

COMP2013/COMP2014 Projects List 2012-2013

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Formal clients will be introduced to the teams in January. All projects will be published as Open Source community projects. For now these project scope summaries set the theme for your prototype Operating System development in COMP2013. You will be working in teams to identify the correct components, software packages, libraries and device drivers in your prototype OS. You will also look at performance and testing issues to reduce the expense to hardware.

All solutions on the applications layer in COMP2014 will require HTML5 based-development and RESTful architectures to provide services.

Project titles

1. Networked Vehicles
2. Kiosk Builder
3. ActiveHistorian
4. Occupancy Operating System
5. Mobile Device Data Collection and Monitoring
6. 3D Games Console
7. Home Automation and Security
8. Interactive School Devices
9. Learning Robotics Platform
10. Ready-to-Go Web Sales and Small Businesses Kit

1. Networked Vehicles

Scope: Enabling vehicles to join wide area networks has a number of advantages, for safety, planning and for journey purposes. This project describes a lightweight OS running a device with mobile phone attached or the Gadgeteer platform (with 3G access).

Modern vehicles have an on-board diagnostics mode that enable a number of features to be revealed over serial IO. This project involves investigating the various types of sensors that can be mechanically adopted in a car system, such as motor measures and fluid gauges. Newer cars also provide low resolution camera feeds for parking etc. Using a lightweight OS and data service, enable the car data diagnostics and sensors that can be placed within the car to be able to:

- a) display close-to-real time heads up display (speed, GPS Google map, car sensors, front and rear cameras) for front and back passengers (upto 4 screens for a car, more for a bus, etc).
 - b) Relay information over 3G networks to give update service to a RESTful site for subscribers to monitor all connected vehicles, including energy usage data.
 - c) Enable upload and broadcast information to be sent from a server to the vehicles screens (e.g. in the same override fashion as emergency broadcasts).
 - d) Enable apps of services over REST to be created. For example, pizza delivery, group taxi services for users of the networked vehicles.
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2. Kiosk Builder

Scope: Advertising billboards and customer facing kiosks in stores can be centrally deployed. Throughout a building such as a museum, gallery or hospital, they can be used in a synchronised manner to enable assistance by sensing presence.

This project looks at creating a Kiosk server that enables a client-server relationship with kiosk terminals that may be interactive or set for sync mode, with the ability to dynamically add new screens.

It should contain a display configuration utility and solution that can deploy a Linux based kiosk network. The solution should be able to control displays using a number of graphical (web-based 2D and 3D) and concurrency mechanisms. This project will define:

- a) A server for loading web based and native code material to broadcast to the kiosk network with protocols for synchronising the playback of the kiosk material.
 - b) A RESTful architecture for submitting data from web forms from the interactive terminals and use of sensors to determine presence and identity, e.g. NFC or smartcards.
 - c) Enabling multiscreen canvases and different screen orientation configurations.
 - d) An app for mobiles and tablets that enable them to attach to the kiosk, either to send and receive data or to become a part of the distribution of synchronised graphics.
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3. ActiveHistorian

Scope: Using Raspberry Pi devices with webcams, or any other relatively cheap hardware combination, create a consumer-style device product for video logging. This device will enable users such as the elderly, ill patients and younger children to easily create video diary entries.

- a) It should auto upload to the cloud when in network capable areas or store locally on device.
 - b) Each device should generate sequence files with time and date overlays, and be able to add basic transitions to the video sequences.
 - c) The device should be operated with minimal physical buttons, support a variety of TV outputs and provide a host RESTful web solution for accessing historical logs.
 - d) iOS, Android and Windows 8 apps should be built to access the ActiveHistorian's video logs.
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4. Occupancy Operating System

Scope: Energy efficiency on-site in large organisations is a growing trend. As part of the Intel Smart Cities view of city-based analytics, several studies at UCL are looking for ways to engage and measure occupancy related data. For example, usage of particular passageways and time spent in various office rooms. Lighting conditions and sensors for ambient heat as well as security entrances need a host operating system to be capturing and analysing a building and its productivity.

- a) Create a RESTful subscriber architecture for all sensor types to become services with availability, duration and discovery.
 - b) Create an apps layer to overlay particular information on a mapping tool, for example "find areas that have too many heat signatures" at set times (representing overcrowding on peak loads).
 - c) Enable performance logging and data collection from the sensors, with suggested models of use from the client.
 - d) Graph the energy loss and wasted power in each floor of a building.
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5. Mobile Device Data Collection and Monitoring

Scope: A hospital close to UCL has requested a lightweight OS installation that creates a generic data collection scenario. A specific scenario of use to trial will be to enable the collection of nutrition data where patients or staff can enter data on a variety of topics, and for this information to be accumulated for post-operative care. Some of the data can be filled in the hospital on a touch screen terminal, but some of the data is required from users of a mobile app. Based on ideas learnt on last year's Restless Beings "Generic data collection" forms, construct:

- a) A RESTful architecture for enabling secured uploading from a large number of host devices.
 - b) Provide database facilities for statistical tools such as R and SPSS as well as mapping features based on the coordinates of users devices.
 - c) Construct a package that enables new mobile app forms to be created for tablets and phones, for hospitals, charities and environment studies users.
 - d) Enable feedback to be sent from the lightweight OS to all connected devices.
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6. 3D and Multiscreen Games Console

Scope: Android and Linux gaming is growing, with opportunities for moderately capable hardware to power high quality gaming scenarios. Creating an open source gaming platform, investigate a number of Linux oriented device drivers that could provide APIs for games developers. The games console should provide:

- a) Customisable home screen and marketplace for downloading games like an online Games Store with profile management.
 - b) At minimum 3 screen multiscreen gaming with surround sound, screens that do not necessarily have to be next to each other. They can represent other views in the games.
 - c) Any form of 3D Stereoscopic display (can be on just one screen if within hardware profiles).
 - d) Native and HTML5 games. The HTML5 games should be downloadable from a RESTful web service which games publishers should be able to upload new packages.
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7. Home Automation and Security System

Scope: Examining existing home protocol systems including X10 devices, construct a management OS with the Gadgeteer platform and/or Arduino. This project will provide an OS that controls a number of sensors and motors around a home or building. It will be hosted on a thin client hardware that runs on a low power always-on state. The system should:

- a) Add and monitor house sensors for usage.
- b) Control motors (for door locking and curtain closing) and switches for controlling circuits of power. Include a smart card reading capability to lock all doors.
- c) All windows and doors should show on an app with closure sensors. Once the app knows you are outside the house it will remind you that some windows and doors are left open.

- d) A RESTful architecture will provide service discovery of multiple property location.

8. Interactive School Devices

Scope: Modern and future classrooms will have a wide variety of technologies at their disposal to aid both students and teachers. From table tops and wall projection, with class interaction and touch control, to tablets and collaborative sharing of learning materials. Construct a lightweight server OS that:

- a) Enables the cloud as a data storage for the progression of students .
 - b) Incorporates a suite of HTML5 and Java based applications for teachers to use (given), modified to enable students to be reviewed and assessed. Also incorporate other open source projects that facilitate engagement in learning.
 - c) Makes use of collaborative learning tools for projection screens.
 - d) Enables tablets and phone devices to interact, join in with existing teaching sessions and become participants. Data collection for session analytics should indicate classroom engagement.
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9. Learning Robotics Platform

Scope: Making use of the Gadgeteer and Arduino platforms and using the API for the current UCL-CS Robots as a starting point, this project is aimed at secondary schools looking to teach sensor and motor programming and a basic understanding of Computer Science principles.

- a) construct utility libraries and an Integrated Development Environment (IDE) for specific scenarios of use.
 - b) Target HTML5/JS applications as downloadable code units that can then operate robot sensors and motors regardless of platform.
 - c) Using a thin client as a “robotics base station” enable the robots to communicate with one another with a number of template examples of use – e.g. swarm, follow each other, create patterns, etc.
 - d) The IDE should enable drag and drop units of code that represents the capabilities of the robots, supporting the creation of new units of code for other robots (using Gadgeteer and Arduino).
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10. Ready-to-Go Web Sales and Small Businesses Kit

Create a low power always-on, thin web services solution that runs off a CD on any bootable PC. This is for new and small businesses, which traditionally do not use much technology, e.g. a local florist.

- a) Enable users to store their deployed company work on the cloud with branding.
- b) Presents opportunities for hosting a website and taking payments, e.g. via Paypal.
- c) A HTML5 apps panel that provides business services, such as product inventory, buyers listings, P & L sheets, tax filings and due reminders.
- d) A suite of office and project management tools installed including tax filing and accounting.

- e) Dynamic generation of webpages from sales models. Marketing and branding opportunities e.g. on products that are selling well or not well, to enable Search Engine Optimisation of special deals on auto-generated WordPress webpages.