Development of Student's Enrolment System Using Depth-first Search Algorithm

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Abstract This paper presents a new electronic system that uses technology which is the student enrolment system (SES) used at the University of Technology (Baghdad). The work aims to save time and effort for both the direct admission staff and the student. Application (SES) was evaluated using several variables: (student score, school branch, student desire, role of success in the high school, admission channel, application date and number of seats allocated to each admission channel in each department). The depth-first search algorithm was used to search in data as a tree or graph data structure and speed up the admission process for first-year students at University of Technology (Baghdad). The results obtained from the (depth-first search) algorithm was tabulated using the SPSS statistical programme (statistical version 20) to analyse variance to determine which of the factors most affected the results of student enrolment to the departments. The results showed that the electronic system (SES) included the acceptance of the highest rates in the scientific departments according to the student's desire and within the qualitative capacity of each department. The results showed that the best average was present at the student model 3 (0.218567 ± 0.0044792), which means that the student made the best choices. The results of (ANOVA) showed that when the value of ($P \leq 0.05$), there will be statistical significance, as it was found that the student score ($p = 0.001$), the role of success ($p = 0.003$) and the number of seats available for each department ($p = 0.004$) are among the most influential factors on student acceptance, followed by the student branch ($p = 0.033$) and application date ($p = 0.060$), while the student's desire ($p = 0.549$) and acceptance channel ($p = 0.56$) have the least influence on the student's acceptance.

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Keywords Depth-first search algorithm · Student enrolment system · Database schema · Graph data structure

1 Introduction

The internet was developed rapidly, and information system over web is quickly increased at unmatched speed [1]. Governments, institution and companies spread their information and manage it over web, which is an important direction. In the websites construction, manage, distribute, mine and utilize information in efficient way are important [2]. While the internet markets are flourish, the concept of web-based applications became more important, processing business and became a method to increase the markets and improve incomes for institutions. Building systems over web may help governments, institution and companies fast set up complicated systems in cheaper operation [3]. Student enrolment system is the first step for students who want to complete their university studies in the Iraqi's universities and institutes to obtain a bachelor's degree or technical diploma. Since 2017, the University of Technology has used its own system to accept new students in nine of its sixteen departments, and this system is the student enrolment system, that uses depth-first search algorithm. There are many researchers who have developed applications that use the DFS algorithm.

Foteini G. and Ioannis H. developed an automatic marking system which assists to lessen the time required in marking and utilize this time effectively for more innovative work. The framework upholds programmed marking of student answers to interactive exercises concerning blind search in DFS. The outcomes demonstrate a decent arrangement between expert and system marking. Additionally, towards the finish of the test, students were approached to finish an internet-based poll about the framework, and it shows that a large portion of the students gave positive reactions [4].

Naoufel W. and Faouzi K. created decision support system (DSS) for student advising. The framework intends to give students with a mechanized programme scheduling and arranging service that best accommodates their profiles while meeting scholarly prerequisites. They found that the DSS was a successful embedding of the essential guidelines, with a systematic and exhaustive search of the academic plans throughout a period scale that ranges from the next term up to graduation [5].

2 Practical Part

2.1 Enrolment System

The direct admission staff in the Registration and Student Affairs Department had to create an electronic system that allows students to apply for admission to the nine

departments according to instructions and controls set by the university, in terms of the total Student Competitive "it's calculated through a mathematical equation developed by the university" which it is the student score, school branch "Applied, Biological and Scientific branch", the student's desire, the role of success in high school, acceptance channel and the number of seats assigned to each admission channel in each department in the university. This system will reduce the efforts and load of the staff of the direct admission staff in the Registration and Student Affairs Department by providing simple interfaces for all possible users.

After the results of the high school announced, the university opens the student enrolment system to receive electronic forms for students applying to the university, students start applying by entering the system, and the application involved several steps:

- Fill in the required fields to enter the system "exam number, password and the activation code";
- The entered data will be matched with the system's database, in case that the entered data is correct, the electronic form will appear with the student's basics information from the database on it "student's name, gender, directorate of education, exam number, high school branch and the name of the school";
- Student writes his options in sequence from (1–9), he is not required to write all options, but it is required to write at least one option or leave the system and not submit;
- After completing the form, the student can print the form or save it and leave the system.

The student score is calculated through a mathematical equation developed by the university; the system calculates total competitive by the following operations:

1. Islamic education degree "for Muslim's students" $= A$;
2. Arabic degree $= B$;
3. English degree * 4 $= C$;
4. Mathematics degree * 8 $= D$;
5. Physics degree * 8 $= E$;
6. Biology degree "for biological and scientific students" * 4 $= F$;
7. Economy degree "for applied students" * 4 $= F$;
8. Chemistry degree * 4 $= G$.

Finally, the student score can be calculated by this equation:

$$\text{total competitive} = \frac{(A + B + C + D + E + F + G)}{30}$$

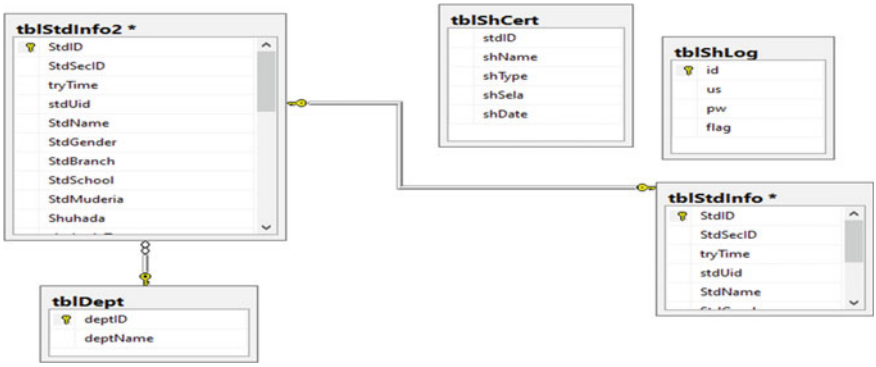


Fig. 1 Database schema

2.2 *Database Design*

A database is an information structure that stores coordinated data [6]. Most databases contain many tables, which may each contain many fields [7]. Simply, it is collection of coordinated data, normally as a set of related lists of entries. The information is regularly coordinated, so it is effectively accessible. Coming up next are instances of database that we use frequently (address book, dictionary and telephone book) [8]. In this system, we used SQL server since it is actual quick, dependable, easy to use, free to download. Figure 1 shows the database schema.

This database schema of system consists of five main tables. Table "tblStdInfo" contains information about all students. It is connected to the table "tblDept" which they belong to. Each record in table "tblStdInfo" connects to tables: "tblDept", "tblStdInfo", "tblShCert" and "tblShLog"; all of these tables are related by one to many relationship. Table "tblStdInfo" contains information about all students. It consists of 18 fields. These fields are store student's ID, students name, admission channel, students score, student's choices and a date time label. The primary key for this table is "StdID" which is automatically incremented.

2.3 *Depth-first Search Algorithm*

Depth-first search algorithm is used for searching data in graph or tree structures [9]. It is selecting some arbitrary node for start searching as a root node in the case of a graph, and before backtracking, it explores each branch as far as possible along the idea is to begin searching from the root node, sign it and move to the next unmarked node; this loop continues until all nodes signed, then backtrack to search for other unsigned nodes. Finally, the nodes are printed in the path [10]. The idea for using depth-first search algorithm in this system is to find the first choice from student's choices while ensuring acceptance of the highest rates in the scientific departments

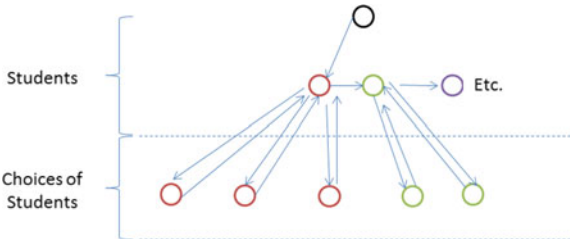


Fig. 2 Depth-first search algorithm

according to the student's desire and within the specific capacity of each department; Fig. 2 shows how the algorithm works in system.

2.4 Statistical Analyses

The student's data was analysed statistically, by using analysis of variance (ANOVA). The specific values of results were done with the SPSS (statistics version 20). The results of the analysed data were estimated significant when the $P \leq 0.05$ [11].

3 Results

3.1 Data Test

In this process, the data tested by executing all processes to all of data. This process was depicted in Fig. 3. The first step was read descending by student score, the second step was looping in the student's choices, if student's score greater than or equal to the lowest limit of the department, then it goes further to the third step, else return to the next choice, the third step was read numbers of an available seats for that department, if there is a seat available, then it goes to the fourth step, else goes to the next choice, the fourth step was accepting the student in department, and that was the last step for the data test [12–15].

Design of interface

Design centres around expecting what users may have to do and guaranteeing that the interface has components that are not difficult to get to, straightforward, reasonable and use to work with those activities [13].

The implementation of SES interfaces. Figure 4 shows the main page "Home page" of the system. It contains textboxes "Enter exam number", "Enter password", "Enter the activation code (Captcha)" and "sign in" button.

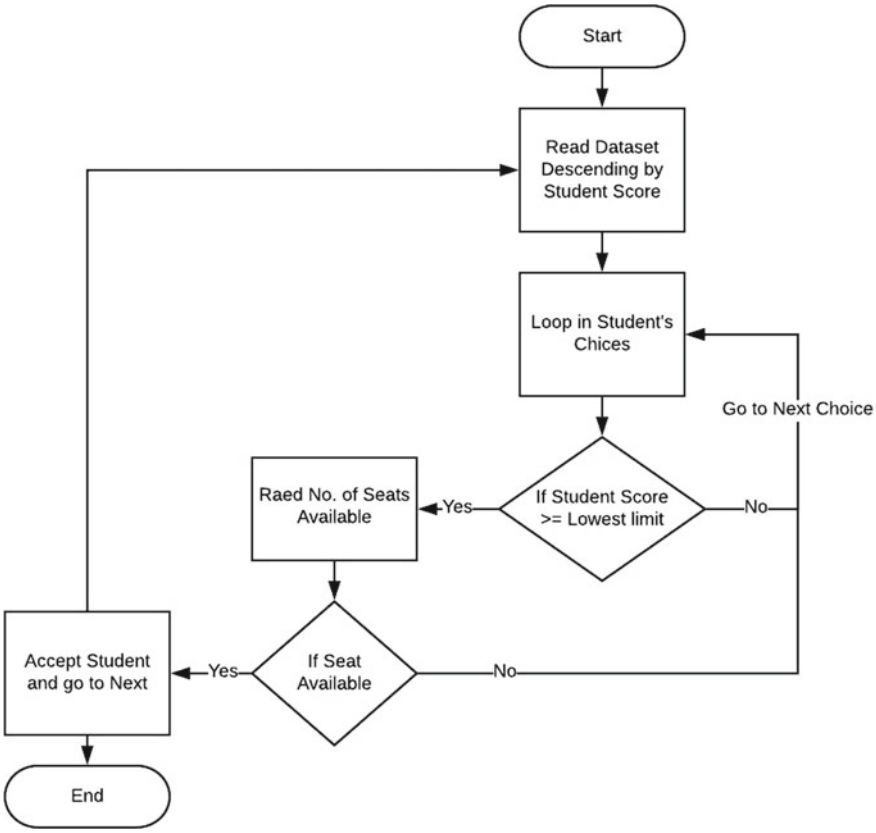


Fig. 3 Students enrolment system using depth-first-search algorithm

Figure 5 shows the page for "student page", it appears when the student entered correct information, this page shows student's information, and the student must choose his admission channel and fill-in his choices and submit.

Figure 6 shows final page as a report; the student must print this page and save it.

3.2 Analyses Static

Table 1 describes results of the mean SES; the relation between mean of ratio and model of students is displayed in Fig. 7.

The results of Table 1 show that the best mean was present at the student model 3 (0.218567 ± 0.0044792), which means that the student made the best choices. This can be explained by the student arranging the area (0.001, 0.003 and 0.004), respectively, has less factors in a better way compared to the rest of the students.

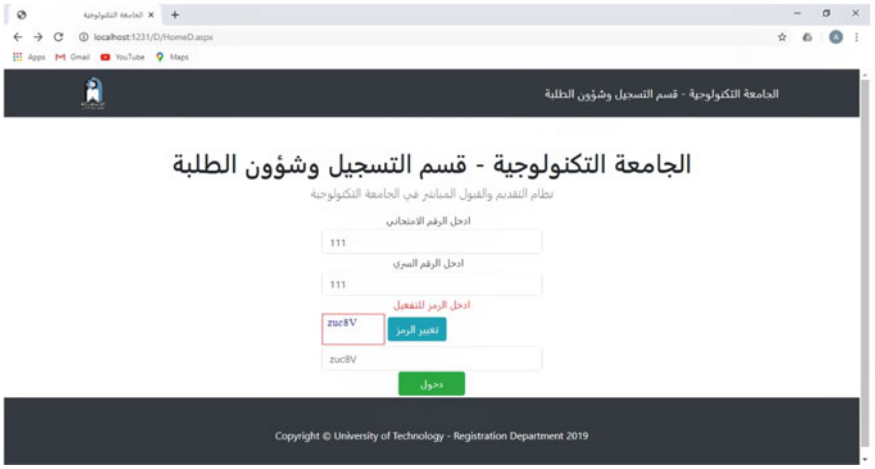


Fig. 4 Home page

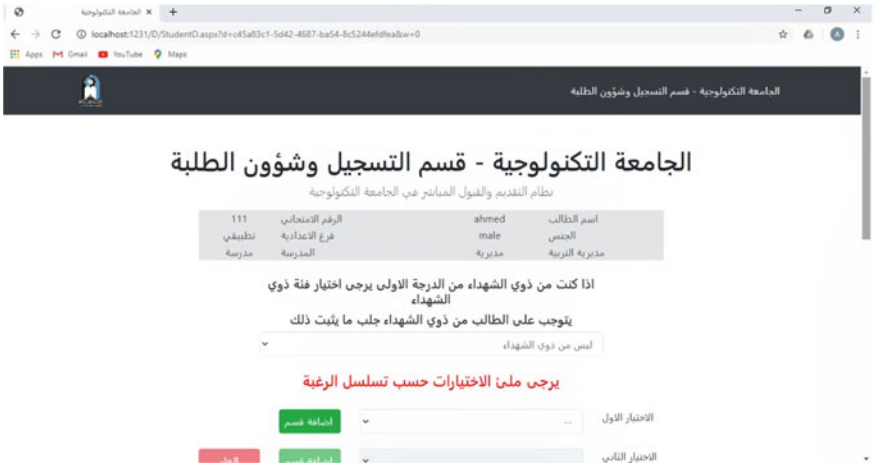
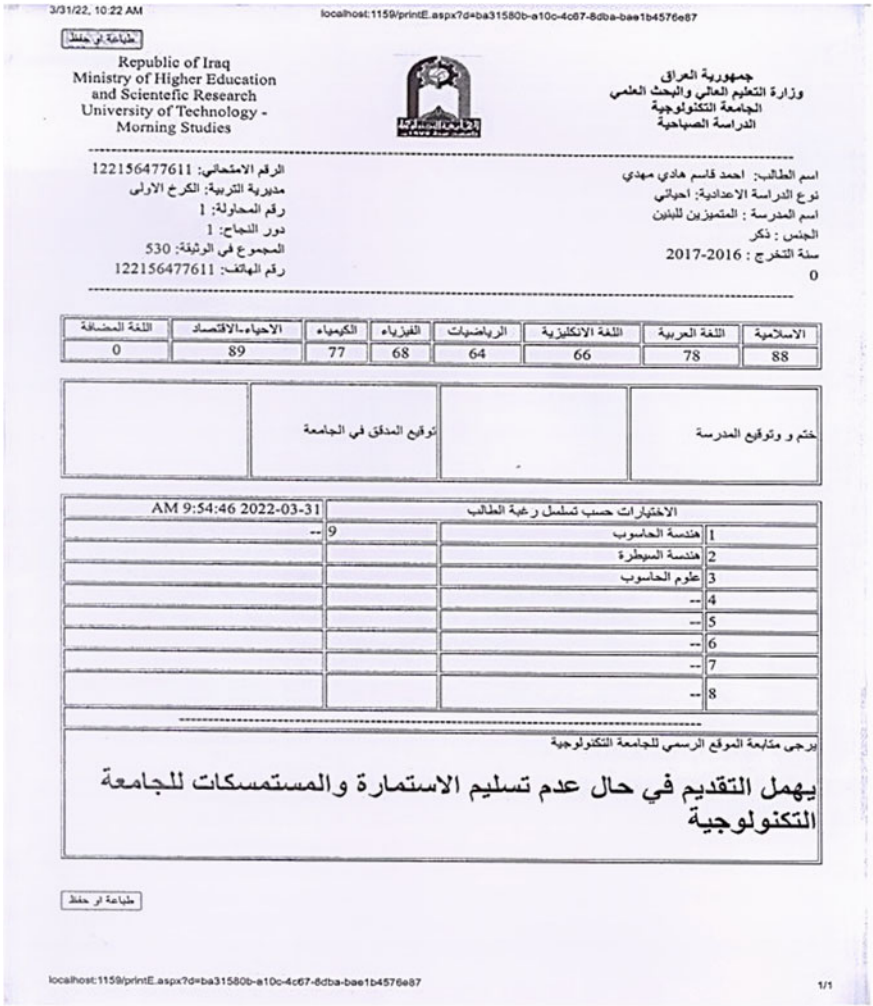


Fig. 5 Student's page

Table 2 offers the ANOVA static analyse for all model of students under all variables. There is variation in the mean value between variable of models of students greater than expected. The *P*-value of student score, role of success in the school and number of seats allocated than 0.05.



3/31/22, 10:22 AM localhost:1159/printE.aspx?d=ba31580b-a10c-4c67-8dba-bae1b4576e87

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الرقم الامتحاني: 122156477611
مديرية التربية: الكرخ الاولى
رقم المحاولة: 1
دور النجاح: 1
المجموع في الوثيقة: 530
رقم الهاتف: 122156477611

اسم الطالب: احمد قاسم هادي مهدي
نوع الدراسة الاعدادية: احيائي
اسم المدرسة : المتميزين للبنين
الجنس : ذكر
سنة التخرج : 2017-2016
0

الاسلامية	اللغة العربية	اللغة الانكليزية	الرياضيات	الفيزياء	الكيمياء	الاحياء-الاقتصاد	اللغة المضافة
88	78	66	64	68	77	89	0

ختم و توقيع المدرسة		توقيع المدقق في الجامعة	

الاختيارات حسب تسلسل رغبة الطالب		AM 9:54:46 2022-03-31
1	هندسة الحاسوب	9
2	هندسة السيطرة	
3	علوم الحاسوب	
4	--	
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يرجى متابعة الموقع الرسمي للجامعة التكنولوجية

يهمل التقديم في حال عدم تسليم الاستمارة والمستمسكات للجامعة التكنولوجية

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Fig. 6 Printed page

4 Conclusion

The goal of the system is to develop of student's enrolments system using depth-first search algorithm to save time and effort for both the direct admission staff and the student. The depth-first search (DFS) algorithm was used to search and speed up the admission process for the enrolment at University of Technology, and the results obtained from the (depth-first search) algorithm were tabulated using the SPSS statistical programme to analyse variance to determine which of the factors most affected the results of student enrolment to the departments. It was found

Table 1 Mean and description of the DAS for the all samples

Samples	Std. deviation	95% confidence interval for mean		Maximum
		Lower bound	Upper bound	
1	0.0032512	0.025724	0.041876	0.0362
2	0.0010817	0.209613	0.214987	0.2135
3	0.0044792	0.207440	0.229694	0.2220
4	0.0013229	0.099214	0.105786	0.1040
5	0.0110151	0.051970	0.106696	0.0900
6	0.0070946	0.122043	0.157291	0.1460
Total	0.0695605	0.096436	0.165619	0.2220

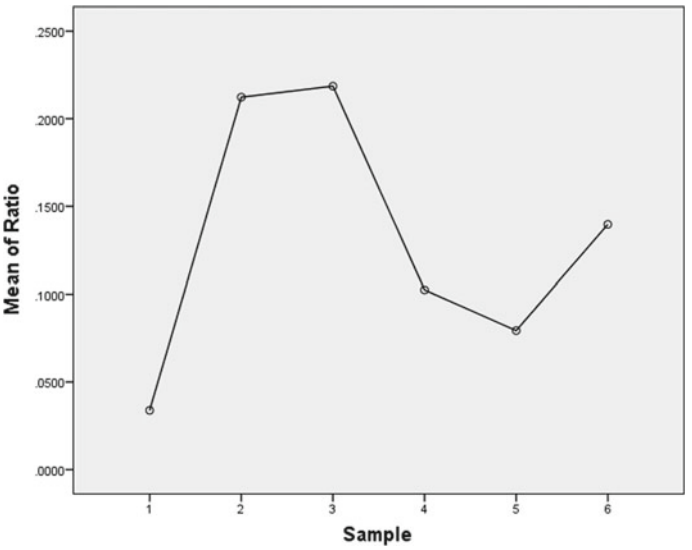

Fig. 7 Relation between mean of ratio and sample

Table 2 Statically results analyse ANOVA of all variables

Source	Adj SS	Adj MS	*F*-value	*P*-value
Student score	0.897523	0.179505	82.35	0.001
School branch	0.005527	0.002763	1.27	0.033
Student desire	0.000229	0.000115	0.05	0.549
Role of success in the school	0.838216	0.167643	75.67	0.003
Admission channel	0.004926	0.002463	0.08	0.56
Application date	0.000374	0.000187	1.11	0.04
Number of seats allocated	0.000470	0.000230	60.30	0.004

in ANOVA that the student score ($p = 0.001$), the role of success ($p = 0.003$) and the number of seats available for each department ($p = 0.004$) are among the most influential factors on student acceptance, followed by the student branch ($p = 0.033$) and application date ($p = 0.060$), while the student's desire ($p = 0.549$) and acceptance channel ($p = 0.56$) have the least influence on the student's acceptance.

References

1. Zhao L, Du S-F (2010) Design and implementation of j2EE-based web website content management system. In: 2010 International conference on E-Product E-Service and E-entertainment (ICEEE). IEEE, New York
2. Fang X, Min D (2007) Development and application of content management system. J Xiaogan Univ 3:020
3. Liu B et al (2010) Website building systems design and implementation based on content management. In 2010 International conference on computer, mechatronics, control and electronic engineering (CMCE). IEEE, New York
4. Grivokostopoulou F, Hatzilygeroudis I (2013) An automatic marking system for interactive exercises on blind search algorithms. In: International conference on artificial intelligence in education. Springer, Berlin, Heidelberg, pp 783–786
5. Werghi N, Kamoun FK (2010) A decision-tree-based system for student academic advising and planning in information systems programmes. Int J Bus Inf Syst 5(1):1–18.
6. Deitel P, Deitel H (2007) Internet & world wide web: how to program. Prentice Hall Press
7. Rainer RK et al (2013) Introduction to information systems. Wiley
8. Official site of School of Computer Science, Carleton University. http://moveableonline.com/blog/2013/10/29/7-advantagesusing-cms-run-site/. Date of access: 06 June 2020
9. Russel S, Norvig P (2001) Artificial intelligence: a modern approach. Prentice Hall
10. Limon Y, Barcenas E, Ben'itez-Guerrero E, Medina MA (2018) Depth-first reasoning on trees. Computación y Sistemas 22(1):189–201
11. Mohammed RA, Al-Zubidi AB, Attallah MS (2019) Analyzing mechanical properties of silica gel filled with carbon fiber into polymeric composite. J Univ Babylon Eng Sci 27(3):224–237.
12. Arwan A, Sagita D (2018) Determining basis test paths using genetic algorithm and J48. Int J Electr Comput Eng (IJECE) 8(5):3333–3340
13. Garrett J (2011) Elements of user experience: user-centered design for the web and beyond, 2nd edn. New Riders, USA, p 191p
14. Obaid AJ, Chatterjee T, Bhattacharya A (2020) Semantic web and web page clustering algorithms: a landscape view. EAI Endorsed Trans Energy Web 8(33)
15. Gadicha AB et al (2021) J Phys: Conf Ser 1963:012141