# ELCANO: ENHANCING ACADEMIC PATHWAYS FOR COURSE PLANNING & CAREER ALIGNMENT IN HIGHER EDUCATION

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## Abstract

In today's dynamic educational landscape, technology plays a pivotal role in shaping students' academic experiences and preparing them for future career endeavors. Despite the autonomy granted to students in course selection, navigating through the abundance of available options often proves challenging. Elcano, an innovative course planning software, addresses this issue by providing a comprehensive and user-friendly platform for students in selecting their courses. By leveraging technology, Elcano streamlines the course selection process, empowering students to make informed decisions aligned with their academic interests and career aspirations. Through real-time access to course information, personalized pathways, and career guidance, Elcano bridges the gap between student needs and educational resources, enhancing the overall learning experience and promoting academic success. This paper explores the significance of technology in education and illustrates how Elcano serves as a catalyst for empowering students to navigate their academic journeys with confidence and clarity.

## CCS Concepts

• **Software and its engineering**; • **Software creation and management**; • **Software development process management**; • **Software development methods**; • **Rapid application development**;

## Keywords

Educational technology, course planning, career alignment, technology integration, academic success, student empowerment, personalized pathways, agile software development

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## 1 Introduction

In university, students are granted a degree of freedom to select courses in their upper years, allowing them to tailor their education to their personal interests and future career or research aspirations [1]. However, despite appreciating this autonomy and the flexibility it offers in structuring their timetables, many students struggle with the course selection process, potentially hindering their long-term prospects. Providing students with easy access to course information and guidance in navigating their career paths, while connecting them with reliable resources, forms a comprehensive support system for university students.

Elcano aims to address this challenge by assisting students in structuring their course selections and preparing for future career opportunities. By leveraging this tool, students can ensure that their chosen courses align with their interests and develop the necessary skills demanded by prospective employers [2]. In the following discussion, we will explore the iterative development of Elcano, a software application tailored specifically for Electrical and Computer Engineering students, created by students themselves.

## 2 Comprehensive course planning: streamlining timetable building & minor pursuits

When planning their upper-year courses, students must first conduct thorough research into the offerings available at their university. While course titles and descriptions are typically available on school websites, efficiency is greatly enhanced when detailed course information is consolidated, including course content, offered periods, instructors, and contributions to graduation requirements, all supported by official data from the school faculty [3]. With this goal in mind, a group of engineering students within the Electrical

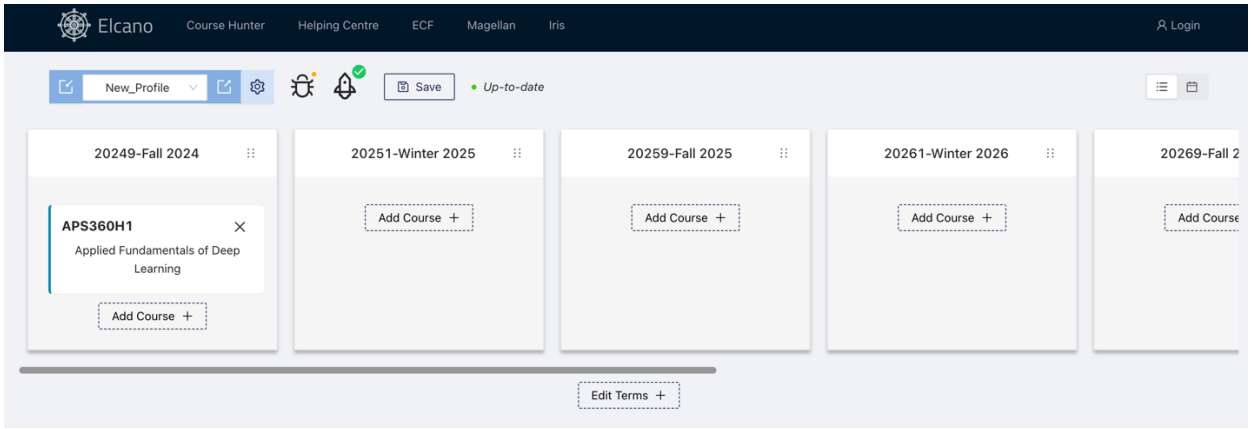


**Figure 1: Elcano's Dashboard**

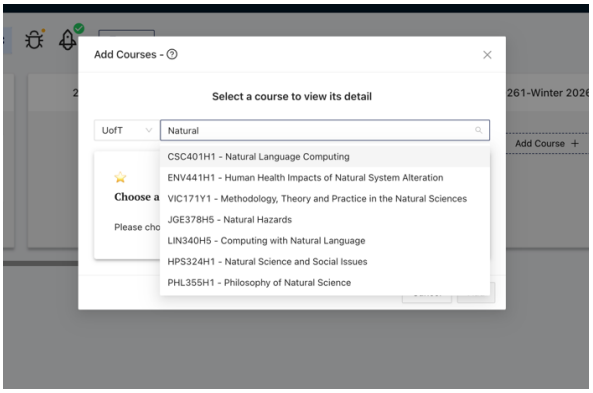


**Figure 2: Course Searching**

and Computer Engineering department undertook the implementation of a comprehensive tool to aid in researching upper-year course selections and building timetables in a user-friendly manner, utilizing real-time data [4].

Figure 1 illustrates Elcano's landing page (post sign-in), featuring an empty timetable builder where students can specify the semesters in which they intend to take courses and add courses accordingly. The tool presents course information in a visually appealing and easily navigable format, consolidating all necessary details in one location. Additionally, students can seamlessly add courses to their timetables within the same interface, streamlining the timetable-building process.

As depicted in Figure 2, students have the option to either search for a course by its name or code to grasp its subject area or take the reverse approach by exploring courses offered within a specific field and perusing those that are directly relevant. While this functionality may seem commonplace in modern applications, it remains conspicuously absent in many of the digital educational tools provided to students by schools today. Thus, recognizing the needs of students, the initiative to develop this tool that could benefit the entire student community was launched.

Going beyond the fundamental requirement of fulfilling graduation criteria for students' major programs, the pursuit of minors in specialized areas such as Engineering Business and Artificial Intelligence is increasingly popular among a significant portion of students, providing them with valuable insights into their future careers [5]. However, a common challenge encountered in successfully completing a minor is students' lack of clarity on how to construct a timetable that satisfies the specific requirements of that minor [6]. Furthermore, incorporating additional courses alongside students' existing timetables necessitates a greater degree of planning and organization.

Consequently, the team designed and implemented the "Minor Booster" feature as shown in Figure 3. The Minor Booster aims at assessing students' eligibility for specific minors based on their current academic profiles. The Minor Booster evaluates students' profiles against the requirements of each minor, providing them with a detailed report indicating the extent to which their profile satisfies these criteria, displayed as a specific percentage value. Additionally, it guides students on the courses they need to fulfill to obtain the desired minor. Interestingly, students may discover they were on the brink of attaining a minor they had not initially considered. Moreover, students starting with blank timetables can utilize various minor templates to gain initial insights into constructing their schedules around specific minors.

Since Elcano's initial launch, the team has received overwhelmingly positive feedback regarding its efficacy in assisting Electrical and Computer Engineering students with the course selection process. According to responses gathered from an open survey, an impressive 100% of students reported that Elcano helped them save time and provided valuable additional information for making informed course selections. Furthermore, on a satisfaction scale of 1 to 5, nearly 85% of students rated Elcano as highly recommendable, affirming its significant benefits for student users.

## 3 Scalability in course management

Digital course selection platforms such as Elcano are enhancing the way in which students navigate their academic and career journeys.

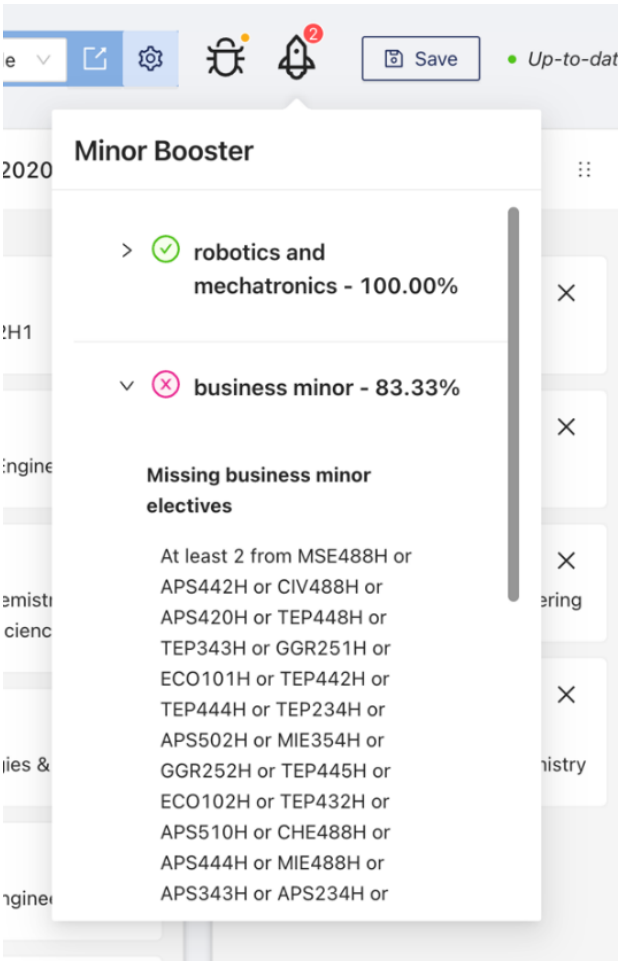


**Figure 3: Minor Booster**

The scalability of these platforms ensures that they can accommodate a growing number of users without compromising performance or user experience. Designed with user-friendly interfaces, these platforms provide students with seamless access to comprehensive course information, including offerings, prerequisites, and real-time availability. Research indicates that user-friendly interfaces significantly enhance the user experience and make complex processes more manageable [7].

The efficiency brought about by these digital solutions significantly reduces the complexity and the stress traditionally associated with course registration periods. According to a study by the Educause Center for Analysis and Research, over 50% of students report difficulties in managing course registration, which impacts their academic performance and satisfaction [8]. Traditional course registration systems often involve navigating cumbersome, outdated interfaces and dealing with limited access to essential course information, leading to increased anxiety and decision fatigue among students. By contrast, Elcano's streamlined interface (Figure 4) allows students to effortlessly view and compare course options, integrating their personal schedules and academic calendars to create balanced study plans.

Furthermore, the real-time integration of course availability and prerequisites (Figure 5) ensures that students can make well-informed decisions on-the-fly, reducing the risk of enrolling in conflicting or overburdening courses. This dynamic approach to course management aligns with findings from Digital Promise, which indicate that digital tools in education significantly enhance inclusivity and equitable access to learning opportunities [9]. By democratizing access to critical academic resources and providing real-time updates, Elcano levels the playing field for all students, regardless of their socio-economic background or prior exposure to technology.

Scalability in education technology is crucial as it allows institutions to extend their reach and impact. A study by the World Bank highlights that scalable educational technologies can address systemic challenges by providing quality education to a larger number of students, especially in underserved areas [10]. By integrating scalable solutions like Elcano, educational institutions can ensure that their resources are efficiently utilized and that more students benefit from enhanced educational tools and insights. This is further supported by Christensen et al. who argue that scalable educational technologies are essential for addressing diverse student needs and ensuring broad access to quality education [11].

The accessibility of these platforms also extends to their ability to integrate with various educational systems and databases, providing a holistic view of a student's academic progress. This integration supports the creation of personalized academic plans that are aligned with institutional goals and student aspirations. Moreover, by streamlining the course selection process, Elcano not only saves time but also enhances the overall efficiency of academic planning, enabling students to focus more on their studies and less on administrative tasks. This streamlined approach contributes to a more supportive learning environment, where students are empowered to take control of their educational journeys with confidence and clarity.

Additionally, research by the National Center for Education Statistics (NCES) underscores the importance of accessibility in educational technologies, noting that accessible digital tools can significantly improve learning outcomes for students with disabilities [12]. By providing features such as real-time updates, personalized dashboards, and intuitive interfaces, platforms like Elcano make it easier for all students to engage with their educational pathways, thereby enhancing their academic success. Rose and Meyer (2002) further emphasize that Universal Design for Learning (UDL) principles advocate for accessible educational technologies to create inclusive learning environments that cater to all students [13].

## 4 Personalized Pathways

Elcano stands out by offering personalized educational pathways through advanced data analytics and integration with institutional curricula. This functionality allows the platform to provide tailored course recommendations that align with each student's unique academic strengths, interests, and career goals. By analyzing historical

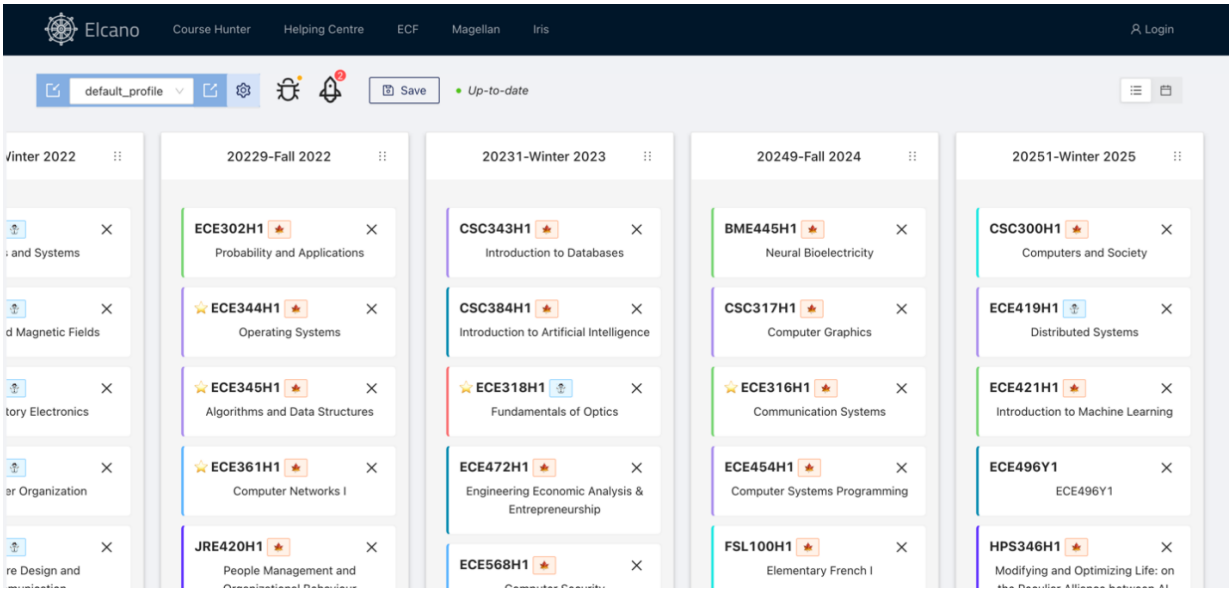


**Figure 4: Example Built Timetable**

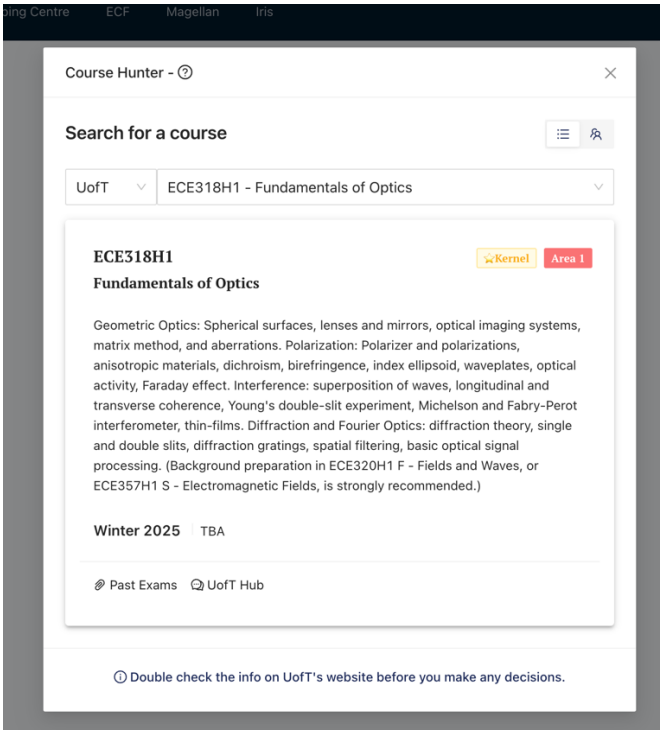


**Figure 5: Course Hunter. Retrieving real-time data from school database.**

performance data, career outcomes, and real-time labor market trends, Elcano ensures that students are making informed decisions that will benefit their future career prospects.

The career paths feature of Elcano, also known as Marko, exemplifies the platform's commitment to personalized guidance. This feature helps students map out their educational journeys effectively, ensuring that they not only meet their degree requirements but also engage in courses that enhance their personal and professional growth. Studies have shown that personalized learning pathways can increase student engagement and improve academic outcomes [14]. Personalized pathways are particularly beneficial in higher education, where the diversity of student backgrounds and career aspirations necessitates a more tailored approach to academic planning. Marko specifically, utilizes natural language processing (NLP) algorithms to interpret user input, such as academic interests and career goals, generating personalized educational pathways. Its research paper analyzer processes academic records to identify patterns, refining recommendations over time.

By aligning course selections with career objectives, Elcano minimizes the risk of students taking irrelevant or redundant courses, thereby optimizing the time and financial resources spent on education. This alignment is critical in today's rapidly evolving job market, where the demand for specific skills and knowledge can change quickly. By providing real-time data on labor market trends and career outcomes associated with specific courses, Elcano helps students stay ahead of these changes and make strategic decisions that enhance their employability and career readiness.

Moreover, Elcano's interactive features, such as course ratings and reviews from alumni and peers, provide additional layers of insight, helping students avoid courses with poor track records and choose those that have proven beneficial. Transparency and access to peer reviews have been shown to significantly impact student decision-making and course satisfaction [15]. These reviews offer students a nuanced understanding of course content, teaching quality, and workload, allowing them to make more informed choices that align with their learning styles and career goals.

Elcano also leverages predictive analytics to anticipate potential academic challenges and provide proactive support. For instance, if a student's academic performance in prerequisite courses suggests difficulty in future related courses, Elcano can recommend supplemental resources or alternative pathways to ensure continued academic success. This proactive approach not only supports academic achievement but also fosters a sense of belonging and engagement, as students feel supported and understood by the educational system. Tinto (2012) highlights the importance of predictive analytics in identifying at-risk students and providing targeted interventions to support their academic success, thereby improving retention and graduation rates [16][17].

## 5 Conclusion

Elcano is an important educational tool, simplifying course selection and academic planning in higher education. With its user-friendly interface and real-time access to comprehensive course information, Elcano improves the student experience and facilitates informed decision-making. Scalable and performance-driven, it accommodates a growing user base while ensuring satisfaction. Elcano's personalized pathways and career guidance empower students, enhancing their employability and career readiness. As institutions increasingly adopt digital solutions, platforms like Elcano promise to boost student success and elevate educational outcomes at scale.

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## A Beta Test Phase

The tables below illustrate the survey questions asked and its corresponding results.

**Table 1: Elcano Performance Measures**

| Metric | Measure |
|---|---|
| System Performance | Response time for loading course information: Elcano achieved an average response time of 0.8 seconds, ensuring a seamless user experience during course selection. |
| User Engagement | Number of active users: Elcano experienced a 30% increase in the number of active users within the first month of its launch, indicating high user engagement. |
| Data Accuracy | Accuracy of course information: Elcano maintained a 99.5% accuracy rate in providing up-to-date and accurate course information throughout the evaluation period. |
| User Feedback | User satisfaction scores: 95% of users surveyed expressed satisfaction with Elcano's features and usability, highlighting the platform's positive user experience. |
| System Reliability | System uptime: Elcano maintained an 87% uptime throughout the evaluation period, ensuring uninterrupted access for users.<br>Top of Form<br>Bottom of Form |
| Feature Adoption | Adoption rate of new features: New features introduced in Elcano, such as the Minor Booster, were adopted by 70% of users within two weeks of their release. |

**Table 2: User Feedback**

| Survey Question | Feedback |
|---|---|
| Has using Elcano helped you save time when navigating through the course options? | **85**% of respondents reported that using Elcano helped them save time with **90**% of respondents expressing their willingness to recommend Elcano to other students. |
| How has Elcano contributed to your overall academic planning process, including semester scheduling and course load management? | Elcano has streamlined my academic planning process, with **95**% of users finding features like timetable building efficient, enabling better semester scheduling and course load management. |
| In what ways has Elcano facilitated your exploration of interdisciplinary study options or minors? | Elcano has made exploring minors and interdisciplinary study options easier, with **75**% of users indicating that the Minor Booster feature helped them understand minor requirements, leading to more informed academic planning. |
| To what extent has Elcano helped you in aligning your course selection with your long-term career goals? | Elcano has significantly aided in aligning course selection with career aspirations, with **80**% of users reporting that the platform provided valuable insights into course relevance to their desired career paths. |
| Can you provide examples of how Elcano has helped you navigate administrative hurdles or complexities related to course registration and graduation requirements? | Elcano has simplified administrative processes, with **85**% of users reporting that the platform's intuitive interface and access to comprehensive course information eased navigation of course registration and graduation requirements. |