COMP9900 Information Technology Project

Project Report

Term 2 2020

Team Salted Fish

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Submission Date: 4th August 2020

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Table of Contents

Project Overview

Background

In recent years, online recruiting and projects collaborating have become more and more popular. There are people with dreams and ideas for new projects, and there are people with proper technical skills, knowing how to turn these dreams into realities. Therefore, a secure and professional online website is needed where both dreamers and collaborators can register, visit, share, match their thoughts and further collaborate on a project. Currently, there are a few websites which are trying to achieve this objective; however, the efficiency is not as user's expected because of not powerful enough recommendation processing, lacking user level statistics and incomplete user profiling information.

What is Dream Matchmaker?

The Dream MatchMaker is a professional system to provide a virtual space for both dreamers and collaborators to find their ideal teams and members actively, flexibly and efficiently. The solution aims to establish an online website to provide information and assistance to dreamers and collaborators. As a platform it brings dreamers and collaborators together and bridges to accomplish dreamer-project-collaborator matchmaker processing. On one hand, it enables dreamers to create projects, find recommended collaborators, invite or approve collaborators' applications and interact with other users. On the other side, it facilitates collaborators to find more suitable projects, apply to join in a project, interact with dreamers and so forth.

This report describes the implementation details of "Dream Matchmaker Project". A project proposal document was submitted which outlined the design and approach to the project and acted as a precursor to this document. Most of the goals set in the proposal document have been met, however, as is true with any journey, a few circumstances, technical and otherwise, were faced and dealt with guidance of the excellent support staff of the course.

This system has been developed using agile methodology where the project was divided into four sprints in Jira, each of which was composed of about 11 days-long development, testing and deployment activities. Project demonstration was conducted with supervising staff periodically in the middle of each sprint and the feedback was incorporated to improve the outcomes of the sprints. In addition, the team created a WeChat group for timely online communication and conducted one online zoom conference call per week. The meetings followed scrum specified agenda. For source code versioning, GitHub was employed, and its project board and issue tool was used to keep track of each sprint and its associated activities.

The rest of the document details the scope of system architecture, key feature highlights, system and feature walkthrough, future feature roadmap, implementation challenges, frameworks and APIs, system setup guide and references on this development journey.

System Architecture

System Design

The main interface of the application is web-based with a demo deployed on Google Cloud Platform. The front end of the application is developed using React, Redux, Bootstrap libraries and frameworks. The back end of the application is designed as a restful API service, using Flask-Restplus, SQLAlchemy and SMTPlib to provide main functionalities. JavaScript was used as a frontend programming language with React framework and Python3 was applied for backend. MariaDB is the main database service and MySQL is used as a database programming language.

All software components can be deployed on a standard Linux environment, tested with Ubuntu and Kali, and compatible with Windows platform. Based on modular design of the project, front end, back end and database service can be deployed separately to provide highest flexibility.

Deployment View

The whole system is deployed on Compute Engine (Google’s Virtual Private Server) of Google Cloud Platform (Compute Engine: Virtual Machines | Google Cloud 2020). Below is the information of the deployment server:

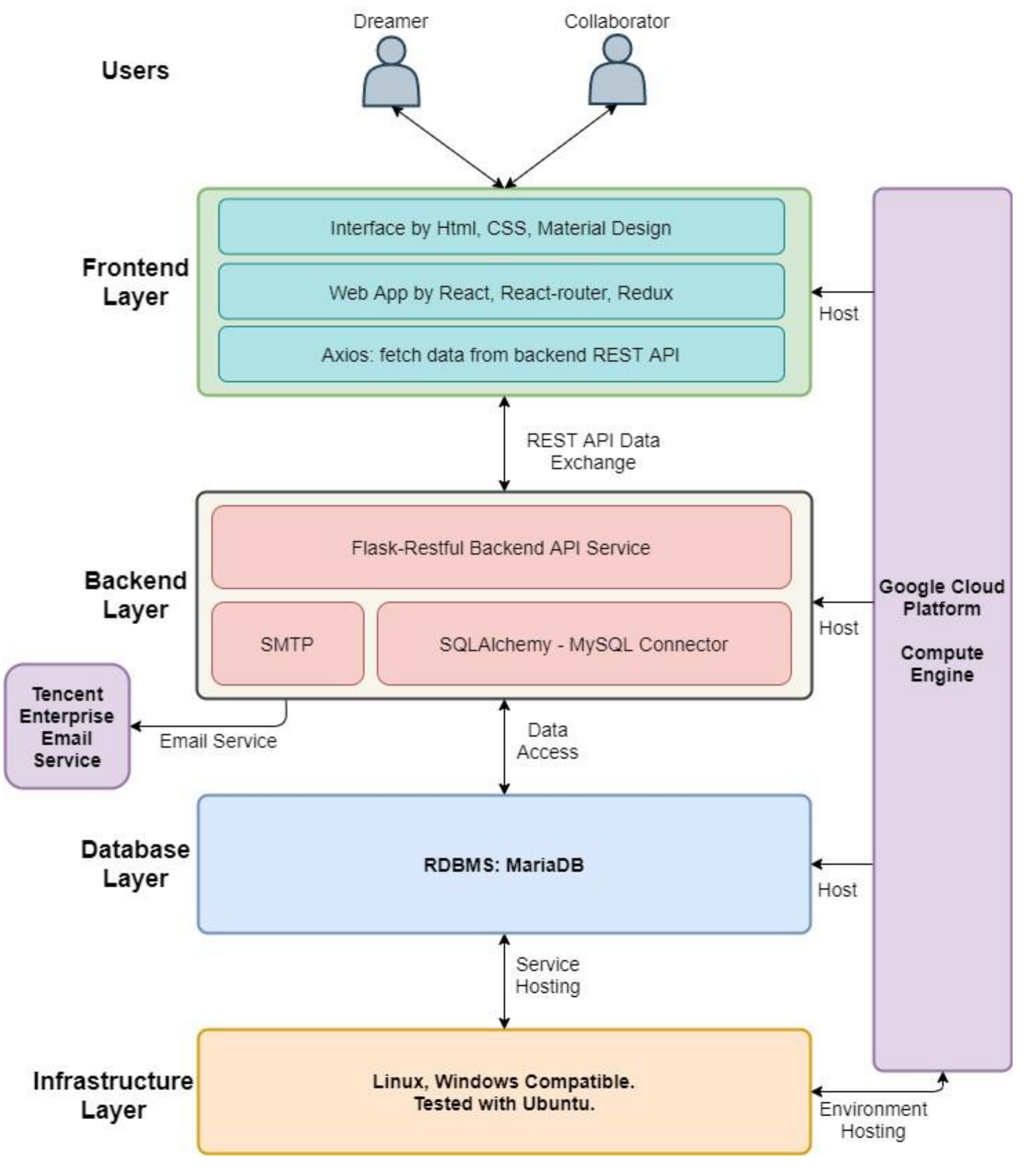
Type: n1-standard-1 (1 vCPU, 3.75 GB RAM)
Platform: Intel Broadwell. Area: Australia-Southeast1-B
Operating system: Ubuntu 18.04 bionic x86_64 (Kernel: Linux 5.3.0-1030-gcp)
External domain for demo: gcp.x-zhou.com:3000/

Model View

The system is developed under MVC (Model, View, Controller) model.

The back-end REST API service is implemented using Python3, Flask-Restplus, providing data in standard JSON format. SQLAlchemy is used for database access, while SMTPlib is used for email service, connected with Tencent Enterprise Email Service. The front end React App interacts with the back end through REST API, and renders views for users.

The architecture can be described as below:

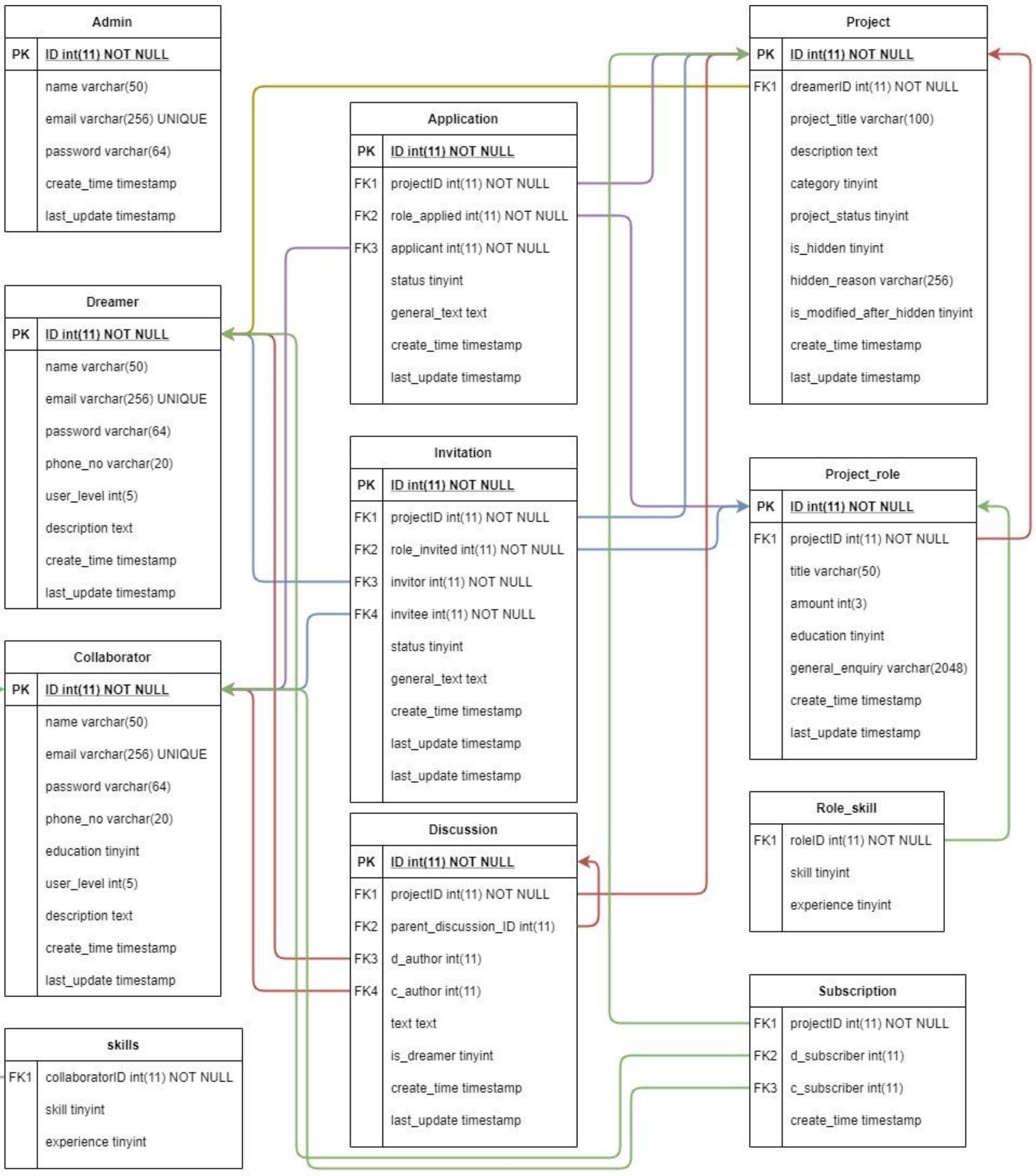


System Architecture Diagram

Although the above diagram shows that database, back end and front end are all deployed on Google Compute Engine, they can be deployed separately with small modification of configurations, which provides cost optimisation by using different platforms for the three parts of the system.

Data View

The system data storage is using MariaDB, a relational database management system (RDBMS). Below ER diagram shows the database relation design of the system.



ER Diagram

Key Feature Highlights

Two identities: dreamer and collaborator

There are usually two identities - dreamer and collaborator in the system besides the admin. Based on different identities signed in, the system provides customized features to the dreamers and collaborators separately. This feature helps to achieve more accurate recommendation information for different users.

Recommendation process

The website provides automatic recommendation information for both dreamers and collaborators. Through matching the role requirements of projects and collaborator's background including education level, technical skill and related work experience, dreamers can receive recommended collaborators for owned projects, collaborators can get recommended projects which are suitable for their own profiles. This feature design helps to implement a more efficient matching process between dreamer's projects and collaborators.

Resume uploading and downloading

The system grants resume uploading access to collaborators and PDF CV document downloading access to dreamers. Resume uploading provides a flexible method for collaborators to present their professional aspects. And CV downloading feature lets dreamers have the opportunity to have a better knowledge about the potential collaborators.

User level statistics

A user level field is designed to show a user's proficiency, which is shown as entry, medium, senior, professional or expert. When a project is completed and marked as finished by its owner, the system updates the user level automatically based on the statistic of projects the dreamer or collaborators have completed up to now. User level statistics is one of the novel features in our system to measure efficiency about the dreamer and collaborators and provides a reference for users.

Admin auditing

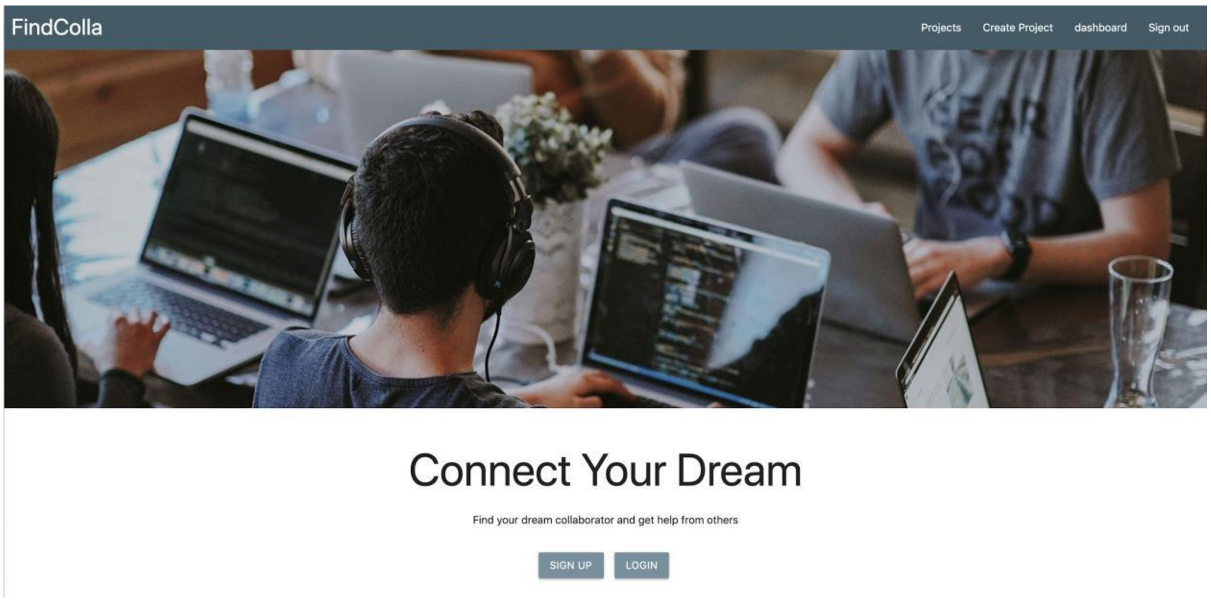
The website gives admin access to audit all existing projects in the system and hide a project with improper or illegal contents. A formatted email will be sent to inform the project owner to do modification. Administrators can reveal a project if the improper or illegal contents have been modified or removed by its owner. All hidden projects are not visible to users and only are available after it is revealed. This auditing process makes sure there is no illegal or improper content showing in the system and brings no bad effects to the whole society.

System and Feature Walkthrough

Customer App

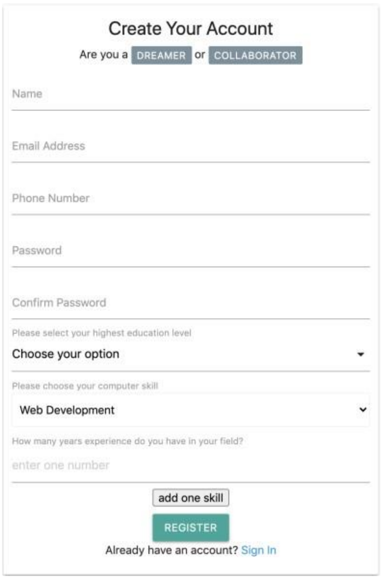
Landing page, Register and Sign in

Dream matchmaker website only provides browsing access to projects for visitors without registration through the Projects button on the landing page. And all other functions are available only after you register as a formal user: dreamer or collaborator.



Users can REGISTER with an email address to Create Your Account and SIGN IN as a DREAMER or COLLABORATOR. Based on different identities signed in, the system presents customized features to the dreamer and collaborator separately.

To secure users' password from potential leaking issues the system stores users' password as SHA256 Hex digest (64 characters long) instead of plain text password, showing as password varchar(64) column in the database system. It ensures that users' passwords will not be exposed to the public even if there is a database leaking.



Create Your Account

Are you a DREAMER or COLLABORATOR

Name

Email Address

Phone Number

Password

Confirm Password

Please select your highest education level

Choose your option

Please choose your computer skill

Web Development

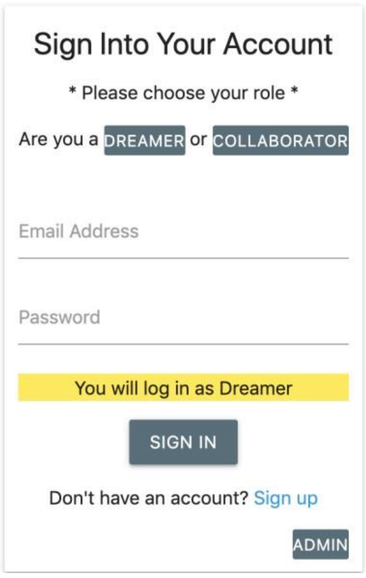
How many years experience do you have in your field?

enter one number

add one skill

REGISTER

Already have an account? Sign In



Sign Into Your Account

* Please choose your role *

Are you a DREAMER or COLLABORATOR

Email Address

Password

You will log in as Dreamer

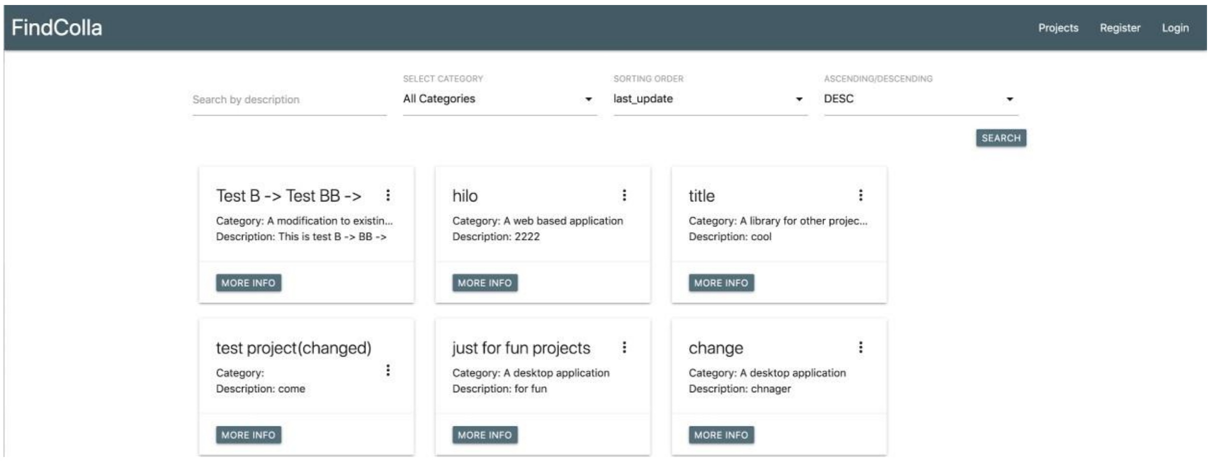
SIGN IN

Don't have an account? Sign up

ADMIN

Projects browsing and searching

This function is used to show and present all projects lists for users visiting this website. All users, even visitors without registration, have the access to browse projects in the system through the Projects button on the upper right corner of the page. Searching for specific category projects or through a keyword of the project's description is available in the Projects page.



FindColla — Projects | Register | Login

Search by description

SELECT CATEGORY: All Categories

SORTING ORDER: last_update

ASCENDING/DESCENDING: DESC

SEARCH

Test B -> Test BB ->
Category: A modification to existin...
Description: This is test B -> BB ->
MORE INFO

hilo
Category: A web based application
Description: 2222
MORE INFO

title
Category: A library for other projec...
Description: cool
MORE INFO

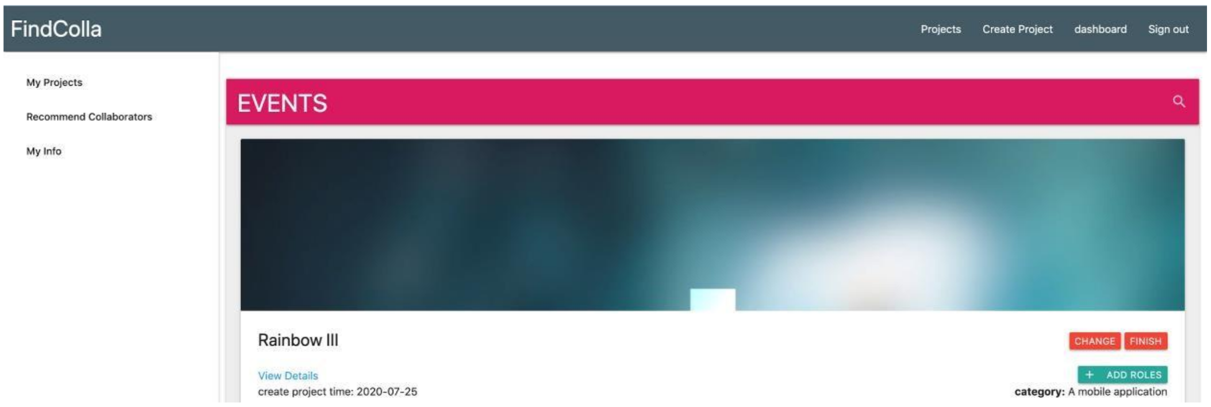
test project(changed)
Category:
Description: come
MORE INFO

just for fun projects
Category: A desktop application
Description: for fun
MORE INFO

change
Category: A desktop application
Description: chnager
MORE INFO

Project creation

Project creation for the project is the first step for a dreamer. From the Create Project button, a new project can be created by filling in the project title, choosing a category and giving a brief description. Dreamers can reach the newly created projects through dashboard or my projects label on the main page.

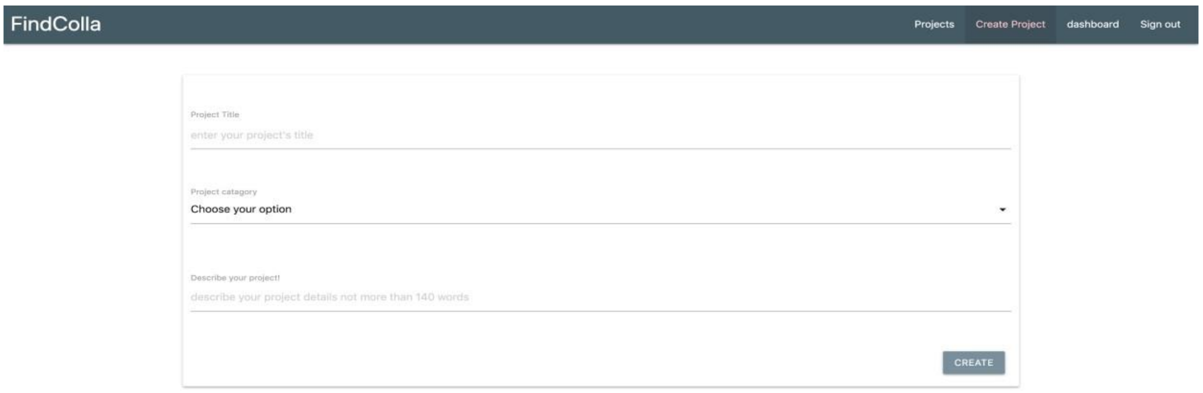


Rainbow III

View Details

create project time: 2020-07-25

category: A mobile application



Project Title

enter your project's title

Project catagory

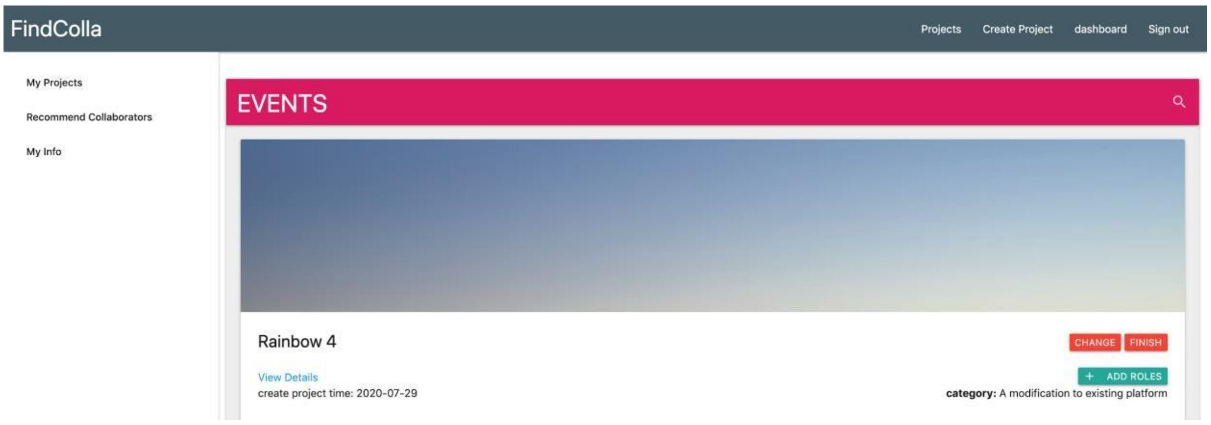
Choose your option

Describe your project!

describe your project details not more than 140 words

Adding roles

By clicking the ADD ROLES button of the newly created project, the dreamer is able to add one role or more roles by ADD ONE ROLE button and use the FINISH button to end the entire adding role operation.

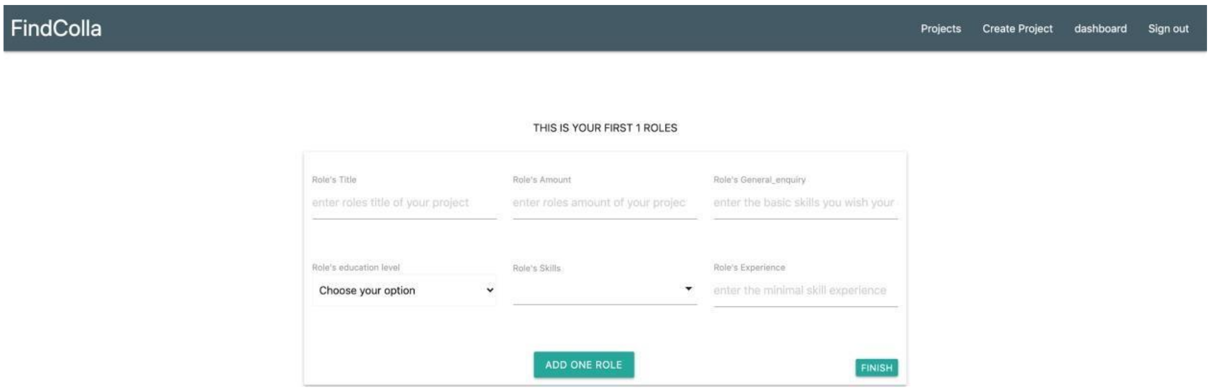


Rainbow 4

View Details

create project time: 2020-07-29

category: A modification to existing platform

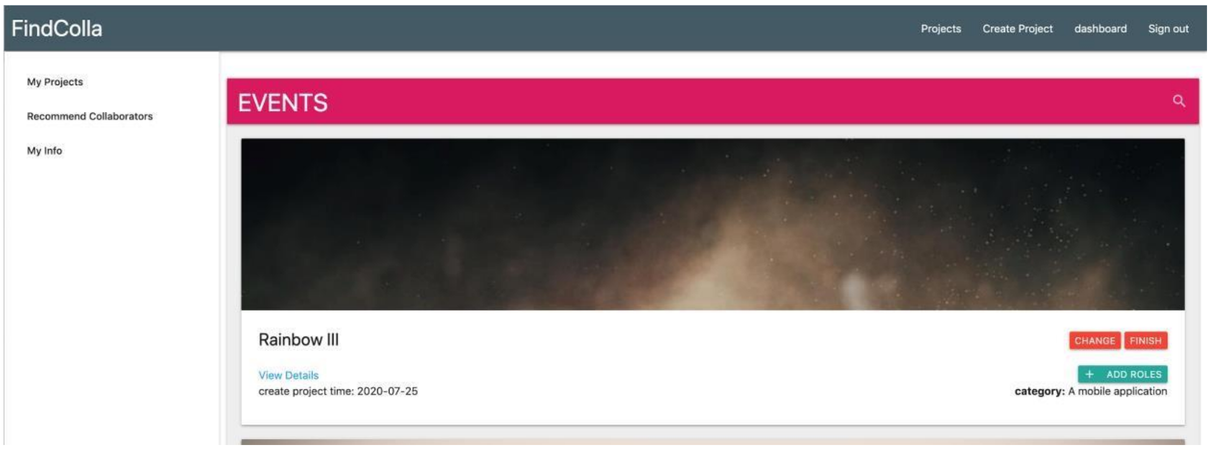


THIS IS YOUR FIRST 1 ROLES

Role's Title: enter roles title of your project
Role's Amount: enter roles amount of your projec
Role's General_enquiry: enter the basic skills you wish your
Role's education level: Choose your option
Role's Skills
Role's Experience: enter the minimal skill experience

My Projects and Dashboard

My Projects label or dashboard button is used to display all projects dreamer created, followed and finished, or the projects collaborators participated, followed and finished. Through this function, users can view details of the projects related to themselves.



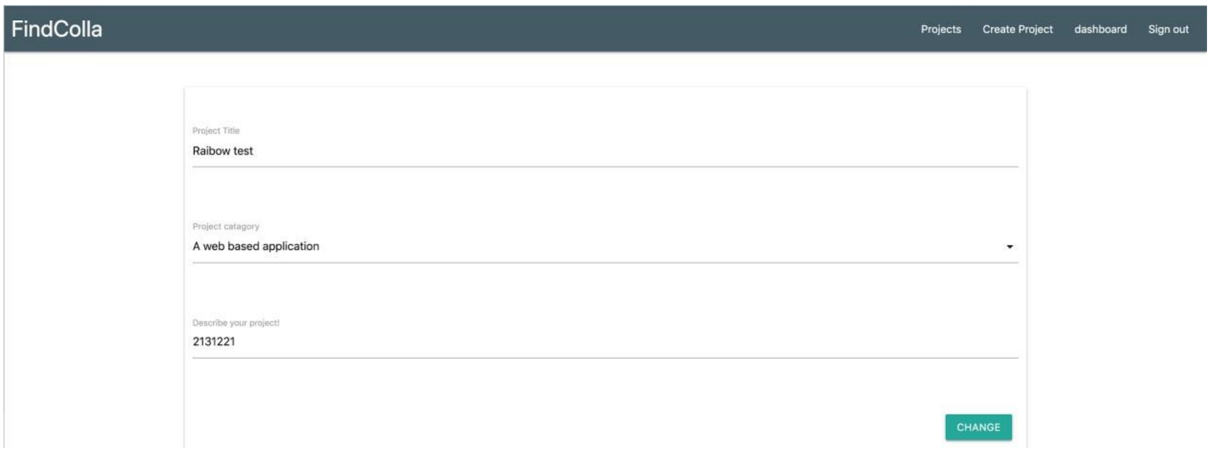
Rainbow III

create project time: 2020-07-25

category: A mobile application

Project modification and Role modification

Only the project owner has the access to patch the project general information and role detail requirements through the CHANGE button designed for each project. This process grants owners more flexibility to modify and provide required information for their projects, or just to correct the mistakes they have made before.

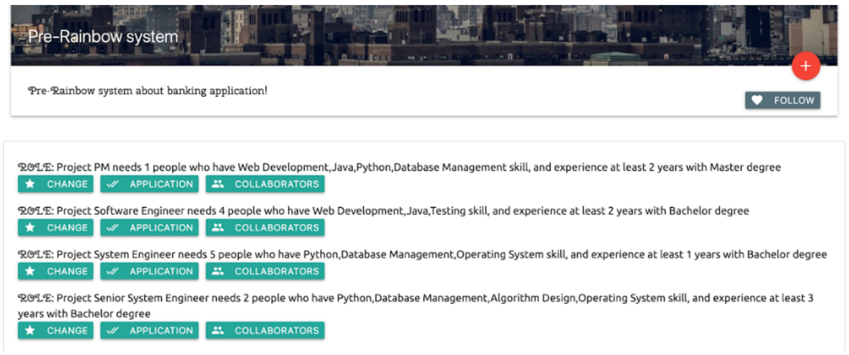


Project Title
Raibow test

Project catagory
A web based application

Describe your project!
2131221

Through the CHANGE button on the project detail page, the project owner has the access to modify an existing role detail including Role title, how many roles needed, general requirements, education, skill and experiences.



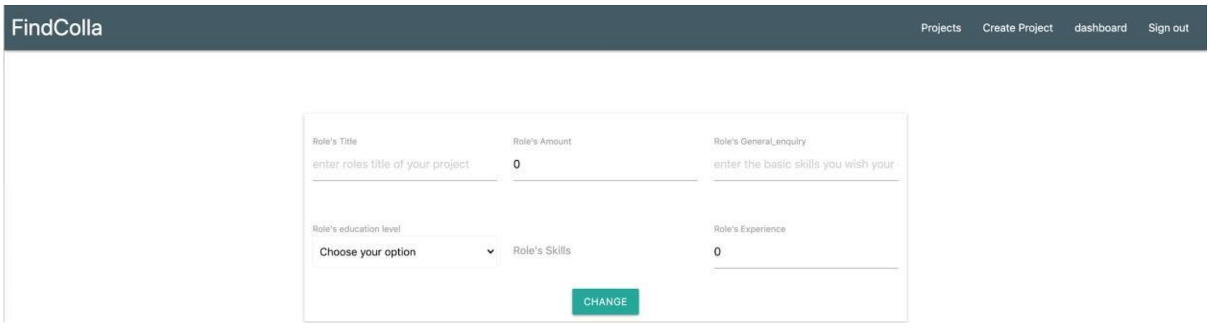
Pre-Rainbow system about banking application!

ROLE: Project PM needs 1 people who have Web Development,Java,Python,Database Management skill, and experience at least 2 years with Master degree

ROLE: Project Software Engineer needs 4 people who have Web Development,Java,Testing skill, and experience at least 2 years with Bachelor degree

ROLE: Project System Engineer needs 5 people who have Python,Database Management,Operating System skill, and experience at least 1 years with Bachelor degree

ROLE: Project Senior System Engineer needs 2 people who have Python,Database Management,Algorithm Design,Operating System skill, and experience at least 3 years with Bachelor degree

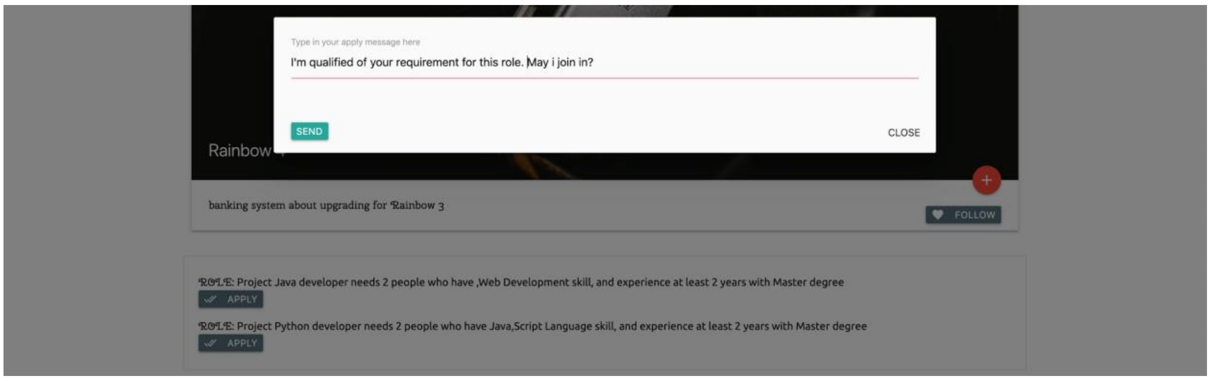


Role's Title: enter roles title of your project	Role's Amount: 0	Role's General_enquiry: enter the basic skills you wish your
Role's education level: Choose your option	Role's Skills	Role's Experience: 0

Apply for a role and Invite a collaborator

While viewing project detail, collaborators are able to APPLY roles on the project detail page, an application email will be sent to the project owner automatically.

SMTPlib of Python3 is implemented to establish a connection to Tencent ExMail and sends emails to users. The system can send emails through the configurable SMTP service to users, not limited to Tencent ExMail.



Type in your apply message here

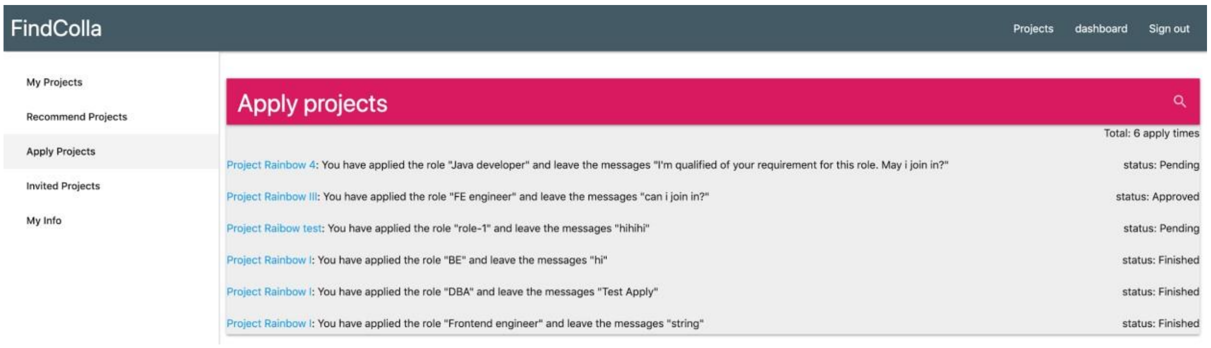
I'm qualified of your requirement for this role. May i join in?

banking system about upgrading for Rainbow 3

ROLE: Project Java developer needs 2 people who have ,Web Development skill, and experience at least 2 years with Master degree

ROLE: Project Python developer needs 2 people who have Java,Script Language skill, and experience at least 2 years with Master degree

A collaborator can check all his applications sent for different roles of the project through the Apply Projects label on his dashboard.



Total: 6 apply times

Project Rainbow 4: You have applied the role "Java developer" and leave the messages "I'm qualified of your requirement for this role. May i join in?" status: Pending

Project Rainbow III: You have applied the role "FE engineer" and leave the messages "can i join in?" status: Approved

Project Raibow test: You have applied the role "role-1" and leave the messages "hihihi" status: Pending

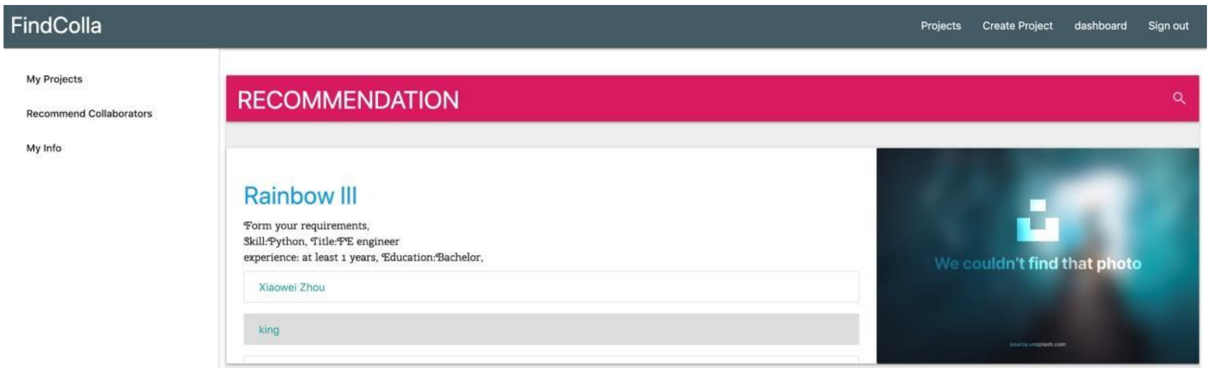
Project Rainbow I: You have applied the role "BE" and leave the messages "hi" status: Finished

Project Rainbow I: You have applied the role "DBA" and leave the messages "Test Apply" status: Finished

Project Rainbow I: You have applied the role "Frontend engineer" and leave the messages "string" status: Finished

Dreamer can invite a collaborator through the recommend collaborators label on the dashboard, click on the name of the recommended collaborators and dreamer can INVITE a collaborator on the COLLABORATOR INFORMATION page.

A notification email of the invitation will be sent to the invitee to remind them to accept or decline the invitation.

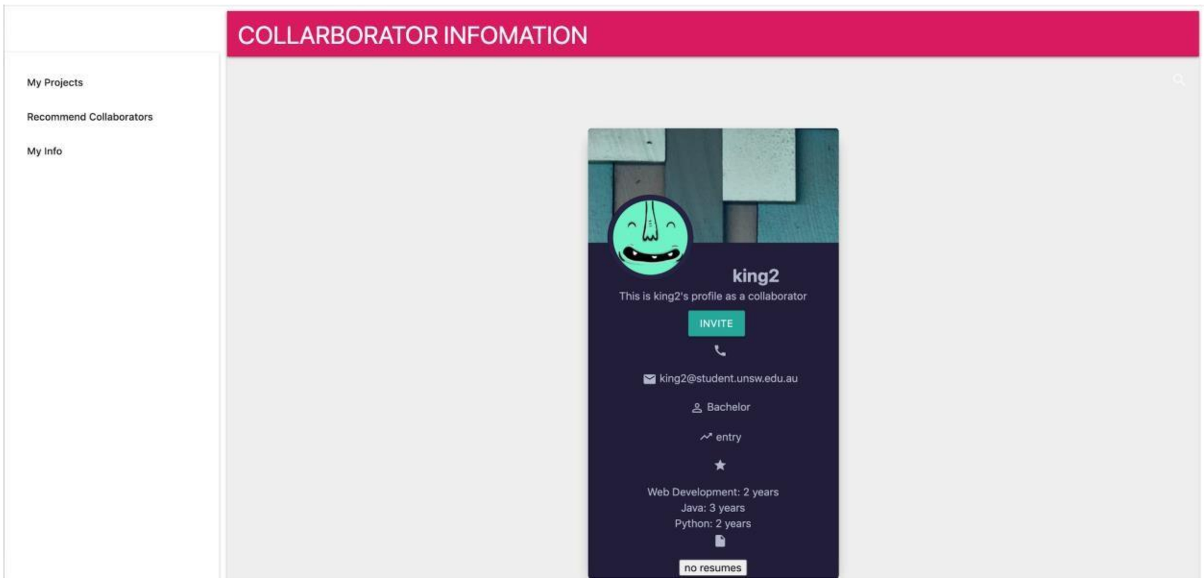


Rainbow III

Form your requirements,
Skill:Python, Title:FE engineer
experience: at least 1 years, Education:Bachelor,

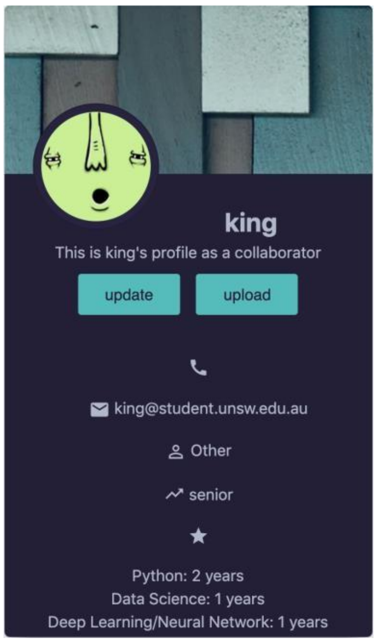
Xiaowei Zhou

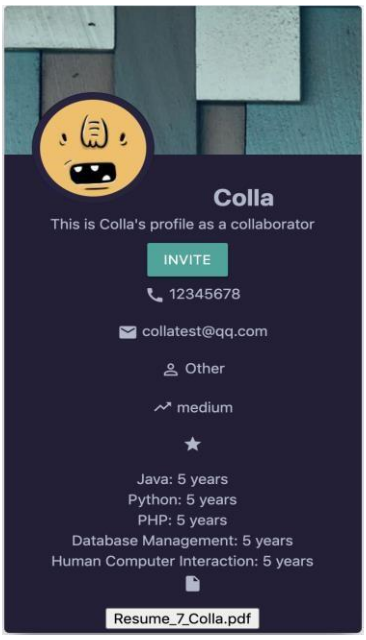
king



Resume uploading/downloading

Resume uploading function is designed for collaborators to upload his formal CV to the system and provides collaborators a chance to show their professional aspects. In order to obtain complete knowledge about the potential collaborators, project dreamers can download the resume of potential collaborators by clicking on the pdf document before they send out an invitation. This is one of the novel features in our system to help acquire formal and complete information of collaborators.



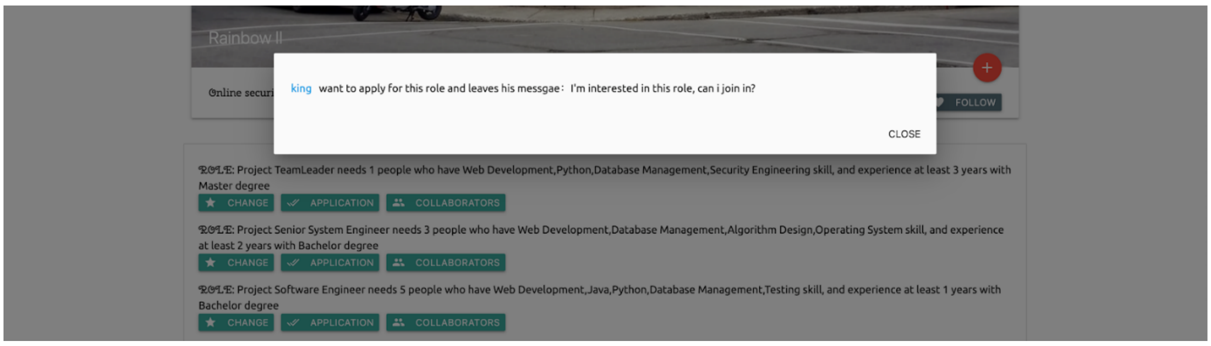

Colla
This is Colla's profile as a collaborator
INVITE
12345678
collatest@qq.com
Other
medium
Java: 5 years
Python: 5 years
PHP: 5 years
Database Management: 5 years
Human Computer Interaction: 5 years
Resume_7_Colla.pdf

The pdf file is not provided through REST API. For smooth experience of downloading and to avoid putting a pdf file in REST API response, the pdf file is backported to provide through Flask, while only its URL is provided in the REST API.

Approve/Decline an application and Accept/Decline an invitation

Through the APPLICATION button on the project detail page, project owners can view one or more applications for each role. By clicking the applicant's name, the project owner can further Approve or Decline the application for a role.

Once all required resources are recruited for a role, the system will automatically decline all other applications which are in pending status and waiting for the dreamer's approval, as well as automatically cancel all related invitations.

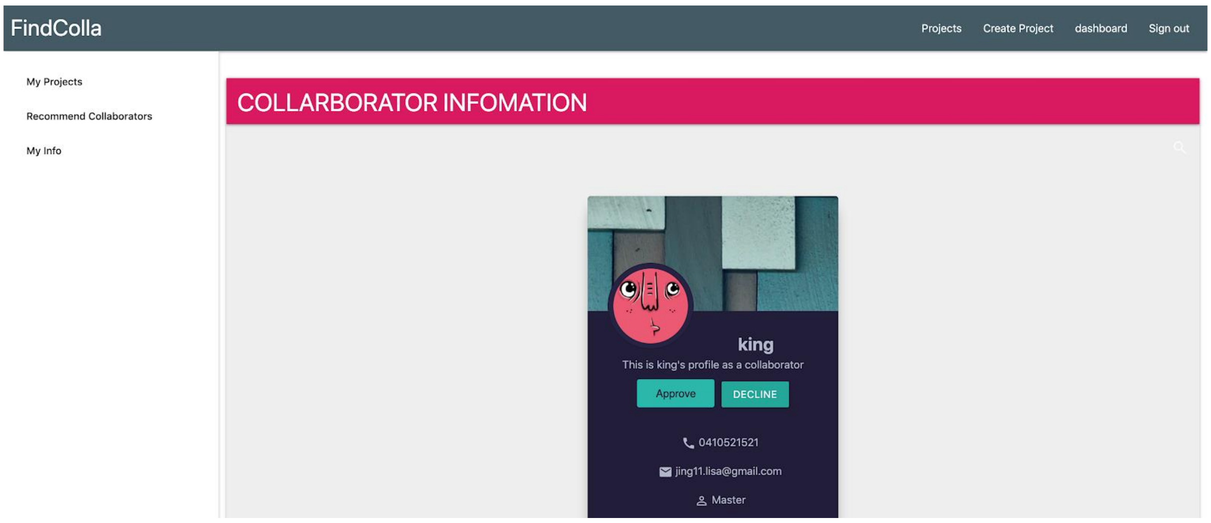


king want to apply for this role and leaves his messgae : I'm interested in this role, can i join in?

ROLE: Project TeamLeader needs 1 people who have Web Development,Python,Database Management,Security Engineering skill, and experience at least 3 years with Master degree

ROLE: Project Senior System Engineer needs 3 people who have Web Development,Database Management,Algorithm Design,Operating System skill, and experience at least 2 years with Bachelor degree

ROLE: Project Software Engineer needs 5 people who have Web Development,Java,Python,Database Management,Testing skill, and experience at least 1 years with Bachelor degree



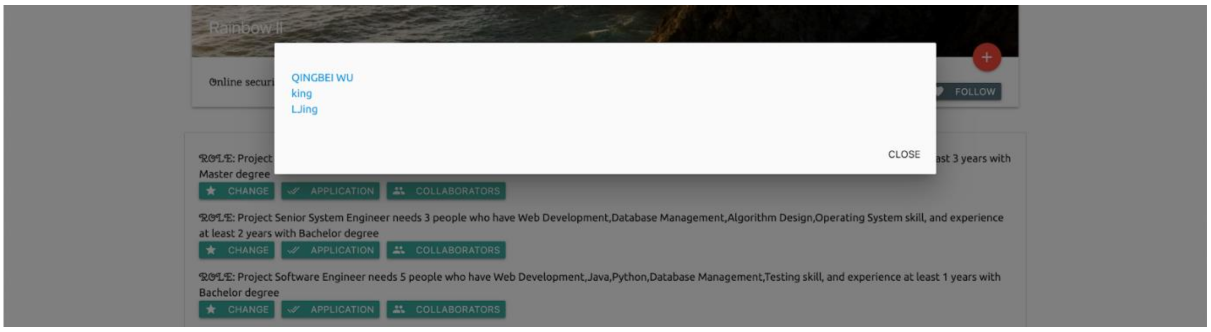
This is king's profile as a collaborator

0410521521

jing11.lisa@gmail.com

Master

After approval, click the COLLABORATORS button under the role, all collaborators who has joined in this role is shown as a list as below snapshot.



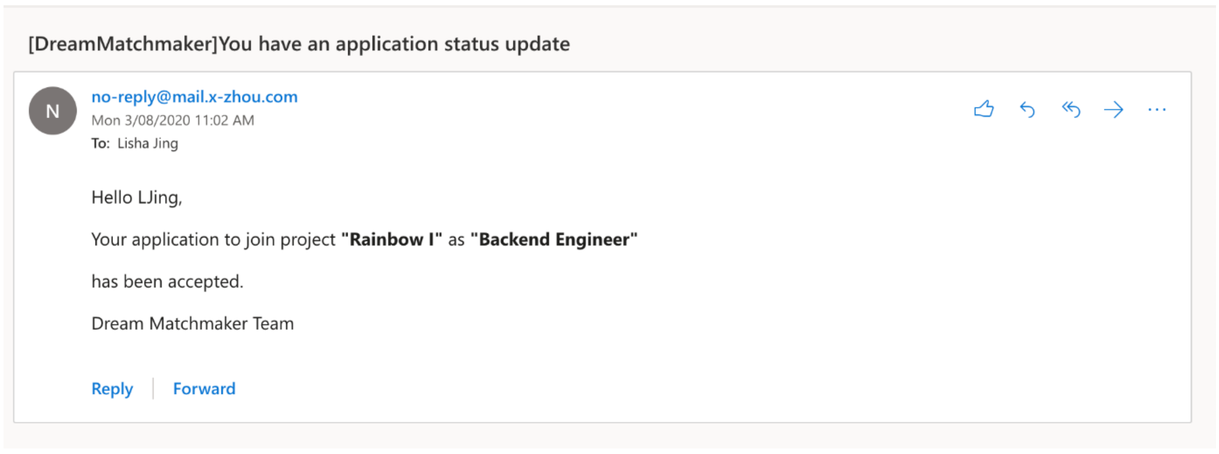
QINGBEI WU
king
LJing

ROLE: Project … ast 3 years with Master degree

ROLE: Project Senior System Engineer needs 3 people who have Web Development,Database Management,Algorithm Design,Operating System skill, and experience at least 2 years with Bachelor degree

ROLE: Project Software Engineer needs 5 people who have Web Development,Java,Python,Database Management,Testing skill, and experience at least 1 years with Bachelor degree

A formatted email will be sent to a related collaborator during the operation after application approve or decline.



[DreamMatchmaker]You have an application status update

no-reply@mail.x-zhou.com
Mon 3/08/2020 11:02 AM
To: Lisha Jing

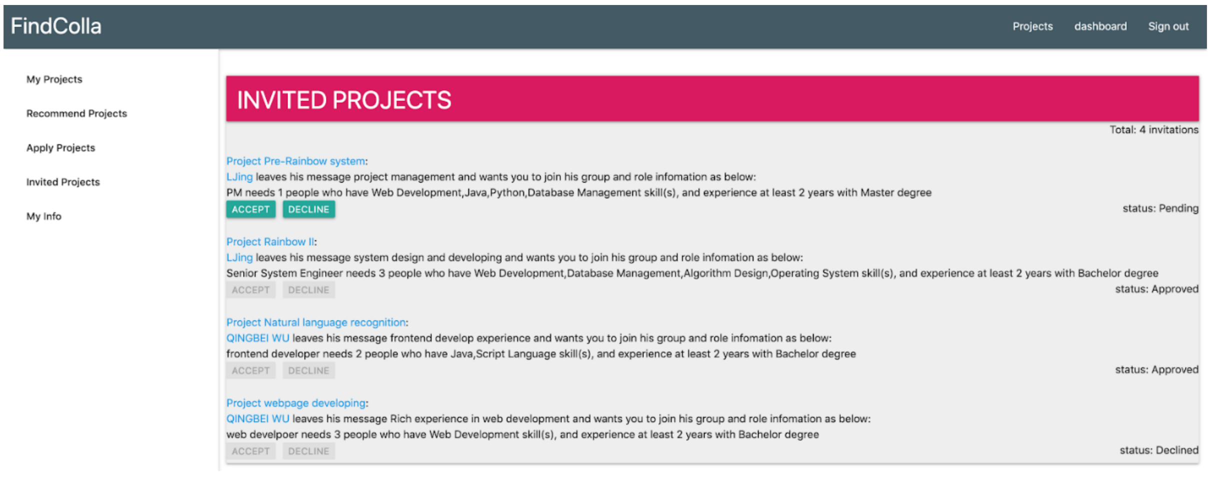
Hello LJing,

Your application to join project **"Rainbow I"** as **"Backend Engineer"**

has been accepted.

Dream Matchmaker Team

Collaborators can ACCEPT/DECLINE an invitation in Invited projects after they get the invitation from dreamers. A formatted email will be sent to the related dreamer during the operation. The ACCEPT or DECLINE button is disabled once the Collaborator has accepted or declined the invitation.



INVITED PROJECTS

Total: 4 invitations

Project Pre-Rainbow system:
LJing leaves his message project management and wants you to join his group and role infomation as below:
PM needs 1 people who have Web Development,Java,Python,Database Management skill(s), and experience at least 2 years with Master degree
status: Pending

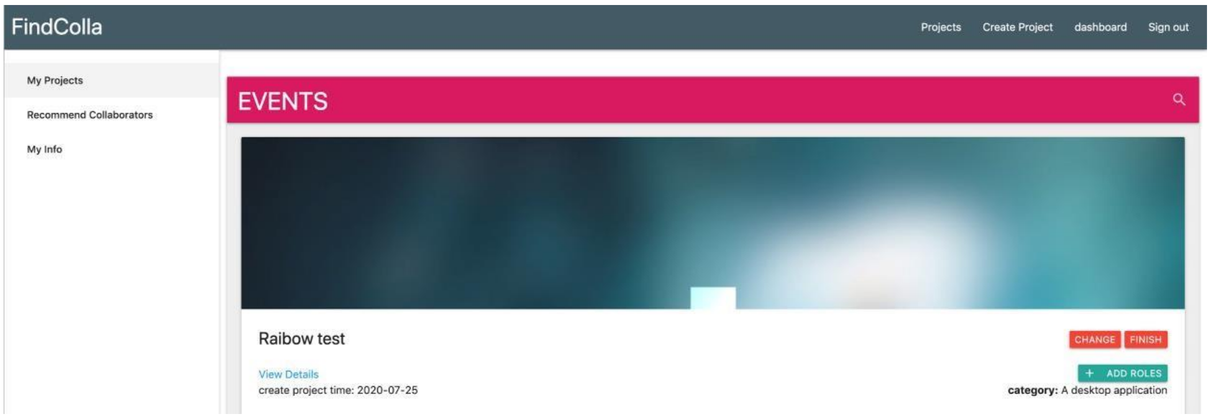
Project Rainbow II:
LJing leaves his message system design and developing and wants you to join his group and role infomation as below:
Senior System Engineer needs 3 people who have Web Development,Database Management,Algorithm Design,Operating System skill(s), and experience at least 2 years with Bachelor degree
status: Approved

Project Natural language recognition:
QINGBEI WU leaves his message frontend develop experience and wants you to join his group and role infomation as below:
frontend developer needs 2 people who have Java,Script Language skill(s), and experience at least 2 years with Bachelor degree
status: Approved

Project webpage developing:
QINGBEI WU leaves his message Rich experience in web development and wants you to join his group and role infomation as below:
web develpoer needs 3 people who have Web Development skill(s), and experience at least 2 years with Bachelor degree
status: Declined

Finish a project

Project owners are allowed to mark the project as finished through the FINISH button once it is completed. Although marked as finished, these finished projects are still visible in my projects label with the lowest priority for both related dreamers and collaborators.

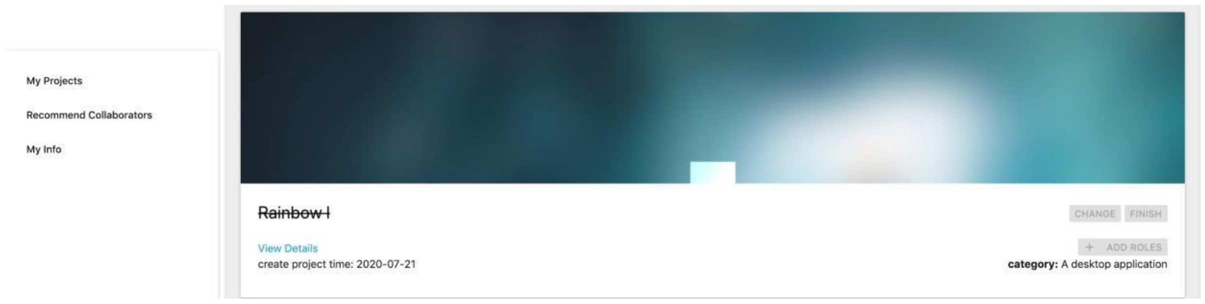


Raibow test

create project time: 2020-07-25

category: A desktop application

Finished projects will be marked with a deletion line on the project name to show that it has been finished. All further modifications of finished projects are disabled.



~~Rainbow I~~

create project time: 2020-07-21

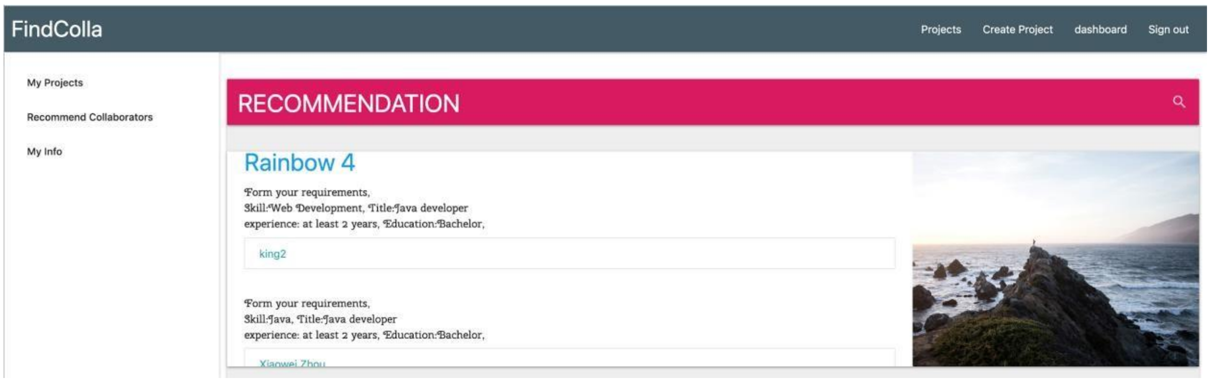
category: A desktop application

Further user level statistics operation for both dreamers and collaborators is implemented in back end system design when the project owner finishes a project. By recalculating how many projects dreamer and collaborators have done separately, the system can set users' proficiency level and provide more professional information for all users, which apparently can facilitate further collaboration between each other.

Recommendation function

The system provides automatic recommendation information for both dreamers and collaborators. Based on the recommendation, dreamer's projects and collaborators can match together more conveniently and efficiently.

Through matching the role requirements of projects and collaborator's profile (including education status, skills and correlated experience) in the back end, dreamers can receive Recommended Collaborators for roles of owned projects.



Rainbow 4

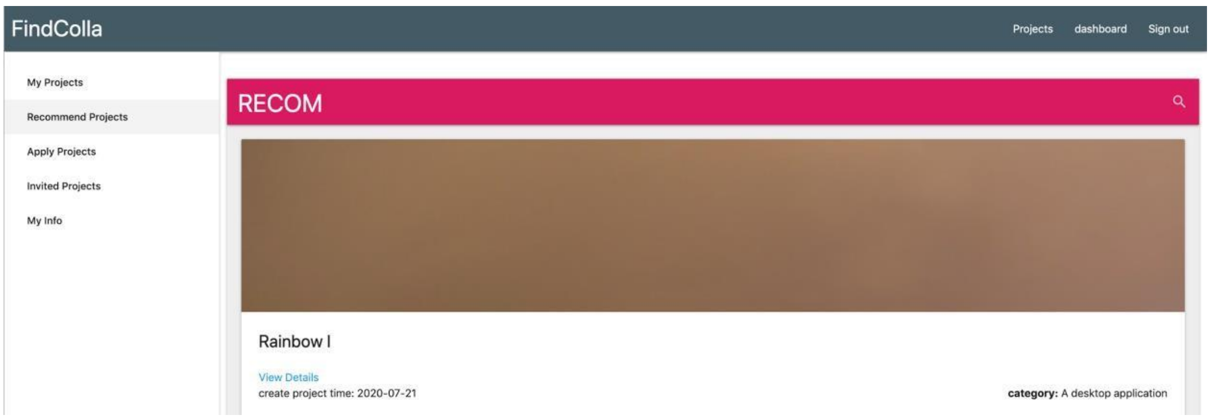
Form your requirements,
Skill:Web Development, Title:Java developer
experience: at least 2 years, Education:Bachelor,

king2

Form your requirements,
Skill:Java, Title:Java developer
experience: at least 2 years, Education:Bachelor,

Xiaowei Zhou

Similarly, the system can automatically provide the recommended projects to collaborators based on their profiles.



Rainbow I

View Details

create project time: 2020-07-21

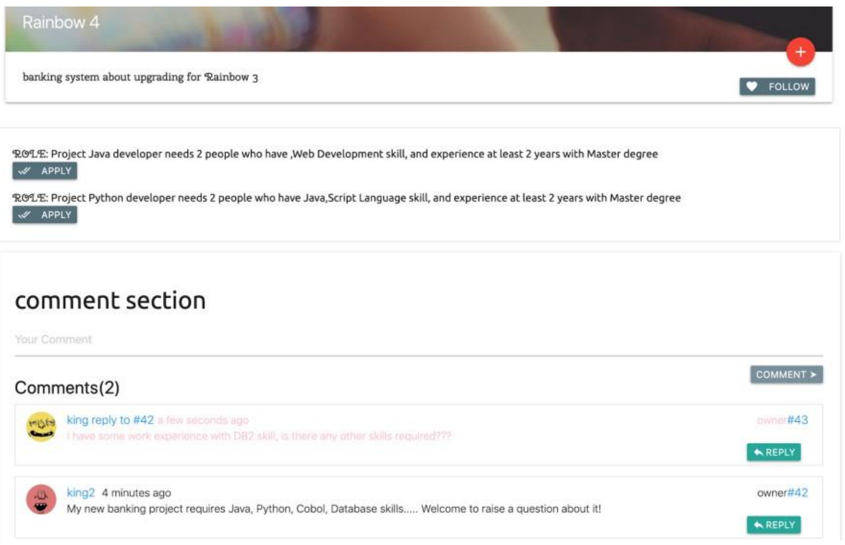
category: A desktop application

A tradeoff was needed to make for the balance of the recommendation quality and quantity during the implementation of the recommendation process. The system should be able to provide the recommendation as accurately as possible and as many as possible. To achieve both goals, the operation is divided into two steps: first matching the role requirements of the project with collaborators' background accurately, then to some extent do relaxing matching with reduced requirements. Through this way, the system can present both accurate recommendations and more qualified records captured by relaxing requirements.

Discussion function

Discussion function is available in the system, In the project detail page, both user and collaborator have the access to COMMENT or give a REPLY in the comment section. This function facilitates the dreamers and potential collaborators to interact with each other about the project.

The discussion section is using a plain design - reply relations are shown by "#discussion id" and "reply to #discussion id" - instead of stacking discussion cards, and the comments from project owner are highlighted with "Owner" label.


Rainbow 4

banking system about upgrading for Rainbow 3

FOLLOW

ROLE: Project Java developer needs 2 people who have ,Web Development skill, and experience at least 2 years with Master degree

APPLY

ROLE: Project Python developer needs 2 people who have Java,Script Language skill, and experience at least 2 years with Master degree

APPLY

comment section

Your Comment

COMMENT

Comments(2)

king reply to #42 a few seconds ago owner#43
I have some work experience with DB2 skill, is there any other skills required???

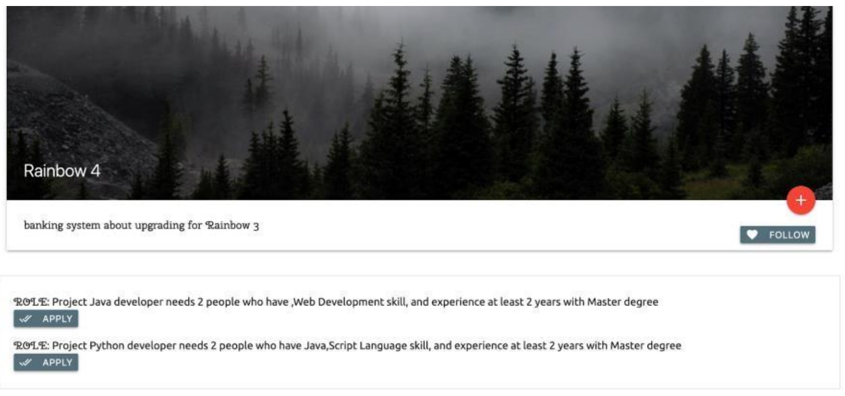
REPLY

king2 4 minutes ago owner#42
My new banking project requires Java, Python, Cobol, Database skills..... Welcome to raise a question about it!

REPLY

Follow/Unfollow function

Follow/Unfollow function is added for each project in this system, Dreamer or collaborator have the access to follow or unfollow a project in the project detail page by clicking FOLLOW/UNFOLLOW button.


Rainbow 4

banking system about upgrading for Rainbow 3

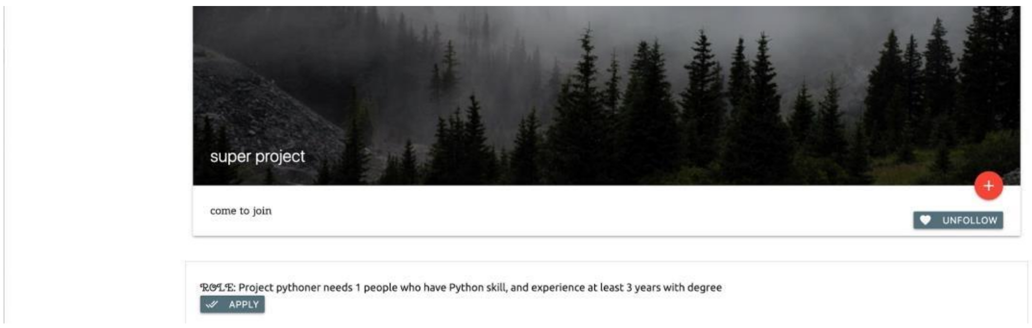
FOLLOW

ROLE: Project Java developer needs 2 people who have ,Web Development skill, and experience at least 2 years with Master degree

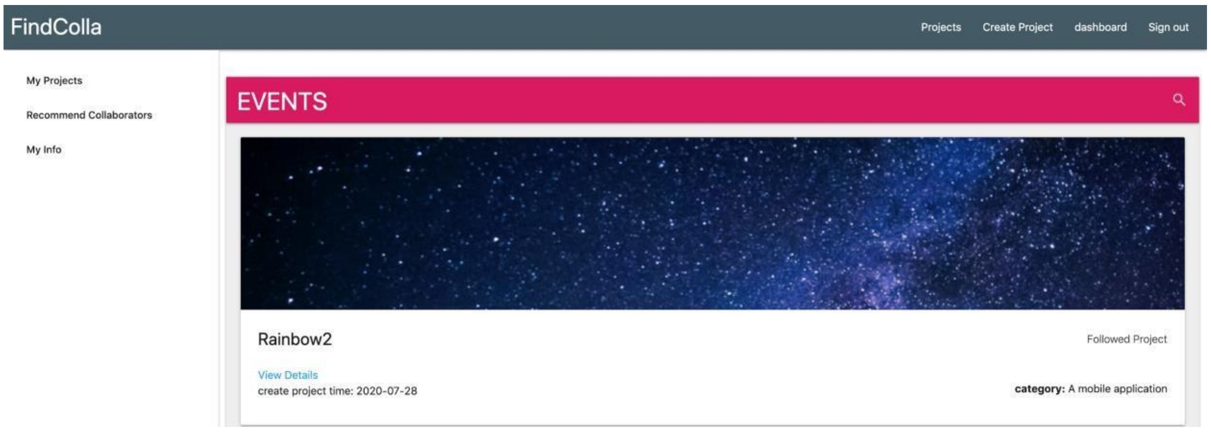
APPLY

ROLE: Project Python developer needs 2 people who have Java,Script Language skill, and experience at least 2 years with Master degree

APPLY

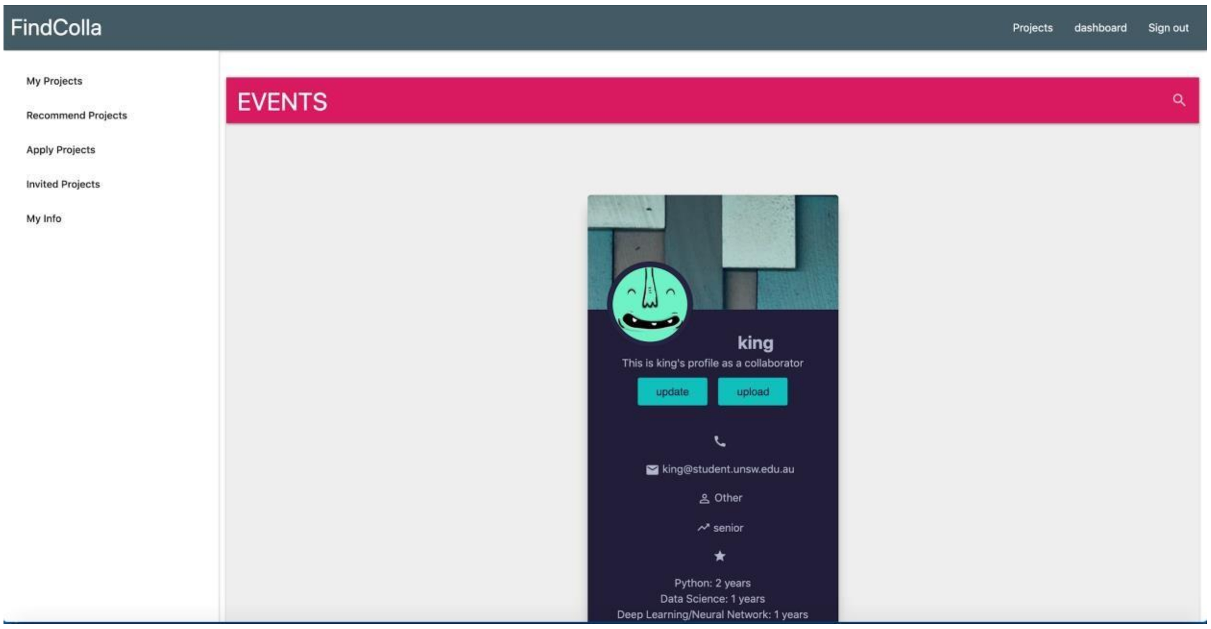

super project
come to join
UNFOLLOW
ROLE: Project pythoner needs 1 people who have Python skill, and experience at least 3 years with degree
APPLY

All following projects are labeled as Followed Project in the My Projects or user's dashboard. Users can find these following projects quickly and access the details easily.



My Info function

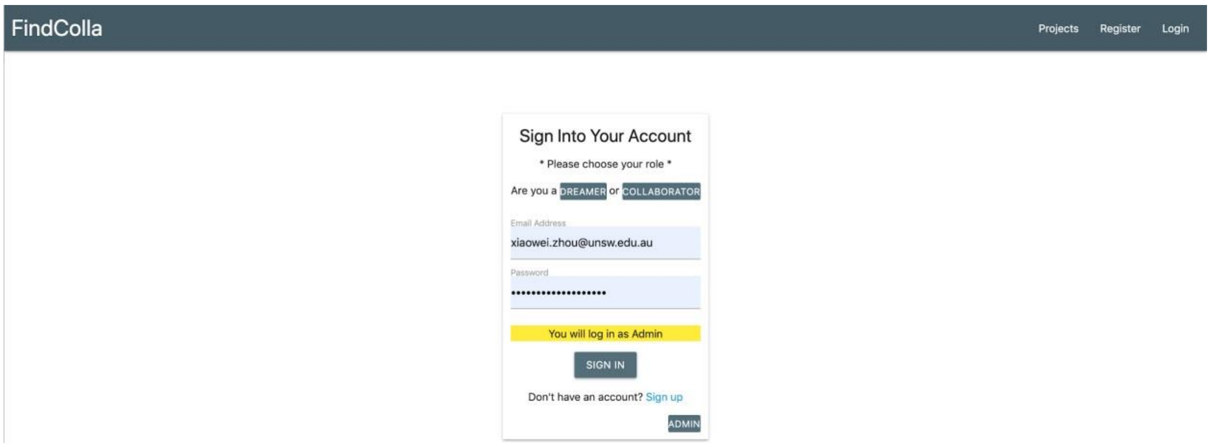
My info is designed to show the user's profile. Collaborators can update their profile info and upload their formal CV into the system. A user level field is used to show the current user's proficiency based on the statistic of projects the dreamer or collaborators have completed, and labeled as entry, medium, senior, professional or expert.



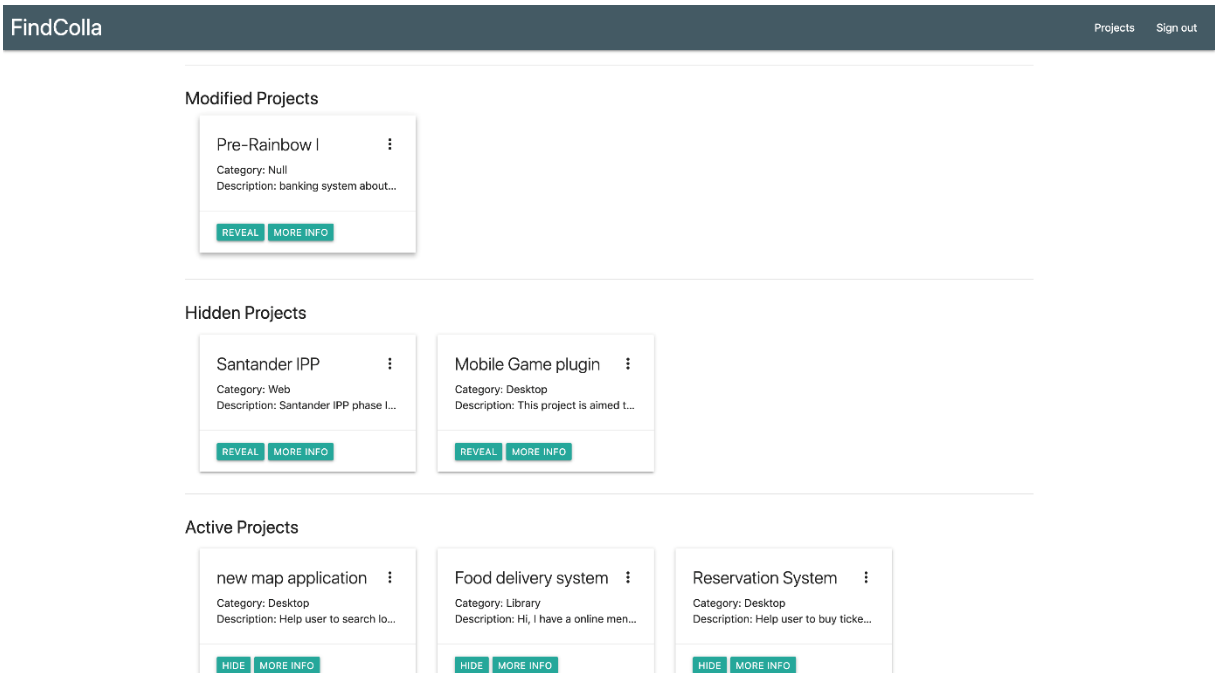
Admin Dashboard

Hide/Unhide function

Admin identity is available on the dream matchmaker website.



Admin has the access to audit all the projects existing in the system and can further HIDE a project if any improper or illegal contents are found, and a formatted email will be sent to inform the project owner to do modification. All Hidden Projects are not visible to all users if it is hidden. Administrators also can REVEAL (unhide) a project if the improper or illegal contents have been modified or removed by its owner. All modified projects after hidden will be listed in Modified projects. The project is visible again to all users if it is revealed.



Future Feature Roadmap

In-site Notification

For a professional and sophisticated website, in-site notification is an indispensable function as it is known. Creating an in-site notification is much quicker than sending an email, and all notifications are available without spending more time checking the mailbox when users are actively using the website. Due to limited human resources during the development, only email notification function was implemented. In-site notification function is not provided as expected in the system. Thus, adding in-site notification is one of the most important tasks in future features.

Front End Page Layout Design

Due to limited time and front-end developers, main functionality implementation was focused during the whole project developing cycle, and only extremely limited time and energy was spent on the front-end page layout design. Therefore, the current website system has a very simple page layout and the page content. So, furthermore improvements can be applied on front end page layout design and enriched page contents can be served for better user experiences.

System Respond Time

As mentioned above, the dream matchmaker system only has a formatted email notification service to inform users about related important actions. Since creating an email and sending it to a user is a time-consuming operation, SMTP connection timeout issue is not inevitable sometimes during mail sending, more time is required to reconnect SMTP to ensure that users can get email notifications about the important operations. That is why sometimes the system response is not as fast as we expect. Therefore, lowering the system response time is another important part to improve user experiences of using this website. Using in-site notification can largely reduce the use of email, leading to a reduction of system response time. Another way is to implement some more professional and advanced methods (e.g. Thread pool and email queue for SMTP sending) for both front end and back end development, and it would require much more human resources and working hours which are out of scope of the plan of this project.

Implementation Challenges

Front End

Redux alert error

The alerts generated by uuid some time are not clear. We use uuid to give each alert one unique id to cleat it in 6 seconds using setTimeOut function. And the outcome is most alerts are clear but some time maybe one alert is still in the Redux store, which continues showing on all the pages. After deleting the browser cookie, the alert message will disappear as expected.

CORS issues

In the first stage of development, the CORS header can not properly get the response values. The connection can be established normally until we tried to use a cross domain proxy.

Modal not response

Some pages with the materialized modals can not be closed normally during the testing phase. After long time analysis and debugging we located that it was the materialize setup issues in React framework.

Back End

SQLAlchemy connection packet id error

SQLAlchemy connection is not thread safe and designed to be thread-local.

In development, a singleton connection object was used to pass into different REST API call functions, taking the connection object as a global object. The thread issue was not noticed until the functional test since we got lots of 500 Internal Server Error.

The team acknowledged that SQLAlchemy connection is thread-local - sharing connection objects among different threads will lead to unexpected packet id error. Finally, we chose to implement our project using thread-local connections as a solution: creating a new connection object for each API call to make it thread-local.

We re-coded the database connection class(db.py) to create a connection object on each call of conn() function. The connections are managed by SQLAlchemy queue pool with configurable size and overflow in db.config.

The main service code in app.py was modified to adopt the changes. In each API method a connection is created by calling db.conn(), and closed at the end of the API method to return the connection to the connection pool, which perfectly implements the connection object to thread-local.

SMTPlib connection timeout to Tencent ExMail

SMTPlib of Python3 is used to establish connection to Tencent ExMail and sends emails to users. The SMTP object threw errors to us during testing though it's thread-safe. Email sending worked normally after the backend restarted but throwing error issues still exist from time to time. The issue is not identified until we deployed our project onto Google Cloud Platform.

To solve it, we tried to reconnect the SMTP object when receiving a timeout. However, this method did not work - reconnecting a SMTP object will directly lead to an error when the connection is up.

We had to move to another solution: catch the SMTPException raised by server.sendmail function which is usually caused by connection timeout, reconnect the smtp connection and send the email again once the exception is captured. In this way, the system can send emails normally with auto reconnection of SMTP and waste no performance cost on keeping the SMTP connection periodically.

Resume upload/download

The system backend uses Flask-Restplus which provides REST APIs as service. REST APIs only allow models and return in JSON format, which is not applicable to include a large resume file. To implement this function, using FileStorage type in werkzeug.datastructures as a field of put parser, file can be uploaded to the system backend. Then check the file and make sure it is in PDF format, rename it into "Resume_userID_user_full_name.pdf" and save it in the file directory. This is the first step to solve the issue.

Since the PDF files can't be put in REST returns, a Flask API is applied to provide the file (/download/<path:filename> in app.py) instead of Flask-Restful API. By providing the file name through REST API (/collaborator/<int:id>/resume in app.py), the front end can figure out the download URL of a specific resume PDF document. and then it can be sent out by send_from_directory method from Flask to users.

Recursive import issue

In the implementation phase, information from several different classes is inevitable as we designed. Cross importing between two classes caused an infinity recursive import issue although Python can process all imports when starting to initialise classes.

To resolve this, several imports were moved from the beginning of class initialisation into the class method call. Thus, infinity recursive import issue can be avoided since Python will not process the import in a class method until it is called. Using this method different methods in each class can be called easily and freely, duplicate codes can be avoided, and the backend programs are more efficient.

Python subdirectory import

Separating code files into several sub-directory makes our developing progress easier. However, the directory path should be considered when importing from sub-directory - the relative path from working directory is hard to be fixed, and using os module to get the working directory will lower the code readability, especially when import classes are across several sub-directory.

Instead of reading the working directory, the trick of the python package is discovered. By adding an empty __init__.py to each directory, these directories are taken as packages in python, then the package format of import can be applied. In this way, classes in projects/ and users/ can be imported by projects.class_name and users.class_name anywhere in the back-end code.

Third-party Functionalities/Frameworks

Platform

Google Compute Engine

Google Compute Engine (GCE) provides great scalability and good balance between price and performance (Compute Engine: Virtual Machines | Google Cloud 2020). The system can be deployed easily with a high service availability by selecting a proper VM.

Tencent Enterprise Email Service

Tencent Exmail (Tencent Exmail 2020) allows custom domain names as email accounts and send-out email addresses with high accessibility of SMTP service. By selecting Tencent Exmail (Basic Edition), we can use the system's domain name as email address and send-out specific email address with SMTP access token instead of normal email SMTP.

MariaDB 10.1.44

As a popular open source RDBMS, MariaDB provides high compatibility with MySQL service and additional enhancements and keeps itself released under GNU GPL license. With MariaDB we can avoid the licensing issue from Oracle MySQL without losing the ease of using MySQL.

MariaDB service code is not shipped with our product, the GPL license does not apply. We only connect to a MariaDB service with no modification, the GNU LGPL v2 license of the connector allows us not to release our product under GNU GPL.

Front End

Node.JS

Node.js is a platform based on the run time of Chrome JavaScript. It is mainly used to create fast and extensible web applications. Node.js adopts an event-driven and nonblocking I/O model to make it lightweight and efficient, which is very suitable for building data-intensive real-time applications running on distributed devices.

Npm

NPM management tool helps solve many problems in code deployment of node.js, e.g. users are allowed to upload/download third-party packages to/from NPM server and install command-line programs for local use.

React.JS 16.13.1

React is an open-source JavaScript library that is used for building user interfaces especially for single-page applications. It handles the view layer for web and mobile apps and reusable UI components creation.

Materialize Css 1.0.0-rc.2

Materialize css is a modern responsive css framework based on Material Design by Google.

Axios 0.19.2

Axios is a popular JavaScript library to perform HTTP requests, which works in both Browser and Node.js platforms. It supports all modern browsers including IE8 and higher. The promise-based feature makes write async/await code to perform XHR requests easily.

Redux 4.0.5

Redux is used for state management for the application.

React-hook

React-hook provides functions instead of constantly switching between functions, classes, higher-order components and render props.

Back End

Flask 1.1.2

Flask (Flask PyPi 2020) is a lightweight web development framework. Depending on Werkzeug and Jinja, it serves as the base of several other Flask related libraries.

Flask is released under BSD License, allows our product to use it freely and can distribute as a commercial product in the future.

Werkzeug 0.16.1

Werkzeug (Werkzeug PyPi 2020) is a “comprehensive WSGI web application library”. It is an important dependency of our other libraries (e.g. Flask) and its original API is used to provide some function.

Werkzeug is released under BSD License.

flask-restplus 0.13.0

Flask-Restplus (flask-restplus PyPi 2020) is “an extension for Flask that supports for quickly building REST APIs”. It is used as the main service of the backend and provides REST APIs for the frontend for interaction.

Flask-restplus is released under BSD License.

PyJWT 1.7.1

PyJWT (PyJWT PyPi 2020) provides an implementation of RFC 7519 in python. It allows us to use jwt HS256 encoded tokens. It works as our authorisation token through front end to back end.

PyJWT is released under MIT License, allows our product to use it freely and can distribute as a commercial product in the future.

PyMySQL 0.9.3

PyMySQL (PyMySQL PyPi 2020) is a MySQL client library or called connector driver in pure python based on PEP 249. It serves as the driver for SQLAlchemy to connect to our database service. PyMySQL is released under MIT License by Yutaka Matsubara, maintained by Inada Naoki.

PyMySQL is released under MIT License.

PyYAML 5.3.1

PyYAML (PyYAML PyPi 2020) is a parser of YAML 1.1, with support of Unicode. YAML is used as our configuration file format and PyYAML as a parser to read in and configure the back end.

PyYAML is released under MIT License.

SQLAlchemy 1.3.17

SQLAlchemy (SQLAlchemy PyPi 2020) provides connections to different types of databases. It connects to our MariaDB service together with PyMySQL as the connection driver. SQLAlchemy provides ORM and pure SQL execution, and thread pool for connections to be reused as well as naturally support multi-threading.

SQLAlchemy is released under MIT License.

System Setup Documentation

Installation Guide

The product has been deployed on our server, at http://gcp.x-zhou.com:3000/. The backend REST API swagger page is set to be publicly accessible for testing and demo, at http://gcp.x-zhou.com:5000/.

The product is supposed to be compatible with both Linux and Windows. The following guide is written for the Linux environment, tested on Ubuntu 18.04 x64.

In this part, text started in $ and with grey background represents commands executed in Linux shell.

Environment Setup

0. (Optional) We suggest using Linux screen command to ensure service is managed properly and can be detached when using SSH. If you have the same thought, you may install screen by:

```
$ sudo apt-get install screen
```

To learn how to use screen, you may follow the guide below:

How To Use Linux Screen, Linuxise 2020.

The link of this online resource is available in reference, as well as all other resources below.

Database:

You may use separate MySQL services or install MySQL/MariaDB in your environment. The following guide may help. The link of these resources is available in reference.

How To Install MySQL on Ubuntu 18.04, Mark Drake 2020.

How To Install MariaDB on Ubuntu 18.04, Brian Boucheron 2020.

Tested version: MariaDB 10.1.44

Backend:

0. (Optional) Update and upgrade your system to avoid dependency issue:

```
$ sudo apt-get update
```

```
$ sudo apt-get upgrade -y
```

1. Install Python3, Pip3 (Together with Python3 usually), git by the following command:

```
$ sudo apt-get install python3 python3-pip git
```

You may also want to upgrade pip3 to its latest version by the following command:

```
$ python3 -m pip install pip –upgrade
```

Make sure you have installed Python 3.6 or higher version - the product backend is not compatible with Python 3.5 or lower.

Tested combination of python and pip: Python 3.6.9 + Pip 20.1.1; Python 3.8.2 + Pip 20.1.1.

2. Now you can clone the project using git https:

```
$ git clone https://github.com/unsw-cse-capstone-project/capstone-project-salted-fish.git
```

or using git ssh:

```
$ git clone git@github.com:unsw-cse-capstone-project/capstone-project-salted-fish.git
```

And then move to back end directory by:

```
$ cd capstone-project-salted-fish/backend/
```

3. (Optional) A Python virtual environment is suggested for properly managing python packages for different python projects. Some package version requirements are fixed and

not latest - which may conflict with other services you may run. You can install virtual environment by:

```
$ python3 -m pip install virtualenv
```

And then create a clean virtual environment by:

```
$ virtualenv --no-site-packages env
```

Now you have created a virtual environment called env, and you will find a folder called env in the backend directory. You can activate (get in) the environment by:

```
$ source env/bin/activate
```

You can quit the environment by:

```
(env)$ deactivate
```

4. (Virtual Environment) Now you can install required libraries by:

```
(env)$ python3 -m pip install -r requirements.txt
```

Frontend:

0. (Optional) Update and upgrade your system to avoid dependency issue:

```
$ sudo apt-get update
```

```
$ sudo apt-get upgrade -y
```

1. The system is built for Node.JS 12.x LTS, you can install by the following steps:

Add Node.js APT repository to your system

```
$ sudo apt install -y curl, dirmngr apt-transport-https lsb-release ca-certificates
```

```
$ curl -sL https://deb.nodesource.com/setup_12.x | sudo -E bash -
```

If you are using other Linux distributions, you may refer to the following resource to check if you are available to use Node.js APT repository:

NodeSource Node.js Binary Distributions, NodeSource 2020.

You may also want to download and install Node.js installer or source code for your system (Windows, macOS, Linux). They are available at:

Node.js Downloads, OpenJS Foundation 2020.

2. Install Node.js 12 LTS:

```
$ sudo apt-get install -y nodejs
```

After installation, you can run:

`$ node -v` and `$ npm -v` to see the version of installed Node.js and Npm.

The front end is tested and deployed with Node.js 12.18.2 (LTS) and Npm 6.14.5.

System Configure and Run

Backend:

0. You need to create a database in your database service, and also create a user with privileges granted to the database identified by some password. Record the name of database, username, password, address of your database service, port of your database service.

There is no fixed command to do these, but you may follow the guide in the Database setup part for some information.

1. Now you can edit backend/db.config to put your database information in. You may also leave it with no change to use the demo server database deployed by us. When editing the config file, you need to ensure it is in valid YAML format with UTF-8 encoding.

2. Edit backend/server.config to set up the admin account information. This will also be the first dreamer and collaborator account. When editing the config file, you need to ensure it is in valid YAML format with UTF-8 encoding.

3. (Virtual Environment) (Optional) If you want to use the demo server database, do NOT process this step as this will clean the demo database.

If you are using your own database and have correctly configured backend/db.config, run:

`(env)$ python3 pre_init.py` to generate all required database tables into your own database.

4. (Virtual Environment) Now you can run the backend service by:

```
(env)$ python3 app.py
```

Now you can see the back end REST API swagger page at http://localhost:5000/.

Frontend:

0. (Optional) If you are deploying front end and back end in separate platforms, or you are deploying the system to public accessible domain name, you may need to change the proxy attribute in capstone-project-salted-fish/frontend/package.json to make sure that front end service is correctly connected to a valid REST API service.

Example: deploy the front end to gcp.x-zhou.com:3000 with back end at gcp.xzhou.com:5000:

Change `“proxy”: “http://localhost:5000”` to `“proxy”: “http://gcp.x-zhou.com:5000/”`.

Then, change the downloadUrl (line 98) variable in file capstone-project-saltedfish/frontend/src/component/dashboard/dreamerCollaCards.js to:

```
const downloadUrl = “http://gcp.x-zhou.com:5000/download/” + this.state.resume.filename;
```

1. Move to front end directory by:

```
$ cd capstone-project-salted-fish/frontend/
```

If you have not cloned the project files yet, see Environment Setup - Backend - 2.

2. Construct the frontend modules by:

`$ npm install` or `$ npm i`. You can find all the dependencies in package.json file

3. Make sure back end service is already running, and then start the frontend service by:

```
$ npm start
```

After this, you can see the front end of the service at http://localhost:3000/.

Use the System

User Register/Login

Refer to System Feature Walkthrough: Customer App - Landing page, Register and Sign in.

Browsing Projects

Refer to System Feature Walkthrough: Customer App - Projects browsing and searching.

Create Projects as Dreamer

Refer to System Feature Walkthrough: Customer App - Project creation / Adding roles.

Modify Projects as Dreamer

Refer to System Feature Walkthrough: Customer App - Project modification / Role modification.

Apply as Collaborator / Invite as Dreamer

Refer to System Feature Walkthrough: Customer App - Apply for a role and Invite a collaborator.

Accept/decline Application or Invitation

Refer to System Feature Walkthrough: Customer App - Approve/Decline an application and Accept/Decline an invitation.

Finish a Project as Dreamer

Refer to System Feature Walkthrough: Customer App - Finish a project.

Use Recommendations

Refer to System Feature Walkthrough: Customer App - Recommendation function.

Post Discussions

Refer to System Feature Walkthrough: Customer App - Discussion function.

Follow/Unfollow Projects

Refer to System Feature Walkthrough: Customer App - Follow/Unfollow function.

User profile Card

Refer to System Feature Walkthrough: Customer App - My Info function.

Upload/Download Resume

Refer to System Feature Walkthrough: Customer App - Resume uploading/downloading.

Hide/Unhide project as Admin

Refer to System Feature Walkthrough: Admin Dashboard – Hide/Unhide function.

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