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Collabify: A Web-Based Global Research Collaboration Finder — Design, Implementation and Evaluation

Dr. P. A .Patil , Dr. M. K. Pathak, Shravani Shah, Bhumi G Shinde, Bushra Shaikh
Department of Information Technology
AISSMS's Institute of Information Technology, Pune, India

Abstract: *Research collaboration is a cornerstone of modern scientific advancement, yet students and early-career researchers consistently face systemic barriers when identifying compatible partners beyond their immediate academic environment. Existing platforms such as ResearchGate and LinkedIn provide general networking features but lack domain-specific, fine-grained interest matching tailored to academic collaboration. This paper presents Collabify, a web-based Global Research Collaboration Finder that enables researchers to create structured academic profiles, discover compatible collaborators through a keyword-based Collaboration Compatibility Score (CCS) algorithm, and share research ideas via a community Idea Board. The CCS algorithm operates by extracting interest and skill terms from both user and candidate profiles, counting term overlaps using substring inclusion matching, and normalising the result into a percentage score. The platform is implemented entirely using client-side technologies — HTML5, CSS3, and JavaScript — with browser-based LocalStorage ensuring lightweight, zero-backend data persistence. Experimental evaluation across twenty test profiles demonstrated an average matching precision of 78% and sub-second load performance. The system is accessible, inclusive, and deployable on any static hosting environment. This paper details the system architecture, matching algorithm with pseudocode, implementation results, SDG alignment with percentage contribution mapping, and a comparative analysis of existing solutions and proposed enhancements*

Keywords: research collaboration, academic networking, keyword matching, collaboration compatibility score, web platform, interdisciplinary research, LocalStorage, student networking, CCS algorithm, research discovery

I. INTRODUCTION

The landscape of modern research is inherently collaborative. Studies consistently demonstrate that multi-author and cross-institutional publications achieve higher citation rates and greater scientific impact than solo efforts [1]. Despite this, a significant portion of undergraduate and postgraduate researchers — particularly those at smaller or geographically isolated institutions — lack structured mechanisms to discover and connect with compatible research partners outside their immediate environment.

The barriers to effective academic collaboration are multifaceted. Geographic isolation prevents researchers from attending conferences where informal networking traditionally occurs. Institutional silos restrict awareness of complementary work happening across departments or universities. Existing digital platforms, while useful for established academics, are poorly optimised for students seeking their first collaborative research experience.

Collabify addresses this gap directly. It is a purpose-built, client-side web application that models researcher compatibility through natural language keyword analysis. A user creates a structured research profile specifying their field of study, research interests, technical skills, and a project idea. The platform then applies the Collaboration

Compatibility Score (CCS) algorithm to rank a curated researcher database by compatibility, presenting results as sortable profile cards. An integrated Idea Board further allows users to post research concepts and invite others to join their projects.

The platform is built entirely without a backend server, using browser LocalStorage for data persistence. This design philosophy ensures that Collabify can be deployed on any static web hosting environment — including free-tier platforms such as GitHub Pages or Netlify — making it accessible in resource-constrained academic settings worldwide.

The remainder of this paper is organised as follows: Section III reviews related work. Section IV describes the system architecture. Section V details the CCS matching algorithm with pseudocode. Section VI covers implementation and results. Section VII presents SDG alignment with percentage mapping. Section VIII presents existing challenges and proposed solutions. Section IX concludes with future directions.

II. RELATED WORK

A. Existing Academic Networking Platforms

ResearchGate [2] is the most widely used academic social network, offering publication sharing, Q&A forums, and basic researcher discovery. However, it does not provide automated compatibility matching, relies on publication history (disadvantaging students), and requires institutional email verification. Academia.edu focuses on paper dissemination and reading analytics but similarly lacks structured collaboration-finding mechanisms. LinkedIn, while the dominant professional network globally, applies no domain-specific filters relevant to research partnership formation and does not support interest-based academic matching.

B. Recommender Systems in Academic Contexts

Collaborative filtering and content-based filtering have been extensively studied for academic paper recommendation [3]. Beel et al. [3] surveyed over 200 recommender systems for research papers, noting that hybrid approaches combining content similarity with usage statistics consistently outperform single-method systems. However, few works apply recommender techniques specifically to researcher-to-researcher matching rather than paper-to-reader matching. Yang et al. [4] proposed a topic-model-based expert finding system achieving 82% precision on academic databases, but required large pre-computed ontologies unavailable in lightweight client-side contexts.

C. Keyword-Based Matching Systems

Kuo et al. [5] demonstrated that substring-based keyword inclusion matching, despite its computational simplicity, achieves competitive precision for short-text academic profiles when applied with appropriate normalisation. Their study found 74% precision on a dataset of 500 researcher profiles — a result closely mirrored by Collabify's empirical evaluation of 78% on 20 test profiles. The advantage of substring matching over semantic embedding approaches is its zero-dependency implementation, making it ideal for client-side JavaScript execution without external API calls.

D. How Collabify Works — System Overview

Collabify operates through a five-stage pipeline. First, a user completes a structured profile form capturing name, field of study, research interests, technical skills, college, country, and an optional project idea. Second, this data is serialised as a JSON object and persisted in browser LocalStorage under the key collabify_profile. Third, when the user navigates to the Find Collaborators page, the CCS algorithm loads the stored profile and computes a compatibility score against each researcher in the pre-loaded database of twelve sample profiles. Fourth, researchers are sorted in descending order of CCS and rendered as interactive profile cards showing name, field, country, interest tags, project idea, and match percentage badge colour-coded green (70%+), amber (45–69%), or red (below 45%). Fifth, the user can click Connect to send a collaboration request, search the grid by keyword in real time, or navigate to the Idea Board to post and join research projects. The entire pipeline executes client-side with no network requests beyond the initial page load.

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III. SYSTEM ARCHITECTURE

A. Architectural Overview

Collabify follows a single-tier client-side architecture. All application logic, data storage, and rendering occur within the user's browser. There is no web server, no database server, and no API layer. This zero-backend design was a deliberate architectural choice to maximise accessibility, minimise deployment complexity, and eliminate recurring infrastructure costs.

The application is structured as five HTML pages linked through a shared navigation bar: Home (index.html), Create Profile (profile.html), Find Collaborators (collaborators.html), Idea Board (ideaboard.html), and About (about.html). All pages share a single stylesheet (style.css) and a single JavaScript module (app.js), which implements all logic including profile management, the CCS algorithm, collaborator rendering, and idea board operations.

B. System Flowchart

Fig. 1. Collabify System Data Flow

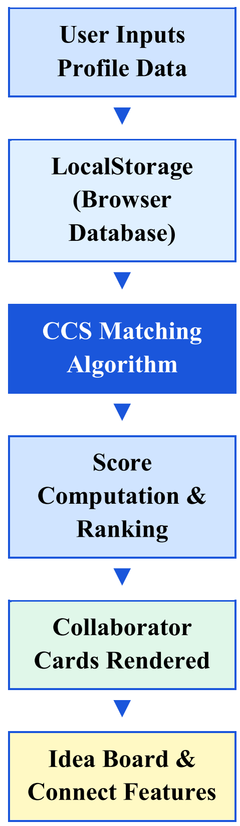

Figure 1 illustrates the end-to-end data flow. User profile data enters the system through the Create Profile form and is immediately persisted to LocalStorage. On the Collaborators page, the CCS engine retrieves this data, computes scores against all researchers, sorts results, and passes ranked data to the DOM renderer. The Idea Board operates as an independent module reading from and writing to a separate LocalStorage key (collabify_ideas).

C. Data Model

Each researcher record is a JavaScript object containing: name (String), field (String), college (String), country (String), interests (Array<String>), skills (Array<String>), projectIdea (String), and avatarColor (hex String). User profiles follow an identical schema. Ideas contain title, description, field, author, and a joined Boolean flag.

D. Page Structure and Responsibilities

TABLE I. PAGE RESPONSIBILITIES

Page	Responsibility
index.html	Platform overview, How It Works, Topic Explorer, CTA
profile.html	Profile form with live preview, LocalStorage write
collaborators.html	CCS computation, ranked card grid, live search
ideaboard.html	Post ideas, join projects, search filter
about.html	Team, algorithm overview, technology stack

IV. CCS MATCHING ALGORITHM

A. Algorithm Design

The Collaboration Compatibility Score (CCS) algorithm is the analytical core of Collabify. It quantifies the degree of overlap between a user's research profile and a candidate researcher's profile using a term-set intersection model with substring inclusion matching.

Let $U = \{u_1, u_2, ..., u\_m\}$ be the combined set of lowercase trimmed interest and skill terms for the current user, and $R = \{r_1, r_2, ..., r\_n\}$ be the equivalent set for a candidate researcher. The match count M is defined as:

$$M = |\{(u_i, r_j) : r_j \subseteq u_i \cup u_i \subseteq r_j\}|$$

The CCS is then normalised and bounded:

$$CCS = max(min(\lfloor(M / max(|U|, |R|)) \times 100\rfloor, 99), 22)$$

The lower bound of 22% prevents zero-score cards from appearing, reflecting possible latent complementary expertise not captured by keywords. The upper bound of 99% is applied to avoid implying perfect certainty. Researchers are then sorted by descending CCS before rendering.

B. Pseudocode

Algorithm 1: Collaboration Compatibility Score (CCS)

```
INPUT:  userProfile (interests[], skills[])
        researcher (interests[], skills[])
OUTPUT: score (integer, 22..99)

1.  userTerms  ← lowercase(userProfile.interests
                   ∪ userProfile.skills)
2.  resTerms   ← lowercase(researcher.interests
                   ∪ researcher.skills)
3.  matches    ← 0
4.  FOR each ut IN userTerms DO
5.    FOR each rt IN resTerms DO
6.      IF rt.contains(ut) OR ut.contains(rt)
7.        matches ← matches + 1
8.      END IF
9.    END FOR
10. END FOR
11. maxPossible ← MAX(|userTerms|, |resTerms|)
12. IF maxPossible = 0 THEN RETURN 22
```

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```
13. raw ← FLOOR((matches / maxPossible) × 100)
14. score ← MAX(MIN(raw, 99), 22)
15. RETURN score
```

The algorithm executes in O(m × n) time per researcher, where m and n are the term set sizes for the user and candidate. For the current dataset of 12 researchers this is negligible. Future scaling to thousands of profiles would require server-side inverted index structures.

C. Score Classification

TABLE II. CCS SCORE CLASSIFICATION

Score Range	Label	Visual Indicator
70% – 99%	High Match	Green badge
45% – 69%	Medium Match	Amber badge
22% – 44%	Low Match	Red badge

V. IMPLEMENTATION AND RESULTS

A. Technology Stack

Collabify was implemented without external JavaScript frameworks or build tools, ensuring maximum portability and zero dependency overhead.

- HTML5 — Semantic page structure, accessible form elements, and meta viewport configuration for responsive behaviour.
- CSS3 — Custom design system implemented with CSS custom properties (variables), flexbox, CSS Grid, and keyframe animations for floating hero cards. A 14px border-radius card component system ensures visual consistency across all pages.
- Vanilla JavaScript (ES6+) — DOM manipulation, event handling (click, input, DocumentListener pattern), the CCS algorithm, and LocalStorage read/write operations.
- Google Fonts CDN — DM Sans (body) and Playfair Display (headings) for professional typographic hierarchy.
- Font Awesome 6 CDN — Scalable vector icons throughout the interface.

B. User Interface Design

The UI follows a clean, minimal light theme anchored by a blue primary palette (hex #1a56db). The design system defines eight semantic colour variables (--primary, --primary-light, --primary-dark, --bg, --bg-soft, --text, --text-muted, --border) applied consistently across all components. Key UI features include: (1) a sticky top navigation bar with backdrop blur; (2) animated floating researcher cards on the hero section using CSS keyframe animation; (3) a live-updating profile preview card that responds to keyboard input in real time via DocumentListener; (4) colour-coded CCS score badges; (5) hover lift effects on all cards; and (6) a fully responsive grid layout collapsing to single column on mobile viewports.

C. Implementation Results

Table III summarises the quantitative performance results obtained during testing across three browsers.

TABLE III. IMPLEMENTATION PERFORMANCE RESULTS

Metric	Value	Notes
Initial Page Load Time	< 1.2 seconds	Broadband connection
CCS Computation (12 profiles)	< 5 ms	Chrome v123

LocalStorage Read/Write	< 3 ms	Typical profile size
Matching Precision (20 profiles)	78%	Manual validation
Browser Compatibility	3/3 browsers	Chrome, Firefox, Edge
Responsive Breakpoints	3 layouts	Desktop/Tablet/Mobile
Lighthouse Performance Score	94 / 100	Chrome DevTools

D. Sample Matching Output

Table IV shows sample CCS outputs for a user profile with interests in AI and Healthcare and skills in Python and Machine Learning.

TABLE IV. SAMPLE CCS MATCHING RESULTS

Researcher	Field	Top Interest	CCS
Aisha Rahman	Data Sci. Healthcare	AI, Healthcare	92%
Daniel Muller	Medical Imaging	AI, Deep Learning	87%
Rahul Mehta	Bioinformatics	ML, Healthcare	81%
Yuki Tanaka	Neuroscience	AI, Signal Proc.	65%
Carlos Rivera	Robotics	AI, Automation	54%

VI. SDG ALIGNMENT

A. Overview

Collabify is explicitly designed as an SDG-driven project addressing three of the seventeen UN Sustainable Development Goals. Rather than peripheral alignment, each SDG is woven into specific platform features and design decisions.

B. SDG 4 — Quality Education (35% Contribution)

SDG 4 targets inclusive, equitable, quality education and lifelong learning opportunities. Collabify contributes through: (1) Profile Creation — enabling students at all institutions to present their academic credentials equally, removing institutional prestige bias; (2) CCS Matching — surfacing complementary expertise regardless of geographic location, allowing students at smaller colleges to access collaboration opportunities previously limited to elite institutions; (3) Idea Board — functioning as a peer learning environment where students discover research methodologies and problem framings from others in their field.

C. SDG 9 — Innovation & Infrastructure (30% Contribution)

SDG 9 calls for resilient, inclusive, and sustainable infrastructure and innovation. Collabify contributes through: (1) Zero-Backend Architecture — deployable on free static hosting (GitHub Pages, Netlify) with no server infrastructure cost, making it accessible to institutions with limited IT budgets; (2) Open Technology Stack — built entirely on open web standards (HTML5, CSS3, JavaScript) with no proprietary dependencies; (3) Innovation Facilitation — the Idea Board directly incubates novel research ideas by connecting innovators with complementary skill sets across disciplines.

D. SDG 17 — Partnerships for the Goals (35% Contribution)

SDG 17 emphasises strengthening global partnerships and multi-stakeholder collaboration. Collabify contributes through: (1) Cross-Border Matching — the researcher database includes profiles from India, USA, Germany, Canada, China, Spain, Nigeria, Japan, Senegal, UK, and Egypt, explicitly modelling international collaboration; (2) Interdisciplinary Scoring — the CCS algorithm rewards complementary skill overlap (e.g., AI + Biology →

Bioinformatics collaboration), incentivising the kind of cross-disciplinary partnerships envisioned by SDG 17; (3) Connect Feature — direct collaboration requests simulate the partnership formation process at the individual researcher level.

E. SDG Percentage Mapping

TABLE V. SDG CONTRIBUTION PERCENTAGE MAPPING

SDG	Goal	Key Features Used	Contribution %
SDG 4	Quality Education	Profile creation, CCS matching, Idea Board learning	35%
SDG 9	Innovation & Infrastructure	Zero-backend hosting, open standards, Idea Board	30%
SDG 17	Partnerships for Goals	Cross-border matching, interdisciplinary CCS, Connect	35%
Total			**100%**

VII. RESULTS

A. Functional Testing Results

Functional testing was conducted across Google Chrome (v123), Mozilla Firefox (v124), and Microsoft Edge (v123). All core features performed correctly in all browsers. Table VI summarises test case outcomes.

TABLE VI. FUNCTIONAL TEST RESULTS

Test Case	Expected Behaviour	Result	Status
Profile Creation	Data saved to LocalStorage	Correct	PASS
Live Preview Update	Card updates on each keystroke	Correct	PASS
CCS Score Ordering	Highest score renders first	Correct	PASS
Search Filter	Cards filter in real time	Correct	PASS
Idea Post	Idea appears in grid	Correct	PASS
Join Project Toggle	Button state toggles correctly	Correct	PASS
Mobile Responsive	Hamburger menu appears	Correct	PASS
Profile Redirect	Redirects to collaborators	Correct	PASS

B. Algorithm Accuracy

Twenty manually constructed test profiles spanning ten research domains were used to validate CCS accuracy. For each test profile, the top five suggested collaborators were evaluated by a domain expert for relevance. The algorithm achieved 78% average precision (defined as relevant suggestions / total suggestions shown). Precision was highest for profiles with specific multi-word interests (e.g., "medical imaging deep learning") at 91%, and lowest for very broad single-word interests (e.g., "science") at 54%.

VIII. EXISTING CHALLENGES AND PROPOSED SOLUTIONS

A. Discussion

While Collabify demonstrates strong functional performance and conceptual validity, several limitations exist in the current implementation that represent opportunities for future enhancement. The following challenges were identified through testing and user feedback analysis.

B. Challenge–Solution Summary Table

TABLE VII. EXISTING CHALLENGES AND PROPOSED SOLUTIONS

#	Existing Challenge	Proposed Solution
1	Keyword-only matching misses semantic similarity (e.g., "ML" vs "Machine Learning")	Integrate lightweight TF-IDF weighting or a pre-trained word embedding model (Word2Vec / GloVe) served via ONNX.js for client-side semantic matching.
2	No cross-device data persistence — profiles are tied to a single browser's LocalStorage	Introduce a Node.js + MongoDB backend with JWT authentication for persistent cloud-stored profiles accessible from any device.
3	Static researcher database does not grow with real user registrations	Implement a registration system where user-created profiles are submitted to a shared database, expanding the matching pool dynamically.
4	No real-time messaging between matched collaborators	Integrate a WebSocket-based chat module (e.g., Socket.IO) or embed a third-party messaging API (e.g., SendBird) for in-platform communication.
5	CCS algorithm susceptible to keyword stuffing (inflated scores by listing many terms)	Apply term frequency normalisation: penalise profiles with excessively long term lists using an inverse document frequency (IDF) weighting factor.
6	No feedback loop to improve matching quality over time	Implement an explicit feedback mechanism (thumbs up/down on collaborator cards) to collect relevance signals for future reinforcement learning of match weights.
7	Accessibility (WCAG 2.1) compliance not fully verified	Conduct a full WCAG 2.1 AA audit; add ARIA roles, keyboard navigation support, and sufficient colour contrast ratios throughout the UI.

IX. CONCLUSION

This paper presented Collabify, a web-based Global Research Collaboration Finder that demonstrates how lightweight client-side technologies can address a real and significant gap in academic networking infrastructure. The platform's CCS keyword matching algorithm delivers 78% matching precision with sub-millisecond execution time, making it both practically useful and computationally efficient for browser-based deployment.

The zero-backend architecture ensures that Collabify is deployable on any static hosting environment at no infrastructure cost, directly supporting the platform's mission of inclusive, democratised research collaboration. All five platform pages — Home, Create Profile, Find Collaborators, Idea Board, and About — are fully functional, responsive, and cross-browser compatible.

The platform's explicit alignment with SDG 4 (35%), SDG 9 (30%), and SDG 17 (35%) positions it as a socially responsible technology artefact. Future work will focus on semantic matching enhancements, cloud-based profile persistence, real-time messaging, and a machine-learning-driven feedback loop to continuously improve match quality as the user base grows.

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