

Mobile and Pervasive Computing
CNT5517 - Section 1G92 & CIS4930 - Section 1376

Term Project

Spring 2016

Professor Sumi Helal

- Due: noon, April 11, 2016
 - Project submission using Canvas
 - What to submit:
 - Project report (pdf) – a template will be provided.
 - Project Presentation (ppt) – a template will be provided.
 - Project Video on the class's YouTube Channel (3 min max).
 - Project#-Project-name.zip
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Overview

In this project, you are expected to innovate to acquire up to 35% of your grade in this class. You will first build strong and balanced teams. Then you will define, design, implement, document, present and demonstrate an IoT device, application, tool, language, middleware, or other elements of what you envision as parts of the future IoT ecosystem.

You must constrain yourself to either: (A) a problem of great importance begging for an IoT solution, or (B) an amazing IoT opportunity that must be realized. If your project is neither A or B it is most likely not going to be an impressive project.

This year, the term project is sponsored by Google¹ who is offering bundle of new IoT technologies (ranging from a month-old to yet to be released (by invitation only)).

Google will provide all the equipment needed by the projects from the following set of technologies:

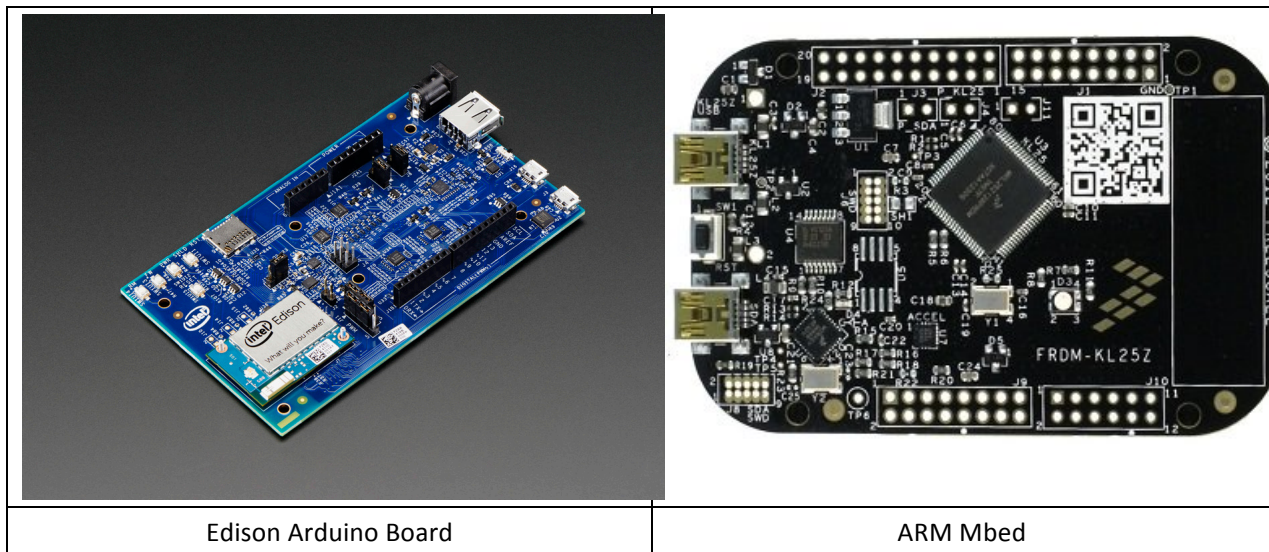
- [Google beacon platform](#) - consisting of the open beacon format Eddystone and various client and cloud APIs, this platform allows developers to mark up the world to make your apps and devices work smarter by providing timely, contextual information.

¹ Pending final approval.

- [Physical Web](#) - based on the Eddystone URL beacon format, the Physical Web is an approach designed to allow any smart device to interact with real world objects - a vending machine, a poster, a toy, a bus stop, a rental car - and not have to download an app first.
- [Nearby Messages API](#) - a publish-subscribe API that lets you pass small binary payloads between internet-connected Android and iOS devices as well as with beacons registered with [Google's proximity beacon service](#).
- [Brillo](#) & [Weave](#) - Brillo is an Android-based embedded OS that brings the simplicity and speed of mobile software development to IoT hardware to make it cost-effective to build a secure smart device, and to keep it updated over time. Weave is an open communications and interoperability platform for IoT devices that allows for easy connections to networks, smartphones (both Android and iOS), mobile apps, cloud services, and other smart devices.
- [OnHub router](#) - a communication hub for the Internet of Things supporting Bluetooth® Smart Ready, 802.15.4 and 802.11a/b/g/n/ac. It also allows you to quickly create a guest network and control the devices you want to share (see [On.Here](#)).
- [Google Cloud Platform IoT Solutions](#) - tools to scale connections, gather and make sense of data, and provide the reliable customer experiences that IoT hardware devices require.
- [Chrome Boxes](#) & [Kiosk Apps](#) - provides custom full screen apps for a purpose-built Chrome device, such as a guest registration desk, a library catalog station, or a point-of-sale system in a store.
- [Vanadium](#) - an open-source framework designed to make it easier to develop secure, multi-device user experiences, with or without an Internet connection.
- **Other Google technology** such as Android smartphones, Android Wear, Chrome Cast, etc.
- Machine Learning: [TensorFlow](#), Google's open source machine learning library.
- A 65" LED screen can also be made available for the project.

For a quick overview on the new Google IoT technology check this video covering Ubiquity – a 2016 developer Summit: <https://www.youtube.com/watch?v=SZLp2cidEB0&list=PLOU2XLYxmsILhJSXjlpNxBE5HkND3wFPL>

We will use either the Intel Edison Board (supports Brillo) or the ARM Mbed boards as sensor platforms for any device or thing inclusion in your project. A tutorial is planned on February 23, to get you started in how to develop and program the boards.



For sensors, actuators, and all kind of gadgets do your own research and dig out anything you may need. One source of gadgets ideas and products check adafruit (<http://www.adafruit.com/>).

Grouping Requirement

This is a group project in which groups of 5 students should be formed on Google Drive: <https://drive.google.com/drive/folders/0Bz1qheeVMMqXb0dTU2dfRm1fN1k>
Smaller or larger groups must obtain written permission by Dr. Helal.

Project Elements

Your project should be based on the following elements:

- A. *Impact* – You should start here – finding a problem whose solution could have an impact. Through brainstorming and discussion plus real world experience of the members if the team, a real problem should be sought. In your presentations and certainly in your final report, you will need to provide clear description of the problem and convincing and substantiated evidence of its importance and expected impact of solving it. Alternatively, your project could pursue new impactful opportunities to which there are no underpinning problems.

- B. *Novel Ideas* – The project is not just an exercise in developing systems, or using sensors and developing apps, it is intended to be an opportunity for you to innovate novel and creative ideas that enable the solution. You will need to articulate the idea clearly and succinctly in your report and presentation. You may think of a new IoT app, device, tool, programming model, run time system, middleware, etc. You may build on top of Google technology to achieve more features and more capabilities.
- C. *System/App Architecture* – what is the overall system architecture? What are the components? Also what technologies: systems, devices, software, sensors, gadgets etc. you are using? How do they interact?
- D. *Design* – like any system or mobile app, human interaction with the system or app is very important. User (or developer) experience (UX) varies significantly based on the design. You should complete a thorough design in terms of app logic, views (screens), and specific interaction methods. You should then try to implement your design - or a subset of your design. Your design should be clearly documented in your report and presentation.
- E. *Implementation and Project Management*– You should implement incrementally to ensure that you have a working system/app at all times. Distribute the development efforts but one member should be focused on integrating the pieces and managing the overall project progress. Are all team members engaged? Is the team getting the most out of each member? Test your project as you go, do not wait till the end to test. It is much better to hand in a working project with lesser features than a system/app full of features that do not work or often crashes.
- F. *Presentation and Demonstration*. This requires skills. So you must work on finding a way where all members can present. Also, demonstrations can be a beast where things do not come across impressive. Carefully plan and rehearse your presentations and demos. Also generate a Video to include with your deliverables.

Project Proposal

A project proposal template is available on Canvas for you to use to start writing down your initial thoughts of your proposal. We have a very tight timeline to get these proposals done, vetted, and possibly re-done, all before Feb 29.

Project Progress Reporting

You will present your progress in class as shown in the updated schedule. Reporting progress will provide part of your grade and should get you and your team valuable feedback.

Project Report

A word template will be provided to you to write your project report. It will consist of sections for each of your project elements in addition to two more sections. The first additional section will report on the status of your project (what works and what does not, plus any other issues you want to inform us with). The second additional section will describe the relative contribution effort of the team members, indicating who worked on what.

A short 3 minutes video describing the project idea and showing the app in action is required. The report should be submitted in pdf on Canvas, and the video should be uploaded to the class video channel on YouTube.

Grading & Competition

Each member of a group will be graded based on the overall project performance. A section in the final report should describes the relative effort of each member of the team. This is not difficult and ethically, the team must accept that some worked more than others and that such facts should be recorded.

The projects will be graded by Dr. Helal and the TAs. Additionally, a competition is likely to be held by the sponsor in which top three projects will be selected for potential awards. Any team who does not wish to enter the competition should so indicate in writing to Dr. Helal.