APPLICATION OF FINITE STATE AUTOMATA IN THE DESIGN OF BOOK LOAN MACHINES IN THE LIBRARY OF PUBLIC HIGHT SCHOOL BATUJAYA

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Abstract

At this time all aspects of life have been greatly facilitated by the times, automation of every job has become commonplace and not a strange thing anymore. Every job has been assisted by an automated and computerized system, making work and data collection very easy and fast to access. In every secondary school, there are usually difficulties in collecting data on borrowed books from the library, usually students borrow books, sometimes without asking permission from the teacher or librarian, but just take them from the bookshelf. 1. Finite State Automata Design At this stage, FSA is described using non-deterministic finite automata. 2. This book lending VM utilizes the osis card as the main transaction tool because the data is already stored on the school server. The application of the FSA concept can be an alternative for designing a VM and can be used as material for consideration and reference for further similar application development.

Keywords : Automata, Vending Machine, Libraries, Books

Introduction

Nowadays all aspects of life have been greatly facilitated by the times, automation of all work has become popular and is no longer a stranger (Krisnandi et al., 2021) (Wicaksono et al., 2019). Nowadays, automation has begun to penetrate into various things such as product sales (Rendy, 2023). The Finite State Automata concept is used to design vending machines like several studies (Haj et al., 2023)(Priyantoko et al., 2023)(Paramitha et al., 2022).

Vending machine or commonly known asvending machine (Kusuma et al., 2022),vending machine first from Alexandria, in 1880 utilizationvendinge machinefor selling postcards (Arifudin & Mulyani, 2023). At this time vending machine used for businesses of various types of products (Nasution et al., 2022).

Each school has a library, but the librarian at each school is limited to only one person, therefore it will be difficult to handle many students who borrow books.

In this research, we will design a Finite State Automata forvending machine borrowing books from the library. In this research will make Finite State Automata (FSA) to createvending machine to make it easy for librarians at SMA Negeri 1 Batujaya.

Many uses Finite State Automata (FSA) in the concept making processvending machine in several studies, such as designing herbal medicine machines (Erni et al., 2020),Finite State Automata (FSA) for educational game design (Ernawati et al., 2022), atvending machine zoo animal feed tickets (Alifudin et al., 2022), even to detect bell's palsy (Fatiha et al., 2021).

Theoretical Basis

A library is a room or building that functions as a place to store books or other publications that are arranged for storage in a certain order for the convenience of readers (Rahma, 2022). The library is a repository of knowledge and information. The role and function of the library is to encourage progress and increase the intellectuality of society

(Endarti, 2022). The school library is a learning resource for teachers and students in the process of teaching and learning activities (Irhandayaningsih et al., 2022).

Finite State Automata (FSA) machine language which is a mathematical model of a system that accepts discrete inputs and outputs (Ernawati et al., 2022).Automata is a component of the field of informatics that underlies ideas and models of computational systems (Wicaksono et al., 2019).Finite State Automata (FSA) is a mathematical model that can accept incoming and outgoing data with a limited number of states and transitions from one state to another (Mestika et al., 2023). Formally FSA is expressed by 5 tuples or M = (Q,Σ,δ,S,F) where:

> Q = collection of state/position
> Σ= input symbol set/input/alphabet
> δ=transition function
> S = initial state/initial position,
> SϵQ F = set of final states,
> F ∩ Q (the number of final states in an FSA can be more than one)

Radio frequency identification or commonly known as RFID is a sensor technology that can identify an object via radio waves. It is basically the same as other door guards in that it has sensors, a processor and a magnetic relay, except that the input is radio identification. This technology can simultaneously identify an object without direct contact (Hermawanto et al., 2022)

An indeterminate finite automaton (NFA) is a type of finite state machine FSM, which can exist in one of the following states: It is not completely determined by the current state or elements. The next set of possible states shows that the automaton can transition from a certain state (qa) to another (qb) in response to an input (α). In NFA, the number of initial and transition states for each member of the input set (Σ) does not have to be exactly one (Handayani et al., 2021).

Research Methodology

In a study, it is necessary to have well-organized stages so that the implementation of the research can achieve the expected goals. The stages carried out by the author are depicted in Figure 1, starting from the design of the FSA, continuing with the design of a book lending system at the library, and then the VM design for the book lending machine at this library.
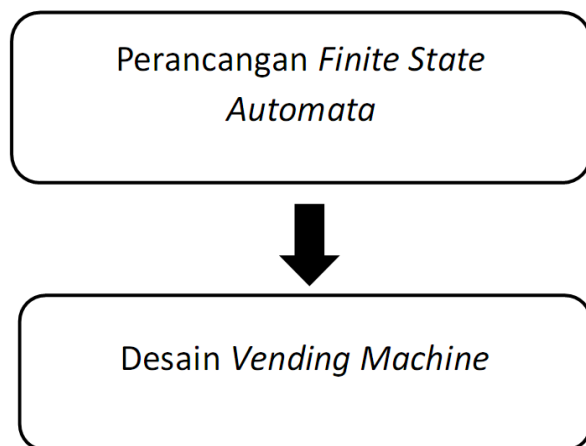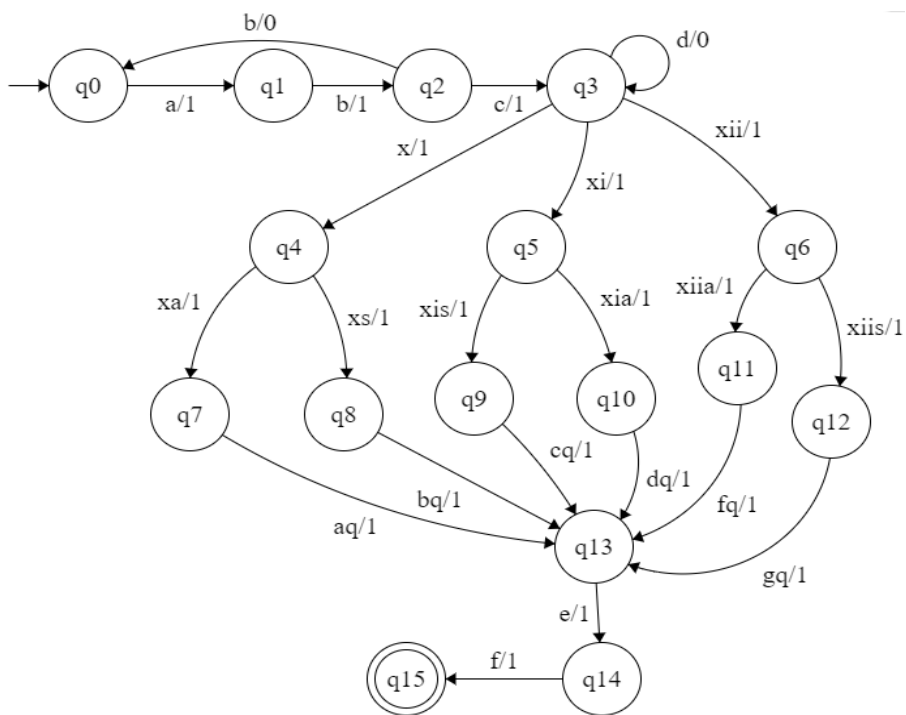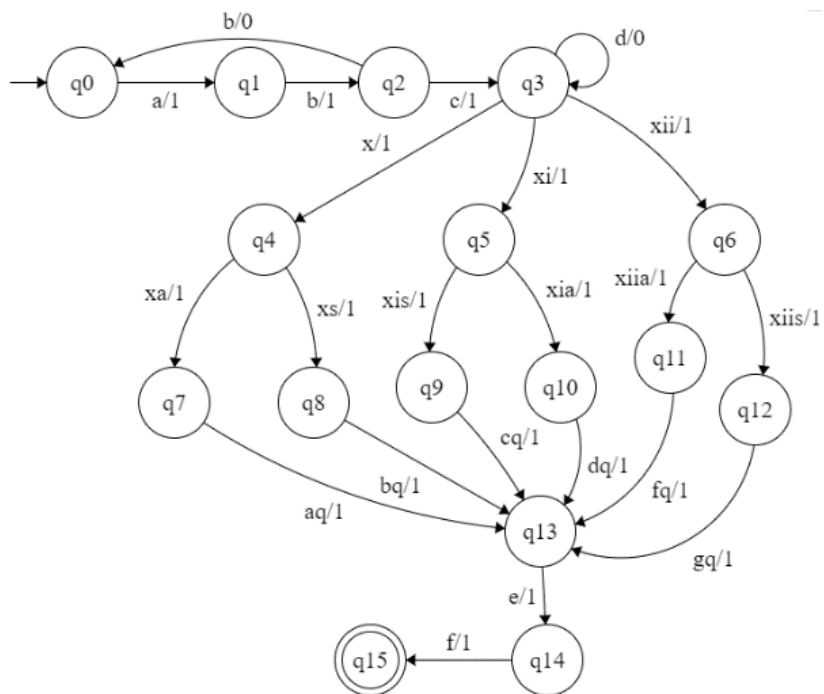

Figure 1. Research Methods

1. PlanningFinite State Automata
   At this stage, the depiction of FSA is carried out using non-deterministic finite automata.

2. Vending Machine Design
   At this stage, the interface design is carried out when the VM is implemented

Results and Discussion

1. Finite State Automata Book Lending VM

Q = {q0, q1, q2, q3, q4, q5, q6, q7,q8,q9,q10,q11,q12,q13,q14,q15,q16}
∑ = {0, 1, a, b, c, d, e, f, x, xi, xii, xa, xs, xia, xis, xiia, xiis, aq, bq, cq, dq, fq, gq}
S = {q0}
F = {q16}

The machine configuration has a state symbol that makes the symbol of a process and is described as follows:

q0 = State initial (Initial State)
q1 = Tap the osis card
q2 = Check if the osis card data is registered / not in the database
q3 = Search category
q4 = class category x
q5 = class category xi
q6 = Kategori kelas xii
q7 = Class book x ipa
q8 = class book x ips
q9 = xi ips class book
q10 = Class book xi ipa
q11 = Class xii ipa book
q12 = class xii ips book
q13 = Save Loan Data
q14 = Reduction in the number of books available in the system
q15 = Books come out according to what was selected

Diagram state on the Figure 2 configuration it receives several inputs. If you receive one input it meansstate it continues tostate next, and if it accepts zero input then it meansstate ends and stops and the task on the machine ends and then returns to its initial state. On that machine receiving input a means tapping the osis card, then there is also input b meaning checking the card data on the server. The input is in the form of an osis card because all students must have an osis card.

The state workflow in this study is as follows:

a. q0 is the initial state and will go to state q1 to start this automata work system
b. q1 is the stage of scanning the osis card after d scan then the state continues to q2
c. q2 is the stage for checking student student osis cards whether recorded or not in the school database, if recorded then the state will go to q3 and not recorded will return to q0
d. q3 is the state for choosing a book category, if you choose a class X book category it will go to q4, class XI book category will go to q5, and class XII book category will go to state q6
e. q4 is the state of the class X book category collection, if you choose a science department book for class X then you will go to satet q7 and if you choose a class X social studies book then you will go to state q8
f. q5 is the state of a collection of class XI book categories, if you choose a science major book for class XI then you will go to satet q10 and if you choose a book majoring in Social Studies class XI then you will go to state q9
g. q6 is the state of class XII book category group, if you choose a science major book class XII book then it will go to satet q11 and what if you choose a book majoring in Social Studies class XII book then you will go to state q12
h. after choosing between q7, q8, q9, q10, q11, or q12 then the q13 state will be stored
i. q13 is a state for storing data into the database and then goes to state q14
j. state q14 is the process of reducing books in the system so that you can find out the remaining book stocks on the machine and finally going to stat q15
k. q15 is the last state and will give the book to the borrower

2.   Library Book Lending VM Design

Figure 3. DesignVending Machine Book Lending

The work process in Figure 3 is the basis of the proposed system interface design, namely students will select books based on categories first and after selecting proceed to the menu to select the title of the book to be borrowed. The working principle of VM borrowing books is that students do it firstscan osis card, then the student selects the book category, then selects the title of the book to be borrowed by pressing the screen on the VM according to the design in Figure 3, after selecting the book it will come out of the pickup area.

Conclusion

Based on the design of the FSA, it can be concluded that the use of NFA in vending machines for lending books at SMA Negeri 1 Batujaya can be useful in collecting loan data and distributing book centers not only in the library. This book lending VM utilizes the osis card as the main transaction tool because the data is already stored on the school server. The application of the FSA concept can be an alternative for designing a VM and can be used as material for consideration and reference for further similar application development.

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