Part IB Group Project Design Briefs 2015

Live Coding for Blind Children
Client: Will Thoms, Morgan Stanley
Educational programming languages like Scratch are rather disappointing for blind children - the visual syntax feedback is no help, the animated visual output is not motivating, and audio screen readers can't read the source code back to you. But it should be possible to make an educational programming language that is easy and motivational for blind children. It would output music, rather than animations, so blind children can create their own artistic results. It would create standard text source code, so screen readers work. Both of these things are already provided by Sam Aaron's amazing Sonic Pi system, but Sonic Pi doesn't have a very convenient way for blind children to create musical code. Your task is to design a simple customisable musical instrument, using Modular Robotics Cubelets, that outputs its state as a running Sonic Pi program for children to inspect (using a screen reader) and modify. You will be able to use a newly-released API for Sonic Pi that supports code insertion via standard Open Sound Control messages.

Planet Builder
Client : Matt Johnson, Frontier
In large-scale space exploration games such as Elite:Dangerous, No Man's Sky and Star Citizen, procedural algorithms are used to generate planets. Your goal is to create a new tool that will help game authors, or even enthusiastic players, to create new alien worlds. You'll need to think about how to control terrain, settlements, life-forms and so on in a way that provides creative control while also being fast and efficient. The visual quality doesn't need to equal that of professional games (you might target delivery on a low-cost platform such as Raspberry Pi), but you should aim to provide a creative tool in which users have a dynamic preview of their work in progress as well as intuitive ways to define and adjust it.

Multi-Lingual SMS
Client: Robert Catherall, ARM
Services such as Google Translate are a useful tool for global languages like Mandarin or French, but many people in remote rural areas contribute to public life in their own local languages. It's not necessary to translate these, but it's useful for UNICEF and other international agencies to know what general concerns these people share with neighbouring regions. Cambridge organisation Africa's Voices has datasets of SMS messages collected from different African countries, in local languages, addressing shared health and human rights issues. Your goal is to create a visual browser, perhaps in the style of word clouds, that would allow international policy teams to explore topic maps bringing multiple languages together. The LDA algorithm might be a useful approach to topic map construction.

Building the Matrix
Client: Radmilo Racic, IMC
Successful virtual reality systems have to get just the right balance between system performance and human response. The time coordination issues in distributed multi-player VR are even more challenging. This project is a chance to test your skills in all of these. We have two Oculus Rift headsets, and your goal is to use these to demonstrate a time-critical distributed VR game. The scenario is cricket - one player runs up and bowls, the other bats. Both have to get the timing exactly right (you can use keyboard/mouse input or a USB game controller if you prefer). The VR rendering can be in a style of your choice - either realistic players and wicket, sci-fi/alien cricket, or even cyberspace cricket in the style of William Gibson's original Matrix, where batting and bowling are just metaphors to control financial, business or political transactions.

Extrusion Finder
Client: Emma Gordon, Metaswitch Networks
Many offices, houses, furnishings and machines are made from lengths of metal or plastic that have a constant cross-section, but come in different lengths of extrusion. When one of these breaks, it ought to be possible to fix it by ordering a replacement length and simply snapping it into place. However, it's not necessarily easy to find the extrusion you want. The result of this project would be a great new market opportunity. A user can simply take a picture of the required cross-section (using their phone, or perhaps a flatbed scanner), and the system should automatically find the closest match from online catalogues or sales sites such as seagateplastics.com. As a last resort, an obsolete product could even be resurrected with 3D printing - but there is far more profit to be made by making online referrals and have someone else worry about the manufacturing!

Intensive Care for Ebola
Client: Luke Jones, TPP
One of the major challenges in Ebola outbreak regions is information management. Most patient care is done by people with neither medical nor IT experience, and often low levels of literacy. Their training is often only 3 or 4 days, mostly focusing on hygiene and use of protective clothing. Your goal is to create an electronic patient record system that will run on a smartphone, suited to the network connections, power supply and hardware limitations in rural Africa. The system should help regular collection and progression monitoring of symptom reports and vital signs as would be done in a hospital intensive care unit, for example using TPP's SystmOne. It might also present users with advice on triage and patient care. Deployment should be easily customisable for local languages, and provide mechanisms to feed data back to international coordination bodies such as the World Health Organisation.

Reinfection Monitor
Client:James Dickin, BAE Systems Applied Intelligence
A constant problem for PC owners is that, even after someone helps them remove a malware infection, they soon repeat the same action that caused the infection in the first place. And because malware doesn't usually advertise its existence, the user never learns how to stop it happening. The goal of this project is to create a network monitor dongle (possibly prototyped on a Raspberry Pi) that can simply be inserted as a router between the PC and home router, and will identify the network traffic that is characteristic of a particular piece of malware. It can be configured and left in place by the technician who cleans up an infection, and will send that person an email as soon as a reinfection is spotted (of course, it should also notify the user, provide a visible warning on the unit itself, and provide a local status report that can be accessed from a browser, with details helping users to understand what has happened). Some knowledge of networking on Linux will be required.

Online Advice Assistant
Client: David Hardcastle Amazon
The Citizens Advice Bureau is an organisation that helps people find information relevant to problems in their lives. A major area of activity is telephone advice consultations, at the end of which the caller might be directed to a website with information leading to assistance - for example, a family law practice or a social welfare agency. Your goal is to create a service that might be more comfortable for younger people, based on anonymous online chat rather than phone lines. The goal isn't to make an intelligent chatbot, because human contact is important to people with problems, but you could help make the process more efficient, for example by directing either callers or advisers to suitable parts of earlier conversations that seem relevant. Remember that a simple Google search won't work here. People describe their problems, not the answer they are looking for, and there are many commercial websites that aim to exploit people with problems rather than offer them neutral advice.

Financial Trading Trends
Client: Piers Thompson, Bank of America
Over-the-counter (OTC) trading of financial products is less regulated than exchange trading, but also less transparent. To improve market fairness and efficiency, near-realtime details of OTC trades must therefore be placed in a public repository (rtdata.dtcc.com/gtr/dashboard.do). However, since this data is not easy to view and analyse, the aim of increased transparency has not been achieved. The aim of this project is to provide a convenient means of accessing, viewing and analysing OTC trade data. This should provide realtime data on current prices and trading volumes, historic trends, and automated identification of pricing anomalies and trend alerts.

Online Identity for the Base of the Pyramid
Client: Pawel Moll, ARM
Initiatives such as Girl Effect and StoryBank provide new content channels for the poorest people in developing countries to gain a visible online identity. How could you minimise the educational and financial obstacles to their visibility in the global media ecosystem? SMS hubs such as Frontline SMS, or village kiosks containing Raspberry Pi with cameras? Are keyboards or screens essential? You'll need to consider user literacy and appropriate interaction mechanisms for those whose technical expertise may be limited, but who will be empowered by gaining new skills. Finally, don't forget that having a voice is not sufficient to have an identity - somebody has to hear it.

Location-Based Teaching
Client: Nicolas Graube, CSR
iBeacons/Bluetooth4 beacons are now being deployed in public, retail, and office spaces and offer the opportunity for micro-location applications (i.e. you are near X so execute Y). The CL has a large deployment of beacons that can provide phones location throughout. Your task is to create a platform that receives beacon sighting information from Android/iPhone devices and exposes it as location information that other can build location-aware applications on. You will then use this platform to create an educational system. It should be possible for anyone to use this platform to create new types of face-to-face interactive content that are advertised as available at particular times and location. Existing content could be imported automatically from sites such as talks.cam.ac.uk, lecture and seminar timetables, supervision management systems and so on, but users should be able to create new location-based content relevant to other learning or event types.

Wild Pet Science
Client: Francesco Petrogalli. ARM
Children are often strong supporters of wildlife conservation, but also have pets of their own. The goal of this project is to help them engage with the science of wildlife tracking (via public data sources such as movebank.org), comparing that data to monitoring information that they collect themselves. Although Movebank uses GPS, sonar and other expensive techniques, you could use simple image analysis from a Raspberry Pi time-lapse camera to identify the position of a goldfish, a guinea pig or a hamster in its cage (you can use toy animals for the public demo). Children should be able to use the data they collect to make comparisons between their own pets and wild animals - this might include foraging behaviour, "migrations" or seasonal variation in activity.

Culture Glasses
Client: Lance Robson, Metaswitch Networks
Google Glass is an amazing product, but can make the wearer seem a little geeky. The goal of this project is to compensate for that, by using the Google Glass camera to identify a barcode on a non-geeky cultural product you are given in a social situation (say a book or vinyl LP), and then provide a private display with cues of clever things to say about it. This will probably come from online reviews, but your software will need to spot the barcode, find the reviews, and distil them into a few words that make the wearer seem as smart as possible.

Flash Mob Learning
Client: Glenn Woodcock, Sparx
School students increasingly use tablet or mobile devices to access online content or submit work, but these depend on network infrastructure. The goal of this project is to create a local content hub that allows students and teachers to collaborate, but without needing an internet connection (for example, in developing countries, in rural locations, or just to avoid the bureaucracy of school internet permissions). You will use a Raspberry Pi as the basis for a WiFi hotspot that also has a built-in educational content platform, allowing students themselves to collaborate in building the content. This could support in-browser creation of shared executable scripts as provided by skulpt.org, or even shared composition of a piece of digital music (see sonic-pi.net) that would be played from a speaker on the central device.

AI Racing Market
Client: Dominic Nancekievill G-Research
As AI-controlled vehicles like Google's Self-Driving Car become more common, the person who gets to work fastest will be the one with the best algorithms. Your task is to create a competitive market in which members of the public can submit algorithms to see which is the best. You'll need to define a simple scripting language and API suitable for creating the entries. Users should be able to enter their script directly into an interactive game then see its performance in an actual real-time car race created with the Unity graphics engine and physics model. The best entries should be stored and ranked in a leader board, with new players able to see existing code and tweak it for better performance. In future, this kind of algorithm market could be applied to other problem domains such as finance.

Careers from Here
Client: Emy Calder, JPMorgan
Future First is a charity closing the career gap for those born in low-income homes, by helping state secondary schools and colleges develop a thriving and engaged alumni community. Their latest idea is to develop tools that can be used by schools to create and maintain a library of videos in which school alumni describe their school experience and subsequent career. The recording app should structure the video recording with interview questions, and constrain recording times relevant to each question with appropriate messages and visual timer countdown, in a way that is encouraging and user friendly. The system should allow current students to find alumni with similar interests and experience to their own. It should also allow school administrators to manage the library of interviews, customize the interview questions for their school, and have a workflow for checking and approving new videos for release.

Micro-Friends Video Diary
Client: Richie Jones, Boeing
This is your chance to be the next Instagram! As more people carry video-capture devices (Google Glass, Go Pro) we collect hours of video. Some of those hours include sequences of friends enjoying themselves. But nobody has time to review and edit all that footage. Your task is to use a face detection algorithm (Viola Jones works well) to extract those precious seconds where a friend's face is moving enough to be exciting. If your friends are a little less expressive, you can crop or speed them up as necessary. The goal is to turn the most engaging video extracts into a collection of animated GIFs, each one or two seconds long, that are embedded in a web page to provide a moving diary of your social life.

Retail Category Mapper
Client: Leigh Simpson, Fusepump
Ecommerce retailers face a seemingly insurmountable barrier to being able to fully automate their online marketing activity. Many marketing channels, such as price comparison sites Google Shopping and Kelkoo, or marketplaces eBay and Amazon, require formatted product data, but each has its own format. Most retailers struggle to adapt their product data to these many distinct formats. This problem manifests itself mostly in the process of product category mapping: that is, the mapping of a retailer's list of product categories onto a different category taxonomy. This is an issue that has caused problems for some of the world's largest ecommerce companies. The aim of this project will be to develop an ecommerce-optimised tool that uses heuristic or statistical algorithms to takes an unmapped category (and potentially other product information) and output a proposed mapping and confidence level. A user interface will need to be created to allow human users to view a list of mappings by confidence level, make manual corrections to mappings, add to the training set, and view the progress of the mapping. As an example, this bicycle retailer example https://wiki.cam.ac.uk/cl-design-projects/Bicycle_retailer_example should be mapped to categories in http://www.google.com/basepages/producttype/taxonomy.en-GB.txt

Audio Websites on Smartphones
Client: Dong Fang, Bloomberg
Mobile phones have revolutionised the developing world making information easily available to those even in the most remote parts of the world. However, the smartphone has yet to make a big impact there. This may be due to users having limited technical or even literacy skills. You will create an app which people can use on their smartphones to create audio websites, for example to advertise their agricultural products. This will allow others in similar geographical locations to make contact and perhaps even purchase directly from the seller using audio as well.