Forward Engineering in Student Mark Recapitulation Application

S Mauluddin1*, R Sidik2
1,2Information System Department, Universitas Komputer Indonesia, Indonesia.
Email: *syahrul.mauluddin@email.unikom.ac.id

Abstract. This research intends to carry out forward engineering of the student mark recapitulation application in the information systems department, Universitas Komputer Indonesia. The forward engineering is the final step of the reengineering process in the mark recapitulation application. Re-engineering is done because the student mark recapitulation application cannot function properly. This re-engineering used the big bang approach, which is to rebuild or change the entire existing system, while the forward engineering stage follows the stages of the general model of re-engineering software, namely conceptual, requirements, design, and implementation. The conceptual and requirements stages have been carried out in previous reverse engineering research, so that in the forward engineering the research phase will start from the design stage then proceed to the implementation phase. The programming language in the existing application uses visual basic and the new application will be rebuilt using the java programming language. The results of this study are the student mark recapitulation application which has nine functions, namely lecture management, curriculum management, student management, import mark, mark management, system settings, temporary transcript printing, final transcript printing, and graduation certificate printing. Based on the results of tests on several computers with different operating systems, this application can function properly as expected.

1. Introduction
The Information System Department has a Student Mark Recapitulation Application to manage student mark data. Currently, the application is still being used, but there are important features that cannot function properly. Besides, the use of the latest operating system causes the application to not run properly. Finally, the application does not support the needs of department [1]. Given the importance of the mark recapitulation application, it is necessary to have a software re-engineering activity to redesign the mark recapitulation application. Re-engineering software itself includes reverse and forward engineering phases [2]. The approach in re-engineering software can use the big bang, incremental and evolutionary approaches [3,4].

Research related to software re-engineering has been carried out widely including re-engineering information system scheduling lectures [5]. In that research, the re-engineering process is carried out by designing and rebuilding new applications with the Java programming language and old applications created with Microsoft Visual foxpro. It also changes its database; the old application uses the Foxpro visual database and the new application uses mySQL. The re-engineering process used the big bang approach. The second previous research was re-engineering academic information systems [6]. In that research, the reengineering process was carried out to add new functions, fix bugs, and change the network architecture from intranet to internet. The programming language used in the reengineering
process is C#.Net. The approach to the re-engineering process includes the Incremental approach. It is still related to research on academic information system reengineering [7]. In that study, the re-engineering process was carried out to rebuild some functions of the academic information system. The programming language used is still the same, but changed platforms from ASP to ASP.Net. Major changes occurred in the database; the database was changed from a SQL Server database to an Oracle Database. This reengineering process is included in the incremental approach.

In this research, re-engineering is done to completely redesign the functions of the old application that was built with a visual basic programming language and will be changed to a new application that is built with the java SE programming language. The database used is still the same as the old application, MySQL. The re-engineering of the whole function then the approach used in this study is the big bang approach. In this reengineering activity, reverse engineering activities have been carried out in previous studies and produce a model in the form of a description of application needs. Therefore, in this forward engineering, the development stage refers to the results of reverse engineering activities. Forward engineering is the traditional software development where information is elaborated and described in more detail while moving from conceptual design, to detailed design, to physical implantation [3]. Forward engineering is the conventional procedure of moving from sophisticated logical and abstract, execution not-dependent designs to the system's physical completion [8]. There are stages of forward engineering that divide into four parts, namely conceptual, requirements, design and implementation [3,4,9], and there are those who describe it into three parts, namely system specification, design and implementation, and new software system[3,8]. In this study, the conceptual, requirements or system specification stages have been carried out at the reverse engineering stage. Therefore, this forward engineering activity will start from the design stage. For this design phase, we will use an object-oriented approach because it is a faster way in developing an application [10]. For the implementation phase or programming, we will use a programming language that used an object-oriented approach namely java.

2. Method
2.1 Approach method
In software re-engineering there are three approaches namely the big bang approach, the incremental approach and the evolutionary approach [3,11]. This research used the big bang approach, which is an approach with the concept of replacing an entire system at one time, as shown in Figure 1. The implementation of the big bang approach in this research is that the application will be completely rebuilt with the java programming language. The programming language used in the old application is visual basic.

![Figure 1. Big Bang Approach](image)

2.2 Reverse Engineering Stage
The stages of forward engineering in this study refer to the general model of software reengineering as in Figure 2.
Based on Figure 2, the forward engineering stage consists of four stages, namely conceptual, requirements, design, and implementation. In this study, the conceptual and requirements stages are no longer carried out because they have been carried out in reverse engineering activities [1]. Therefore, in this study there are two stages to be carried out namely the design and implementation process. At the design stage that will be designed includes interface design, as for the database used the database on the old system. Then at the implementation stage will make an application using the Java SE programming language.

3. Results and Discussion
Forward engineering is also defined as the process of changing the model into program code [12]. Based on the results of previous reverse engineering activities, that the application that will be built in this forward engineering activity has 9 functions [1], as shown in Figure 3.

Figure 3 illustrates that the recapitulation application for students is a secretariat. The Secretariat has an access rights to lecture management, curriculum management, student management, import marks, mark management, system settings, temporary transcript printing, final transcript printing, and graduation certificate printing.

Based on the results of previous studies [1], the database design that will be used in this forward engineering can be seen in Figure 4.
Figure 3. The functionality of Mark Recapitulation Application [1]
In this research, the forward engineering stage starts from the design stage and continues with the implementation stage namely the creation of a mark recapitulation application. The following is a sample comparison of the old application that was built using the visual basic programming language with the new application that was built using the java SE programming language. First, a comparison of the mark import features can be seen in Figure 5 and Figure 6.

---

**Figure 4.** Database of Mark Recapitulation Application [1]

---

**Figure 5.** Form import mark in old applications
Figure 5 is the import mark form in the old application. In the old application, the mark import feature did not have a data validation function. Therefore, the data that was successfully imported into the mark table could not be ascertained whether all of the mark data had been successfully imported all or not.

In the new application, as shown in Figure 6, the validation function has been added in two stages. The first stage, the mark data from the excel file will be imported into a temporary table and ensure the amount of data in the temporary table is the same as the data in the excel file. The second stage is the process of checking the validation of the NIM (Student ID Number) and course code, whether all the NIM and course code match the data in the student table and the course table. When all data are valid, then it can be saved to a table of marks. A comparison of the two marks management features can be seen in Figure 7 and Figure 8.

**Figure 6.** Form import mark in new applications

**Figure 7.** Mark Management in Old Applications
Figure 8. Mark Management in New Applications

In the old application mark management was made in two forms, namely the form for input taking courses and input marks, as shown in Figure 7. In the new application, taking the course and input marks are changed into one form. Therefore, that makes it easier to manage marks without moving forms, as in Figure 8.

Based on the testing results, new applications using the Java programming language can be run in various versions of Windows operating system, so that when there is a change in the operating system the application can run well. Nine features needed can work well.

4. Conclusion

The forward engineering in the mark recapitulation application has resulted in a new mark recapitulation application built with the Java SE programming language. Based on the test results, the problem of application incompatibility with the operating system has been resolved because the new application can be run on various versions of the Windows operating system. Problems related to application features have been resolved, nine application functions are running well.

Acknowledgment

We would like to thank Universitas Komputer Indonesia who have funded this research.

References

[1] S. Mauluddin and R. Sidik, 2019. Reverse Engineering in Student Mark Recapitulation Application, in IOP Conference Series: Materials Science and Engineering, 2019, 662(2).
[2] Jyoti and R. Kaur, 2013. Software Re-Engineering Metrics,” Int. J. Comput. Sci. Technol., 4(1), pp. 153–155.
[3] M. Majthoub, M. H. Qutqut, and Y. Odeh, 2018. Software Re-engineering : An Overview, pp. 266–270.
[4] R. Radhakrishnan and S. Balasubramanian, 2010. Business Process Reengineering Text and Cases. New Delhi: PHIL.
[5] I. Ikbal, M. R. Effendi, and S. Mauluddin, 2018. Reengineering sistem informasi penjadwalan kuliah,” Sistemik, 3(112), pp. 77–84.
[6] S. D. Ariyanto, Y. Sari, and S. B. Utomo, 2018. Reengineering Sistem Informasi Akademik Politeknik Manufaktur Astra Dalam Jaringan Berbasis Web Internet, vol. 5(1).
[7] S. Rochimah, C. Zain, and D. H. Murti, 2006. Penerapan Rekayasa Ulang Iteratif pada Sistem
Informasi Akademik FTIF ITS Surabaya,” *Juti*, 5(1), pp. 19–25.

[8] A. C. Graciamary and M. Chidambaram, 2018. EESRM: An Effective Approach to Improve the Performance of Software Re-Engineering.

[9] M. Muzammul and M. Awais, 2018. An empirical approach for software reengineering process with relation to quality assurance mechanism,” *ADCAIJ Adv. Distrib. Comput. Artif. Intell. J.*, 7(3), p. 31

[10] P. Tilakaratna and J. Rajapakse, 2011. Forward Engineering the Object Oriented Analysis and Design,” pp. 107–112.

[11] A. Afshar and T. Padenga, 2010. Application Software Reengineering. *New Delhi: Pearson*

[12] A. Haryanta, A. Rochman, and A. Setyaningsih, 2017. “Perancangan Sistem Informasi Perencanaan dan Pengendalian Bahan Baku Pada Home Industri,” *J. Sisfotek Glob*, 7(1), pp. 87–95