CollabUS

Ignite Innovation

Capstone Project Proposal
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BE Third Year- CSE

CPG No. 183

Under the Mentorship of

Dr Payal Mittal

Designation

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

Computer Science and Engineering Department

Thapar Institute of Engineering and Technology, Patiala

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Mentor Consent Form

I hereby agree to be the mentor of the following Capstone Project Team

Project Title: CollabUS		
Roll No	**Name**	**Signatures**
102216099	Arshdeep Palial	
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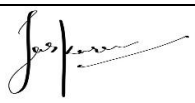
102216110	Jaskaran Singh	
102216071	Hardik Kundal	

NAME of Mentor: Dr Payal Mittal

SIGNATURE of Mentor: 

Project Overview

CollabUS is a next-generation collaboration platform designed to connect students and teachers, fostering academic growth and interdisciplinary innovation. It leverages advanced AI-driven features to help students find the right peers for projects, competitions, and research, while also enabling teachers to securely share their work, identify potential mentees, and contribute to knowledge-sharing communities.

Key Features

1. Smart Collaboration & Team Building

- **Solution:** AI-driven recommendations match students with ideal teammates based on skills and goals.

2. Skill Verification

- **Solution:** AI assessments and mentor evaluations ensure team members are qualified and reliable.

3. Mentorship & Knowledge Sharing

- **Solution:** A dedicated space for sharing insights via blog posts and discussions.

4. Research Collaboration

- **Solution:** A hub where educators post research ideas to connect with interested students.

5. Personalized Opportunity Management

- **Solution:** A curated system prioritizing relevant internships, scholarships, and competitions.

Additional Functionalities

- **Digital Notice Boards:** Academic and extracurricular updates.
- **Lost & Found Services:** Community-driven feature for recovering lost items.

Future Enhancements

- **Live Leaderboard Services:** Real-time tracking of competition performance.
- **Blockchain Security:** Secure storage for research papers.
- **Random Brainstorm Roulette:** AI-matched discussions for creative collaboration.

Problem Statements

- **Collaboration and Team Building**
  Students often struggle to find the right peers for forming effective teams for competitions, hackathons, capstone projects, and other initiatives.
- **Ensuring the Right People**
  It's challenging to determine if a candidate truly possesses the skills they claim. A right person is someone you can trust to complete assigned work using their skills without constant oversight. Without proper verification, it becomes difficult to build teams with dependable members.
- **Learning from Experiences That Matter**
  Many students face significant challenges in academics, extracurricular activities, and career decisions but often lack access to effective guidance and mentorship.
- **Connecting the Right Student to the Right Teacher**
  Students often struggle to pursue their desired research topics due to difficulties in finding the right mentor. At the same time, teachers find it hard to locate passionate students for collaborative research projects, which stifles innovation.
- **Focusing on What Really Matters**
  Students frequently miss out on important opportunities like internships and competitions because their academic inboxes are cluttered with irrelevant emails, leading to wasted time and effort.

Need Analysis

The academic community is evolving, yet there remains a lack of structured collaboration between students and faculty. CollabUS bridges this gap by offering:

- **Effortless Peer Matching**: AI-powered recommendations help students find the best teammates for collaboration.
- **Knowledge Sharing**: Blogs and discussion forums connect juniors, seniors, and faculty, fostering knowledge exchange.
- **Skill Authentication:** A credible verification system enhances students' employability and learning credibility.
- **Secure Research Sharing**: Teachers can safely distribute their work while ensuring intellectual property protection.
- **Gamified Learning Environment**: Badges and leaderboards encourage engagement and participation.

Literature Survey

Introduction

Our collaboration platform is designed to empower students and teachers by addressing key challenges in academic and extracurricular environments. We focus on five core areas: team building, skill verification, mentorship and guidance, research collaboration, and opportunity management. By leveraging advanced AI and NLP technologies, our platform transforms student profiles into actionable insights, verifies competencies in real time, and connects users with meaningful opportunities. The following survey outlines how seminal research inspired these features.

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1. Collaboration and Team Building

Challenge:
Students often struggle to form teams that blend the right mix of skills and share a common vision—critical for success in competitions, hackathons, and capstone projects.

Solution in Our Project:
We use an NLP-based recommendation engine that transforms detailed student profiles (covering skills, interests, and project goals) into natural language representations. Advanced language models then compare these profiles to recommend balanced, cohesive teams.

How Research Inspired This Feature:

- **MDPI Paper "Collaboration Recommendation for Academic Teams":**
  This study detailed how machine learning and big data techniques can evaluate team compatibility by measuring complementary skills and shared vision. Its approach provided a blueprint for our matching criteria.
  Link: https://www.mdpi.com/2504-2289/6/4/147/

- **"Finding a Team of Experts in Social Networks" (Lappas et al., 2009):**
  Originally focused on expert team formation via social network analysis, this work's concept of balancing expertise and communication cost was adapted into our NLP framework by comparing textual descriptions of student profiles rather than network connections.
  Link: https://dl.acm.org/doi/pdf/10.1145/1557019.1557074/

2. Ensuring the Right People (Skill Verification)

Challenge:
It's crucial to continuously verify that candidates truly possess the skills they claim, as unverified skills can lead to underperformance and jeopardize team success.

Solution in Our Project:
Our platform integrates AI-powered assessments focused solely on verifying competencies. Adaptive algorithms and machine learning models update each student's competency profile in real time using a minimal number of targeted questions, ensuring that team formation is based on accurate, up-to-date skill measurements.

How Research Inspired This Feature:

- **"Knowledge State Networks for Effective Skill Assessment in Atomic Learning" (Rasch & Middelbeck, 2021):**
  This paper introduces neural network architectures that accurately predict a learner's full knowledge state from limited data, showing that fewer assessment items are needed. This insight directly inspired our continuous verification module.
  Link : https://arxiv.org/abs/2105.07733/

- **Large Language Models for Education: A Survey (2024):**
  This survey provides a comprehensive review of the transformative role of large language models (LLMs) in educational settings. The paper systematically examines how LLMs are being deployed to enhance various facets of education—from personalized learning and virtual tutoring to the automation of grading and assessments. In particular, it highlights the following insights:

  - **Automated Assessment & Feedback:**
    LLMs are now capable of accurately grading student assignments and providing detailed, personalized feedback. Their emergent abilities (such as in-context learning) enable them to evaluate open-ended responses and simulate a dynamic knowledge state assessment—even exceeding the performance of traditional knowledge state networks.

  - **Efficiency & Scalability in Education:**
    By automating routine assessment tasks, LLMs help reduce the workload on educators, enabling more time for creative and critical instruction. This insight has directly inspired the development of our continuous verification module, which leverages LLMs to provide real-time, adaptive assessment feedback.

  - Link: https://arxiv.org/pdf/2405.13001

3. Learning from Experiences That Matter (Mentorship and Guidance)

Challenge:
Many students face academic, extracurricular, and career challenges without effective guidance, leading to isolation and uncertainty.

Solution in Our Project:
We offer a community-driven space where students and teachers share their experiences and insights via blog posts and digital storytelling. A built-in text editor makes content creation seamless, fostering an environment of reflective learning and authentic mentorship.

How Research Inspired This Feature:

- **"The Power of Digital Storytelling" (ASCD Article):**
  This article shows how digital storytelling can create authentic, engaging narratives that enhance learning and self-reflection. Its insights inspired us to incorporate digital storytelling into our mentorship space, enabling users to share personal experiences in a compelling format.
  https://ascd.org/el/articles/the-power-of-digital-storytelling/

- **"Does Mentoring Matter? A Meta-Analysis of Mentoring and Career Outcomes" (Eby et al., 2008):**
  This meta-analysis demonstrates that effective mentoring significantly improves career outcomes and skill development. Its evidence supported our decision to build a dedicated mentorship space, ensuring that students access guidance that fosters both academic and professional growth.
  https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2352144/

4. Focusing on What Really Matters (Opportunity Management)

Challenge:
Students often miss critical opportunities—such as internships, competitions, and research projects—because their academic channels are cluttered with irrelevant information, wasting time and effort.

Solution in Our Project:
Our platform delivers concise summaries of opportunities along with a personalized relevancy score, calculated based on each student's interests, skills, and interaction history. This enables students to quickly identify and act on the opportunities most aligned with their goals.

How Research Inspired This Feature:

- **Revisiting Relation Extraction in the era of Large Language Models**
  This recent ACL 2023 paper by Somin Wadhwa, Silvio Amir, and Byron C. Wallace reexamines the task of relation extraction using very large language models (e.g., GPT-3 and Flan-T5). The study shows that even with only a few examples (few-shot prompting), these models can achieve near state-of-the-art performance on standard relation extraction benchmarks. Importantly, the work highlights that careful supervision—such as incorporating Chain-of-Thought reasoning—can substantially improve the quality and precision of the extracted relations. This finding underlines the potential of LLMs to adapt dynamically to complex extraction tasks, inspiring our own work on leveraging in-context learning for accurate and efficient relation identification.
  Link: https://aclanthology.org/2023.acl-long.868.pdf

Novelty

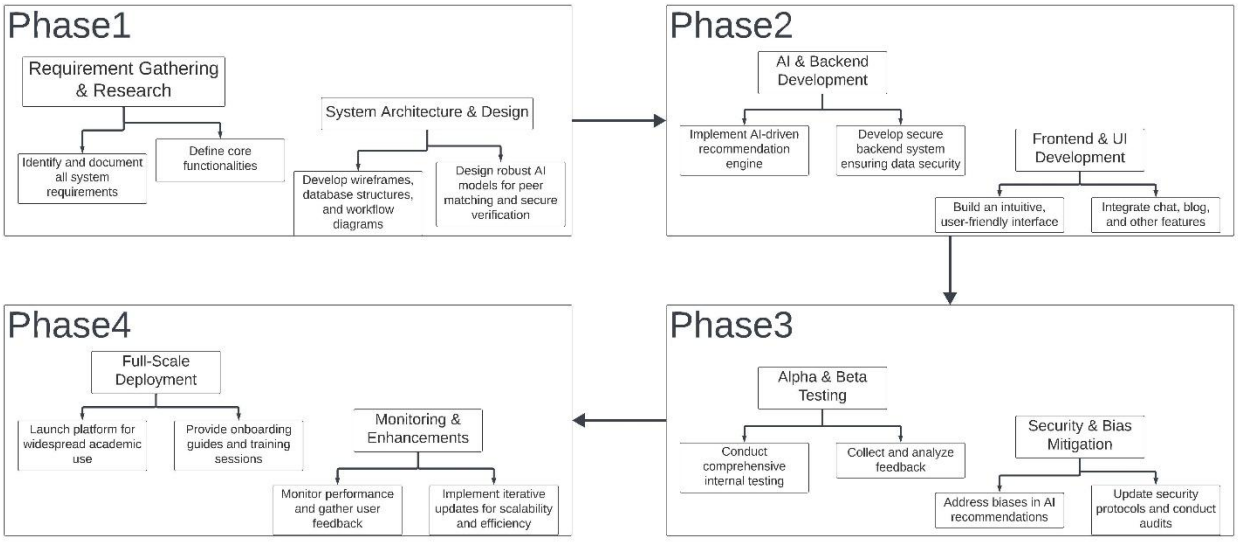
- **Integrated Multi-Feature Ecosystem:**
  The platform uniquely combines five core functionalities—collaboration and team building, skill verification, community-driven knowledge sharing, targeted mentor-student connections, and personalized opportunity management—within a single, cohesive ecosystem.
- **Advanced Actionable Summaries:**
  By employing state-of-the-art transformer-based models, the system distills complex communications into concise, actionable summaries. This, combined with personalized relevance scoring, effectively filters out information overload and ensures that users focus on critical opportunities.
- **Dynamic, Data-Driven Match Making:**
  The innovative matching engine not only forms effective teams for competitions, hackathons, and projects but also continuously verifies users' skills through AI-powered assessments and mentor evaluations. This dual approach builds a foundation of trust and verified capability, setting a new standard for team formation.
- **Empowering Community-Driven Knowledge Sharing:**
  The platform fosters an interactive environment where students and teachers can share insights, experiences, and guidance via blog posts and content creation tools. This democratizes access to valuable knowledge and nurtures a supportive network for mentorship and collective learning.

Objectives

- **Enhance Collaboration and Team Building:**
    - Develop a smart collaboration engine that intelligently matches students based on specific skills, shared vision, and project requirements.
    - Enable the formation of highly effective teams for competitions, hackathons, capstone projects, and other collaborative initiatives.
- **Ensure Authenticity Through Skill Verification:**
    - Implement AI-powered assessments and integrate teacher/mentor evaluations to continuously verify and authenticate students' skill sets.
    - Guarantee that team members are dependable and truly capable, thus enhancing the reliability of team recommendations and overall project outcomes.
- **Facilitate Learning from Experiences That Matter:**
    - Create a community-driven space that allows students and teachers to share their experiences, insights, and guidance through blog posts and interactive content.
    - Provide a built-in text editor and support tools to simplify content creation, enabling users to disseminate valuable real-life experiences and effective mentorship.
- **Focus on What Really Matters with Personalized Opportunity Management:**
    - Design a personalized system that distills incoming opportunities into concise, actionable summaries, effectively filtering out noise and irrelevant content.
    - Assign relevance scores to each opportunity based on a comprehensive analysis of students' interests, skills, and interaction histories, ensuring that users can quickly identify and act on the most pertinent opportunities.
    - Base recommendations on each user's interests and profile.

Methodology

The project will be executed in four distinct phases: Requirement Analysis & System Design, Development & Integration, Testing & Refinement, and Deployment & Continuous Improvement. Each phase is designed to build upon the previous one, ensuring a smooth transition from conceptualization to full-scale deployment.



Phase 1: Requirement Analysis & System Design

- **Requirement Gathering & Research:**
    - Identify and document all system requirements.
    - Define core functionalities, including AI-powered matching algorithms, blockchain-based security, and real-time communication capabilities.
- **System Architecture & Design:**
    - Develop detailed wireframes, database structures, and workflow diagrams.
    - Design robust AI models for peer matching and implement blockchain mechanisms for secure verification of research and other academic credentials.

Phase 2: Development & Integration

- **AI & Backend Development:**
    - Implement the AI-driven recommendation engine for matching students based on complementary skills, interests, and project goals.

- Develop a secure backend system that ensures data security and authenticity.

- **Frontend & User Interface Development:**
  - Build an intuitive, user-friendly interface catering to students, teachers, and recruiters.
  - Integrate interactive features such as chat systems, blog functionalities, and live leaderboard displays to enhance user engagement.

Phase 3: Testing & Refinement

- **Alpha & Beta Testing:**
  - Conduct comprehensive internal testing with a select group of users to validate the performance of AI algorithms and blockchain features.
  - Collect and analyse feedback to refine user experience and system functionality.
- **Security & Bias Mitigation:**
  - Address potential biases in AI recommendations to ensure fairness and transparency.
  - Regularly update blockchain protocols and conduct security audits to maintain robust protection against vulnerabilities.

Phase 4: Deployment & Continuous Improvement

- **Full-Scale Deployment:**
  - Launch the platform for widespread academic use.
  - Provide comprehensive onboarding guides and training sessions to facilitate smooth adoption by students, teachers, and other stakeholders.
- **Monitoring & Enhancements:**
  - Continuously monitor system performance, gather user feedback, and analyze usage metrics.
  - Implement iterative updates and enhancements to ensure scalability, efficiency, and long-term success.

Work Plan

Project Outcomes

- **Efficient Team Formation:**
  Our platform harnesses advanced AI-driven matching algorithms that assess individual skills, interests, and project objectives. This ensures the formation of well-balanced teams, poised to excel in both academic endeavors and extracurricular projects.
- **Accurate Skill Verification:**
  Trust is paramount. Through ongoing assessments and insightful mentor evaluations, the platform meticulously verifies each participant's capabilities, fostering an environment where team members can confidently rely on one another's verified skills.
- **Shared Experiences & Peer Support:**
  The platform fosters a community where educators and peers share their personal journeys and offer valuable guidance. This collaborative space encourages mutual learning and support, promoting both academic success and personal growth.
- **Innovative Research Collaboration:**
  Serving as a central hub for scholarly initiatives, the platform bridges the gap between motivated students and seasoned educators. This synergy promotes collaborative research projects and sparks innovative academic inquiry, driving forward new ideas and discoveries.
- **Targeted Opportunity Management:**
  Personalized notifications, crafted to align with individual profiles and interests, ensure that users receive timely updates on academic, internship, and extracurricular opportunities.

Individual Roles

- **Backend Development (Django, Integration):**
  Team: Arshdeep Palial, Pranav Duggal
  Focus: Core backend functionality and seamless integration.
- **Frontend Development (React.js, UI/UX Design):**
  Team*:* Jaskaran Singh, Hardik, Rohan Purohit
  Focus: Responsive UI and engaging user experience.
- **AI & NLP Model Development (Recommendation & Matching System):**
  Team: Rohan Purohit, Arshdeep Palial, Pranav Duggal
  Focus: Developing algorithms for effective peer matching.
- **Testing & Optimization (User Feedback, Performance Enhancements):**
  Team: Jaskaran Singh, Hardik, Pranav Duggal
  Focus: Rigorous testing and continuous system improvements.

Course Subjects

- **Conversational AI:**
  Leverage NLP algorithms for intelligent peer-matching and chat analysis, interpreting user inputs and extracting sentiment.
- **Machine Learning:**
  Develop AI-driven solutions for team formation, sentiment analysis, and ranking systems that continuously learn from user interactions.
- **Software Engineering:**
  Utilize full-stack development, robust system design, and agile methodologies to create a scalable, secure, and seamless platform.
- **Artificial Intelligence:**
  Employ deep learning models for personalized recommendations and adaptive content moderation.
- **Data Science:**
  Use advanced analytics and visualization techniques to derive actionable insights, enhancing platform performance and user engagement.
- **DBMS:**
  Implement robust database management solutions to ensure efficient data storage, rapid retrieval, and data integrity for scalability.

References

- **Collaboration Recommendation for Academic Teams**
  Authors: Suleiman Ali Alsaif (2022)
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- **Large Language Models for Education: A Survey**
  Authors: Hanyi Xua (2024)
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- **The Power of Digital Storytelling**
  Authors: Michael Hernandez (2023)
  Link: https://www.ascd.org/el/articles/the-power-of-digital-storytelling
- **Does Mentoring Matter? A Meta-Analysis of Mentoring and Career Outcomes**
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