1.**Laser cutting round boxes from square sheets**
Client: Dr Laura James LBJ@cantab.net , Cambridge MakeSpace
Kerf bending is a cute method for making round boxes with a laser cutter, but it requires quite a bit of planning. The goal of this project is to build a system that can be used by customers to design their own wooden boxes in arbitrary shapes (e.g. letters of the alphabet), with the templates for the round sides automatically produced using kerf bending. The resulting pieces should be suitable for posting in a flat-pack format, in as few pieces as possible, with tongue and slot assembly. Examples of the resulting designs will be fabricated using the Computer Laboratory laser cutter.
Background on kerf bending: http://hackaday.com/2012/06/12/bending-laser-cut-wood-without-steam-or-forms/
Special resource - interfacing details and access to laser cutter will need to be arranged with Brian Jones bdj23@cam.ac.uk

2.**Touch screen prototyping at school**
Client: Ian Hosking, Engineering Design Centre imh29@cam.ac.uk
Secondary school design and technology teaching includes an emphasis on inclusive design - creating products that are available for use by a wider range of the population. At present, school students don't get to learn about interactive software design, but they probably know that products like touch-screen smart phones are a major obstacle for their grandparents, and students should have a chance to learn about how to improve matters! Your task is to create a low cost system for prototyping new touch screen interfaces, that is sufficiently easy to use that 12 and 13 year-olds can experiment with alternative phone designs. The whole system should be sufficiently compact that it can be deployed on a Raspberry Pi (we can supply large touch screens that can be interfaced to the Pi)
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3.**Measuring glass-to-glass video-conference latency (Hardware project)**
Client: John Bain, Cisco jbain@cisco.com
A key consideration in the design of video-conferencing systems is to minimise the latency added to the video and audio, since this can have a marked effect on the naturalness of communication. Many software solutions exist for measuring various aspects of the system latency, but there is no substitute for end-to-end (often called glass-to-glass, referring to the lens of the camera and display screen) measurements of video and audio latency. This type of measurement has traditionally been subjectively measured by humans, and is hence prone to error and bias. Your task is to automate this by presenting an audio plus video signal to one end of a video-conference link, and measure the latency of the screen/speaker output at the other end. The two ends may be geographically separated - even in different continents. The Altera teaching board will be used to provide I/O facilities. Some technical ingenuity will be involved in ensuring that any delays or offsets in measurement are accounted for.

4.**Reliable cycle-aware traffic light (Hardware project)**
Client: Nigel Day, ENEA Nigel.Day@enea.com
Most central Cambridge junctions snarl up at critical moments between lectures, with accidents, broken limbs and worse as students jump red lights after realising they are running late. Your task is to create a fault-tolerant traffic light controller (using a pair of Raspberry Pis with a hardware fail-over), that builds a traffic model based on weather data, university building management systems, bus timetables, and any other data sources that you can discover to accurately predict cycle volumes. This database should be combined with traffic sensor data to invent a new cycle-aware junction control model.

5.**Scrobble Exchange: A massively multiplayer game**
Client: Sunil Shah, Last.fm - sunil@last.fm
Last.fm is the world's most popular music recommendations website with tens of millions of users. Users scrobble http://www.last.fm/help/faq/ category=Scrobbling tracks that they listen to, which we collate into charts which show the most popular artists and tracks and can be filtered by geography and genre. Using our extensive API http://www.last.fm/api , this project's goal is to create an online multiplayer game where users can invest in a portfolio of artists and gain returns based on the performance of their portfolio. The mechanics of the game are up to you but you should take steps to prevent cheating, and implement market dynamics so users' behaviour has a visible effect on the market price of an artist. A successful project would likely see implementation on Last.fm and be made available to our large userbase, so scability is a key design goal, as is portability to the Last.fm operating environment (Python or PHP against a Postgres database under Debian Linux).

6.**Safer social media**
Client:David Kynaston E.Kynaston@btinternet.com
Young people with learning disabilities such as Down's Syndrome, ADHD or dyslexia are increasingly excluded from social media opportunities. Your goal in this project is to create a new front end for Facebook (using the Facebook API) to provide a straightforward set of social functions optimised for users who have very limited ability to use text in any form. Rather than the single-user mode of typical Facebook usage, it is also likely that a parent or carer may need to assist or review interactions. Your design should take account of this in a sensitive manner, including considerations of privacy and vulnerability.

7.**Personal/national mood tracker**
Client: Tomas Cervenka, VisualDNA tomas@visualdna.com
National wellbeing is the aggregate of the population mood, but it's difficult to know whether mood estimates are accurate or not. In fact, even individuals find it difficult to estimate how their mood has changed over time. The goal of this project is to automatically estimate a number of factors that effect national mood - news, weather, economic indicators - and aggregate these with personal mood estimates measured via your mobile phone's sensors. These could include movement or orientation data (facing into the wind?), feeds from a Facebook profile, or other data. If users are unsure what mood they are in, they can check their phone. And a longitudinal graph might help to review the year, or forecast important mood transitions - like when the end of term is approaching.

8.**The Poet Laureate's web thresholds**
Client: Vicky Smith, StrideDesign vicky.smith@stridedesign.com
The Poet Laureate Carol Ann Duffy has appointed 10 leading poets to work with Cambridge University Museums and young people from the county. Your task is to provide a novel tool that can emulate the exact layout of any page from a museum web server, but with the original text (perhaps partly) removed. Invited poets and young people should be able to substitute their own poetry or other text by typing directly over the visual layout as if in a drawing editor. These transformed pages can then be published and viewed from an alternative server that offers a "mashed up" version of any museum page for public viewing. The technical challenge is to give users the impression that they are really typing directly onto the rendered web page, as if onto a piece of paper, and to do so in a way that emphasizes typographic freedom, allowing poets direct control over all concrete aspects of the juxtaposed text.

9.**Countryside web server**
Client: Peter Cowley, CamData peter.cowley@camdata.co.uk
A ruggedized version of the Raspberry Pi can be used for outdoor applications, like monitoring wildlife activity via USB peripherals (e.g. GPS) analogue and digital inputs (e.g. monitoring the weight of nesting birds, or entries to a burrow). The kinds of hobbyist and researcher who do this need to specify data capture via a rubberised keyboard and LCD display, but also make that data available more widely via popular websites. Your task is to design a system that allows users to configure battery-powered data capture and website structure in the field via the embedded display, but then turn the same device into a fully-functional web server with data visualisations when it is brought inside and plugged back into a network port. If required, you will also be provided with a licence for the ENEA Polyhedra realtime embedded database.

10.**Race the wild**
Client: Craig Mills, United Nations Environment Programme World Conservation Monitoring Centre
Craig.Mills@unep-wcmc.org
The UNEP-World Conservation Monitoring Centre wants to improve public engagement with wildlife conservation. One very successful approach is to help those interested in wild animals to learn more about their daily activities, and to imagine the environments that the animals have to survive in. The goal of this project is to create a game that runs on a mobile phone platform, allowing players to compare their own movements to those of wild animals that are fitted with satellite tracking devices. You are free to design a game scenario in any genre that makes use of play location data and animal tracking information.

11.**Password and privacy protection with Pi**
Client: Luke Morgan, IBM MORGANLU@uk.ibm.com
Few children (or even adults) really understand what makes a password secure, or how to keep their online information safe. Your task is to create a simple set of password cracking and message encryption/decryption tools that children can run on the Raspberry Pi, together with a scripting language or GUI for them to run simple statistical

experiments to understand what factors make their messages more secure. Children love code-breaking, so it should be easy to make this into an entertaining Raspberry Pi game, not just boring school work.

12.**From Hogwarts to hackers**
Client: Jeff Patmore, Engineering Design Centre jjp43@cam.ac.uk
Many children are more interested in imaginative stories than tinkering with circuit boards. But they need not be excluded from Raspberry Pi. The goal of this project is to create a multiplayer online game, where each room of a castle runs on a different Raspberry Pi. The owner of that Pi should be able to define surroundings, objects, characters and scripted interactions (e.g. to learn spells or solve challenges) as well as visiting other player's rooms. Players get to learn about network topologies, scripting languages and command lines - but all while having sociable fun. A text adventure game might be the best choice - for example, of the kind that can be created with plot scripting language Inform7, or LambdaMOO, but you are free to attempt simple graphics or other presentation styles.

13.**A platform for live online modding**
Client: Matt Johnson, Frontier mjohnson@frontier.co.uk
In sandbox games like Minecraft, the only way to define more interesting game scenarios is to write and install Java mods. It is possible to make automatic behaviours in the Minecraft world, but only using the cumbersome "redstone" logic blocks. The goal of this project is to make a new multi-player sandbox game, based on a 2D grid, where users can define more complex behaviours by clicking on a grid element to embed pieces of code written in a scripting language like Lua. You are welcome to use a commercial or open source rendering engine, but maintaining a shared persistent world will still involve solving problems of persistence, networking, live world management and session control.

14. #f**ollowthemarket**
Client: David Rubin, Bloomberg drubin19@bloomberg.net
Sentiment analysis of social media is now fairly routine, but it's still relatively new in the world of finance. Coupling popular sentiment with market data could provide a very useful tool for financial decision makers. Your task is to derive sentiment data from Twitter and present its relationship to market data in a tool for traders to test their knowledge of the market. The user selects a date range and a stock, and is then asked to sketch a graph of how they believe popular sentiment and stock price trends behaved over that time. The system gives visual feedback, and awards a competition score based on comparison to the actual data. This system might be used simply for practice and training, or as a game for would-be traders. But in the long term, statistical data showing the ways in which the judgments of real traders predict (or lag) Twitter trends might provide an extremely valuable product!

15.**Science exhibit interaction adviser**
Client: Dave Ansell, Cambridge Science Centre dave@cambridgesciencecentre.org
The newly established Cambridge Science Centre is building a major interactive public science exhibition space in Cambridge. We want this to be the best of its kind in the world! One issue faced by interactive science exhibits is the tendency for visitors to play with the knobs and handles in a random way, without the guidance that might make the discovery experience more enjoyable and educational. The goal of this project is to make a configurable exhibit monitor (delivered via an embedded Raspberry Pi), that will prompt visitors to explore behaviours they haven't yet seen. This should have a simple authoring language associated with it (perhaps configured via a flow chart) that describes possible exploration paths, and allows a scientific adviser or exhibit designer to tag those that appear to be off-topic, incomplete or unhelpful. Configuration and review of interaction statistics should be available remotely, via a network connection to each exhibit equipped with one of these devices.

16.**Personal status server**
Client: Chandra Harrison, Qualcomm c_charri@qti.qualcomm.com
There are several ways that computers can "read your mind" by observing emotional state - measuring skin conductance, or even estimating pulse rate with a camera pointed at your face. A dedicated device like the Raspberry Pi could run its own web server, serving a single page that is modified according to the detected emotional state of the user. Of course, it should be possible to customise this behaviour with a simple end-user language, so that different texts or images are included in the page in response to different detected emotions. Finally, friends should be able to add their own supportive feedback to the page ... using appropriate security!

17.**Rule-tris introduction to programming**
Client: Luke Tunmer, Qualcomm ltunmer@qti.qualcomm.com
All kids love Tetris, so why not help them learn programming by making a Tetris-playing robot? You need to start with a simple Tetris port on the Raspberry Pi (code your own, or use an open source version), then add facilities allowing kids to "play" it automatically with the assistance of an interpreted rule language. This language can be applied by users to define piece rotations and movements based on queries of the current game state and simple algebraic expressions. The rule condition queries and actions must be sufficiently constrained that it would take significant coding effort to make an optimal player, but should also be simple enough to provide incremental feedback for students, so that each new rule (if correctly specified) produces satisfying improvements.

18.**Terabyte threat analysis**
Client: Paul Reid, BT paul.reid@bt.com
Large networks such as the BT phone network generate terabytes of routing metadata, but the size of the dataset makes it difficult to interact with that data in realtime. This means that threats to the network - whether natural disasters or intentional attacks - may not be recognised until it is too late. Your task is to create a threat visualisation and rapid response tool that uses the Hadoop distributed data framework to identify network vulnerabilities from data traffic analysis, and helps to plan and prioritise technical responses
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19.**Friend meeting/tracking application for the Elderly**
Client: Austin Donnelly, Microsoft Research Austin.Donnelly@microsoft.com
Elderly people sometimes need help to remain active and social. This project explores how a smartphone can arrange social gatherings/ meetings for them. This might include encouraging people to meet up by locating their friends, perhaps notifying them that a friend is nearby, and maybe even suggesting a location to meet. It may also be useful as a monitoring device for patients who make a habit of wandering off, distressing their family and carers. The user interface is important, since it must be accessible to those with less good eyesight and hand coordination. There will be little credit for boilerplate features such as user registration, account maintenance and database design, rather we expect to see innovative technical solutions to the user interface, messaging, security (privacy) and identity. The final goal is a Windows Phone 7 application that has been accepted into the Marketplace for general availability. Phones will be provided for testing.
Note that Windows Phone 7 development requires .NET tools, so the development language for this project will either be C#, F# or VB.

20.**Cycle path mapping with a custom hardware platform**
Client: Steven Johnston, Microsoft Research v-stejo@microsoft.com
The aim of this project is to produce a highly accurate map of the Cambridge cycle network including information about inclines, one way roads, restricted access. Since this will require more data than can be gathered using a simple GPS device or smartphone this project will have a custom hardware element based around the .NET Gadgeteer platform. The first part of the project will build a device to capture data such as GPS, accelerometer, compass, cadence, wheel rotation, heart rate etc, to produce a sample dataset representative of the Cambridge cycle network, as well as providing the cyclist with relevant data.
The second part of the project will process and visualise the sample dataset. This will include removing erroneous data, fusing data streams and maps to improve accuracy and inferring cycle features from the data whilst keeping an emphasis on data accuracy. This information could be used to recommend cycle routes or diversions in real time, assist with finding a bike rack, or perhaps the addition of new cycle lanes. The resulting dataset should be open and accessible.
Note that Gadgeteer development requires .NET tools, so the development language for this project will either be C# or VB.