Connecting Students and Faculty Research Efforts Through the Research and Projects Portal (RAPP)

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Abstract

Developing projects is an integral task in course work for students at universities. Extensive projects span over semesters and hence are incrementally worked upon by multiple teams of students. Ideally, projects are documented and structured to be readily accessible to future students who may choose to continue the project, with features that emphasize the local community, university, or course structure. The Research and Projects Portal (RAPP) is a platform enabling students to post both their completed and ongoing projects with all the resources and tools used. Students can access RAPP to understand the contributions of past students and may choose to extend the projects that fall within their domain of interest. Industry collaborators and faculty from other departments could document their ideas on RAPP for students to engage in. Actively curated, the portal enables instructors to label the projects which helps students to filter and browse across the portal with ease. RAPP enhances the collaboration of students across semesters by supporting their documentation hence enabling longevity of projects.

Introduction

Students engage in multiple projects during their course work at universities every year. Most of these projects are later abandoned because the students ran out of time, or they could not accumulate all the resources they needed in a semester span. Inspired by "Communities of Practice" (Wenger, 2018; Wenger et al., 2010), this paper presents the idea and application that is developed at University of North Texas (UNT) to address this issue. A survey conducted on the campus indicated that projects done by students every semester are available on individual git repositories. New students, who are in the process of picking a project for the semester needed a common platform where all the past student projects of the department are archived along with their documentation. This lack of aggregation of resources hindered students to refer past work, track resources and choose to increment an existing project.

Students working on multiple projects had to navigate through multiple platforms to maintain documentation and track the status of each project. Recruiting, to onboard new students for a project was very elaborate where the concerned instructors and students sent out email communication along with putting up flyers on department dashboards. On the other hand, new students in search of open projects needed a community to tap into. Similar kind of

communication was taking place with students needing funds for their projects or sponsors seeking good projects. Additionally, an interface that could bridge the gap between industry collaborators and the department student projects was not available. Industry collaborators, given a better communication platform could bring in value-added solutions, resources and provide a perspective on the current market necessities in any given domain (Silva et al., 2018; Fernandes et al., 2018). This survey led us to create a better design which addresses the challenges by having an archival of past projects, support organized documentation with all the relevant resources and tools, curate the project list for end users (refer Figure 1).


Figure 1. RAPP Features
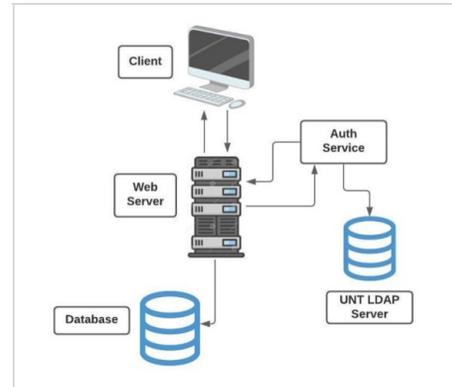
Figure 2. RAPP Architecture

The emphasis on having long-term student projects that span over multiple semesters was experimented at Grinnell college in Iowa. They have redesigned their 'Software Design' course to enable students to engage in multi-semester, community service projects (Davis & Rebelsky, 2019). These changes were done to accustom students to not just the development of real-time applications that served the local non-profits but also to introduce them to the terrain of software project maintenance. The student teams were using Git to maintain code versioning along with documentation. Alumni mentors were assigned to the student groups who help them navigate through design problems and advice on the optimal technical solutions. This line of work displayed promising results in increasing the technical and soft skills of the students (Davis & Rebelsky, 2019).

In recent years, significant work has been done on archiving, evaluating, and assessing student projects through various web portals (Li Li et al., 2007; Di Blas et al., 2014). At the University of Bradford, a knowledge portal was implemented to support the collaboration of MSc student projects (Munive-Hernandez, 2011). This portal supports monitoring of project tasks and tracking the milestones achieved. It also enables communication and feedback from supervisors. The portal is actively being used for project definition, project planning, literature review report, supervisor's feedback, and development of knowledge repository. Similar efforts were initiated in 2003, at the University of Pretoria in South Africa. The web portal was a massive success and was also made the official architecture at the university (Pienaar, 2003). More recently in 2018, Monash University in Australia developed and launched an online research portal that grew to be accessed by almost ten thousand people and implemented throughout the campus (Rodafinos et al., 2018). Another example of the successful

implementation of an academic research portal occurred at Vanderbilt University. Features of this portal included research support, and guidance for future projects (Harris et al., 2011). The success of similar efforts provides a reference for the future success of RAPP.
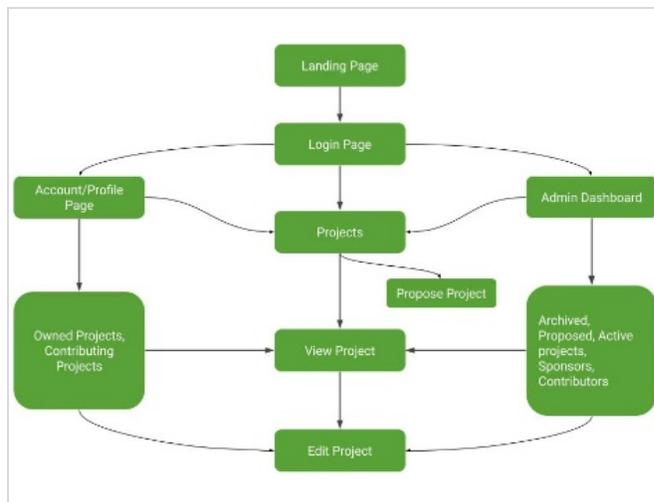
Figure 3. Application Workflow

Figure 4. Project Statuses

While many web portals lag in displaying incomplete projects, the goal of RAPP is to build a website that is actively curated with a list of student research projects that are active and well suited for students and faculty to continue. An archive is also intended to showcase the research and class projects that students work on to excite prospective students, interested faculty, and prospective donors (Rodafinos et al., 2018). The user-friendly graphical user interface of RAPP enables professors and students to spread awareness of what they are currently working on and tag their projects as "actively recruiting" to seek students. While at the same time, students can browse through to see the projects that belong to their specific domain of interest and find the materials to work with or a faculty member best suited to advise them.

While still in the formulation phase, an idea can be proposed on the portal to become a prospective project. This feature of RAPP makes it possible for students to collaborate with a professor and arrive at a project plan that best suits both parties. Furthermore, this invites industry collaborators to bring in their value-added suggestions to these proposals or proactively fund a project. The influence of university-industry collaboration on innovation has gained a lot of attention in recent times due to its positive impact (Barnes et al., 2000; Hansen et al., 2017; Kukreja et al., 2020; Szabo, 2014; Gorlatova et al., 2013). The portal's user community includes students, faculty, and industry collaborators.

All the users in the community should sign up to the portal to gain access to all the features provided. To add a new project, one should upload a brief description, source code link, documents, and output snippets of their projects. The portal then prompts the user to tag key names related to the project which are later used in filtering the projects list. Signed up users can browse through the list of projects and filter based on tags assigned to the projects. Students are benefitted by the portal, by being able to upload their ideas/projects and seek out projects that

fall within their domain of interest. Faculty and industry collaborators are empowered by the portal to be able to reach out to students actively seeking projects and resources, by hosting projects that are to be worked upon.

Implementation and Methods

RAPP is developed using the MERN stack, designed to run on Node.js and Express.js for server-side operations (refer Figure 2 & Figure 3). The front end of this portal uses a react and redux combination. Redux is a predictable state container that handles server and client interactions. The client relies on the index.js file and app.js files for redux setup and client-side routing. The MongoDB is responsible for storing and serving all the user and project data. User accounts and project listings are stored on different tables within the database.

This portal leverages the EUID-based login (LDAP) system implemented by UNT, based on Microsoft Active Directory service. Using this unified login information service, any authorized user with valid UNT credentials will be able to login to the portal. Administrator role is assigned to users who are responsible for the maintenance and health check of the portal. An admin user is also accountable for reviewing the proposed projects. RAPP has a responsive web design enabling it to be rendered and fit into any screen resolution, size, and orientation of the user's device.HTML5, CSS, JavaScript and Bootstrap v4.0 are used to enhance the frontend experience of the user. Bootstrap is the most popular CSS framework for developing responsive, mobile-first projects on the web.

Results

RAPP enables the user to navigate through multiple tabs that facilitate and host the features. This web portal allows any member of UNT to submit projects or ideas for review by a site administrator. Once an administrator approves a submission, it becomes visible among the list of all projects. This list has a robust set of search and filter functions, allowing members to view and share a completely customizable set of projects. Contact information is included with every project, so adopting an existing project is easy. Projects can be edited by their owners, and by site administrators, so changes in status and team ownership are easily updated. Administrator has a suite of tools to curate and manage the database of projects. These tools include approving or removing newly submitted projects, batch editing multiple projects, exporting the current database as a spreadsheet, and importing multiple projects at once from a spreadsheet. Administrators also can promote and demote other site users to administrator status. Functional features available on RAPP are described below.

 a) **Add Project**

A user starts with uploading his idea to the portal via this form. User is expected to feed in the information of the project (refer Figure 5.1 & Figure 5.2). Actively recruiting label, is a check box which lets the users understand if there are open positions in the project. GitHub link label is a text box to feed in the link to the source repository. Cover Image label is an upload option for a .jpg or .png file that serves as a cover image for this project on the portal.

Figure 5.1 Add Project Form Part1

**Figure 5.2 Add Project Form Part2**

b) Edit project:

Users are provided with an access to update the projects owned by them. This serves as a crucial feature for the portal since these user activities help actively curate the project list. This form is same as the "Add project" form since the portal provides complete access to the user to update all sections of the project.

c) Dashboard for browsing projects:

A dashboard with all the projects listed except for the archived projects. The page comes with user-friendly interface for the user to be able to navigate through with ease (refer Figure 6.1 & Figure 6.2 & Figure 6.3). A search bar is available for the user to feed in the project name. This helps the application to find the desired user project from all the hosted projects. A list of project status filters (refer Figure 4) is provided to the user to choose from. The filters are segregated based on three categories namely, development status, administrator approval status and recruiting status.
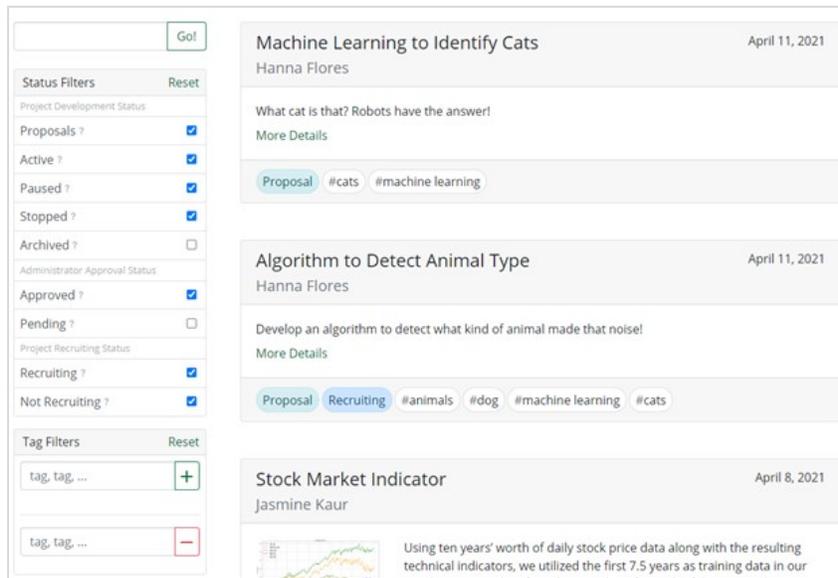
**Figure 6.1 Dashboard to Browse Projects**
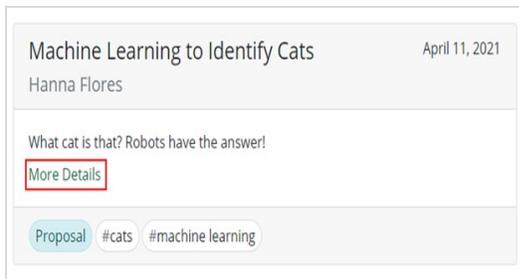
Figure 6.2 Project Tile

**Figure 6.3 Application Menu Bar**

The project development status reflects the implementation status of a project. The administrator approval status depicts whether the project had been approved by the admin of the portal or not. This filter is used by the user to check if the projects onboarded by him/her is approved by the admin. The user can leverage the filters in the project recruiting status section to filter or filter out the projects that are actively recruiting. All the projects, except for archived status that fit the search and filter criteria are listed. Each project in the list is contained in a tile which holds all the details of the project. The principal feature of RAPP is to curate the user content. To be more specific, projects that are recently updated, active or actively seeking resources will be prioritized and will be on the top of the list.
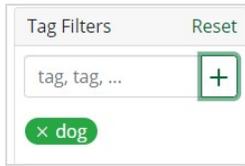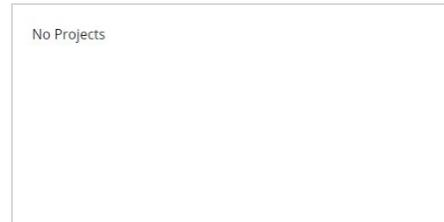
Figure 7. 1 Include Tag Filters


Figure 7. 2 Include Tag Results
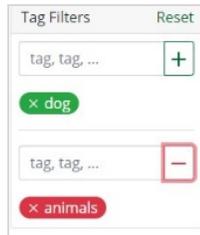
**Figure 8.1 Exclude Tag Filters**

Figure 8. 2 Exclude Tag Results

Each project tile contains a "More Details" link that when clicked upon would help the user navigate to a different page where more elaborate details of the project are available. Thumbnail picture attached to the project is projected on the project tile for a visual reference. Filters to search for projects by their tags. While creating a project, the user is entitled to assign tags to the project. These tags reflect the technology or domain specific keywords related to the project. Furthermore, the results can be narrowed by specifying tags you do not want to include (R\refer Figure 7.1 & Figure 7.2) and exclude (refer Figure 8.1 & Figure 8.2) in your search.
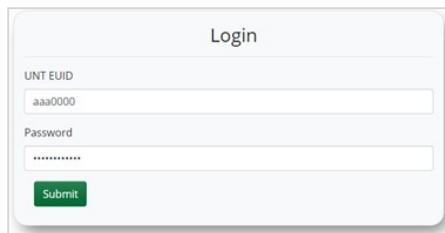
**Figure 9.1 Login Page**
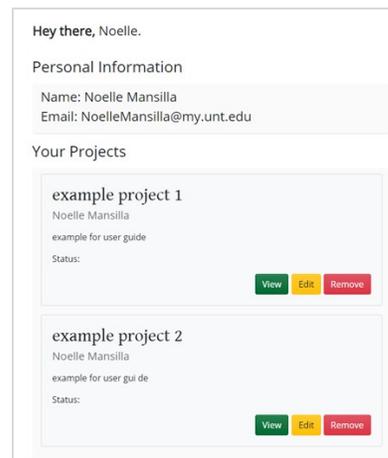
Figure 9.2 User Profile

d) Maintain user profile:
The portal provides a profile page for the logged in user to display all the projects under the user's ownership (refer Figure 9.1 & Figure 9.2). This helps the user to track the statuses of all his projects and have easy access to navigate to those specific projects and update the content

and details. The absence of this feature forces the user to navigate to the dashboard and search for these projects. From this profile page, the user can navigate (view), edit, and delete the project.

e) Admin Dashboard:

The admin privileges enable a user to have access to a set of features that help manage the portal. Admin features include import and export of projects; privilege to approve, deny and edit projects; view all the users and have the privilege to assign or revoke admin role to any user on the system. The Pending projects tab helps user navigate to the admin dashboard where a list of projects, that are to be reviewed by the admin are available (refer Figure 10 & Figure 11). Each project tile in this dashboard comes with an approve button and a reject button. Upon approval, the project will be made available to all the users on the portal. In case of rejection, the project is not available on the projects dashboard for the users to view and work on it.
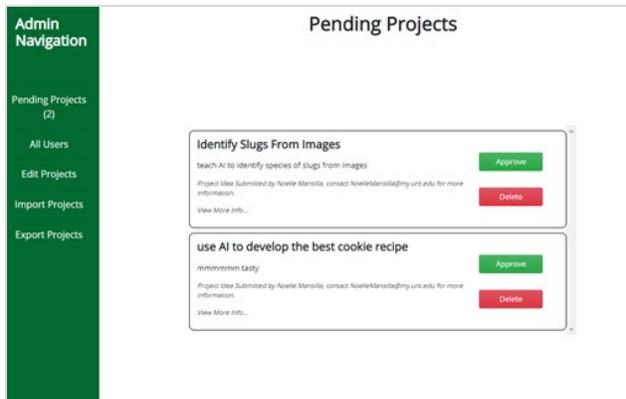
Figure 10. Admin Dashboard
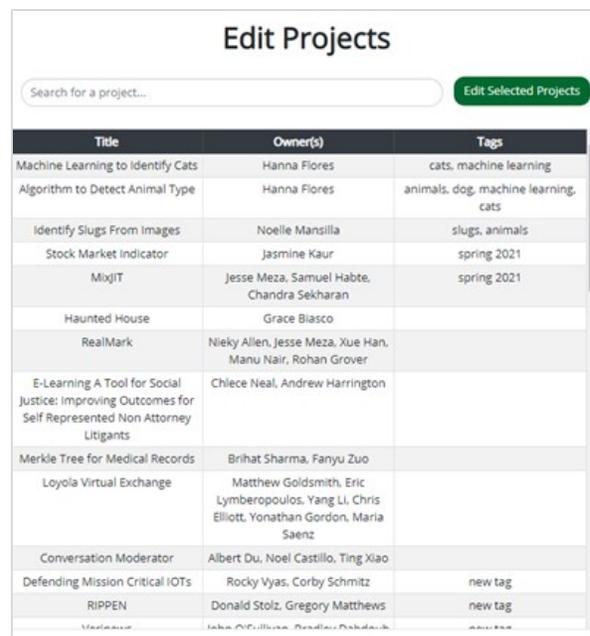
Figure 11. Projects Edit Page for Admin

When there are multiple projects that are to be onboarded to the portal, it is a tenuous process for the user to manually type in all the details and upload the project one by one. In such scenarios, the user may reach out to the admin and provide all the project details in an import template. The template is available for download on the import page. The admin is supposed to upload all the projects through the template alone for this bulk project upload to be successful. When changes are to be applied to multiple projects, it is ineffective for the admin to navigate to individual projects and update the changes. In such instances, admin has the flexibility to export all the projects and update the content in excel at ease. Post applying the changes, admin can import the same for the portal to reflect the updated content. The export also helps to take a backup easily, in case of system migration or upgrade.

The admin has a privilege to manipulate the tags on a project along with its status. An option to delete the project is also provided here (refer Figure 13). This gives the admin complete access over the projects, so that the portal does not encourage malicious content, projects on the portals hold relevant tags that enable effective filtering, and the status of each project is reflecting its needs or implementation status as expected. The admin user will be able to view all the users registered on the portal. This feature enables the admin to provide or revoke admin access to other users on the portal (refer Figure 12).

Figure 12. View Users   **Figure 13. Admin projects edit page**
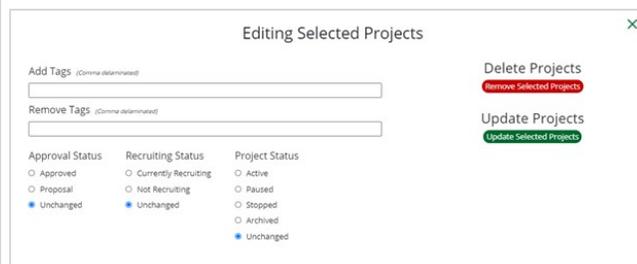
Evaluation

The portal is launched in April 2021 with a primary goal to be available for the "bio-medical AI lab" summer program at UNT. The "UNT AI Summer Research Program" brings together students from a variety of AI-related academic programs to supplement their traditional course-based educational experiences with focused, project-oriented research efforts. Faculty and students with promising ideas uploaded their proposals on the portal. The members of the review panel were given admin roles on the portal to review the proposal submissions and approve them so that they could become prospective projects. The rejected proposals are not available for the users on the "Projects" dashboard. We had a team of students to administer a survey on the user experience of RAPP. This survey involved extensive feedback collection in weekly lab meetings throughout the summer program. The prime objective of this survey is to understand if the portal provides ease to the user while navigating through different tabs, if the forms provided were wholesome and relevant, if there were any glitches throughout the experience, if the filters and tags provide relevant curated content that helps the end user, if the aesthetics of the portal were appealing. The portal received an extremely positive reception.

Admin users were able to manipulate the tags on any given project with ease along with being able to edit the approval status, recruiting status and project status. This meant that they could refine the content with ease so that search results for the end users would be appropriately curated. Besides, the admins could monitor for any rogue tags and censor them to maintain the integrity of the portal. The import and export project options also received critical acclaim since the admin users were able to instantly onboard multiple projects effortlessly from past summer programs. With more proposal submissions, the admins were able to appoint new admins and scaleup the panel and remove their admin access when the workload receded. This was made possible with the 'Make Admin' and 'Remove Admin' options that are available on the "All Users" page accessible to all admins. Furthermore, the portal provided the admin with a

prioritized queue of pending approvals that would make sure that the users who submitted their projects early would not have to wait for a longer period to receive the approval status. The survey proved that a feature as subtle as this could bring in a magnificent shift in user experience. Prior to this, the review panel had to track their mails and refer the tracker updated by the students and found it extremely tedious in identifying the order of approval. At times, this delay would lead to vexation of many proposers.

The faculty in the lab got back to the survey team that they were able to easily recruit students for open projects since it was as easy as marking the project as "Actively Recruiting". Students were able to effortlessly filter out projects that had open positions through the portal and then reach out to the team with the contact information available on the project page. The well-organized portal facilitates grant writings for faculty since they could access all the resources in a centralized location. The fact that the portal does not need a separate registration process was an open invitation to people from all walks of academia at UNT, to propose ideas and manage their projects. This feature has created a substantial scope for the expansion of the portal to wider audience soon at UNT.

Discussion

Unlike GitHub, RAPP's goal is to go beyond just hosting projects. RAPP allows faculty and students to connect over unfinished projects, while still being able to display completed projects. To achieve this goal, we used appropriate client-side design tools to make the collected data user-friendly for browsing. Current project features include adding, searching, viewing, and filtering projects. They can also add tags, images, GitHub links, contact information, and upload files to projects. The fact that RAPP provides actively curated content along with dynamic tags, makes it a robust application that brings in a difference to the user experience. Taking it further, RAPP could provide a feature for the user to compose and send out an email to the project team directly. A chatbot that interacts with the user and suggests filters or projects would enhance the user experience further. A feature that would enable all the logged in users to participate in a conversation via text messages could push the collaboration to the next level. Though RAPP is launched as a pilot for the summer research programs at UNT, the goal is to refine and expand this application to be used widely throughout the campus.

Conclusion

Student projects with a substantial scope need incremental development, that spans over multiple semesters. Lack of a well-built model to bridge these efforts could obstruct the continuation of the projects. RAPP addresses this issue by enabling students to host projects with documentation, and respective resources. While completed and paused projects help with retrospection, new and active projects could be tagged with appropriate labels that results in curation of content hence encouraging users to find most active projects or projects with open positions. These features help the university's faculty and students to find resources and related work while at the same time they encourage industry collaborators to bring in contributions. RAPP has a profound impact on its user community by creating a sustainable and collaborative environment for student work to thrive.

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