardcore coding or critical design skills, and the more time you'll spend balancing cash flow and fund-raising.
- If you don't have much experience with managing delivery of inter-related tasks and deadlines, it is worth seeking out a trusted advisor or partner to help.
- Someone on the team needs to keep an eye on how things are progressing; which things must be done before other tasks can proceed; and, peering further into the project timeline, spot (and deal with) problems before they become a roadblock for the rest of the team.

PCB

- Many of the online PCB services include a quoting tool, so even before the design is finished, you can get a feel for the likely price.
- You should be able to make a reasonable guess on the size of PCB you need and the number of layers it's likely to require; those are the main factors that the quoting tools use to work out the cost, plus extras if you want something out of the ordinary such as a different colored solder mask.

PLASTICS & OTHER PHYSICAL COMPONENTS

- Pricing the plastics or other physical components depends far too much on the design for us to be able to give meaningful numbers here, but getting a hardened steel tool made, which will be good for churning out 100,000 parts before it needs replacing, could easily run to €10,000.

CERTIFICATION

- And to get through certification, you are likely to need a similar amount again.
- Simpler devices being certified in fewer territories might get through certification for around €2,000; more complicated designs, particularly those involving uncertified RF modules, could see costs 10 times that amount (€20,000) to get all the certifications in place.
- Naturally, as the project progresses, you will get more accurate quotes (and eventually completely accurate invoices...) as you talk to suppliers and get ready to place orders with them.
- This will let you update your BOM and cost spreadsheets and have the new information ripple through your plans.

SCALING UP SOFTWARE

FAQ

1. Discuss the issues in scaling up the software for large scale IOT devices.

- The following are the issues in scaling up the software for large scale IOT devices:

Deployment:

- The process of moving software from machine to where it is to be executed is known as deployment of the software.
- In the case of embedded systems, the software will be burnt on the controller during manufacturing itself.
- The software for an online service will tend to run in a single location and is more vulnerable to malicious inputs that might cause it to stop working.
- One must also focus on how to update the software regularly.

Correctness and Maintainability

- While dealing with an embedded environment, the software should do what it was meant to be.
- Example, it shouldn’t happen that the coffee machine makes cappuccinos when the customer asks for a latte.
- So the software should do its given task efficiently and safely.
- Testing your code before it is deployed is an important step in helping to avoid such a situation.
- The embedded code in the device, however, is particularly important to test.
- Also one should focus on updating the software efficiently.

Security

- Following are some of the more important guidelines:
- Servers should be kept up-to-date with the latest security patches; user passwords should never be stored in plain text.
- If your database were ever compromised, an attacker could easily log in as any user.
- Use of Hashing is encouraged.
- Never simply trust user input, be alert with spoofing attack and attacks like SQL injection.
- Be aware of cross-site request forgery (CSRF) attacks from other malicious or compromised websites.

Performance

- Whenever you think of scaling up software see to it that the system performance is not degraded.

User Community:

- Once the software is made available, you should be in a state to provide good customer service.
- While few large companies can boast Apple's famous commitment to "insanely great customer service", a small, focused startup can often match them for responsiveness and enthusiasm.
- If not then at least keep good online tutorials, forums, blogs and chat room that lets users support each other.

ETHICS

CHARACTERIZING THE INTERNET OF THINGS

Characteristics	Description
Dynamic & Self Adapting	Devices have the capability to dynamically adapt with the changing contexts and take actions based on their operating conditions, user's context or sensed environment
Self-Configuring	Allows a large number of devices to work together to provide certain functionality
Interoperable Communication Protocols	Supports a number of interoperable communication protocols and can communicate with other devices and also with infrastructure.
Unique Identity	Each IoT device has a unique identity and a unique identifier
Integrated into information network	Allows the devices to communicate and exchange data with other devices and systems.

PRIVACY

FAQ

1. Explain privacy with respect to IOT devices in detail.

- To address privacy concerns related to IoT devices, various stakeholders must take proactive steps:
- Manufacturers should prioritize privacy by design, incorporating robust security features and data protection measures into their devices from the outset.
- Privacy policies and terms of service must be transparent, clear, and easily accessible to users.
- They should explain how data is collected, used, shared, and stored.
- Users should be given meaningful control over their data, including options to delete, modify, or limit data sharing.
- Governments and regulatory bodies should establish comprehensive privacy laws and standards specific to IoT devices.
- Continuous monitoring, vulnerability assessments, and regular software updates can help improve the security and privacy of IoT devices.
- User education and awareness campaigns are essential to help individuals understand the risks and best practices for safeguarding their privacy in the IoT ecosystem.

CONTROL

FAQ

1. Discuss the advantages and disadvantages of technology.

Advantages of Technology

- **Improves communication:** Many businesses are using various business communication technologies to change the way their employees interact and communicate while at work.
- **Encourages Innovation and Creativity:** Workers can use different business technologies to create innovative business ideas which can be used in business growth and expansion.
- **Improves on Human Resource Management:** It improves on the process of screening, recruiting and hiring new employees. Many human resource managers are using the internet to advertise job openings.
- **Saves Time:** Technology can be used to automate various tasks at work, this automation will guarantee efficiency and will also increase production at work.

Disadvantages of Technology:

- **Causes Distraction at Work:** There are so many ways technology can distract employees at work. The use of social networks at work can cause so much distraction and it affects the productivity of employees.
- **High Maintenance costs:** It is expensive to buy technology, but it is also costly to maintain it.
- **Makes employees lazy:** Since most tasks are automated by technology, many employees become lazy at work, technology kills their creativity and skills.
- **Affects Workplace Relationships:** Employees communicate via cell phones, text messages, email or virtual video conferencing tools. This type of communication technology eliminates face-to-face communication.

DISRUPTING CONTROL

FAQ

1. "The internet destroys the state". Discuss

- The other major possibility that Eaves suggests is that "The Internet Destroys the State".
- When we refer to a technology as "disruptive", we mean that it affects the balance of power.
- If one of the fears about the Internet of Things is that it will transfer power away from the citizens, the subjects of technology, to the elite, then perhaps it can also be used to redress that balance.
- For example , if we look at CCTV, if you install a CCTV in your private space and put the boards around saying that "You are under CCTV Surveillance" the people coming to the nearby area is aware about the same and might look up to their actions as they are been monitored by someone.
- This might reduce the wrong doings in the personal space.
- Now imagine the same situation with CCTV cameras, since there is no one to check what you are doing, you are free to do whatever you want and don't hold any fear of getting caught.
- Another scenario is that the internet undermines our connection with the state.

  (Undermine means to erode the base or foundation of (a rock formation).)

- Online we become increasingly engaged with epistemic communities – be it social, like someone's World of Warcraft guild, or professional, such as an association with a scientific community.
  (Epistemic means relating to knowledge or to the degree of its validation.)
- Meanwhile, in the physical world, local communities – possibly at the regional level – become ascendant.

  (Ascendant means rising in power or influence.)

- In both cases, regulations and rules created by the state feel increasingly like an impediment to conducting our day to day lives, commerce and broader goals.

  (Impediment means a hindrance or obstruction in doing something.)

- Frustration flares, and increasingly someone in one state feels less and less connected with someone in another state – and the common sense of identity, the imagined community, created by the state begins to erode.

Crowdsourcing

FAQ

1. Discuss the five critical requirements for sensor commons project.
2. What is Crowdsourcing? Explain.

- Crowdsourcing is the practice of turning to a body of people to obtain needed knowledge, goods or services.
- Governments and companies simply do not and cannot have a monopoly on all recording of data: there are infinite combinations of data sources.
- Choosing which data to record is a creative and engaged act, as well as, perhaps, a political one.
- As he points out, "The air quality data collected by the government is likely sampled from far, far away and then applied to you on a regional level, almost completely useless from the standpoint of trying to understand or change the local dynamics of pollution that affects you".
- Crowdsourcing this data is an entirely innocent scientific activity yet is profoundly radical, too.
- Andrew Fisher, a technologist with interests in big data and ubiquitous computing, has written persuasively about a quiet revolution of the "sensor commons", his term for this collaborative voluntary effort to provide environmental data.
- Fisher's original definition observed five critical requirements for a sensor commons project.
- It must

Gain trust:

- Trust is largely about the way that an activist project handles itself beyond the seemingly neutral measurements;
- Understanding local issues
- Being sensitive about the ways that the sensor network itself affects the environment (for example, local Wi-Fi bandwidth usage),
- Engaging the public with accessible and readable information about the project, and dealing with the local authorities to get access to the systems the project wants to measure.

Become dispersible:

- Becoming dispersible means spreading the sensors throughout the community.
- Getting mass adoption will be easier if the proposed sensors are inexpensive (both the physical sensor itself and the ongoing costs of keeping it powered and connected to the network) and if the community already trusts the project.

Be highly visible:

- Being visible involves explaining why the project's sensors are occupying a public space. We've already discussed the ethics of hidden sensors.
- Being honest and visible about the sensor will help to engender trust in the project and also advertise and explain the project further.
- This may reduce the probability of vandalism too.

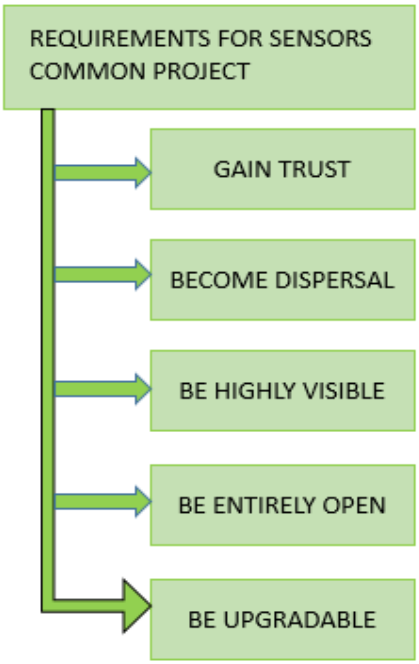
- Advertising not just the sensors but the data (both online and in real life) and the ways that data has helped shape behavior will also generate a positive feedback loop.

Be entirely open:

- Being open is perhaps what distinguishes the sensor commons from a government project the most.
- Government data sets are often entirely closed, but the data that is released from them will be given a lot of attention because of the rigor and precision that (we expect) their sensor projects will have.

Be upgradable:

- Finally, the project should be designed to be upgradable, to enable the network to remain useful as the needs change or hardware gets to the end of its working life.
- This requirement interplays with the dispersibility and openness of the project, and the up-front thought to managing the project long term will feed back into the trust in the project.



ENVIRONMENT

FAQ

1. Discuss the environmental issues associated with IOT devices.
2. What is the environmental cost of Internet service for IOT devices? What is the solution?

Privacy Issues

Definition

- The internet, which is considered as one of the vast open publishing sources in the environment, does not provide privacy up to 100% and with such more issues.
- This is known as environmental issues in IOT

Denial of Service Attack(DOS) :

- Sometimes the server is unable to detect multiple requests given by a specific user due to which it gets confused and gets stuck in the cycle due to which termination and leakage of data occurs.

Information manipulation:

- Information is a basic primitive thing in IOT where if this information gets manipulated then the performance of our system also gets manipulated and thus results in giving less performance as compared to the earlier performance it gave.

Information Disclosure:

- Our sensors in IOT devices are mainly responsible for taking up and sharing data/information to cloud storage, local database or on a temporary basis in our devices.
- So attackers try to locate the position or place there amongst where the data has been stored.
- Then as soon as the attacker recognizes the location of the data they can black mail us with our private data in exchange for a sum of money.

Physical Thing:

- Whenever any product is developed it will include the cost of different components which includes the raw materials, the processes used to shape, the packing materials, and the shipping required to ship them from the manufacturing plant to the customer. The cost also includes different plastics used for 3D printing.
- While developing any new product, make sure environmental ethics are followed like waste disposal/recycling.

Human Cost:

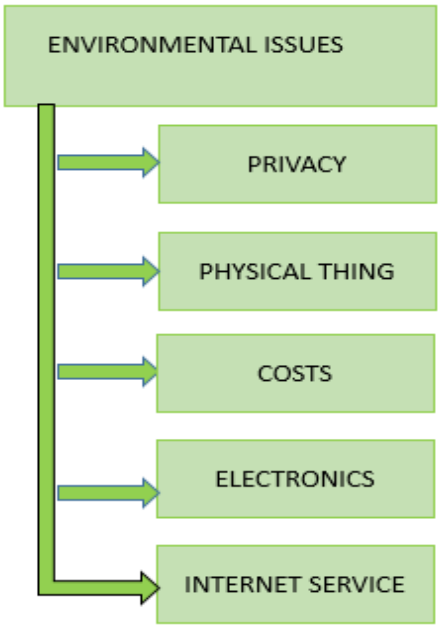
- It is also important to consider the human cost, the communications, transport, and logistics required are certainly a part of the technology.
- The combination of technical expertise and relatively low labor costs, has reduced overall manufacturing cost.
- The advances in operator-less manufacturing tools such as 3D printers and laser cutters are, however, enabling small-scale industry to return to the First World

Electronics:

- The electronics contained in a Thing have their own environmental cost.
- Ranging from PCB to advanced tools like CNC milling, laser cutter, 3D printer etc.
- Shipping the raw material from mine to refinery to manufacturer has its own cost too.

Internet Service:

- This is one of the main component of IoT, running the Internet has a cost: the electricity to run the routers and the DNS lookups, plus establishing the Infrastructure
- Laying cabling across the sea, setting up microwave or satellite links, and so on.
- As well as the cost of transferring the data across the Internet, running your own web server uses power.



SOLUTIONS

FAQ

1. What is the environmental cost of Internet service for IOT devices? What is the solution?

The Internet of Things as Part of the Solution

- If a sensor reading helps the government and international science measurement we should encourage the same.
- Reducing home energy usage, transport costing and other costs will effectively help the environment.
- Projects such as carbon sources can be taken up by companies to record the carbon emission of their production and improve for the same.

Cautious Optimism

FAQ

1. What is cautious optimism? Explain

- Cautious optimism is a context which refers to maintaining a careful and realistic approach so that they can be implemented with a proper amount of risk in IOT.
- It is true that any technological advance adopted by corporations, governments etc. always aim that technology can be used socially, responsibly, efficiently to mitigate and manage the given set of operations. Assuming that the Internet of Things can be fun, but being aware of the ethical issues around it, and facing them responsibly, will help make it more sustainable and efficient.
- When designing the Internet of Things, or perhaps when designing anything, you have to remember two contrasting points:

Everyone is not you:

- Though you might not personally care about privacy or flood levels caused by global warming, they may be critical concerns for other people in different situations.

You are not special:

- If something matters to you, then perhaps it matters to other people too.
- This tension underscores the difficulty of trying to figure out overriding concerns about any complex area, such as the Internet of Things!

The Open Internet of Things Definition.

FAQ

1. Discuss the main goal of Open Internet of Things definition.

- The Open IoT Assembly 2012 culminated in the drafting of the “Open Internet of Things Definition”.
    - An emergent document, created after two days of open discussion, it seeks to define and codify the points of interest around the technology of the Internet of Things and to underscore its potential to “deliver value, meaning, insight, and fun”.
    - A particularly interesting consensus in the definition was that, even though the Data Licensor (usually the person who has set up the sensor or paid for that data) should quite reasonably own the data from that sensor, some rights should also apply to individuals whose data is recorded (the Data Subjects).
    - They must be granted license to any data that regards them and should be allowed to license the anonymised aggregate data for their own purposes.

- We can summarize the main goals of the definition as follows:

Accessibility of data:

- As a stated goal, all open data feeds should have an API which is free to use, both monetarily and unrestricted by proprietary technologies with no alternative open source implementation.

Preservation of privacy:

- The Data Subjects should know what data will be collected about them and be able to decide to consent or not to that data collection.
- This is a very strong provision (and most likely unworkable for data which is inherently anonymous in the first instance) but one which would provide real individual protection if it were widely followed.
- As with any information gathering, "reasonable efforts" should be made to retain privacy and confidentiality.

Transparency of process:

- Data Subjects should be made aware of their rights.
- For example, the fact that the data has a license—and that they are able to grant or withdraw consent. In addition, where the data is collected from a public space, the public should get a right to participate in decision making and governance of that data.
- We could imagine that planning-permission notices might be posted, as they are in the UK for building developments.
- The importance placed by these principles on data is unsurprising: the Internet of Things brings the gathering and collation of data into the everyday world and has real consequences on individual privacy and power.