

## **ANALYTICS-LED DIGITAL INTERNSHIP MANAGEMENT PLATFORM FOR INDUSTRY- UNIVERSITY COLLABORATION**

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### **ABSTRACT**

*Internship training is a key tool in bridging theoretical knowledge and the industry applications and expectations. While commercially available job matching platforms serve the needs of employment seekers and job providers, a paucity is seen in facilitating a similar need for internship training. Anchored on the Learning Analytics Framework, the proposed research application, referred to hereafter as InternNexus, aims to provide a practical model of a digital internship management platform for analytics-based decision making by transforming the internship experience into a structured, transparent, and efficient process. By being into action research, the proposed prototype in this study suggests creating profiles demonstrating applicants' academic background and other qualifications, allowing them to match their interests to training opportunities, track applications in real-time, and receive personalized recommendations. Meanwhile, the employers post the internship vacancies, manage candidates, and make offers directly through the platform, while the university administration can verify internship status, monitor student progress, and review the entire process of the internship. The technological architecture used in this research are ReactJS for a responsive frontend interface, NodeJS, and ExpressJS for a scalable backend framework supported by MongoDB's flexible document-oriented database technologies. Due to its exceptional performance in handling real-time data exchanges, MongoDB was selected to support cross-platform compatibility that is essential for connecting diverse*

*stakeholders. The users of this system are students who seek internship opportunities, companies looking for trainees, and the educational institutes monitoring and analyzing student performance during their industrial training. Theoretically, the research advances the Learning Analytics Framework to the action research domain, and its practical contribution can be extended beyond the immediate implementation to a government-sponsored centralized platform to streamline industrial training of students, especially at the university level, to accelerate the timely completion of degree programs and to produce well-trained graduates. This action research opens the possibilities of widening theoretical models for immediate value-generating software development projects for the education sector to yield the paybacks of action research in computing.*

**Keywords:** Action Research, Agile Methodology, Computing for Education, Industrial Internship, Sri Lanka

## **1. Introduction**

The industrial training component in an academic program ensures a smooth transition from academic learning to the application of such learning while absorbing industry exposure. Students with internship experience have demonstrated a competitive advantage in the job market due to professional competencies developed and the enhanced workplace readiness from the experience (Gault et al., 2010; Ahmed et al., 2025). Studies show that such individuals secure jobs faster than their counterparts and have evident long-term employability, resulting in universities and employers increasingly recognizing the importance of an internship for career success (Callanan & Benzing, 2004). As Academia (2019) highlights, internships improve employability, and 73% of the graduates with internship experience secure jobs 53% higher than their counterparts who are without the experience. Given the rise of digital platforms, a shift is observed in the intermediary role of the educational institute in arranging industrial training, as students and employers directly connect through platforms. Technology-driven platforms create a dynamic and responsive ecosystem, improving efficiency as demand and supply are directly connected. In comparison to university-mediated placements, technology-enabled internship matching systems have created a higher satisfaction rate among both

students and employers (Molodchik, N., Ostapenko, G., & Nagibina, N., 2020).

Though commercially available employment platforms like LinkedIn (LinkedIn, 2025), Indeed (Indeed, 2025), Glassdoor (Glassdoor, 2025), Monster (Monster, 2025), and CareerBuilder (CareerBuilder, 2025) have transformed the job market globally, for internships, such a breakthrough is underdeveloped, especially in Sri Lanka. As per the University Grants Commission of Sri Lanka (University Grants Commission, 2023), there are 16 government universities, 19 approved private educational institutes, and over 50 university degree programs requiring mandatory internships. As per a recent survey conducted by the Federation of Information Technology Industry of Sri Lanka (FITIS, 2023), 78% of undergraduate students struggle to find relevant internship opportunities, while 65% of employers find it difficult to identify qualified candidates. Despite the undeniable contribution of internships in a degree program and the growing need for structured internship opportunities, a need exists for a centralized platform for timely connecting all stakeholders for this purpose.

With the purpose of addressing this action research gap, the current study proposes a framework named InternNexus, a data-driven digital internship platform to enhance industry-university collaboration to streamline the industrial training/internship process. The proposed prototype is based on the Learning Analytics Framework (LAF) by Siemens (2013). The objective of the study is to use the Learning Analytics Framework in action research, where a prototype is presented for immediate use. LAF is about four components: data, metrics, analysis, and intervention to optimize the learning environment through collecting, measuring, analyzing, and reporting data related to learners and their context. Accordingly, the proposed model has main features such as profile creation, vacancy posting, skill-based internship recommendations, real-time application tracking, candidate shortlisting, student progress monitoring, direct communication between users, and structured reporting mechanisms. The framework is built with a selected tech stack: ReactJS, NodeJS, ExpressJS, and MongoDB. ReactJS ensures responsive front-end development, NodeJS and ExpressJS for a scalable backend, and MongoDB for flexible data management (Chowdhury, M. S. N. 2024). Expanding beyond mere

internship demand supply matching functionalities, InternNexus allows mentors/supervisors to assess student performance based on a standardized competency framework while facilitating academic institutes for continuous student progress monitoring. Since the design principle is Agile, InternNexus promises nationwide scalability, transforming it into a government-sponsored centralized platform, integrating internship/training processes of all higher educational institutes in Sri Lanka. Centrally coordinated educational platforms can achieve up to 100% adoption rates compared to fragmented decentralized systems, while also improving student-employer matching outcomes through enhanced communication and task coordination (Abode HR, n.d.). With the broader objective of addressing a paucity and inefficiencies in existing internship systems and aiming to revolutionize internship accessibility, the proposed system contributes to the action research domain in computing towards the Sri Lankan education sector.

## **2. Literature Review**

The proposed system with advanced internship listings, real-time tracking, skill-based matching, structured document management, and comprehensive analytics aims to address the gap in internship portals in the higher education sector. Especially in the Sri Lankan context, a paucity is observed in systems that integrate students, employers, and the managing education institutions. Anchored in the Learning Analytics Framework by Siemens (2013), this section reviews the existing literature of widely used job and internship platforms.

As per the learning analytics framework proposed by Siemens (2013), learning analytics aims for optimizing the learning environment by collecting, measuring, analyzing, and reporting data related to learners and their context; the four essential components of such a framework are data, metrics, analysis, and intervention. This framework guides the development of digital learning platforms. The framework was used as the base for the development of InternNexus by incorporating all those components of the framework for the employer, university, and the student to track the performance, progress by offering data-driven insights for all the parties, aligning with academic requirements.

In the absence of exactly similar systems to compare in the Sri Lankan context, several globally available commercial platforms are evaluated for the purpose. The proposed system addresses key gaps in the existing internship portals with added features such as advanced internship listing, real-time tracking, skill-based matching, structured documentation management, and sophisticated analytics. Unlike other platforms, InternNexus facilitates progress monitoring by educational institutes while direct interaction between users is stimulated, promising an inclusive, transparent, and efficient internship experience to all stakeholders.

LinkedIn (LinkedIn, 2024), the widely used employment platform with its primary objective of connecting demand and supply of employment, is limited by its features of serving internship/industrial training opportunities due to its general job matching algorithms that are not optimized for internships and have minimal application tracking capabilities. Furthermore, it is limited by centralized documentation storage for educational institutes to monitor progress and analyze data, and for employers to seek candidates from particular academic institutes. Today, these features have become key expectations from a digital platform.

Internshala (Internshala, 2024), being specialized in internships, offers minimal filtering options for internship listings, provides only basic facilities for application tracking, status updates, and lacks academic alignment in recommendations. Though it allows basic document uploading facilities, it needs improvements to claim a structured documentation management feature. The main drawbacks noted are its limitation of data sharing capabilities with academic institutes and candidate filtering by university affiliations. These are basic expectations of users from a system that caters to the internship purpose.

Indeed (Indeed 2024) demonstrates similar shortcomings. For instance, it does not provide structured reports tailored for academic institutes to evaluate the training program's effectiveness, nor does it offer companies options to filter candidates by the educational institutes and lacks degree program-based filtering for a precise searching experience. Even though the platform lists both jobs and internships and allows

tracking applications, it is limited by document tracking features. Also, indeed does not provide real-time updates, which are crucial for time-sensitive internship matching. The job matching algorithm does not prioritize internship-related skills, which is different from the set of skills a company would look for in a candidate for employment.

TopJobs (TopJobs, 2024), a platform primarily focusing on full-time jobs, also caters to internships and industrial training, but exhibits the most significant limitations, such as tracking facilities. The training opportunities are also listed among the available full-time job vacancies, which creates unnecessary competition among trainees and people searching for full-time employment opportunities. This, in turn, wastes the time and efforts of companies that are different in their purposes of search purposes. The platform does not provide services such as internship documentation, internship analytics by educational institutes, and employer filtering based on university affiliations.

In contrast to all the above systems compared, InternNexus distinguishes itself by providing a sophisticated solution to the internship process with features such as comprehensive filtering options, real-time application tracking capabilities, internship-based skill matching algorithms, a structured documentation management system that streamlines the administrative process, and comprehensive analytics for timely decision making. It also serves hidden layer of expectations of employers, such as allowing them to filter trainees from specific educational institutes and degree programs. The wider coverage of user needs in the proposed framework ensures an internship experience characterized by efficiency, transparency, and alignment between academic requirements and industry needs, allowing universities to monitor student progress in the internship.

### **3. Methodology**

#### **3.1. Research Design**

Agile software development methodology was selected as the research method as it enables the developers to make improvements to the product during the development process, offers flexibility in terms of user feedback, and effectively prioritizes tasks. This design will provide

the platform with the flexibility to cater to the evolving needs of the users, yet provide a well-organized development cycle in short sprints and constant delivery cycles. Agile is iterative, which makes it easy to develop features in an incremental manner so that the necessary changes can be made in the development process as the stakeholders provide feedback.

### **3.2. System Architecture**

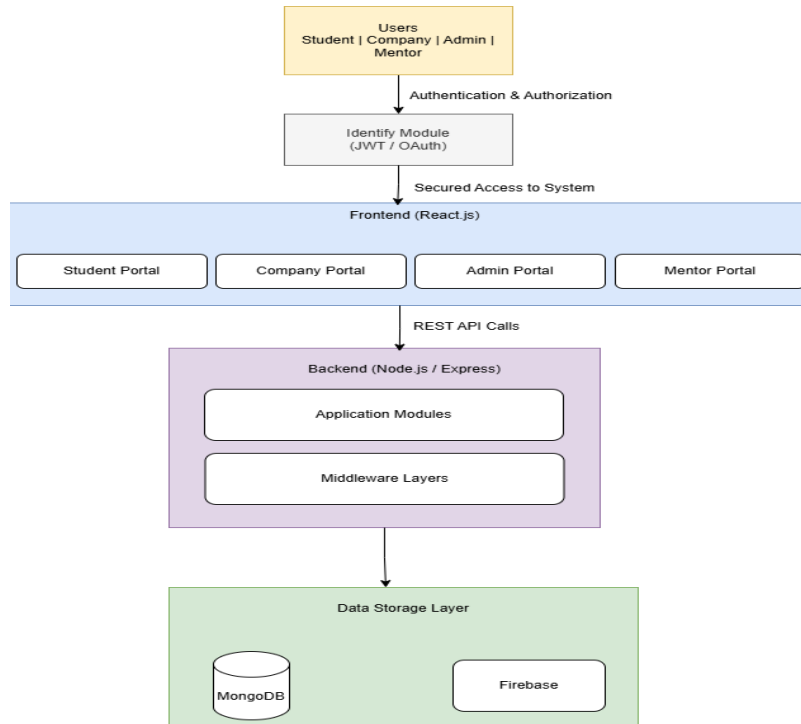
As shown in Figure 1, the internship management system is developed based on a monolithic architecture with all the components acting as one application. The React.js frontend has individual interfaces to Students, Companies, Mentors, and Administrators, and React Router facilitates the navigation and the state management of the data flow.

Express.js and Node.js backends are designed to follow middleware, business logic, and data access layer design. The middleware deals with authentication, validation, and uploading files, whereas controllers deal with fundamental activities of user management, internship posts, and applications. All the structured data is stored in MongoDB, the files such as CVs and images are stored in Firebase Storage, and email notification services are provided. This architecture makes the system easy, efficient, and maintainable.

### **3.3. Role and Functionalities of Users**

The platform uses Role-based Access Control that allows four main types of user access with different functionalities. The smart matching system provides students with an opportunity to make profiles, filter and browse through internship openings by skills, preferences, academic programs, and location, to apply, upload necessary documents (CVs, cover letters), and monitor application status in real-time. For the companies, functions such as posting internship opportunities, defining requirements and responsibilities, smart filtering to find the right candidate, generating automatic CV matching scores, managing candidate pipelines, and generating performance reports are available. The administrators have control over the whole platform, check the uploaded documents to be authentic, trace activity on the system,

manage accounts of users, receive detailed analytics dashboards, and ensure the integrity of data on all operations.



**Figure 1:** Top-Level Architecture

### 3.4. Technology Stack

**Frontend:** The interface was created with React.js and Tailwind CSS style that is responsive, modern, and will look the same on all devices. The interaction was done through the creation of intuitive and user-friendly interfaces with the help of UI/UX tools such as Figma and Canva, which increase engagement and accessibility.

**Backend Development:** Node.js with Express.js was used to develop the backend, thus offering a lightweight and efficient platform for processing HTTP requests, combining middleware, and creating scalable RESTful APIs to facilitate an easy flow of communication with the frontend.

**Database Management:** Project data (user profiles, internship listings, and application records) were stored and managed in MongoDB. It has a



flexible document-based architecture that enables dealing with data efficiently and can be easily connected with the Node.js backend.

### **3.5. Testing and Quality Assurance**

A strong testing plan was introduced to make sure that InternNexus is a reliable, secure, and user-friendly program. Unit testing followed by validating core functionalities and backend components, and API testing followed by ensuring that the frontend and the backend communicated seamlessly with each other. Integration testing ensured that various modules, such as authentication and database operations, coexisted well.

Security testing was done to examine vulnerabilities in JWT authentication, document storage security, and data encryption protocol to ensure the security of sensitive user information. To achieve the best platform performance in different environments, performance testing was done to test response times, system scalability at different loads, and cross-browser compatibility.

The context and usability validity of the user interface and functionalities were established with the help of several university students and industry professionals. A few improvements were made to the interface and workflows, ensuring that the platform ultimately meets the practical needs of its users.

### **3.6. Risk Management**

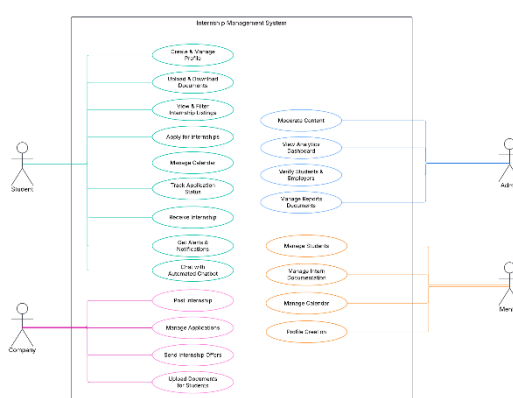
Agile software development was followed in the project to steer the iterative development. Moreover, a risk management strategy was employed to find and address the possible issues, including technical issues, security threats, and scheduling issues. It involved straightforward procedures such as (a) risk identification related to authentication, database, or delays; (b) evaluation of all risks; (c) planning responses such as deciding how to avoid or lessen each risk (Ex, prioritizing important tasks) and (d) follow up on the risks, such as tracking the progress and resolving arising problems.

Critical functions such as authentication and integration of the database were given priority and time when debugging and correcting the errors.

This strategy served to keep the project within the scheduled time frames, prevent unnecessary functionalities, and ensure the system is secured, functional, and achieves its primary objectives.

#### 4. Results/Analysis and Discussion

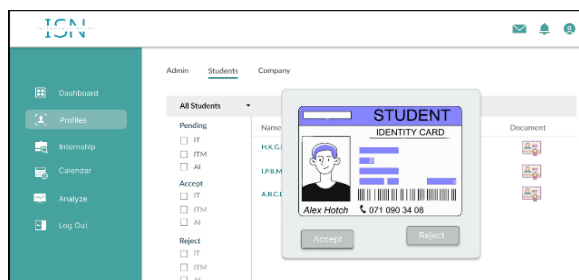
As shown in Figure 2, the system models the interaction among users of the system: students, mentors, university administration, and companies. The illustration reveals user engagement in profile management, internship postings, application tracking, and mentor feedback. It also depicts certain purposeful constraints and associations created to enhance efficient monitoring and integration.



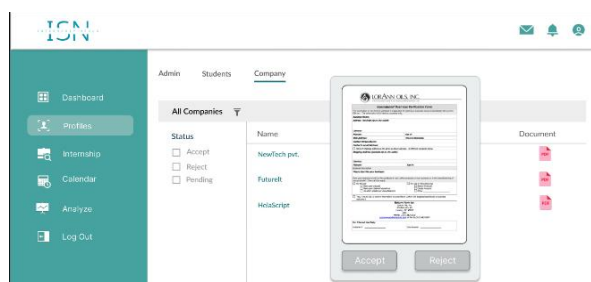
**Figure 2: Use Case Diagram**

##### 4.1. User Authentication and Role Management

The role-based access control ensures smoother navigation for all users while allowing the admin to hold the responsibility of reviewing and verifying documents for accuracy and secure data management. Role-based signup depicts a simple login/signup interface with role-based access control. The profile verification process ensures the authenticity of both undergraduate students and companies. As shown in Figures 3 and 4, upon receiving verification documents, the administrator reviews and decides on approval or rejection of the registration request. The platform uses JWT-based authentication for secure login and session management. *RESTful APIs* enable integration in the system, and the database uses normalization for efficiency and indexing for faster queries.



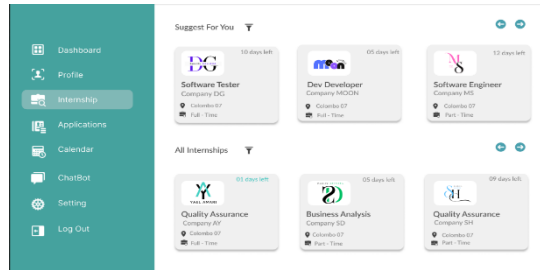
**Figure 3: Admin's Student Verification Page**



**Figure 4: Admin's Company Verification Page**

## 4.2. Internship Listings and Smart Matching

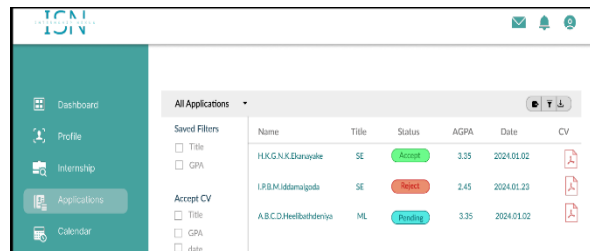
The filtering system is designed to effectively narrow down internship opportunities for students, as the system allows employers to customize their vacancy postings to target specific candidate profiles. As depicted in Figure 5, employers can post internships with filters such as skills, degree requirements, and location. Based on set profiles and preferences, students receive filtered, customized recommendations on their feed, allowing them to access relevant opportunities in no time. Upon clicking on a selected post, a student can review the details of the post and apply for a post using a curriculum vitae (CV). Due to keyword-based filter matching, the internship posts are dynamically displayed to students based on their changed preferences. The backend utilizes *Elasticsearch* to efficiently index and search internship data, ensuring fast and accurate results based on keywords and user preferences.



**Figure 5:** Skill-based Internship Opportunities Filter Page

#### 4.3. Employer Dashboard and Application Tracking

As shown in Figure 6, the filtering feature enables employers to sort received CVs and proceed to accept or reject any. Simultaneously, the students are able to track their application status, receive real-time updates on the progress. When employers accept or reject CVs, the *ExpressJS* server processes the request and updates the CV status in MongoDB using Mongoose. The real-time updates are sent to the frontend via RESTful APIs, allowing students to track their CV statuses instantly.



**Figure 6:** Company-Side Application View Page

Figure 7 shows a sequence diagram illustrating how the automated CV filtering process works. The system checks the CV URL and internship ID, extracts the relevant parts (technical skills and projects) from the PDF, and then uses a weighted matching algorithm to compare them to the internship criteria. It deals with mistakes like missing parameters or invalid IDs and gives recruiters a match score with matched keywords.

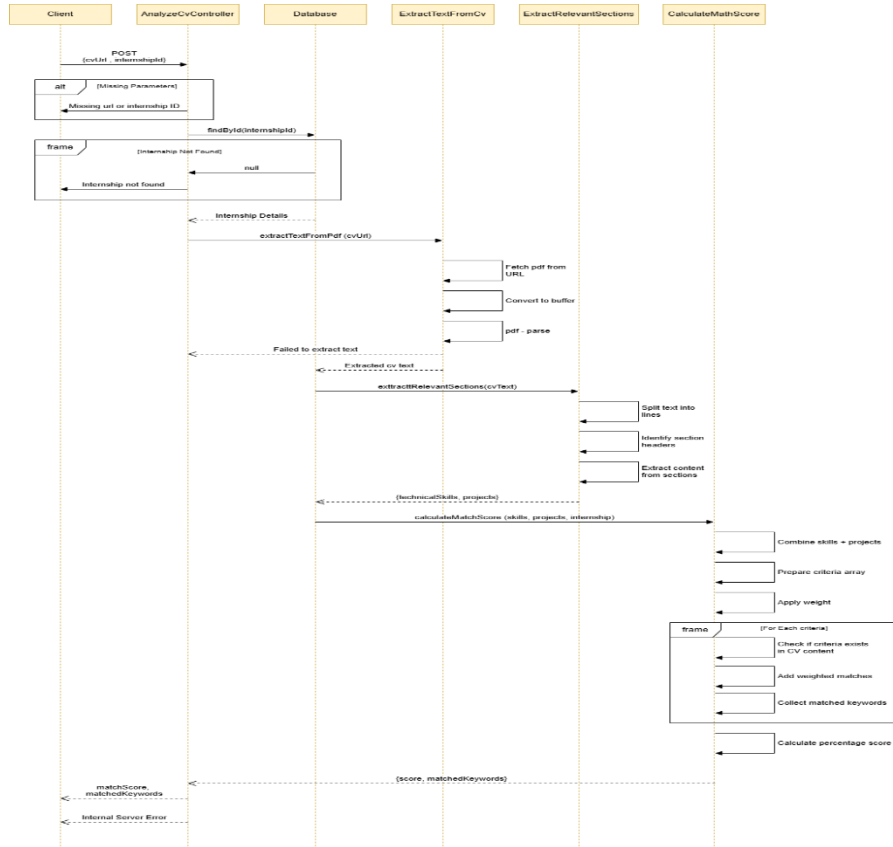


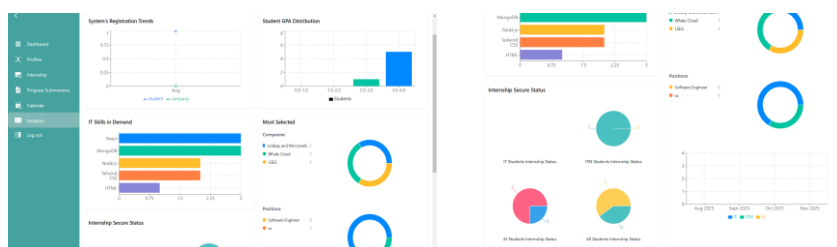
Figure 7: CV Filtering Sequence Diagram

#### 4.4. Document Management and Verification

A centralized document management facility is established, allowing all users of the platform to verify and access essential internship documents in the system, providing a secure and transparent way to handle documents. Students are expected to upload weekly, monthly, and final internship reports/diaries, allowing mentors and admins to view these reports. Mentors can generate monthly feedback reports automatically by filling in minimal details on the dashboard. The *Controller* handles the logic by processing requests, interacting with the model to save or retrieve data, and sending responses to the client. The *Route* defines the endpoints and maps them to specific controller actions, such as handling file uploads or fetching reports.

#### 4.5. University Analytics and Reporting

The facilities enabled for academic institutes (universities) serve as a unique feature in this system compared to other commercially available job matching platforms. The analytics (Figure 8) provide valuable insights into the entire internship process and student performance and thereby stimulate a healthy relationship between the university admin and the employers. Universities can track student progress using interactive reports and charts. The system automatically generates real-time reports on student performance and overall internship success for universities to make data-driven decisions. In NodeJS, reports are automatically generated using data from the MongoDB database. The system retrieves relevant data and then visualizes it using the chart library ChartJS. These graphical representations of the performance increases user experiences in the system.



**Figure 8:** Admin Analytics Dashboard

## 5. Conclusion and Implications

Anchored on the Learning Analytics Framework as the theoretical base, this action research aimed at providing a prototype of how analytics-driven decision-making can be facilitated through a digital internship platform. As the LAF stresses, data can be used to make more informed decisions- data needs to be timely collected, processed, and necessary interventions thereby. This study contributes to the literature on how LAF can be extended towards an internship training context to make an ecosystem where stakeholders interact, monitor each other's progress, and make analytics-based decisions.

With an evolving higher education sector in Sri Lanka, the internship/industrial training component is becoming mandatory in many degree programs. Miserably, there is no centralized platform to connect the demand and supply sides of the internships and

administration of the education sector to make the process more structured and seamless. While students find it difficult to secure timely, relevant internship placements to complete their degree programs with the required exposure being received, the employers have no place to target certain profiles and degree programs to offer their training vacancies; instead, searching them on the same platforms of full-time employment. Meanwhile, educational institutes struggle to monitor students' internship progress, for which direct interaction with the employer is needed. Unlike generic job portals, the proposed system, InternNexus, is designed specifically to address these challenges by offering a streamlined, transparent, and efficient internship management platform tailored to the Sri Lankan higher education sector. By integrating different user needs, such as real-time skill-based matching, application tracking, a comprehensive document management system, and timely analytics of the progress and feedback, InternNexus bridges the gap between academia and industry. If implemented at the national level, InternNexus would guarantee wider accessibility and connectivity between distributed stakeholders while showcasing the possibility of revolutionizing the education sector through computing, resulting in higher employability for students.

Though the system presents a well-structured foundation, when deployed at a large scale, it would require additional resources such as advanced database infrastructure, cloud storage, and enhanced security measures. Since InternNexus is currently at the research level, further development is needed to meet national-level policy requirements in the system. The authors invite education policy makers to explore the possibility of expanding this research and the prototype to strengthen industry-academia collaboration. In conclusion, this action research showcases the power of computing in creating inclusivity and nationwide system implementation to better prepare the future workforce.

Apart from resource requirements for national-level scalability, a few other limitations must also be noted. The system has to go through a series of tests and match with data protection laws and the national education policies of the country. Also, the system is limited by a lack of integration with university databases, which hinders automation of student performance tracking and validating academic credentials,

which are essential for employers to join the system. Several test runs are required to find other shortcomings of the system and to train the users of the system.

To advance InternNexus into a fully scalable and sustainable national-level platform, several suggestions are made for future research. The system architecture must be enhanced using cloud-native technologies like AWS or Kubernetes, which would allow for managing massive data processing and guarantee steady performance even under high load at the national level. Given the promises of AI-driven matching algorithms at present, the system can be further improved for a higher level of personalization, recommendations, and selection decisions using user profiles, academic credentials, and employer requirements. The system can be enhanced for user privacy, data security, and internship accreditations. Furthermore, there is a possibility of integrating the system with existing Student Information Systems and Learning Management Systems by enabling educational institutes and students to access all facilities in one place while enabling automated progress monitoring and academic validations. A separate longitudinal study can be carried out to compare the conventional internship placement methods and digital platforms like InternNexus for their effectiveness on career success and employability of students.

Furthermore, adding a virtual interview scheduling and hosting feature would guarantee a completely integrated system of the process from searching to reporting the progress of the internship. Such an advancement would enable students to receive real-time updates, prepare materials for the interview, receive automated reminders of interviews, and, thereafter, for employers to conduct interviews on the system itself or to integrate with existing online tools for communication. In essence, InternNexus demonstrates a possibility of expanding it to a comprehensive, end-to-end internship management ecosystem encompassing all stages of an internship lifecycle.

InternNexus can be positioned as a national platform that assists in transforming the Sri Lankan education sector by preparing students for future employment while stimulating and embracing the industry-academia relationship. It then differentiates itself from platforms that



merely connect users in the system by creating an ecosystem encompassing all stages of the internship lifecycle.

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