Quarterly Projects

Fall 2016

Data-Driven Web Design:

Science and Fiction

**Participant Entry Packet**

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Welcome to Quarterly Projects: Fall 2016!

In this document, you will find everything you need to know about competing – project specifications, expectations, guides to getting started, and the how the whole process works.

# What Are Quarterly Projects?

Quarterly Projects (QP) are entry-level projects designed to get students to start building. We (IEEE at UCSD) don’t expect experience or expertise – instead, we look for people motivated to create. Each quarter, we develop a challenge that will teach competitors fundamental skills in computer and electrical engineering – such as (but certainly not limited to!) Arduino, Raspberry Pi, web design, prototyping, and building mobile apps – which leave participants with the tools and knowledge necessary for designing their own projects.

While we aim to teach, this isn’t a class. We provide the challenge, materials, some starter guides and workshops, and I (the Quarterly Projects chair) will be available for support and advice. The product is up to you. We expect you to use resources available through campus and IEEE to learn by doing, and apply your creativity to jump off and above the specifications we set for the competition at the end of the quarter.

## Why Participate?

Projects take time, and college student have no excess of that. So why compete in Quarterly Projects?

1. **Development experience**

Even the best students can’t sit down and physically build something their first time. Inventing is a whole realm of skills separate from academics, and is equally necessary for becoming an engineer – arguably more necessary, since there are countless Jeffersonian engineers who self-taught and wrote those great Instructables that we students follow. Building experience creates engineers, and QP gently introduces beginners to the world of building. You can list projects like these on resumes, LinkedIn, and Portfolium.

1. **Preferential selection for annual projects**

Our branch hosts four annual competitions – Grand PrIEEE, Micromouse, SparkfunAVC, and Quadcopter. While we want to support as many students as possible, we don’t have the resources to fund enough teams for every student who applies, making placement highly competitive. Participating in QP shows us that you possess the kind of character we want on our teams, and helps you develop skills that we look for in annual team members. We record all participants and keep an eye out for you on annual applications – it’s not an assurance that you’ll be selected, but it provides a “leg up.”

1. **Publicity**

Each team is expected to write documentation for their product. This documentation is recorded in the QP Archive, which is associated with our website and available to the public. We also have a “Featured Project” display on our homepage which promotes our builders to website visitors. We take completed projects to tabling events and present them to students, faculty, and industry contacts each quarter. This publicity serves us by demonstrating our activity as an organization, and promotes the students who build with us to the engineering community on-campus and throughout San Diego.

## Project Cycle

IEEE @ UCSD has a “life cycle” for projects created by our teams. It has three phases:

1. **Build**  
   Teams create the project.
2. **Showcase**IEEE displays the product in Project Space and presents it at publicity events to promote the org and our competitors. Participants can request to borrow it for interviews, but IEEE houses and maintains it for the duration of this phase.
3. **Return or Salvage**The project is released back to the team lead, unless the lead has specified another team member to give it its personal home. If no member of the team wants to reclaim the project, relevant parts may be removed for use by current teams in the spirit of reuse.

Each phase has the same duration – for Quarterly Projects, it is a quarter (naturally). You will receive a Project Contract, confirming that you agree to conform to the cycle, at the introductory workshop.

# The Challenge: Data-Driven Web Design

**Design a data-driven web application hosted by a Raspberry Pi webserver**

The theme is **Science and Fiction**

You can use or create data pertaining to either, or solve a challenge faced by people in these fields. The goal for this quarter is to familiarize you with Raspberry Pi and web design, so you are expected to fulfill these minimum specifications:

1. Receive and use input from the Pi GPIO (and/or) Send commands to Pi GPIO from the webserver/database
2. Perform analytics on data and display it (using charts, tables, graphs, etc.)
3. User can interact with the data – search for entries, add/change/delete entries, etc. (it does not have to use all forms of interaction; it should make sense for your project)
4. Write documentation for developing your project according to the template found at <https://github.com/WigginWannabe/qp16-resources.git>

These specifications are minimum – be creative and find interesting ways to display your data, interact with it, and/or generate more of it. The more (well-designed) features on your webserver, the better! You can pull data from the web, or use a sensor to gather data from your immediate environment (fulfilling spec. 1).

You must send a proposal to me by week 4, using the template file on git, so that I can collect your materials for you.

## Demo

I chose meteorology as my science and created a very basic weather indictor.

* **(spec. 3, where data is the user preferences)** On the website, a user can set what they consider, “hot,” “cold,” and “comfortable.”
* **(spec. 1)** A temperature and humidity sensor reads in data
* **(spec. 1)** Different light combinations turn on to indicate the temperature according to the user’s preferences
* **(spec. 2)** A line graph displays the previous 24 measurements, a pi chart displays the percentage of time spent in different zones as configured for spec. 3, and bar graph shows the percentage of time spent in ranges of ten.

That fulfills the basic requirements, so to add some spice I included an alternative mode. Instead of GPIO output based on sensor readings, the user can switch to “presets” and use buttons to simulate weather conditions like a thunderstorm and a sunny day.

I stopped there, but to go even further I could use a weather API to retrieve the forecast for a particular area and emulate it (idea not mine – credit goes to the creator of the “tempescope”). **Remember, judges will be looking for a robust application that could be delivered to a hypothetical client, so include as much (relevant and useful) functionality as you can!**

NEW PICTURE

## Why Raspberry Pi and Web Design? Why “Data-Driven”?

Raspberry Pi is the glorious hybrid of computer and Arduino – it is a Linux machine that you can use to program, browse the web, and any other activity you use a computer for, *and* you can set up autonomous systems like on an Arduino. In my – and the engineering community’s – opinion, this makes it *awesome*. It is a common choice for Internet of Things projects because it interfaces between hardware and the internet.

Web design has lost some of its sparkle with the advent of no-programming options like WordPress, but familiarity with HTML, CSS, JavaScript, and PHP makes developers more capable when personalizing their site and enabling it with custom functionality. Moreover, they are still useful skills in industry – when you are hired to develop software, you are creating new applications. Combinations of functionality that already exists won’t cut it. After this quarter, you will be fully capable of designing your own website from scratch, which provides opportunities for personal use and is attractive to employers.

Data is everywhere. There aren’t many applications that don’t involve gathering, parsing, and applying data. To be precise, an rPi project with sensors is limited unless you can do something with the sensor information, and a website that doesn’t store information can’t provide much utility. Thus, data is the glue that holds applications together, and being comfortable with manipulating databases will empower you in almost any project you undertake.

# Timeline

|  |  |
| --- | --- |
| Week | Milestone |
| 1 | Accepting applications |
| 2 | Accepting applications |
| 3 | Announce teams at the beginning of the week  Introductory workshop at the end of the week: Meet Pi, Planning |
| 4 | Project proposals due at the end of the week |
| 5 | Office hours 1 day in the week |
| 6 | Office hours 2-3 days in the week |
| 7 | Office hours throughout the week  Finish iteration 1 - mandatory check in with me |
| 8 | Office hours 2-3 days in the week |
| 9 | Office hours throughout the week  Mandatory check in with me to touch base and determine what you will showcase  Showcase weekend between 9 and 10 |
| 10 |  |

# Rubric

This is a sketch of what we are looking for in your final product. Judging will proceed as a majority vote for each category, and your team will receive as many points as you do votes for that category. Your points for each category are summed to find your final score. The highest 3 scores win! In the event of ties, they will be broken by which team earned a higher rank in more categories.

You must submit documentation to be allowed to compete! You can email it to me or bring a printed version to the competition.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| General Favorite | Best web design | Best use of data | Most impressive\* | Score |
| Rank 1: 3 points  Rank 2: 2 points  Rank 3: 1 point  Else: 0 points | **Rank 1: 3 points**  **Rank 2: 2 points**  **Rank 3: 1 point**  **Else: 0 points** | **Rank 1: 3 points**  **Rank 2: 2 points**  **Rank 3: 1 point**  **Else: 0 points** | **Rank 1: 3 points**  **Rank 2: 2 points**  **Rank 3: 1 point**  **Else: 0 points** | **General Favorite**  **+**  **Web design**  **+**  **Data**  **+**  **Impressive** |

\*attempted difficult functionality, achieved a lot with inexperienced team, etc.

# Getting Started

I highly suggest following the three tutorials found at <https://github.com/WigginWannabe/qp16-resources.git> . They walk you through setting up the Pi, establishing it as a webserver, making a website with the webserver, and talking to the GPIO. These topics are essential to succeeding in this project, and otherwise you will have to find the information yourself, scattered around the web.

In addition to the main tutorials, here are some links to tutorials other useful tasks. They may not be directly related to this project, but they pertain to general Pi use:

* Screen sharing with a mac:  
  <http://4dc5.com/2012/06/12/setting-up-vnc-on-raspberry-pi-for-mac-access/>
* Making a backup (on a Mac):  
  <https://smittytone.wordpress.com/2013/09/06/back-up-a-raspberry-pi-sd-card-using-a-mac>

# Resources Available to You

* **Project Space**

PS is our organization’s workspace, located in EBU1 4710. You can store materials here (each team receives a cubby), work on your project, and use the soldering stations. It is only available when officers are in the room, So make sure to arrange to meet with me or come during my “office hours.”

* **MSE Maker Space**

The Maker Space room in the MSE building is available to students after taking an online quiz at … . You can use your student ID to access the room during lab hours, which are posted on the website. It has 3D printers, workstations, soldering stations, and I giant TV.

* **Digital Media Lab at Geisel**

There are 3D printers and professional design software available at the DML in Geisel, with student employees there to help use them. Reserve a timeslot on Dibs, but beware: getting spots for the 3D printers is extremely difficult; they fill up quickly, so be ready to reserve them a midnight on the dot.

* **Warren Labs**

Anyone who has been in an ECE lab class knows how these work. They have materials, computers, power supplies, function generators, and oscilloscopes available, and are open whenever you know someone enrolled in a class – their PID will open certain labs. You can also try knocking; people inside will let anyone in, and door are often propped open.

* **Google**

You are welcome to use all of the online tutorials and resources you want. This isn’t a class, there’s no “academic integrity.” Do whatever necessary to get’er done, just give proper credit in your documentation.

* **Facebook**

Post questions, concerns, and updates on your progress to the quarter’s Facebook group. I will be available as support through that forum. You are also welcome to answer other people’s questions.

# Appendix A: Available Sensors and Materials

These are the sensors and materials that I can provide to you – request as many as you can with your proposal, and if you need additional parts during development I will place them in your team’s PS cubby. If you own other materials that you would like to use, talk to or email me about it.

* Sensors
* Materials