

Improving Student Experience Using Automated Toolset of Academic Services

Hicham H. Hallal, Fadi Aloul, Sameer Alawnah, Praveena Kolli, Ahmad Alnabulsi
Department of Computer Science & Engineering

American University of Sharjah

{hhallal, faloul, salawnah, pkolli, aalnabulsi}@aus.edu

ABSTRACT

Automation in education has become a major factor shaping a direct relationship between the offered automated services and the academic performance of students in universities. In this paper, we discuss a toolset that features several services aimed at improving the overall experience of students during their stay at the Computer Science and Engineering Department in the American University of Sharjah. The toolset is an attempt to replace many processes that were still, until recently, dependent on paper and pencil. The proposed transformation includes services that affect, on daily basis, the performance of students in their classes. In particular, the toolset automates services related to academic advising, course registration (planning for course sections, availability of courses and handling of waiting lists), exam scheduling (detecting conflicts), tracking attendance in courses, helping students find the proper internship program, and monitoring student progress in their study plans (admission for the second year). The toolset is made accessible through a mobile friendly web portal. Our initial evaluation, based on conducted surveys, shows appreciation from the part of students of the provided services.

CCS Concepts

- **Software and its engineering** → **Software creation and management** → **Designing software**
- **Information systems** → **Information systems applications**

Keywords

Student Services; Electronic Advising; Tool Development; Curriculum Planning; Waiting Lists; Attendance Tracking.

1. INTRODUCTION

Student retention has always been a major concern for higher education institutions for many reasons. The need to retain, and consequently, graduate students constitutes a leading driver why universities are increasingly adopting a customer based approach towards students [9]. This approach focuses on offering students quality services to support them during their residence at the institution. Such services cover mainly academic advising, curriculum planning, course registration, career and placement,

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Permissions@acm.org.

ICCTA 2020, April 14–16, 2020, Antalya, Turkey

© 2020 Association for Computing Machinery.

ACM ISBN 978-1-4503-7749-2/20/04...\$15.00

<https://doi.org/10.1145/3397125.3397138>

and even attendance tracking in courses. At the same time, the ongoing digital transformation affecting almost every aspect of our lives has resulted in a strong tendency to automate any possible service in order to help students avoid several of the problems associated with the classical paper based approaches. Most recently, web and mobile based applications have made the access to the offered services even more convenient and efficient for both students and administration. In particular, students can avoid waiting in long lines around campus while gaining access to most services almost anytime anywhere. In this paper, we report on the development of an automated toolset implementing several services aimed at improving the overall experience of students during their stay at the Computer Science and Engineering Department (CSE) in the American University of Sharjah (AUS). The toolset is an attempt to replace many processes that were still, until recently, dependent on paper and pencil. The proposed transformation includes services that affect, on daily basis, the performance of students in their classes as well as services that help students plan more efficiently for their curriculum implementation. In particular, the toolset automates services related to:

1. **Academic advising:** E-Advise is a mobile friendly web-based application that offers both students and their academic advisors several services that facilitate the advising process and make it more efficient. Worthy to note that prior to the use of E-Advise, academic advising was performed manually and by paper, where students meet their respective advisor who had to pull out courses from the system and then manually mark the advising sheets. This process used to be lengthy and prone to errors.
2. **Course registration:** A set of tools that automate parts of the processes of planning the course offerings in future terms, handling the registration waiting lists, and detecting conflicts in the schedules of the final exams.
3. **Tracking attendance in courses:** An easy to use mobile based application that allows instructors automate the process of taking attendance in the classroom while minimizing the time needed.
4. **Finding internship programs:** allows students to search for internship offers and post their profiles to make them available for partnering companies.
5. **Monitoring student progress in their study plans:** This is a tool that allows students to verify their admission to the second year of their programs based on completed credits and grades in specific courses

The developed toolset is made accessible through a mobile friendly web portal, where the focus has been on equally important factors including

- **User Friendliness:** Students should be able to use the services in the toolset with relative ease.
- **Accessibility:** The users should be able to access the implemented services from anywhere and at any time. The exception, here, is the service to track attendance in classrooms.
- **Versatility:** The toolset should offer as many services as possible to the students in order to respond to their daily needs.

Our initial evaluation, based on surveys conducted among students using the services, shows appreciation from the part of students of the provided services over the classical methods that were in use previously.

Section 2 of this paper provides a literature review of existing tools targeting student services. Section 3 discusses the implementation of the proposed toolset. An evaluation of the deployment of the proposed advising system is presented in Section 4. Finally, the paper concludes in Section 5.

2. RELATED WORK

This work belongs to the category of attempts to automate the services a university can offer to the students in order to improve their experience during their stay in academic programs. Since the proposed toolset covers several services, structure our review of the existing literature based on the services offered in the toolset, and we focus on the main two services: the academic advising and the attendance tracking tools.

2.1 Academic advising

The need for an automated academic advising approach in educational institutions can benefit from the use of technological advancements among other improvements [1]. The survey provided in [3] analyzes more than 40 works in the area of automating academic advising. Among those, we try to compare E-Advise to the following main approaches which have resulted in tools:

- **My_eAdvisor [4]:** An automated tracking tool that provides students and advisors with immediate semester-by-semester feedback regarding the students' progression on their major study plans.
- **E-Advisor [7]:** A multi-agent intelligent advising system designed for the Master of Science in Information Systems in Athabasca University in Canada. E-Advisor allows students to add preferences of specialization to their profile and then recommend courses based on these preferences.
- **Adviseme [8]:** An intelligent web-based application, which provides a reliable, user-friendly interface for the handling of general advisory cases in special degree programs offered by the Faculty of Science and Technology (FST) at the University of the West Indies (UWI), St. Augustine campus.
- **Online Advisor [2]:** A decision system that supports both advisors and students in their use of than existing student information system. It integrates with the student information system (SIS) to relieve clerical burdens and enable advisors to be student centered, allow academic advisors to aid students beyond the routine. The experiment was conducted in the school of business at the American University of Beirut, but was not extended to include other schools and departments.

While the main features of E-Advise toolset are common in existing solutions, our proposed solution provides a more interactive environment that follows a workflow between the advisor and the advisee. The student starts the process by accessing his/her study plan that displays what courses he/she passed and

what he/she is currently registered in and what is left for the student to graduate. The student will select the desired courses for the next term, and submits the selection to transfer the control to the advisor. In case the selected course needs a pre-requisite that the student didn't have, the system will alert the student to that. The advisor can confirm, modify, or reset the selection and return it to the student. In both cases, a notification process is implemented through which both the student and the advisor receive email messages of the actions taken. Alternatively, the users can exchange instant messages within the main selection window to discuss modifications when suggested. The final selection is archived for future reference if needed.

Another advantage is that the E-Advise toolset is implemented independent of the student information system of the university. This allows for avoidance of interference between the two platforms and for more security in the SIS ecosystem.

2.2 Tracking attendance in the classroom

The surveys in [6] and [11] discuss several approaches and tools that use different methods to take attendance in the classroom. The analyzed works include approaches that use various software based or hardware based techniques, and a wide range of different tools to record the attendance like barcode, RFID, biometrics, face recognition [9, 13], and voiceprint [12]. The conclusion in [11] is that in order to achieve an efficient approach to track attendance in class, one has to add more hardware, more advanced software, and even more time to complete the process. The proposed attendance tracking system does not require extra hardware or sensors for its implementation. We developed a mobile application that students can use on their own mobile phones to scan a random QR code (changes for each lecture) that is displayed in class using the data projector.

3. IMPLEMENTATION

In this section we present the implementation details of the proposed toolset. We address the three main components of the toolset:

3.1 E-Advise

The E-Advise tool is a mobile friendly web-based application that offers both students and their academic advisors several services that facilitate the advising process and make it more efficient.

E-Advise interacts with an existing student information system to enable students to:

- Access their advising records.
- Visually display their progress in their academic plan.
- Select their desired courses for an upcoming term.

On the other hand, the academic advisor accesses the E-Advise application to:

- Monitor the student progress.
- Confirm selected courses for registration or suggest modifications.
- Communicate with the students via instant messaging to discuss decisions.

E-Advise has been deployed and used in the CSE Department at AUS for two consecutive academic years, where the feedback from students has been positive about their improved advising experience (as will be discussed in the next section).

Figure 1 shows the workflow of the E-Advise tool, which includes two main components:

The GUI: E-Advise includes a friendly GUI that offers the following main features:

- Visual display of the study plan of each student as shown in Figure 2.
- Use of color-coding to distinguish between courses per category.

One categorization of courses is following their status:

- Completed courses (pink)
- Currently registered courses (orange)
- Courses available for selection in the next term (yellow)
- Courses selected for next term (green)

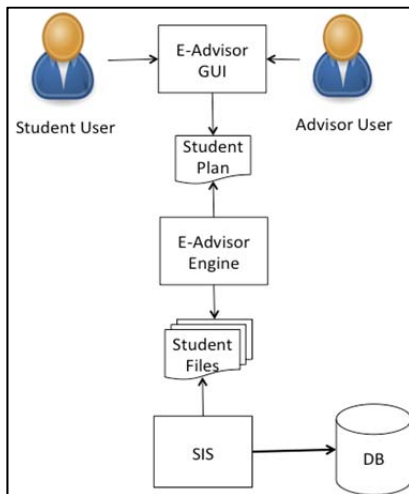


Figure 1: Workflow of the E-Advise toolset.

Another categorization is according to the type of the course:

- Required
 - Major Elective
 - General Education Requirement or Free Elective
- Critical path identification: Through depicting the prerequisites of courses, the tool helps the user identify the critical path in the study plan by showing the courses that become available as a result of completing any specific course. The tool can also display the longest sequence of remaining course that is needed for graduation and hence the minimum time left for graduation.
 - Identification of missing pre-requisites for any course that the student wants to take.
 - Manual insertion of courses in the schedule of the upcoming term, especially when the desired course is not in the displayed plan (Figure 2).
 - Display of the completed hours, currently registered hours, remaining hours, the major of the student, and the version of academic catalog followed to specify the study plan of the student.

The Intelligent Engine: This component is responsible for the following functions:

- Communication with the existing SIS to retrieve up to date student files and data related to their study plans.
- Reorganization of the retrieved student records to become usable in the visual display of the study plan. This includes computation of values like:

- Number of completed credits
 - Number of remaining credits
- Communication between the student user and the advisor user to share comments on a specific study plan.
 - Analysis of the pre-requisite relationship between courses to indicate dependence and ordering.

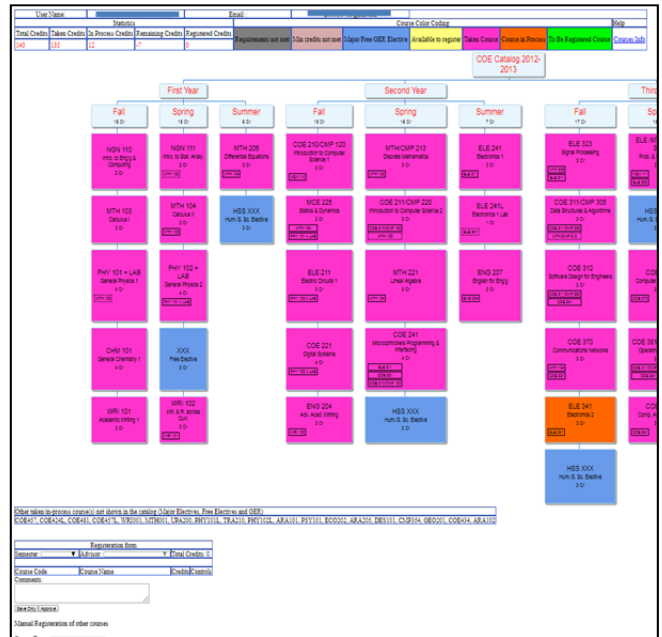


Figure 2: Color-coded display of the study plan in E-Advise.

3.2 Attendance Tracking

This tool is implemented in the form of a mobile application that students get to download on their mobile phones and use it in class. The application is available for users of both Android and IOS operating systems.

The process of taking attendance in class (Figure 3) involves the following steps:

- The instructor logs in to his/her attendance control panel and chooses the right section of the course for which attendance shall be called.



Figure 3: Attendance tracking system in classroom.

- The system displays a QR Code on the whiteboard through the data projector. The QR code will be displayed for a

duration that can be set by the instructor. Our experience shows that 60 seconds are enough to take the attendance even in large classes. The code becomes invalid as soon as the instructor stops the system.

- Students scan the displayed QR code through the mobile application on their phones.
- The server send confirmation to all the students of the section about their attendance status (present/absent).
- The faculty can easily manually mark the students as late, present or absent later if needed.

3.3 CSE Portal

The CSE portal is host to several services that students can benefit from on continuous basis during their stay at the department. The main services made available through the portal include:

- Admission to Second Year Calculator (Figure 4): Students are admitted to the CSE programs, namely Computer Engineering and Computer Science on the freshman level. The progress of students through their study plans requires them to meet specific requirements to be promoted (admitted) to the second year of their studies. These requirements include completing specific fundamental courses (called gateway courses), mainly in the STEM (Math and Sciences) and in English writing categories. Unless students complete the Gateway requirements, they are not allowed to enroll in specific courses that are considered essential in the study plan. The developed web-based application allows each student to check his/her status and receive feedback on what is the reason why he/she did not pass the Gateway requirements.
- Course waiting lists: During registration periods, it is common that some students do not get to enroll in all the courses they plan for. The existing process to handle the waiting lists in the university is paper based, where the student has to pass by each department where they miss a course to add their names on the waiting list for that course. In order to facilitate the process of handling such cases, the portal offers, to the students, the possibility of adding themselves to the waiting list of the courses they missed during registration. The lists are compiled and analyzed by the administration of the department.

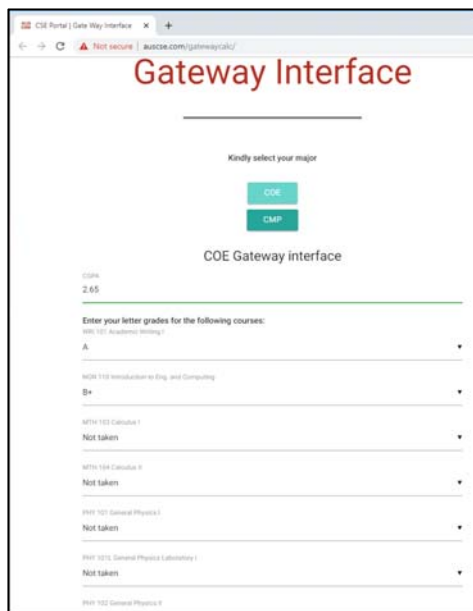


Figure 4: Admission to second year calculator.

4. EVALUATION

We focused in our preliminary evaluation on the E-Advise tool and its impact on student satisfaction with the advising process in the CSE department. To evaluate the tool, we deployed a survey to students asking them about their impressions of the experience of using the automated advising approach and the electronic E-Advise application. In the survey, we asked students to answer two direct questions about their experience of using the E-Advise toolset and to compare the experience to the scenario before the deployment of the tool. The answers of the students showed a positive impression as indicated in the following tables.

The number of participating students was in the range 120 to 130 students out of almost 400 students in the CSE department.

Question 1: The new electronic advising system was useful?

The new electronic advising system was useful?		
Answers	Results	
	Fall 2017	Spring 2018
Strongly Agree	71	76
Agree	29	37
Neutral	15	11
Disagree	2	2
Strongly Disagree	1	2
Score	4.42	4.43
Number of Participants	118	128

Question 2: I prefer the new electronic advising system over the traditional paper-based advising system.

I prefer the new electronic advising system over the traditional paper-based advising system		
Answers	Results	
	Fall 2017	Spring 2018
Strongly Agree	80	94
Agree	19	21
Neutral	14	11
Disagree	3	0
Strongly Disagree	2	2
Score	4.46	4.60
Number of Participants	118	128

5. CONCLUSIONS AND FUTURE WORK

We presented a toolset to automate many of the services used by the students in the CSE department at AUS on a daily basis. The toolset, which includes mobile friendly web-based applications to facilitate the processes of student academic advising, tracking student attendance in classrooms, monitoring student progress in the study plan, and maintaining course waiting lists.

The various tools, implementing essential services, have contributed to raising the level of satisfaction of students as was shown in the surveys conducted.

Further development of the toolset is already in process and more features are being added to it. In addition, a major improvement on

the tool development is to launch a mobile version of the E-Advise application that can add to the flexibility of its use and to its efficiency. In addition, our plan includes completing an evaluation survey for the attendance tracking and the gateway monitor to analyze students' feedback and use it in the improvement of the tools.

6. ACKNOWLEDGMENTS

The authors of this work would like to recognize the contributions of the IT unit of the College of Engineering at AUS to the development and the expansion of the E-Advise toolset.

7. REFERENCES

- [1] Z. Chan, H. Chan, H. Chow, S. Choy, K. Ng, K. Wong, and P. Yu, "Academic Advising in Undergraduate Education: a Systematic Review," *Journal of Nurse Education Today*, vol. 75, pp. 58-74, 2019.
- [2] T. Feghali, I. Zbib, and S. Hallal, "A web-based decision support tool for academic advising," *Journal of Educational Technology & Society*, vol. 14, no. 1, pp. 82-94, 2011.
- [3] O. Iatrellis, A. Kameas, and P. Fitsilis, "Academic Advising Systems: A Systematic Literature Review of Empirical Evidence," *Education Sciences*, vol. 7, no. 4, pp. 90, 2017.
- [4] S. Jhaj, "Visual Case Studies in Educational Equity and Transformation", OpenBook Publishers, 2019. <https://doi.org/10.11647/OBP.0157>
- [5] L. Keston Henderson and W. Goodridge, "AdviseMe: An Intelligent Web-Based Application for Academic Advising," *International Journal of Advanced Computer Science and Applications (IJACSA)*, 6(8), 2015.
- [6] Z. Kotevski, N. Blazeska-Tabakovska, A. Bocevaska, and T. Dimovski, "On the Technologies and Systems for Student Attendance Tracking," *International Journal of Information Technology and Computer Science*, vol. 10, pp. 44-52, 2018.
- [7] F. Lin, S. Leung, D. Wen, F. Zhang, and M. Kinshuk, "E-Advisor: A Multi-agent System for Academic Advising," *International Transactions on Systems Science and Applications*, vol. 4, no. 2, pp. 89-98, 2009.
- [8] A. Noaman and F. Ahmed, "A New Framework for E Academic Advising," *Procedia Computer Science*, vol. 65, pp. 358-367, 2015.
- [9] K. Puthea, R. Hartanto, and R. Hidayat, "A Review Paper on Attendance Marking System based on Face Recognition," in *Proc. of the International Conference on Information Technology*, pp. 303-308, 2017.
- [10] A. Rummel and M. MacDonald, "Identifying the Drivers of Student Retention: A Service Marketing Approach," *Journal of Business*, vol. 1, no. 2, pp. 1-7, 2016.
- [11] A. Sawant, A. Dongare, I. Gilbale, A. Thakur, and P. Tekawade, "A Survey on Smart Attendance System Based on Various Technologies," *International Journal of Innovative Research in Computer and Communication Engineering*, vol. 5, issue 10, October 2017.
- [12] S. Yang, Y. Song, H. Ren, and X. Huang, "An automated student attendance tracking system based on voiceprint and location," in *Proc. of the International Conference on Computer Science & Education (ICCSE)*, pp. 214-219, 2016.
- [13] B. Yuvaraj, M. Srikanth, V. Kumar, Y. Murthy, and S. Koolagudi, "An approach to maintain attendance using image processing techniques," in *Proc. of the International Conference on Contemporary Computing (IC3)*, pp. 1-3, 2017.