

Implementation of Finite State Automata in Graphic Design Class Process Online

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ABSTRACT- The development of technology is growing rapidly, the number of increasingly sophisticated inventions can also help humans in carrying out their activities, one of which is online classes, especially graphic design from various official organizers such as from coursera, udemy, and other organizers. Online graphic design classes are currently in great demand by the general public, especially at the school level, some have to pay a certain nominal, there are also free ones to access the class, besides that the classes offered are starting to vary, ranging from the beginner level to the advanced level also with certain software such as Adobe Photoshop, Figma, and other design applications and also with different systems, online or offline, graphic design is much needed, especially in the world of work such as printing, advertising and other fields. In this study, it was designed by using the FSA (Finite State Automata) method with the TYPE of NFA (Non-deterministic Finite Automata) to help students in the process of online graphic design classes starting from registration on the website to getting a class certificate so that students do not feel confused about what to do after registering, and is expected to make students understand in the process of online graphic design classes, The results of using FSA with nfa type can help students to better understand the flow of the registration process for online graphic design classes, with the creation of an FSA with this type of NFA is also expected to help students in registering online to get a certificate because they have attended an online graphic design class.

Keywords : desain grafis, FSA, NFA, corel, adobe.

1. INTRODUCTION

The current COVID-19 pandemic requires the world community to carry out their activities at home and must carry out social distancing. Based on a survey from the Dailysocial.id and the JakPat mobile survey platform to 1,447 respondents, at least 59.7% of the total respondents had participated in online activities such as learning coding, design, and other things as self-development of the community [1].

Online graphic design classes are currently in great demand by the general public, especially at the school level, some have to pay a certain nominal, there are also free ones to access the classes, besides that the classes offered are starting to vary, ranging from the beginner level to the level that is already proficient also with certain software such as Adobe Photoshop, Figma, and other design applications, in addition, graphic design is needed, especially in the world of work such as printing, advertising and other fields [2], it can also provide skills in communicating visually such as through media, text, or images to provide information [3].

Usually in taking graphic design classes, especially online, students register on certain websites with different features obtained from each course organizer by taking their classes both with videos on certain websites and through Zoom, Google Meet, and other media with instructors who are experts in their respective fields, then also

students do their assignments as taught, after that the student takes an exam which usually must include all the material that has been taught and the last one gets a certificate from the course organizer because he has taken the class until the end. But sometimes many students are still confused about what to do after registering, especially those who have never attended this class, especially online graphic design.

In this study, the author developed a previous study that only used Corel Draw as a medium in his teaching into 3 additional classes namely Adobe Photoshop, Adobe Illustrator and Figma, and also on the system in his teaching which was previously carried out offline, now in his teaching is carried out online through a website provided by the class organizer [4].

This research will be designed using FSA with NFA type to help students in the process of online graphic design classes from registration to getting a class certificate so that students do not feel confused about what to do after registering, and is expected to make students understand in the process of online graphic design classes.

The creation of this FSA was created using an application called JFLAP with version 7.1. JFLAP (Java Formal Language and Automata Package) is a software or package of graphic tools created by Susan H. Rodger and Thomas W. Finley at Duke University that is useful for making experiments

especially on formal languages such as NFA and DFA and automata theory [5]. The main purpose of this JFLAP software is to create Type 0 languages, Type 1 languages, Type 2 languages, Type 4 languages, Parsers and visually present complex concepts and mathematical models of Automata Theory [6], using this JFLAP can develop generation and recognition devices not only for regular languages but also for non-regular languages as well [7].

The FSA is a mathematical model that accepts inputs and outputs also includes states that move from one state to another based on inputs and transition functions [8].

The FSA has 5 tuples, there are : [9]

- a. Q = Set state
- b. Σ = Set of input symbols
- c. δ = transition function
- d. S = Beginning of state
- e. $S \in QF$ = The set of the final set
- f. $F \cap Q$ = Number of final states

FSA is divided into two types, namely DFA and NFA. DFA is a state where exactly one state is the next each symbol input received [10] while NFA is a state that has more than one transitional direction between states [11].

The set of possible states further states that automata can move from the exclusive state (q_a) to another state (q_b) in response to an input (α) [12].

The use of FSA with the type of DFA, one of which was implemented in another study with the topic of Designing an Application for Daily Money Calculations for Ministry Of Service Trips [13].

The use of FSA with NFA type, one of which was implemented in another study with the topic of Making Cereals using Automatic Selling Machines [14].

2. RESEARCH METHOD

The following are the stages of research that will be used in the research, there are:

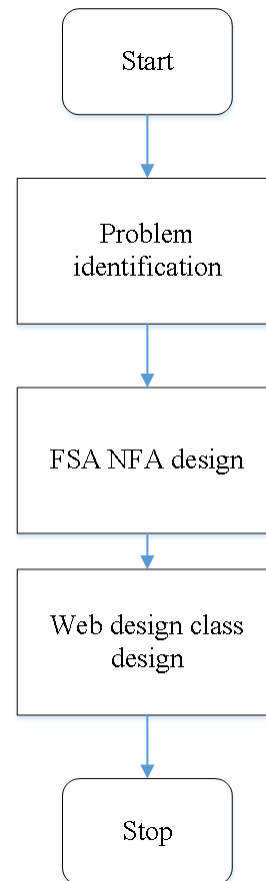


Figure 1. Flowchart

The following are the stages of research that will be carried out, there are :

- 2.1 Problem identification
- 2.2 FSA NFA design
- 2.3 Web design class design

2.1 Problem Identification

This stage will be carried out to identify the problems that students usually get such as what to do after registration, whether they can immediately follow the class or not.

2.2 FSA NFA Design

This stage was designed by FSA with the NFA type using JFLAP 7.1 software starting from q_0 as the initial state to get a certificate from an online graphic design class which was followed by students until q_9 as the final state (getting a class certificate), but q_1 is also the final state because

sometimes students only see a video trial class and not register it.

2.3 Web design class design

This stage is the creation of website design using Adobe XD software version 13.1.32.8 (starter) of the design class, starting from the main menu, register, enter, schedule, exams and class certificates.

3. RESULT

3.1 FSA

The following is the result of the registration process for an online graphic design class using the NFA type FSA with the following tuple, there:

$$Q = (q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9),$$

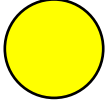
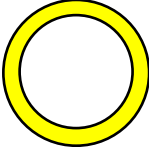

$$\Sigma = (0, 1), (\text{Yes}, \text{No})$$

$$S = (q_0),$$

$$F = (q_1, q_8, q_9)$$

Here are the symbols or symbols of the FSA displayed in table 1, there are : [15]

Table 1. FSA Symbol

Symbol	Information
	State
	Final State
	Transition

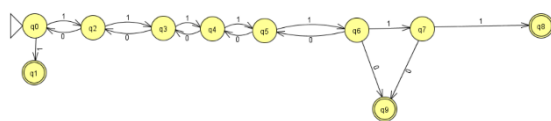


Figure 2. FSA NFA Diagram

Based on the results of the FSA with the type of NFA above, several processes are needed, starting from students opening the website in a browser, registering personal data also choosing a maximum of one graphic design class, taking classes together with instructors, taking exams from those classes if students take at least 3 modules and getting a class certificate because they have taken classes and a certificate of completion if the student passes the class exam with a minimum score of 70 and there is also a short process, namely from q0 only to q1 because students do not register on the website of the online graphic design class and only see the class trial video.

The following is a detailed process of an online graphic design class using an FSA with the NFA type in table 2, there are:

Table 2. Graphic Design Class Process

No	State	Information
1	q0	Visit the online graphic design class website (Initial State)
2	q1	See the class trial video from the website only. (State End 01)
3	q2	Register the class and choose a maximum of only 1 class
4	q3	The system verifies students register
5	q4	Registered as a student of Adobe Photoshop / Adobe Illustrator / Corel Draw / Figma class
6	q5	Log in to the account that has been created to the main menu
7	q6	Take an Adobe Photoshop / Adobe Illustrator / Corel Draw / Figma class via the design class website
8	q7	Take an exam from a class Adobe Photoshop / Adobe Illustrator / Corel Draw / Figma
9	q8	Obtain a certificate of completion and class (if passed the exam) or a class certificate only (if it does not pass the exam) (State End 02)
10	q9	Did not get a class certificate, due to not taking exams and classes (Final State 03)

3.2 Transitional Relation

Here are the transitional relations of the FSA NFA diagram in the form of table 3, there are:

Table 3. Transitional Relation

δ	0	1
q0	ϕ	q2
q1	ϕ	ϕ

q2	q0	q3
q3	q2	q4
q4	q3	q5
q5	q4	q6
q6	q5,q9	ϕ
q7	q9	q8
q8	ϕ	ϕ
q9	ϕ	ϕ

For example, when in the initial state (q0) the student visits the online graphic design class website and only sees the class trial video, does not register (q1) and the student fills in personal data on the online graphic design class website (q2).

3.3 FSA Testing

This test from the FSA is made in table 4 and figure 3 starting from the input results to the results using JFLAP software by conducting 10 tests, namely:

Table 4. FSA testing result

No	Input	Result
1	1111111	Accept
2	1111110	Accept
3	111110	Accept
4	1	Accept
5	101	Accept
6	0	Reject
7	1100110	Reject
8	10	Reject
9	01	Reject
10	0000000	Reject

The screenshot shows a window titled 'Table Text Size' with a table containing the same data as Table 4. The table has two columns: 'Input' and 'Result'. The rows are: (1111111, Accept), (1111110, Accept), (111110, Accept), (1, Accept), (101, Accept), (0, Reject), (1100110, Reject), (10, Reject), (01, Reject), and (0000000, Reject).

Figure 3. FSA testing result

The following is an explanation of the test results of each of them, there are:

- Entered with the number 1111111 it is accept because the process flow connects starting from students visiting the website, filling in personal data, choosing a maximum of one graphic design class, the system of verifying student data entering certain classes taking certain classes, taking

certain classes, taking certain exams and getting a certificate of completion (if passed) and a class certificate.

- Entered with the number 1111110 it is accept because the process flow connects starting from students visiting the website, filling in personal data, choosing a maximum of one graphic design class, the system of verifying student data entering certain classes taking certain classes, taking certain classes, taking certain exams and not getting a certificate of completion and only a class certificate because the student did not pass the class exam.
- Entered with the number 111110, it is accept because the process flow connects starting from students visiting the website, filling in personal data, choosing a maximum of one graphic design class, the system of verifying student data entering certain classes taking certain classes, taking certain classes, taking certain exams and not getting graduation certificates and only class certificates because students do not take design classes more than 3 times.
- Entered with the number 1 only, it is accept because the process flow connects whose process only sees the class trial video.
- Entered with the number 101, it is accept because the process flow connects starting from the student visiting the website, filling in personal data, but because there is something, the student does not register so that the student only sees the class trail video.
- Entered with the number 0 then reject because there is no input on JFLAP.
- Entered with the number 1100110 it is rejected because there is no input on the JFLAP.
- Entered with the number 10 then reject because there is no input on the JFLAP.
- Entered with the number 01 then reject because there is no input on the JFLAP.
- Entered with the number 0000000 then rejected because there is no input on JFLAP.

3.4 Use Case Diagram

Here is the use case of the online graphic design class in figure 4, there are:

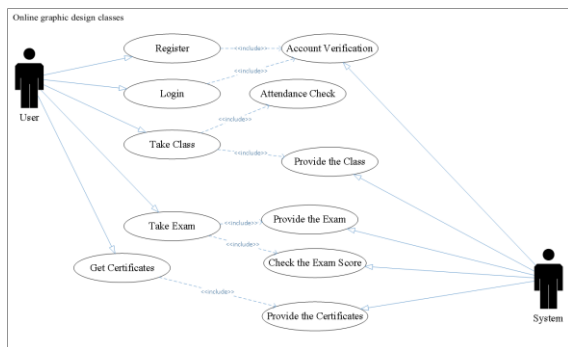


Figure 4. Use Case Diagram

The use case of the online graphic design class process there are 2 users, there are students and the system, starting from registering accounts then the system verifying accounts to getting certificates.

3.5 Activity Diagram

Here is the activity diagram of the online graphic design class in figure 5, there are:

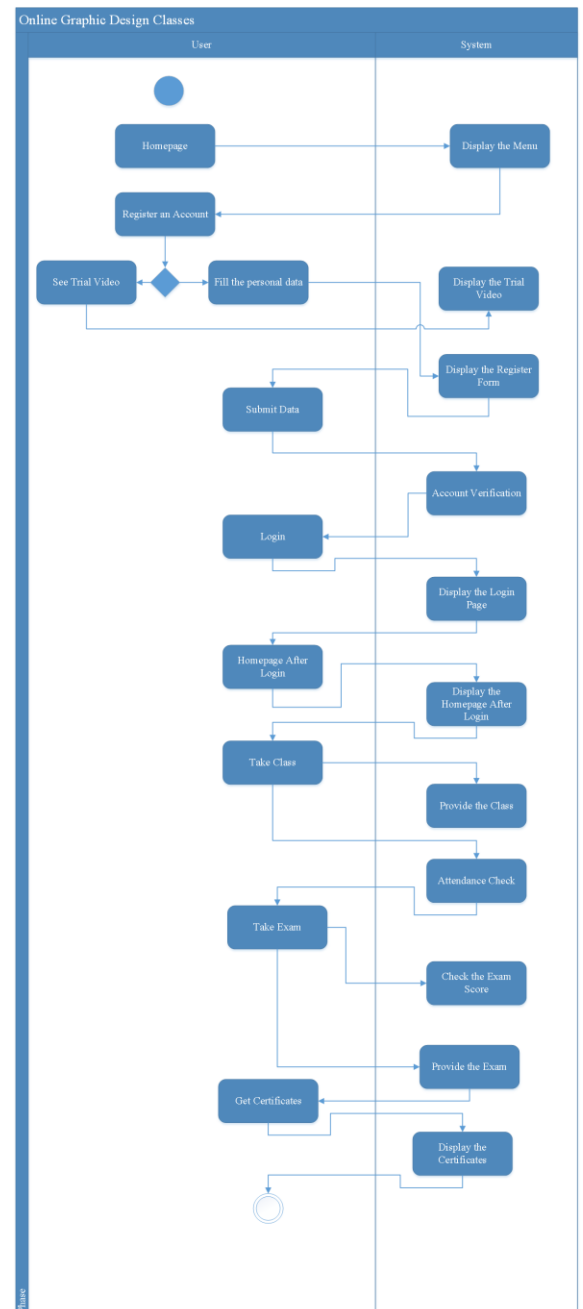


Figure 5. Activity Diagram

Activity diagrams of this online graphic design class process are carried out by users and systems, starting from registering for online graphic design classes, taking classes, taking exams to getting a certificate for taking classes.

3.6 UI (User-Interface) Design

Here is the UI (user interface) design of the online graphic design class in figure 6 to figure 12 starting from the initial display to the class certificate, there are:



Figure 6. Homepage

The Homepage of the kelasdesainonline.id, with the menus "Home", "Demo", "FAQ", "Contact" and "About Us", in addition to that there is also a "Register" display for registering a new account and "Login" to log in to an already registered account.

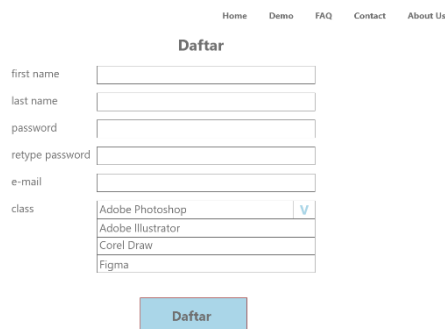


Figure 7. Register

Students register in the personal data provided and choose a maximum of 1 online graphic design class.

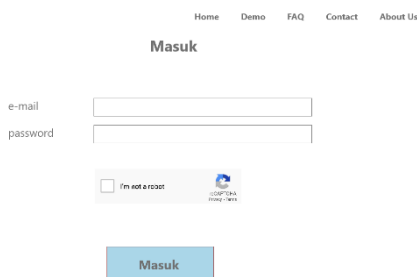


Figure 8. Login

Students log in to their accounts with their registered e-mail and password.



Figure 9. Homepage after login

Students are directed to enter the main menu, there are various menus, namely "Profile", "Class Schedule", "Class Exam", "Class Certificate", "Message" and "Exit".

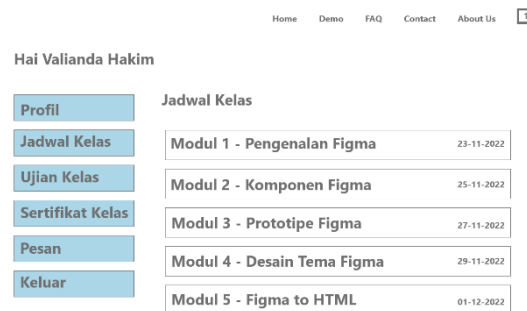


Figure 10. Class schedule

Students access the class schedule, there are various modules arranged from Module 1 to Module 5 with a different schedule for each module.

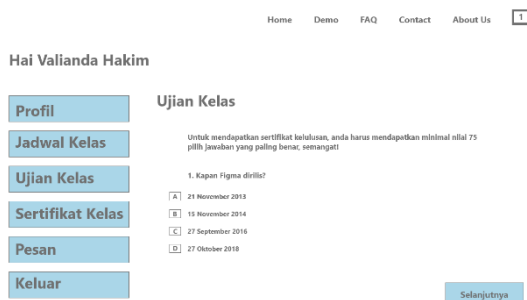


Figure 11. Class exam

Students access the class exam menu to conduct exams after students have taken a minimum of 3 modules.

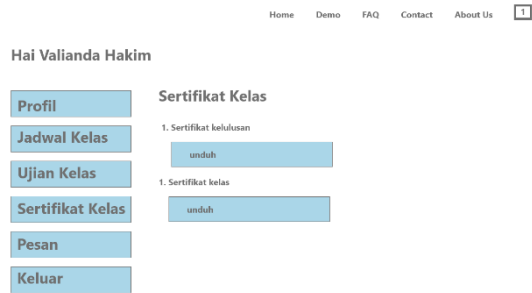


Figure 12. Class certification

Students access the class certificate menu to download two certificates, a certificate of completion (if passed the exam) and a class certificate.

4. CONCLUSION

Based on the application of the NFA type of FSA in online graphic design classes can provide benefits to students who want to take online graphic design classes with 4 variations of classes such as Adobe Photoshop, Adobe Illustrator, Figma and Corel Draw which can be selected according to their interests and can help students in registering online, to get a class certificate and graduation (if passing the exam with a minimum score of 70) because they have attended an online graphic design class. For the next application, it is hoped that it can apply FSA with the NFA type by adding several processes to make it clearer, such as adding state - state in detail such as adding variations of other graphic design software such as Blender 3D also added sequence diagram designs and class diagrams so that the last one for online graphic design class participants is not only specifically for students but general.

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