6.170 Project 4.3 Design Document

Dwyane George, Deborah Chen, & Yi-Shiuan Tung

Overview

Purpose

Urop.io is a web application that connects students to the UROP supervisors and projects that are right for them. 85% of MIT undergraduates do a UROP during their time at the Institute; yet, the process of finding and choosing a UROP can be daunting. Though there are many parts on the path to obtain a UROP -- including find the right project, filling out the formal UROP application through the UROP office, and submitting onboarding documents for a particular department -- our application focuses on the first stage, that of finding the right match.

Problem Analysis

- Identifying UROPs of interest is hard
    - There are hundreds, if not thousands of postings spread over department websites, individual lab websites, jobslists, and the official UROP office website.
    - Students can spend hours culling through all the postings by hand, trying to find a project they are interested in.
    - At the same time, Supervisors struggle with finding the right means to publicize their openings to reach as many students as possible.
- Reaching out to professors can be intimidating and tedious
    - Assuming a student does find a potential project, many students, especially under-classmen tend to feel intimidated at the prospect of emailing the supervisor to express interest.
    - The need to write many, separate emails for each opening is tedious as well, and supervisors can have a hard time keeping track of all the interest applicants.
- Selecting who to work for is
    - Finally, after a student has a UROP offer in hand, he or she rarely has enough information to make an informed decision on how good of an experience they will have with a supervisor.

Goals

- Solve the above problems by providing a central repository UROP postings.
    - Supervisors reach a broad audience by submitting their postings to urop.io, which are viewable and searchable by all students at MIT.
    - Urop.io also provides a means for students to apply directly to postings they like, eliminating the need to write tedious introduction emails, and a means for professors to see all the applicants in one place.

- Provide an outlet for student feedback on the UROP experience
    - Students write and read useful student-generated reviews of past experiences with specific supervisors
    - Gives students more information about how good a fit a supervisor and UROP project is for them, helping them choose the right supervisor to commit to.

Context Diagram

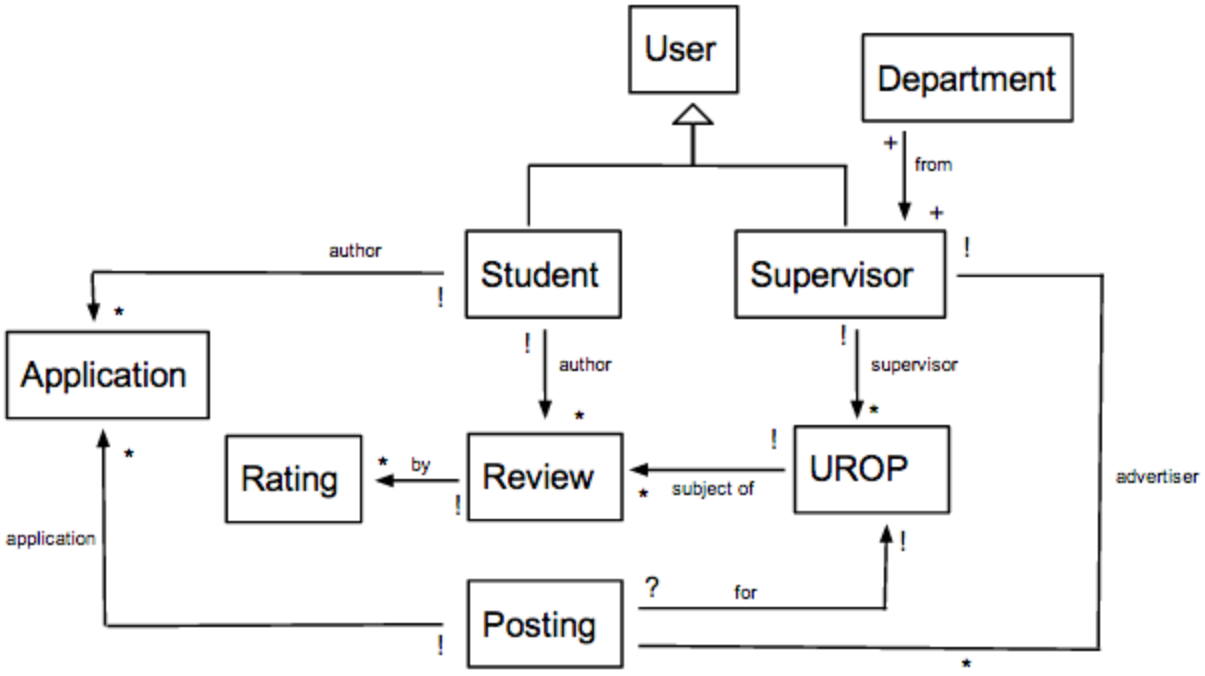
[Insert Context Diagram here]

Concepts

Key Concepts

- **Supervisor:** A supervisor is anyone at MIT who is eligible to sponsor a UROP project, such as a professor, post-doc, or research scientist.
- **Student:** Any undergraduate student at MIT.
- **Review:** A review is written by a Student to review their overall UROP experience, after their UROP project with the Supervisor is completed. A review has numerical ratings, as well as room for free-from comments. A review's function is to help other students decide which projects they should take on, and who they should work for; accordingly, reviews are viewable only to other students.
- **UROP:** A project, usually spanning a semester or summer that is sponsored by a faculty member under MIT's Undergraduate Research Opportunities Program.
- **Posting:** An advertisement of a UROP project, posted by a Supervisor. It contains a brief description of the project, the prerequisites/skills required, the name of the lab/group, and contact info of the supervisor.
- **Application:** An application, submitted by a Student for a particular Posting, makes the following available to a supervisor: a student's profile, with optional resume, and an optional text box where the student can write a personalized note to the Supervisor.

Data Model



Behavior

Feature Descriptions

- **Central repository for UROP postings**
  - Supervisors can submit postings for UROP projects, viewable by all students.
- **Search for UROPs**
  - Students can search for a prefered UROP based on interest, skills and ratings of the previous UROP experiences sponsored by a faculty member.
- **Simple application process**
  - Students drop their profile, short note, and resume for UROP postings they are interested in
  - Applications are instantly available to supervisors, who can get in touch (outside the application) with the students that are right for them.
- **Review UROP experiences**
  - Student will be able to write reviews of their previous UROP experiences, viewable to all students and all supervisors. Reviews may be anonymous.

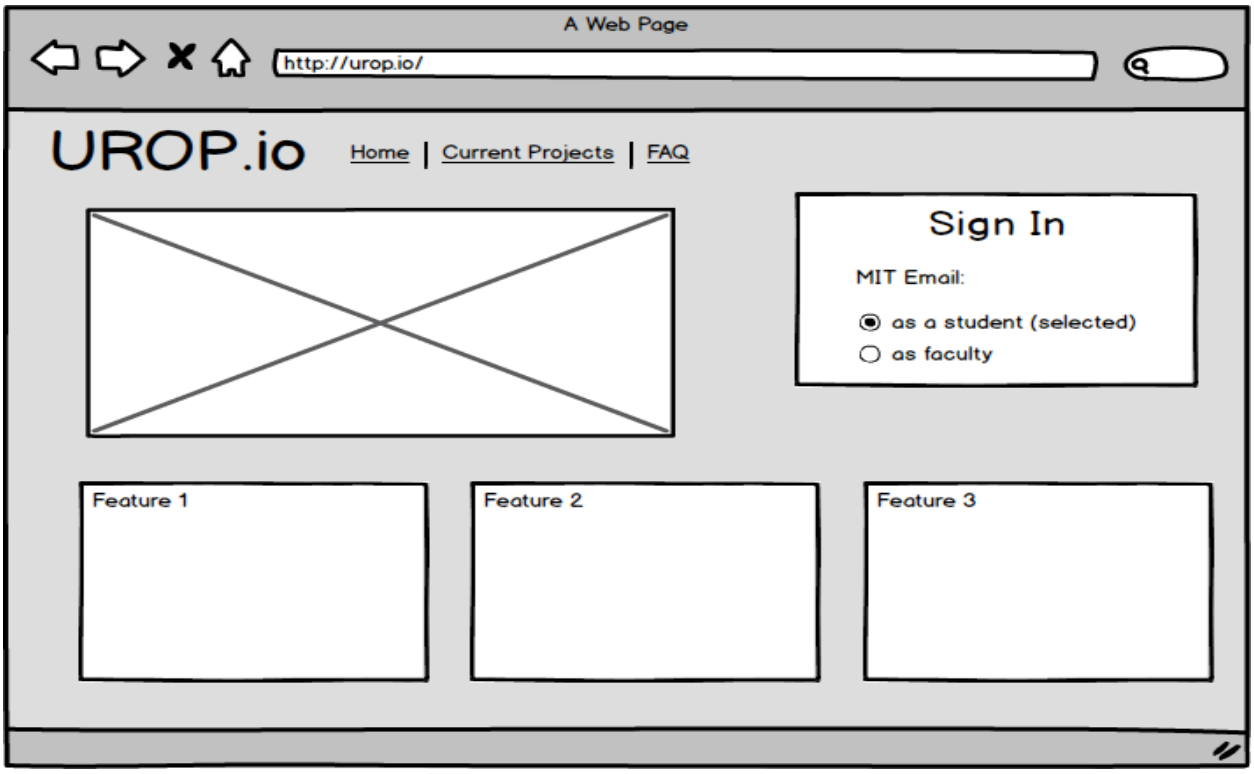
Security Concerns

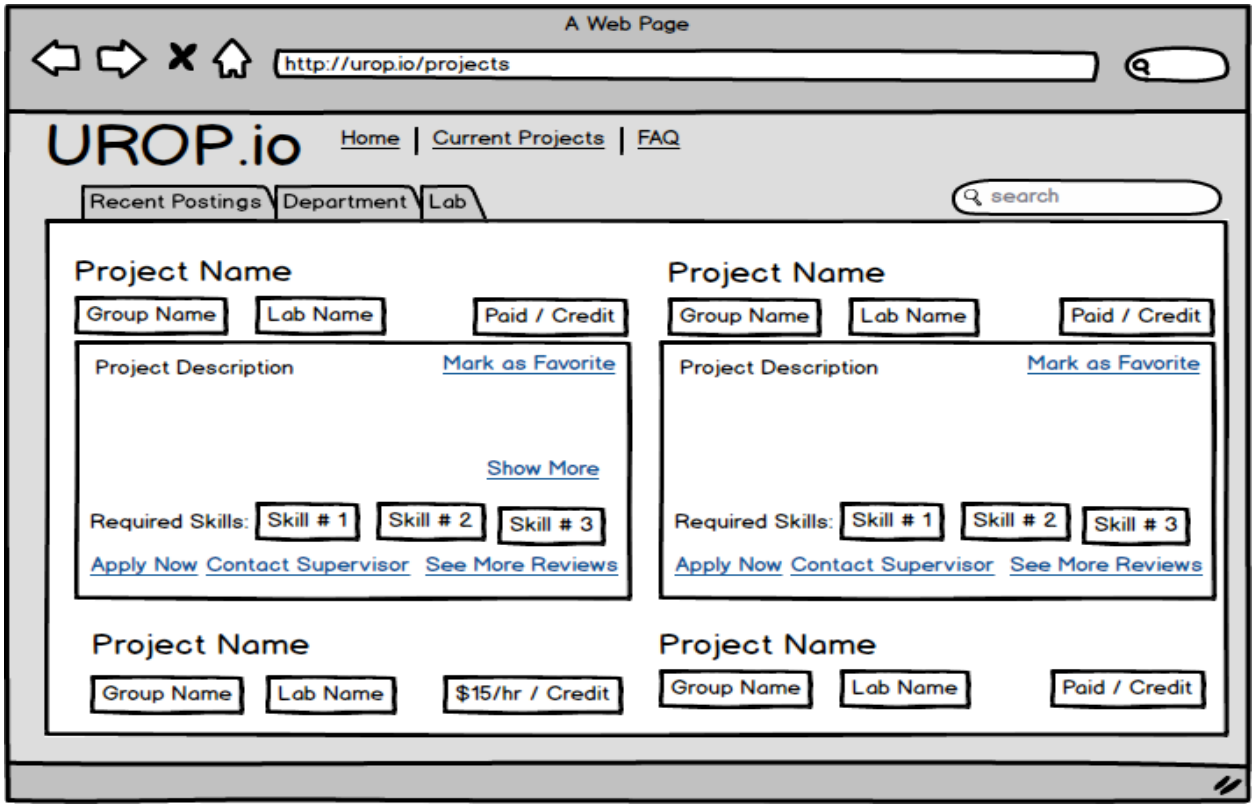
- **Fraudulent reviews:** Students should not write fake reviews for UROP experiences they did not have, and should not use the app to retaliate against professors they did not like.
- **Impersonation of roles:** Students should not be able to impersonate faculty members to advertise for fake UROP postings, and should not be to impersonate other students to post fraudulent reviews under their name.
- **User data privacy:** Users will only be able to access their personal profile and not that of other students.
- **Password exposure:** Password fields (rather than text fields) are used on login and signup forms to reduce the likelihood of exposed passwords. In the database, passwords are stored in hashed form, so that accidental database exposure does not put user passwords at risk.
- **SQL & JavaScript injection:** Attackers may attempt to include SQL and JavaScript code in any input in our app. To avoid the likelihood injection attacks, the app will sanitize all inputs before processing them (only needed parameters accepted in required form).
- **Packet sniffing:** Attackers may attempt to collect user's login details or cookies via packet sniffing. To prevent this, the app will utilize SSL for requests (HTTPS protocol)

Threat Model

- **Spammers:** users who post fraudulent reviews, fake postings, or general spam (from inside and outside MIT)
    - We assume spam will be the biggest problem, as we trust MIT students to post authentic reviews, and supervisors to post real UROPs.
    - Mitigation:
        - Sign-up required before posting: email verification used to make sure users are from MIT.
        - Site will have a comments/feedback form that allows users to tell us about fraudulent reviews or postings.
- **Information thieves:** users who attempt to steal account information of other users
    - Biggest concern is students try to view other students' profiles, with resume information.
    - Unlikely to face many outside attackers such as big hacking groups or government actors, since site contains no sensitive information like credit card numbers.
    - Mitigation:
        - Strong access controls features will prevent unauthorized cross account access.
        - Passwords are stored in hashed form, so that accidental database exposure does not put user passwords at risk.
        - Sanitize input to avoid injection attacks
        - To prevent attackers from collecting user's login credentials through packet sniffing we will utilize SSL for requests.

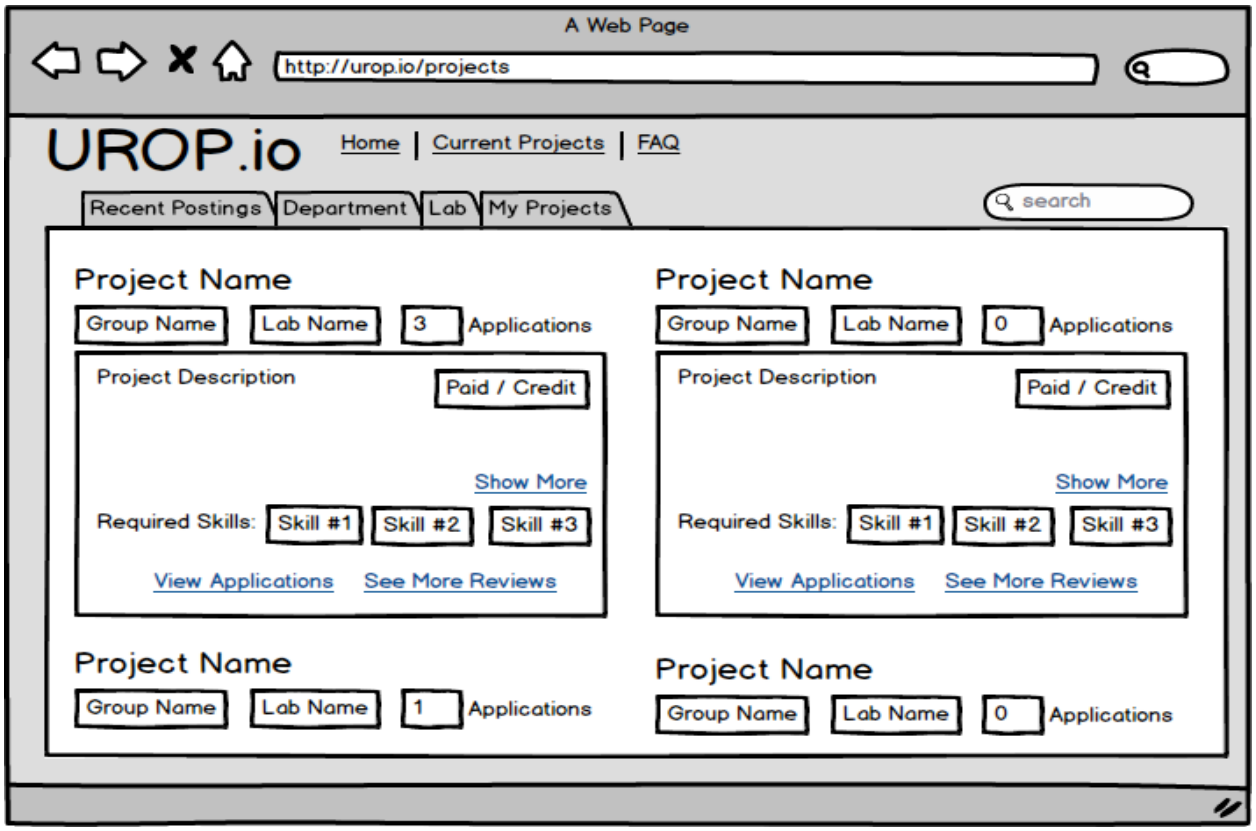
Wire Frames



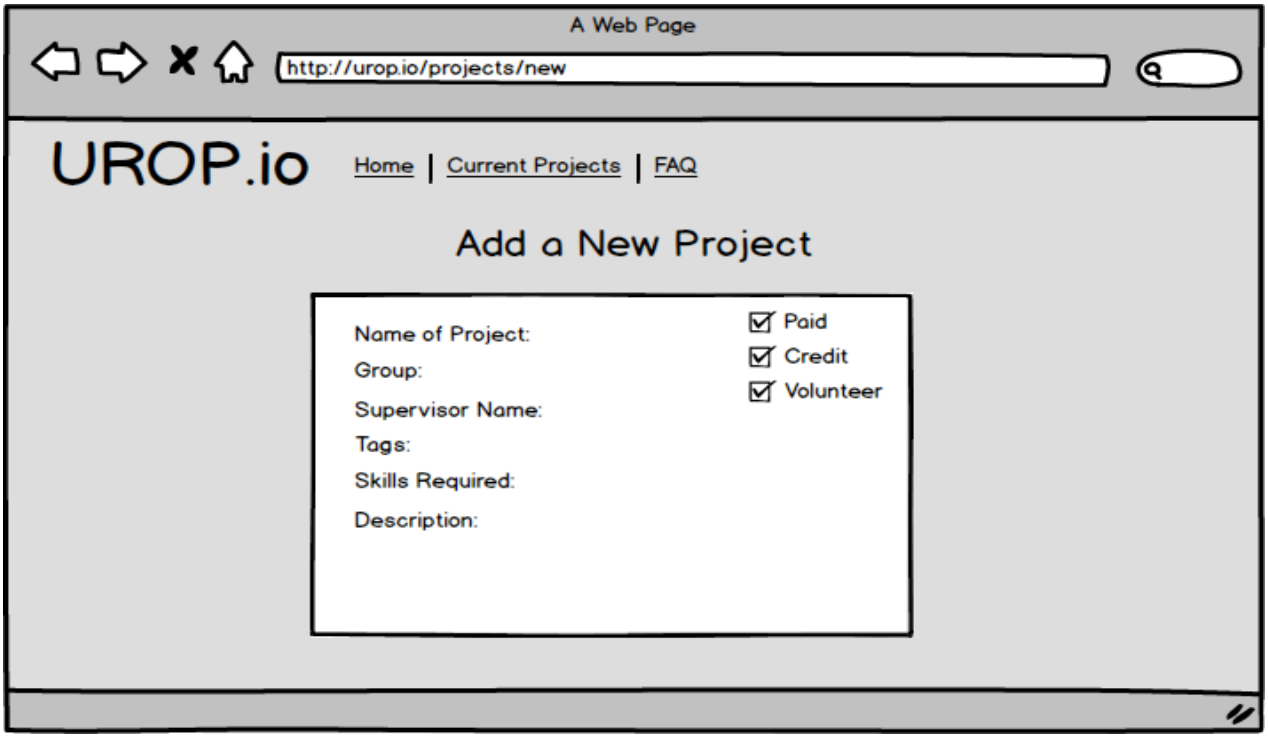


UROP Postings Page for Students (above)

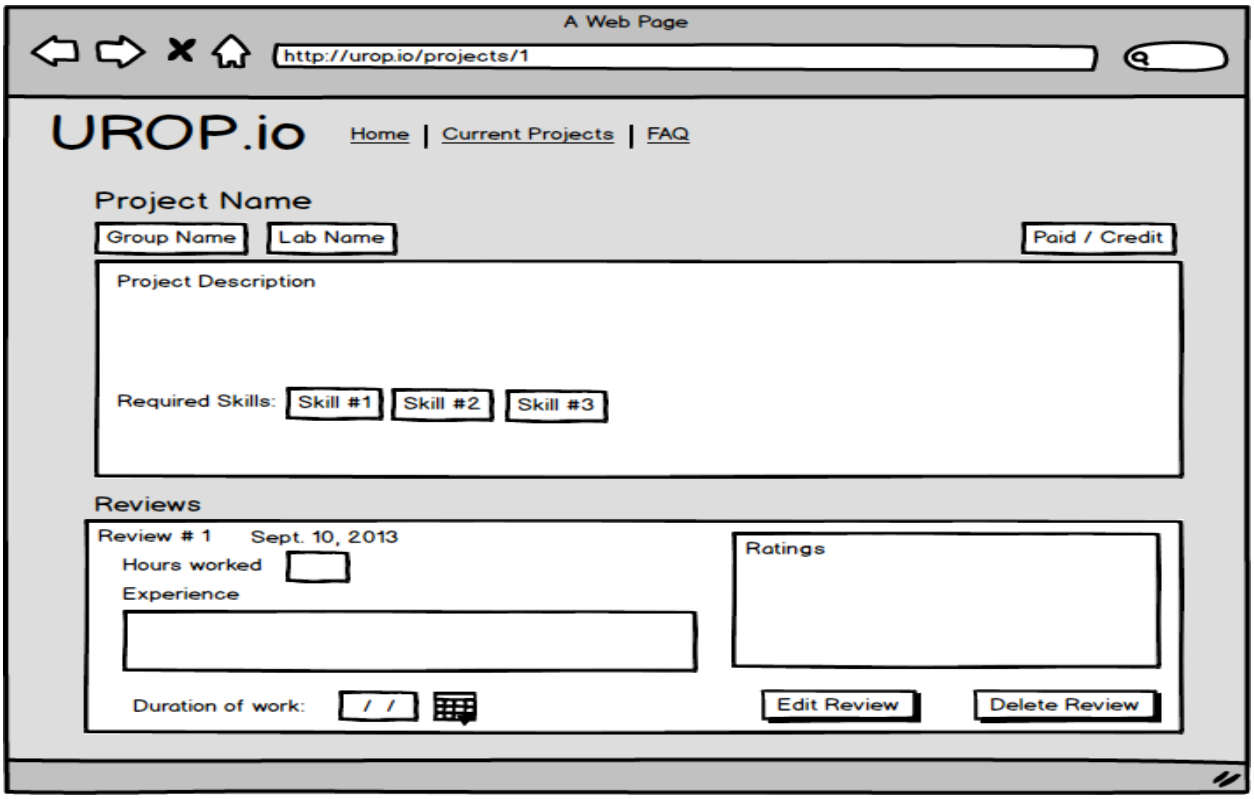
Wire Frames



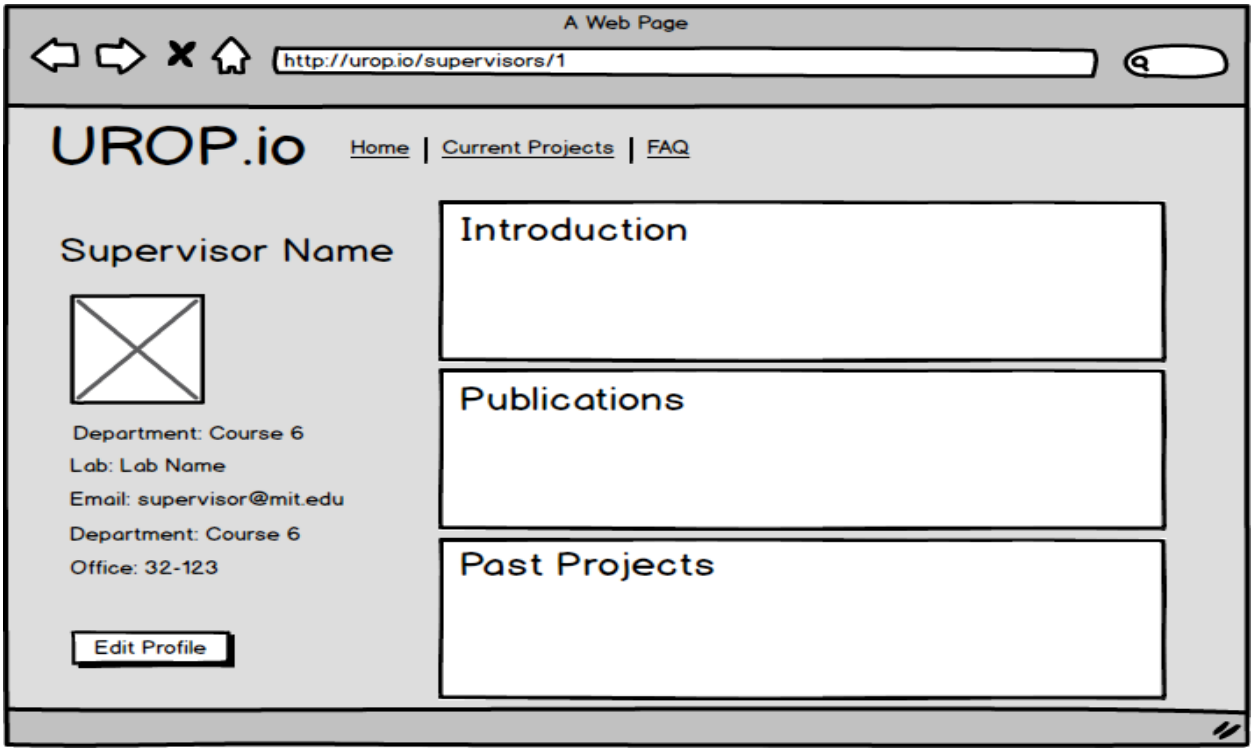
UROP Postings Page for Supervisors (above)



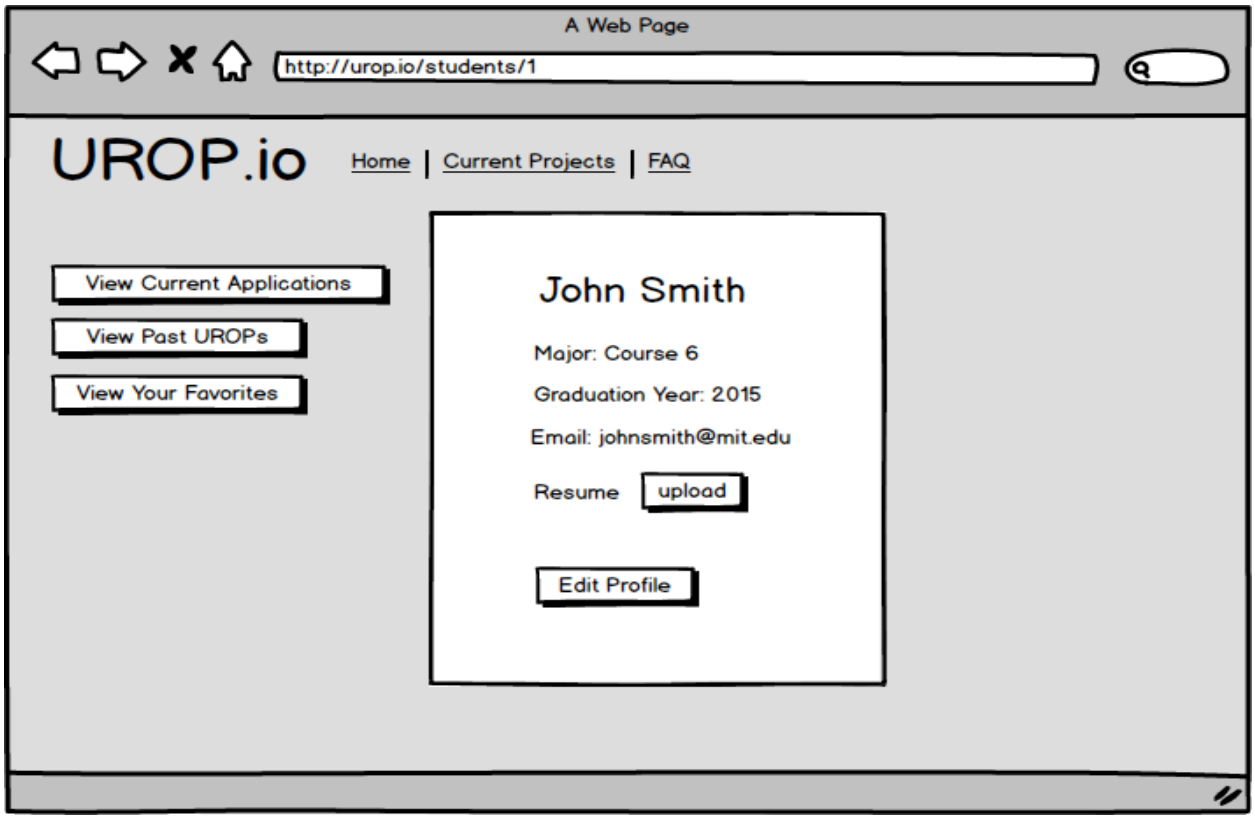
Wire Frames

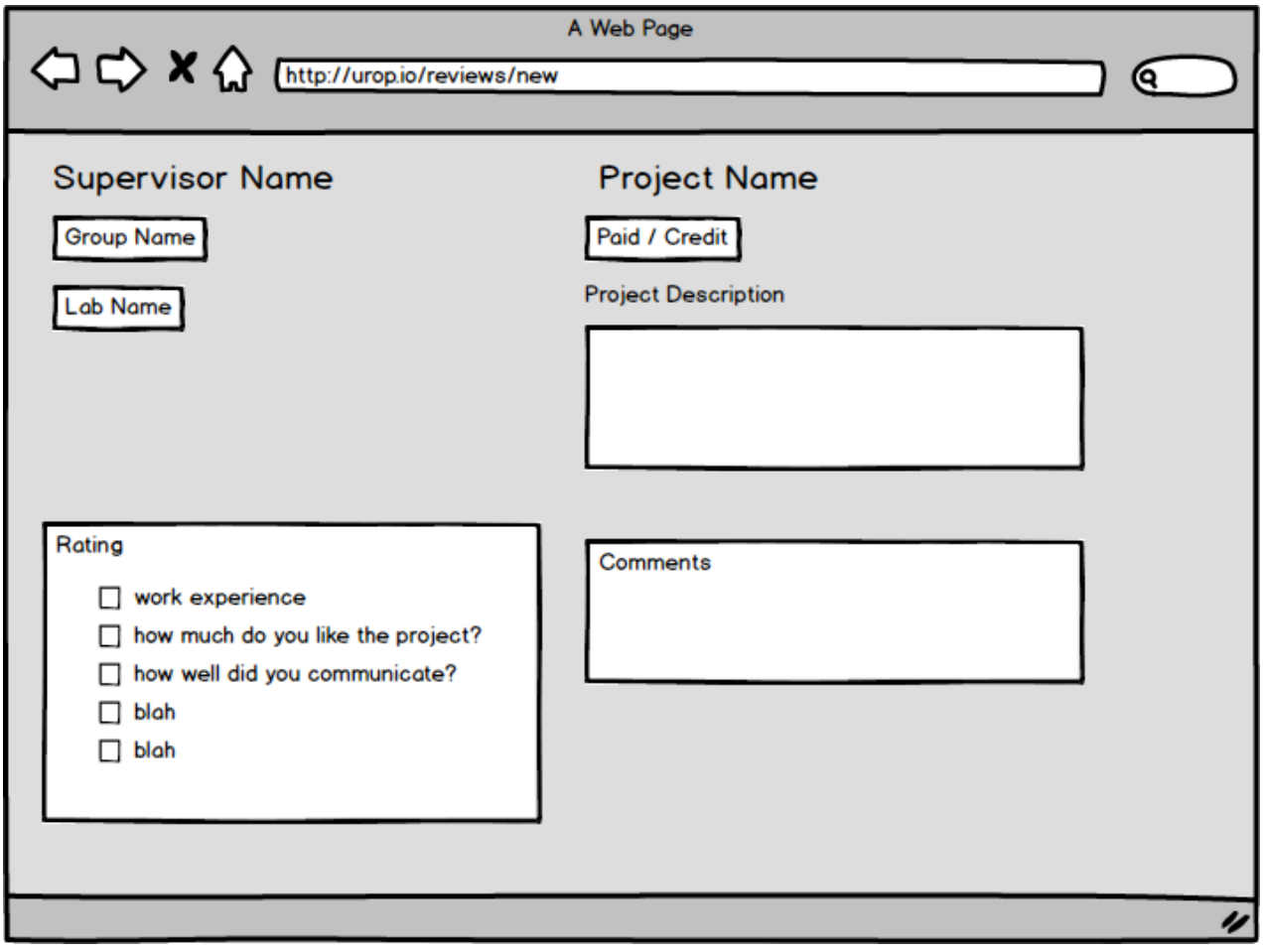


Individual Posting View Page (above)

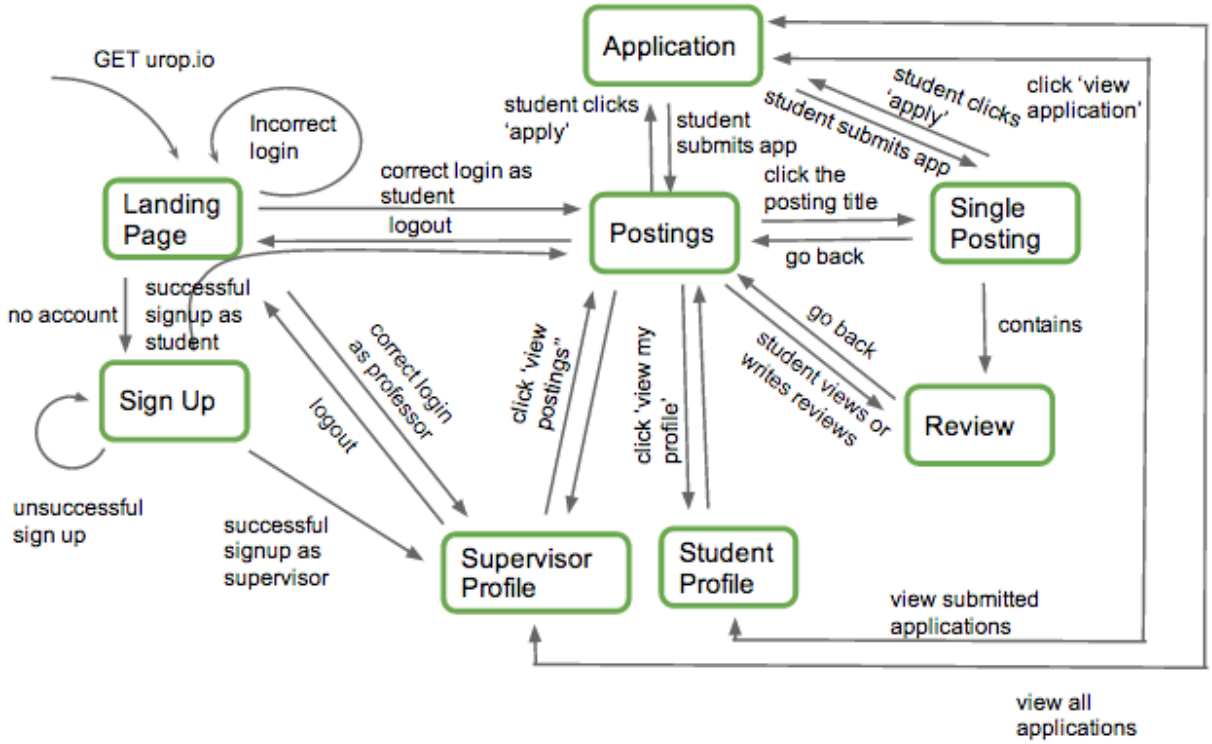


Wire Frames


A Web Page
http://urop.io/students/1
UROP.io
Home | Current Projects | FAQ
View Current Applications
View Past UROPs
View Your Favorites
John Smith
Major: Course 6
Graduation Year: 2015
Email: johnsmith@mit.edu
Resume
upload
Edit Profile


A Web Page
http://urop.io/reviews/new
Supervisor Name
Group Name
Lab Name
Project Name
Paid / Credit
Project Description
Rating
work experience
how much do you like the project?
how well did you communicate?
blah
blah
Comments

Page Flow



Challenges

Overview

A major challenge was to make the review system useful and secure for students and supervisors.

In order to achieve this, reviews must be authentic and honest. However, there is potential for fraudulent review. For example, a student might write a fake review to bad-mouth a professor they had a bad class experience with, or a student may impersonate another student to ruin their online reputation. At the same time, we want to make sure students who genuinely have negative, but constructive feedback are not deterred from making themselves heard. To balance these concerns, we made the following behavioral and code design decisions.

Under code challenges, the site must adequately support separate roles for students and supervisors.

Behavioral Design Challenges

Challenge #1: Should urop.io allow anonymous reviews?

Option 1: No anonymity - students must identify themselves by name in their reviews.

Pros:

- Makes moderation and verification of reviews easier
    - Easy to check author a real MIT student
- Deters students from posting fraudulent reviews, as they wouldn't want to be publicly associated with the review

Cons:

- Increases barrier to entry faced by students who want to post reviews in general, since they could feel subject to more scrutiny when their name is attached to the review.
- Could discourage negative, but honest feedback about UROP experiences that would be useful for other students on the site.
    - Most reviews on the site would likely be positive

Option 2: Anonymity optional - students can choose to identify themselves, but are not required to do so

Pros:

- Lowers barrier to entry if students were previously hesitant about publicly reviewing their UROP.
- Students would feel more comfortable posting negative, but honest reviews that are helpful for other students on the site.

Cons:

- Lowers protections against fraudulent reviews.
- Students may not feel the reviews are truly anonymous anyway
    - If a supervisor only has a few UROP students, and the project was specific to a student, then it is not hard to pinpoint who wrote the review.
- Students may not trust anonymous reviews, or may be more skeptical or them.
    - If the majority of the site's reviews are anonymous, and people are turned off by them, they will stop using the site.

Decision: Option 2 - Anonymity optional - students can choose to identify themselves, but are not required to do so

Reasoning

- We value encouraging participation, assuming the risk of an occasional fake review.
- On balance, assume most students at MIT are not malicious and will post honest reviews.
- Assuming there are many reviews aggregated over multiple semesters from different sources:
    - A single fraudulent review has less influence.
    - It is hard to tie a particular anonymous review to a specific student

- Students can use their own judgment about how they want to interpret the review.
- Mitigations against cons:
    - Send email verification to users upon profile creation, making it harder for students to impersonate other students.
    - Could have used certificates, but this could deter students who may not feel their anonymous reviews are truly anonymous.
    - The site will have a “Feedback/comments” form, where we will encourage people to let us know about fraudulent reviews, which we will moderate.

Challenge #2: Who should see the reviews?

Option 1: Only students can see the reviews, not supervisors

Pros:

- Students can feel free to be more honest in their reviews if they know their supervisors can’t view them

Cons:

- Supervisors may be put off by the fact that they can’t see what other people are writing about them, and would refuse to use the site to advertise UROPs

Option 2: Both students and supervisors can see the reviews

Pros:

- Supervisors can see feedback from their UROP students and improve
- Could discourage trolls and fake reviews, if students know “important” people will see them.

Cons:

- Could deter students from posting negative, but honest reviews for fear of their supervisor seeing the review
    - Students could worry about effect on recommendation letters or standing in the lab/department

Decision: Option 2 both students and supervisors can see the reviews

Reasoning

- In making our decision, we came back to a key goal of urop.io: to help students have a better UROP experience by finding the right supervisor for them
    - Supervisors can benefit from candid feedback about their effectiveness
    - Would incentivize them to improve, making UROP experience better for students
- Mitigation against cons: Deterrent effect on negative, but honest reviews will be small:
    - We assume if a student had a bad experience with a supervisor, the conflict was resolved offline.

    - Assume students know the purpose of negative review to provide guidance to other students who are thinking about working for the supervisor.
    - Through the comments box in a review, students can reveal a negative experience without going into revealing detail, which is still helpful for other students

Challenge #3: Should the reviews be project, or supervisor focused?

Option 1: Project focused - ask specific questions about the nature of the work (e.g. how difficult/interesting was the project, what languages did you use)

Pros:

- Students might want to know more about technical nature of the work
- More neutral subject students may feel more comfortable posting about

Cons:

- Projects can change year to year, old reviews about a project may not be relevant
- Key factor in UROP experience is how good a supervisor is, project focused may not help students as much

Option 2: Supervisor focused - ask specific questions about effectiveness of supervisor (e.g. how accessible were they?

Pros:

- Information about supervisor effectiveness is very relevant to students

Cons

- Reviews of people students know is tricky, leads to design challenges described in Design challenges 1&2

Decision: Combination of option 1 & 2 - both supervisor and project specific questions

- Mix of numerical and free-form ratings:
    - identity of supervisor
    - overall 1-5 rating of UROP experience
    - overall 1-5 rating of supervisor
    - time commitment in hours/week
    - recommend to other students?
    - general comments box
- Each review is tied to a supervisor in the model, to make it easy for students to see all reviews about a particular supervisor

Reasoning

- Having both better helps students choose the right UROP; project + supervisor are key components in UROP experience

Code Design Challenges

Challenge #1: Handling two different user types in the model

The site has two roles, the Student and Supervisor role, who have different levels of access to site resources. These roles must be supported in the model.

Option 1: Polymorphic association: Two separate Student, Supervisor models, inheriting from a User model, type stored in each user instance

Pros:

- Students and supervisors don't have a lot of overlapping fields, so fewer "NULL" fields in db.
- Easier to add other user roles in the future.
- Only need to implement sign-up and login once

Cons

- Team less familiar with implementation in Rails

Option 2: Single table inheritance - one User model, with all fields

Pros:

- Only need to implement sign-up and login once
- Easier to implement for team

Cons:

- Will be ~50% 'NULL' fields for students and supervisor instances due to lack of overlap in fields

Decision: Option 2: Single table inheritance

Reasoning:

- Neither option is ideal, but we decided to take a path that would be easier to get our MVP running
- In a production environment, we would go with Option 1.

Challenge #2: Searching UROP postings

The main challenge is to make sure the fields students will want to search on will correspond to what is actually searchable in the review and postings model. For the MVP, users were able to search by keywords in the description; for the final version, users will be able to search by titles, required skills, descriptions, and departments.

Option 1: Using ajax calls to perform simultaneous searches in titles, required skills, descriptions, and departments.

Pros:

- Students can search for UROPs on the same page as viewing the postings.
- They can view the different sections that satisfy the search criteria all on one page
- Ex. Student searches for "C++", the web page shows students UROPs with titles that includes "C++", required skills that includes "C++", and so on.

Cons:

- Most of the time, especially if the site is not well populated, some categories would have no matches and be empty.

Option 2: Allow students to choose the categories for which they would like to search in.
Pros:

- Students can search for keywords in a specific category.
- Allows for simple UI

Cons:

- Selecting categories is an extra step for users

Decision: Option 2: Allow users to select categories
Reasoning:

- UROP postings page doesn't have to be divided into categories
- Simple UI

Design Document Changes

General Changes

- More bulleted lists throughout the document
- Everything in one design document, including images and diagrams

Design Challenges

- Focused more on the pros and cons of each challenge

Context Diagram

- Drew lines in boxes that correspond to systems or external applications
- Drew lines should go from urop.io to student and to supervisor to show that students and supervisors can retrieve data from urop.io

Data Model

- Fixed multiplicity and arrow issues
- Added UROPs to the data model and appropriate associations

User Interface/Wireframes

- Deleted reviews from postings
- Added separating view and create reviews pages

Security Concerns

- Added a threat model

Page Flow

- Changed the homepage for supervisors to supervisor profile