

Digital Library Analysis and Design Using Iconix Process Method (Case Study: SMA Negeri 1 Ngimbang)

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Abstract— The application of information technology in various companies will improve employees' performance so that the business results obtained by the company are of higher quality. The school library has a relatively significant influence on the learning process and expands students' knowledge. However, in reality, many libraries still have not utilized information technology to manage their management, so some parties sometimes encounter obstacles that can hinder performance and efficiency. This study built a web-based library information system using the Iconix process method with the case study *SMA Negeri 1 Ngimbang, Indonesia*. The findings of this study will be able to be implemented, promoting the efficiency of data and library information management and boosting.

Keywords— Analysis and Design, Information System, Digital Library, Iconix Process.

I. INTRODUCTION

The digital revolution has made it easier and quicker to acquire information, which has a wide range of effects on daily life. Using information technology in various agencies will raise staff productivity, resulting in better organizational business outcomes. One of the effects of the development of information technology is that it is widely used by organizations to carry out their executive activities [1]. Due to the information system, all data and information are more integrated, which speeds up decision-making.

School libraries have a significant impact on students' learning [2]. Students are more motivated to learn due to the school library's contribution to increased operational effectiveness. It also services the school's students, teachers, principals, and other administrative personnel [3]. Hopefully, students will gain more learning materials and broaden their knowledge through the school library's offerings. Consequently, effective library administration is required. However, many libraries still do not use information technology to manage their operations. As a result, some parties occasionally run into challenges that can impair performance and effectiveness [4]. The advantages of a library information system are that it can speed up the borrowing and returning of books and help borrowers with their search processes because the book data is better organized. In addition, this system also makes it easier to manage library data so that data can be accessed anywhere and anytime [5].

Several previous studies revealed that designing information systems using the Iconix process method can produce websites that can be used more effectively [6]. The Iconix process consists of a few stages that each address a different requirement and generate a specific artifact as a UML model. In addition, research on web application

development with the Iconix process and UML can provide an overview of the techniques that exist in web application development and share the results of analysis, design, and implementation of web-based applications [7][8]. Performance in previous research that uses the website to adopt a user satisfaction model [9], to find out the business model [10] and can also be used as an analysis and design process in the development of web-based mapping applications [8].

The research object is one high school that manages its library data using a manual system. As a result, library staff feels overwhelmed managing data due to almost all transactions using the manual recording process ranging from borrowing, returning, and searching for books to making library reports. This problem allows for various risks such as loss and non-centralized data or information [11].

Due to the mentioned issues, the research object needs to implement information technology in its library. Because of this, the author put together research titled "Digital Library Design Iconix Process Method." This study used the Iconix process to create a web-based library information system. This study expected that the digital library at *SMAN 1 Ngimbang* will improve the efficiency of managing the library's data and information and improve the library staff's performance.

II. RESEARCH METHODOLOGY

A. Digital Library

A Digital library is a collection containing information managed with services for a set of communities where the information is stored in a digital format and can be accessed through a network [12]. Digital libraries are considered capable of providing easy access to information for users anytime and anywhere [13]. Not only that, but digital libraries

can also store large amounts of data[14]. The digital library not only provides a collection of books managed by the library management, but there are also transactions carried out such as borrowing, returning, and so on.

B. Use case Driven Object Modeling with UML (ICONIX Process)

Iconix Process in Figure 1 is a method used to build a software system which more focused on user requirements and simplifies the process so that the software development process will be more efficient.

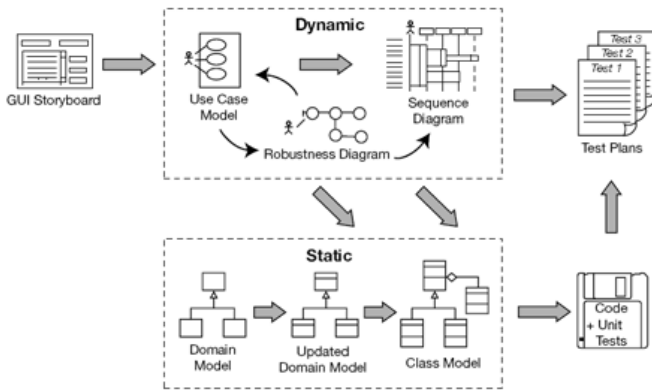


Figure 1. Iconix Process

There are four stages in the Iconix Process[15], including:

1. Requirements
 - Functional Requirements. At this step, an analysis of the functional requirements that are required for the manufacture of software.
 - Domain Modeling. This step is carried out by identifying the main objects (nouns) involved in the business processes of a system.
 - GUI Storyboard. This step is an initial and straightforward depiction of the appearance of the system to be created.
 - Use Case Modeling. This stage identifies the system's actors (users) and each base scenario and alternate scenario.
2. Analysis and Preliminary Design
 - Robustness Analysis. Robustness diagrams, the bridge between analysis and system design, were used for this study step. The specifics of the already-formed use case are described in this stage.
 - Update Domain Model. The next step is changing the domain modeling from the previous requirements process.
3. Detailed Design
 - Sequence Diagram. A sequence diagram is a flow chart arranged based on a robustness diagram. This diagram is created for each use case.
 - Class diagram. Class diagrams are a part of a unified modeling language (UML) that displays a software's static structure by showing the classes within a piece

of software and the logical relationships between those classes[16].

III. RESEARCH METHODOLOGY

The stages in Digital Library Analysis and Design Using Iconix Process Method with a case study at SMA Negeri 1 Ngimbang, Indonesia, are:

- 1) *Literature Studies*: The literature study step involves gathering data from published works and research-related references found in books, journals, e-books, and articles.
- 2) *Data Collection*: In this study, data collection was carried out by conducting interviews directly with library officers. Data collection with this interview method aims to enable researchers to obtain information about the processes and problems in managing library data.
- 3) *Requirements Analysis*: This process is carried out as an analysis of business processes or system flows before and after submitting proposals. Then, determine the functional needs, create domain modeling, and review requirements.
- 4) *System Design*: The system design process is carried out according to requirements. Creating the GUI display is the first step in system design, followed by creating the domain model and a class diagram. Next, the author should design use-case diagrams to describe system characteristics and robustness analysis[7]. The sequence diagram is the following step based on the use case and robustness diagram.
- 5) *Conclusions and Suggestions*: The conclusion is the answer to the problem. Meanwhile, suggestions can be considered an effort to improve the quality of further research.

IV. RESULT AND DISCUSSION

A. Business Process Analysis

Business process analysis is identifying business processes within an organization to determine the needs of the business[17]. Business process analysis often begins with the identification of the existing process or system (the old system), followed by the provision of a proposed system in the form of a computer program (new system). The following business processes have been identified in the object of the research library, including the current member registration process, the current book-lending process, the current book return process, the proposed member registration process, the proposed book-lending process, and the proposed book return process, and proposed book request.

Figure 2 and figure 3 are an illustration of how the procedure for borrowing a book has been created. Based on figure 2, the process of lending books in the object of the research library is still being done manually. Meanwhile, figure 3 shows the process of lending books by implementing a system.

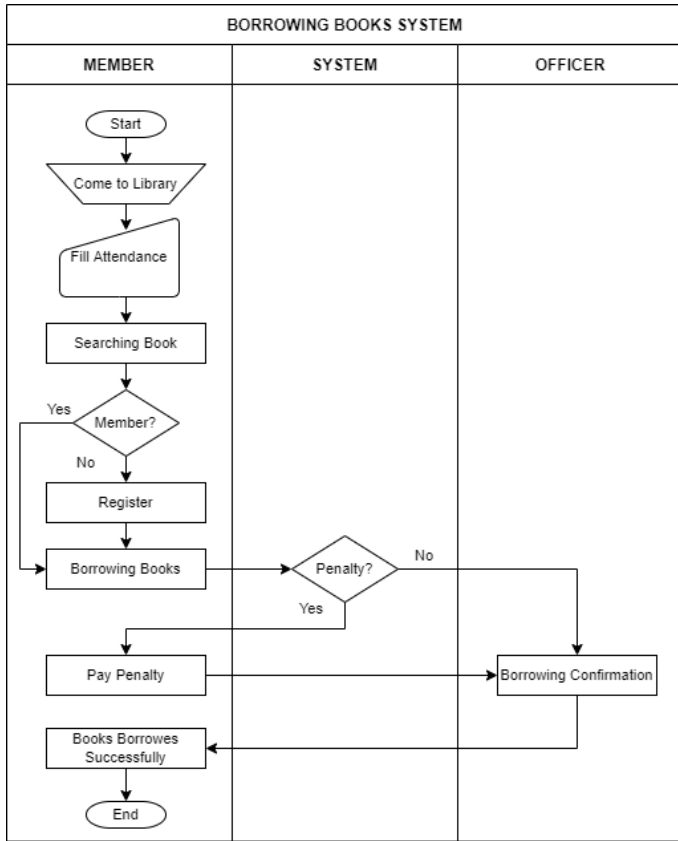


Figure 1. Current Lending Process

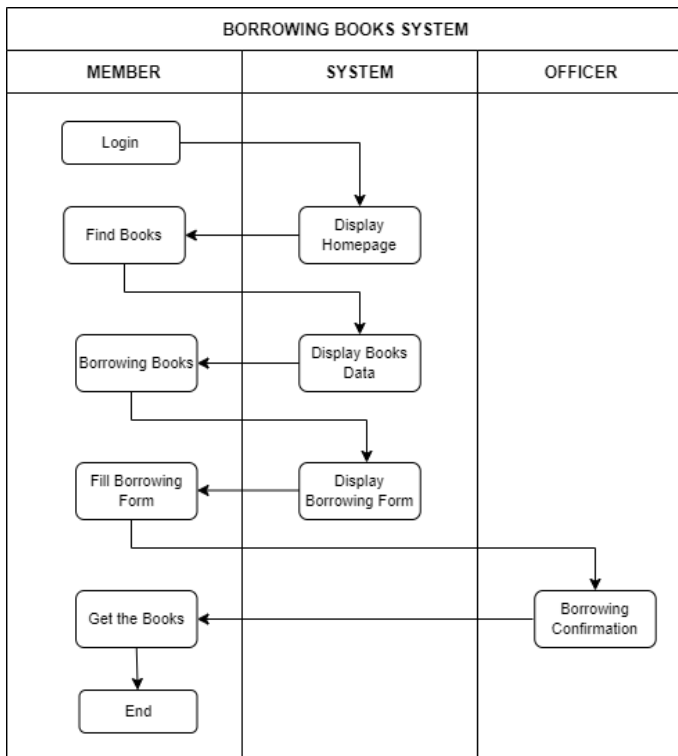


Figure 2. Proposed Lending Process

B. Requirements

1) *Functional Requirements*: Functional requirements are any procedures or services the system must offer, such as how it should respond to input and operate in specific circumstances[11]. This system has three actors: members, officers, and admins. The system to be created must meet the following functional requirements registration, login, borrowing books, returning books, book collection, managing members, managing books, operating officers, and book requests.

2) *Graphical User Interface (GUI)*: The initial display design, or GUI, describes The object of the research library system's characteristics and functionality. For example, figure 4 illustrates a GUI view of the book collection menu that presents details from the selected book. The lending menu is one of the features of the transaction menu. This menu serves to display information about the book to be borrowed. The book information displayed is in the form of title, author, rating, year of publication, number of pages, publisher name, and synopsis.

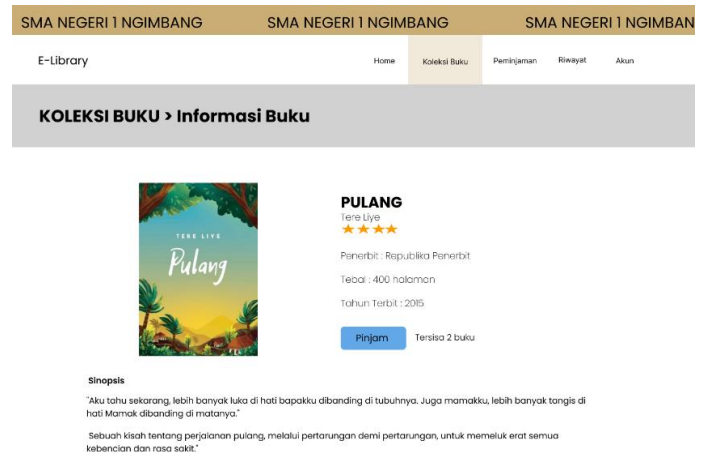


Figure 4. GUI View

3) *Domain Modeling*: The identification of nouns contained in the system's functional requirements is carried out. After identifying nouns related to the system, nine domains were obtained, as shown in figure 5. The members have a transaction because members made a borrow and return transaction. The transaction consists of borrowing and returning. The occurrence of lending and return transactions involves books. Collection of several types of books forms a book catalog consisting of a wide variety of categories. Transaction reports has transactions because transaction reports are created due to borrowing transactions and book returns between members and officers. The officers have a transaction report because officers have authority to manage the transaction report.

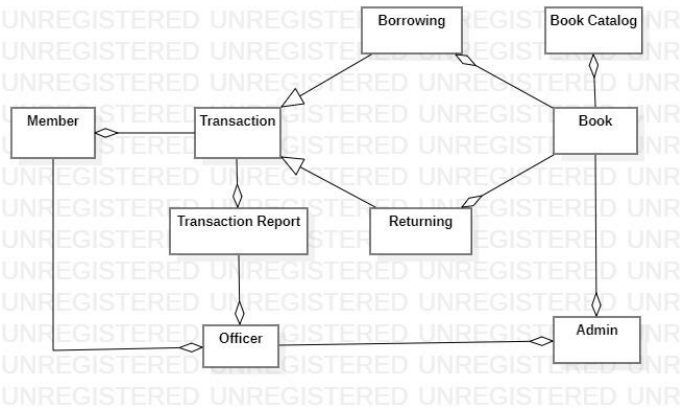


Figure 3. Domain Model

4) *Use Case Diagram*: This step includes determining the actors involved and the roles or activities carried out. Figure 6 shows 13 use cases with three actors, namely admins, officers, and members. Each actor has his permission to access this system. Members can access the search for books menu, request books, return books, borrow books, and view transaction history. Officers have access rights to manage member menus, view transaction reports, validate borrowing, and validate returns. Meanwhile, admins can access the manage members menu and manage books. All actors can access the login and register menus.

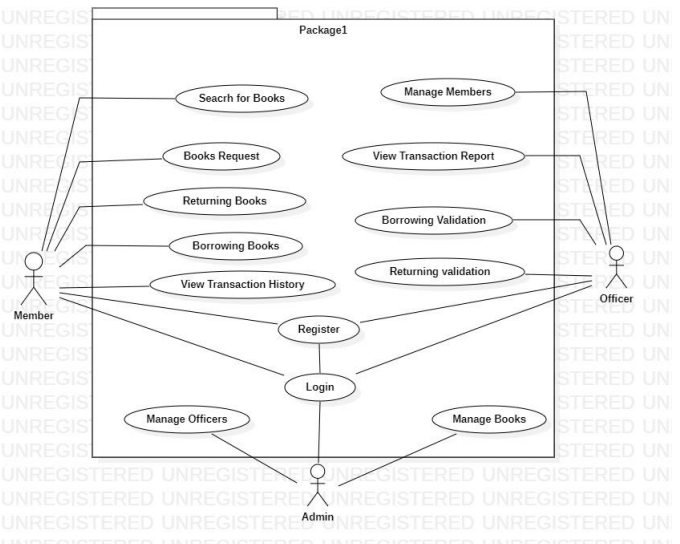


Figure 6. Use Case Diagram

C. Analysis/Preliminary Design

5) *Robustness Diagram*: Robustness diagrams are developments of use case diagrams. The robustness of this diagram is in the form of a more detailed description of the use case diagram previously designed. Figure 7 is a robustness diagram of the flow of borrowing books by library members. The flow of borrowing books starts from accessing the book collection page of the member. Then, the member enters the book title they want to borrow, and the system displays the book's information page. If you're going to borrow, the member presses the borrow button, and the system will display the loan form. Then, members enter the data of the borrowed book on the loan form, and the system will check the completeness of the book loan data. The system displays an incomplete data message if the loan data is incomplete. If the book lending data is correct, the system will display the book information entered on the book loan form. Book lending data will be automatically entered into the lending database.

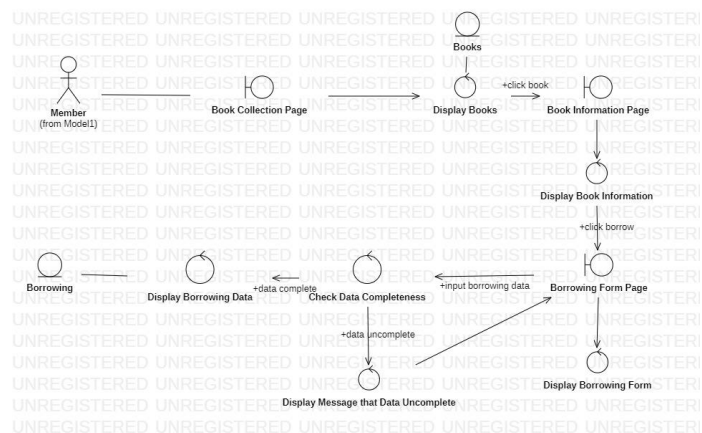


Figure 4. Robustness Diagram

D. Detailed Design

1) *Sequence Diagram*: The sequence diagram flow follows the robustness diagram, which is also inseparable from the results in the use case scenario and robustness diagram. The sequence diagram illustrates the details of the library system. Figure 8 is a sequence diagram of the book lending menu.

2) *Class Diagram*: The class diagram describes the structure and description of the class, attribute, method, and class relations. The class diagram is almost the same as the domain model because the class diagram is the result of the development of the domain model. For example, figure 9 is a digital library system class diagram.

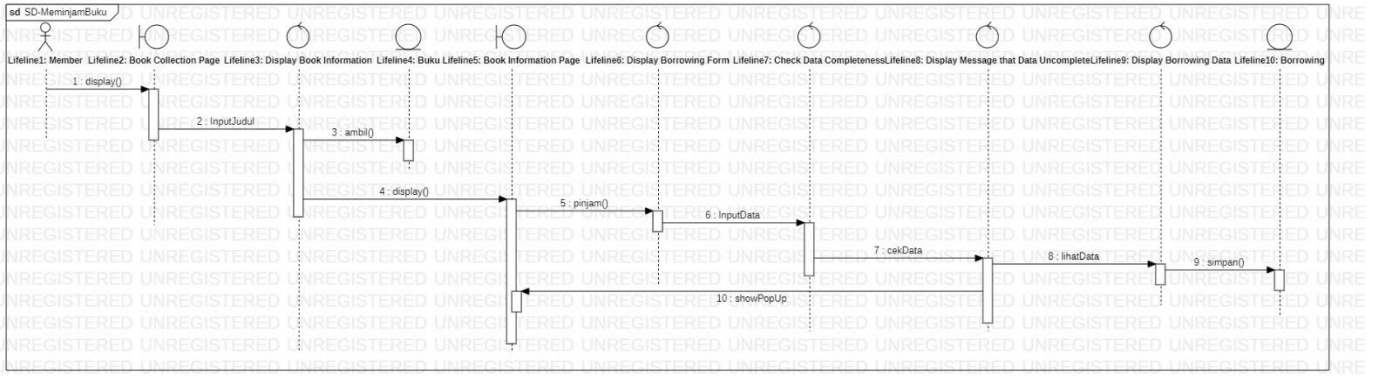


Figure 8. Sequence Diagram

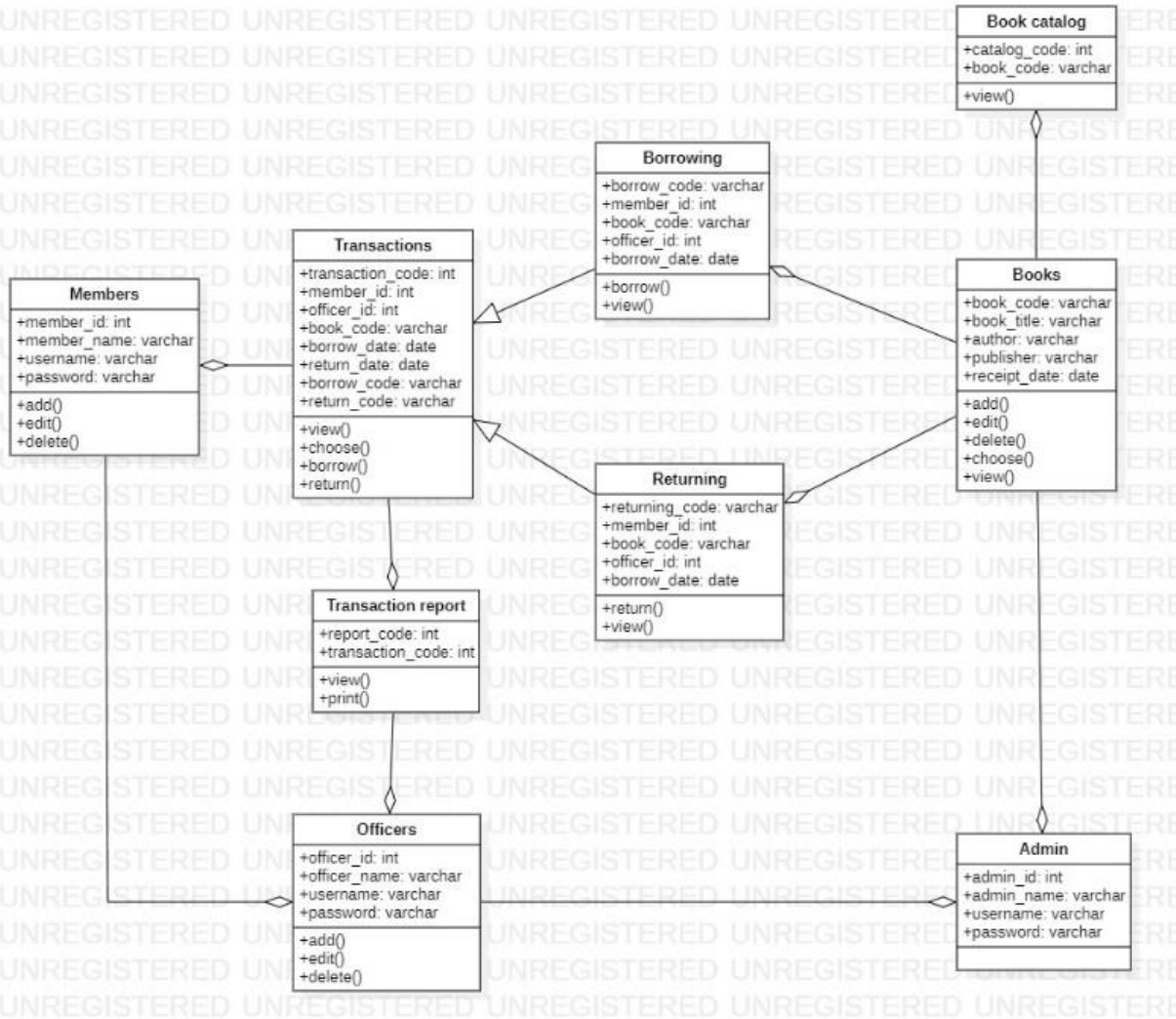


Figure 9. Class Diagram

V. CONCLUSION

Based on the analysis and design of the digital library system using the Iconix process method, it can be concluded that iconix process is a method used to build a software system that focuses on user requirements to make the software

development process more efficient. There are four steps in the Iconix process, requirements, analysis/preliminary design, detailed design, and implementation.

The requirements analysis steps have two processes: business process and requirements. The business process analysis describes how the current system is running in the

library and the proposed new system that facilitates the transaction and processing of library data. While in the requirements process, there are four steps, namely functional requirement, domain modeling, and behavioral modeling. The step of functional requirement produces nine system features. Then, at the domain modeling stage, the identification of nouns is carried out at the step of functional requirement and has nine domains. The step of behavioral modeling produces GUI, the initial display design of the system, and a use case diagram with 13 use cases and three actors, administrators, officers, and members.

There are two processes in the design steps: analysis/preliminary design and detailed design. The analysis/preliminary design produces a robustness diagram which is the development of a use case diagram that has been made. And then, the design detail produces a sequence diagram that refers to the use case and robustness diagram. The final step of the program design model using the Iconix process method is implementation. This step is given to the programmer to be realized into program code.

Based on the research results, some recommendations are given regarding the digital library system of The object of a research library, such as program testing so that the resulting program follows user requirements and adding a backup feature as a regular backup of data to avoid data corruption.

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