AGILE-SCRUM IMPLEMENTATION IN THE DEVELOPMENT OF KAMPUS MERDEKA INFORMATION SYSTEM

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Abstract

Merdeka Belajar Kampus Merdeka (MBKM) program is a program initiated by the Minister of Education and Culture to encourage students to master various disciplines for their preparation in the job market. At the Institut Teknologi Del, the MBKM program is also offered to students. However, its implementation is not yet fully automated and utilizes various different platforms. This research aims to design and develop the Independent Internship & Study Implementation Information System in the Merdeka Campus at the Institut Teknologi Del using the Agile-Scrum approach. The Scrum method is an iterative software development approach that is flexible to changes. The implementation of Agile-Scrum in the development of the MBKM information system helps achieve goals and automate existing systems. This research involves Scrum activities such as sprint planning, daily scrum, sprint review, and sprint retrospective to produce an information system that meets the requirements. The Scrum product backlog is used as a reference during system development throughout the sprint. The development of the information system through agile-scrum has received feedback during the sprint review and has been functionally tested using several testing methods.

Keywords: Merdeka Belajar Kampus Merdeka Program, Agile-Scrum, Scrum Activities, Scrum product backlog

Abstrak

Program Merdeka Belajar Kampus Merdeka (MBKM) adalah program yang digagas Menteri Pendidikan dan Kebudayaan untuk mendorong mahasiswa menguasai disiplin ilmu demi persiapan dunia kerja. Di Institut Teknologi Del, program MBKM juga ditawarkan kepada mahasiswa. Namun, proses pelaksaannya masih belum terotomatisasi dan menggunakan beberapa platform yang berbeda. Penelitian ini bertujuan merancang dan membangun Sistem Informasi Pelaksanaan Magang & Studi Independen Kampus Merdeka di Institut Teknologi Del menggunakan pendekatan *Agile-Scrum*. Metode *scrum* adalah pendekatan pengembangan perangkat lunak iteratif yang fleksibel terhadap perubahan. Penerapan *Agile-Scrum* dalam pembangunan sistem informasi MBKM membantu mencapai tujuan dan mengotomatisasi sistem. Penelitian ini melibatkan aktivitas *scrum* seperti *sprint planning*, *daily scrum*, *sprint review*, dan *sprint retrospective* untuk menghasilkan sistem informasi sesuai kebutuhan. *Product backlog* sebagai artefak *scrum* digunakan sebagai acuan dalam pembangunan sistem informasi selama *sprint* berlangsung. Pembangunan sistem informasi telah mendapatkan *feedback* selama *sprint review* dan diuji secara fungsional menggunakan beberapa metode pengujian.

Kata kunci: Agile-Scrum, Aktivitas-Scrum, Backlog Produk Scrum, Program Merdeka Belajar Kampus Merdeka

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INTRODUCTION

Kampus merdeka is one of the *Merdeka Belajar* programs issued by Ministry of Research, Technology and Higher Education of Indonesia at the end of January 2020 (Ihsan, 2021). This program, which aims to support the education system in Indonesia, provides opportunities for college students to master various disciplines to enter the job market. This opportunity is obtained by utilizing programs that are already running such as internships and independent studies.

Del Institute of Technology is one of the universities in Indonesia which has started to participate in the implementation of the *Kampus Merdeka*. However, it was found that the implementation in terms of preparation and execution of the *Kampus Merdeka* was still not running optimally on campus. The main factor that causes the maximum target of *Kampus Merdeka* not to be achieved is the process flow that is not yet uniform and the system that has not been automated in facilitating the implementation of the Independent Campus Internship & Independent Study within the scope of the Del Institute of Technology.

The technology used at the Del Institute of Technology in conveying information on every procedure for implementing the Merdeka Campus from the socialization stage to the running of the program at companies has not been automated to accommodate every activity flow where each party involved has to switch platforms such as E-Course, email and WhatsApp. Therefore, in this study a special website-based information system will be created that standardizes each implementation procedure and automates each process so that it can assist the implementation of the Independent Campus Internship and Independent Study at the Del Institute of Technology within the scope of the Faculty of Informatics & Electrical Engineering.

In the current era, the application of information technology is indispensable in implementing activities in various fields, one of them is in higher education sector (Zukirman and C. Rahayu, 2018). One of the applications of information technology is to create an information system. Information systems will help various human jobs run more effectively and efficiently (Y. Wahyudin and D. N. Rahayu, 2020). The benefits obtained from information systems are that they can improve management planning and control, accelerate activities, and prevent errors from occurring (Eryc, 2021). Therefore, seeing the obstacles that occur in every process of implementing the *Kampus Merdeka* at the Del Institute of Technology, a special information system is needed with the aim of assisting the delivery of socialization, especially in providing information about the *Kampus Merdeka*, targeted administrative submission services as well as monitoring media and consultation between supervising lecturers and students. All activity processes in the information system will be made more automated so that the system is more structured, systematic and efficient in the use of time and energy.

The information system will be created using the Agile-Scrum method. Agile and Scrum can be said to be interrelated where Scrum is included in the agile development process. Scrum uses Agile principles where this is based on collaboration between teams, incremental products and development

iterations that create the final result (Suare, 2022). The Agile method itself covers all areas of traditional software engineering where the key to this method is that project development is broken down into a series of shorter development cycles (called "Sprints" or "iterations") where each iteration is carried out 1-4 weeks (Firdaus, 2017). In the Scrum framework, it is possible to change requirements, of course, because this model is structured and iterative so that if the product in the first increment does not meet the needs, it can be developed in the next increment based on user evaluation (Hadji et al., 2019). Scrum has excellent benefits so that it can produce an application that is able to adapt to change. This can be seen from its characteristics that are flexible to change so that it can produce a system that is suitable for use and in accordance with the goals set (Andipradana, 2021).

METHODS

Agile Scrum

Agile is a way of developing software that relies on iterative changes to feedback from clients. This iterative approach allows the customer to evaluate software improvements on a regular basis, provide the necessary feedback to the software development team, and influence the adaptation of processes made to accommodate the feedback that has been provided. Scrum is an agile model that is adaptive, flexible to changes and can provide products that meet user expectations. Within each framework activity, tasks are performed in a process pattern called a sprint.

Scrum Framework describe there are sprint activities, namely sprint planning, daily scrum (stand up), sprint retrospective, and sprint review. Sprints themselves are run by a team. The organizational structure of a Scrum team includes a product owner whose job is to maximize the business value of the products produced. Then there is the scrum master, whose job is to monitor and ensure the smooth development of the product to conform to the scrum framework. And the last is the development team, whose job is to complete all tasks in product development.

Microservices Architechture

Microservices is a type of software development architecture other than monolithic. This architecture is a set of independent and small processes or services that interact with each other to form complex applications that do not depend on a particular programming language (Yohakim and Badiyanto, 2019).

Functional Testing

Functional testing is a type of software testing that aims to validate the software system according to predetermined functional requirements and specifications. The main purpose of functional testing is to test every function in the software application by providing the appropriate input, as well as verifying the resulting output is in accordance with predetermined functional requirements.

API Testing

API testing aims to validate the Application Programming Interface (API). The focus of API testing is checking the functionality, reliability, performance and security of the programming interface.

API testing does not use standard input from the user such as a keyboard, and the output is also not a display intended for the end user. API testing has significant differences from Graphical User Interface (GUI) testing because it is not focused on the appearance and visual aspects of the application. API testing focuses more on the business logic layer of the software architecture (Hamilton, 2023).

User Acceptance Testing (UAT)

User Acceptance Testing (UAT) is a test carried out by user (Yusmita, 2023). The expected end result of this test is a test result document which can be used as evidence that the software being developed meets the requirements. During testing, users test the software to ensure that the software can handle the tasks required in real scenarios.

Root Cause Identification

In this study, the root causes of the problems that occurred in the implementation of the *Kampus Merdeka* program at the Del Institute of Technology were identified using the 5 why analysis technique which is an iterative and interrogative technique used to find cause-effect relationships that underlie certain problems (Rahmana et al., 2021).
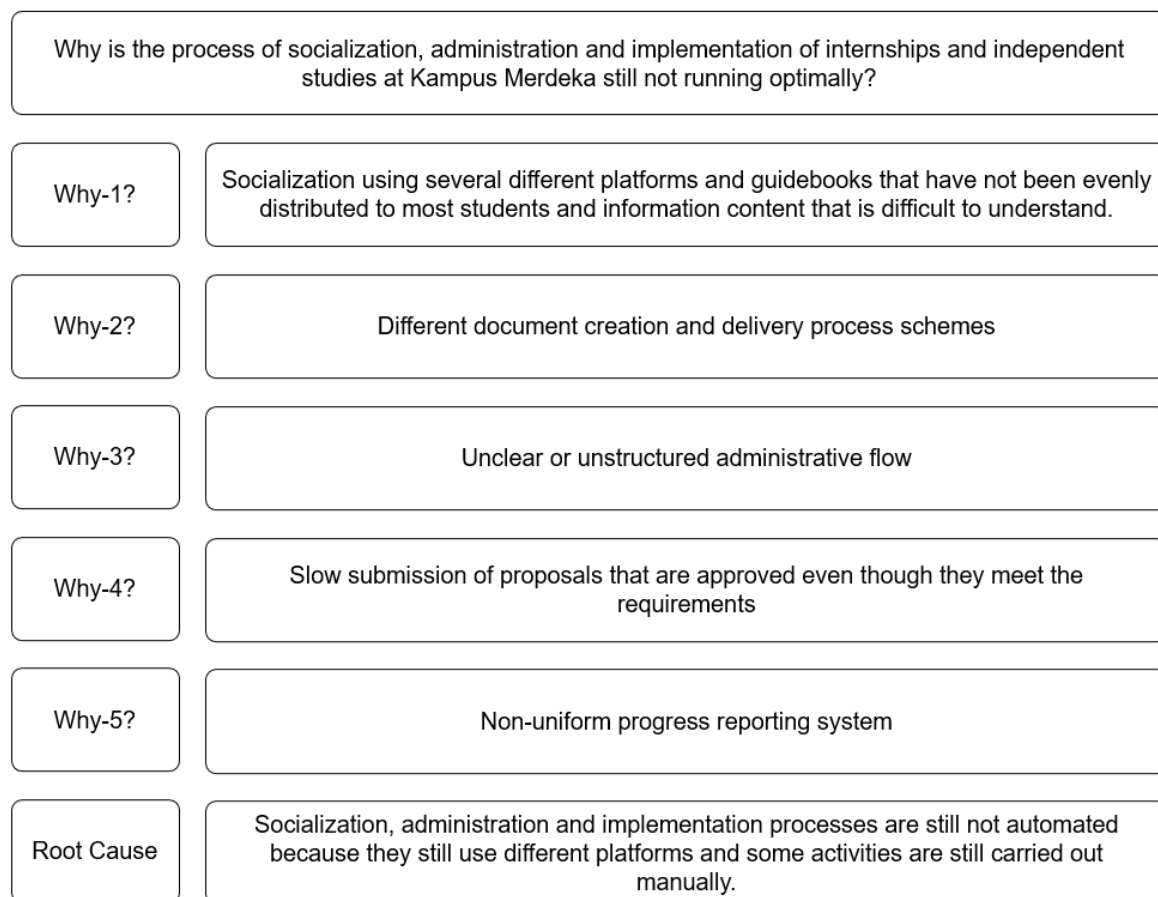

	Why is the process of socialization, administration and implementation of internships and independent studies at Kampus Merdeka still not running optimally?
Why-1?	Socialization using several different platforms and guidebooks that have not been evenly distributed to most students and information content that is difficult to understand.
Why-2?	Different document creation and delivery process schemes
Why-3?	Unclear or unstructured administrative flow
Why-4?	Slow submission of proposals that are approved even though they meet the requirements
Why-5?	Non-uniform progress reporting system
Root Cause	Socialization, administration and implementation processes are still not automated because they still use different platforms and some activities are still carried out manually.

Figure 1. Root Cause Problem

In Figure 2, it is identified that each process is still not automated where the process still uses a different platform and some activities are still carried out manually. The process of socialization, administration and implementation that is not uniform and uses several platforms makes the existing

system unstructured and not systematic besides that approval, preparation and sending of administrative documents which are still done manually will make the use of time and energy inefficient.

Scrum Implementation

- Product Backlog

Creating a product backlog is the first step in building a system that uses the Scrum method. The contents of the product backlog itself are the results obtained from the identified user story designs and literature studies related to the system being developed.

Table 1. MBKM Information System Product Backlog

ID	Item Backlog
1.	Design Interface
2.	Sharing services and databases
2.	Login
3.	Open the Kampus Merdeka Batch
4.	Make Announcements
6.	MBKM Coordinator Assignment
7.	Manage Coordinator Lists
8.	Manage Student List
9.	Manage Lecturer List
10.	Manage Staff List
12.	Upload Administrative Document Templates
13.	Proposal Review
15.	Supervisor Assignment
16.	View the Mentored Student List
19.	View the list of MBKM Students
20.	Proposal Submission
21.	Input Acceptance Information at MBKM Partners
22.	Recommendation Letter Management
23.	SPTJM Management
24.	Grade Transcript Management

- Sprint Iteration

The sprint iteration of Scrum is carried out in 4 sprints. The duration of sprint 1 was carried out for 4 weeks and sprints 2, 3 and 4 were carried out for 1 week each. For each iteration of the sprint that is carried out, the sprint goals/sprint goals are determined, the tasks carried out during the sprint as well as the effort and estimated days.

- Sprint 1

The sprint goal in sprint 1 is "Work on Admin Features and Development of Preliminary Features of the Information System Internship and Independent Campus of *Kampus Merdeka* program at the Del Institute of Technology" which will be carried out in 4 weeks. The development team selects several items from the product backlog that will be worked on in sprint 1. In table 2, backlog items 9 and 10 have not been completed and are included back in the product backlog.

Table 2. Sprint 1 Backlog Item & Story Point

No	Backlog item	Story Points (Effort)	Estimation (Day)	Work Days/Status
1.	Design user interface	8	8	7/Done
2.	Sharing services and databases	5	3	3/Done
3.	Login	5	4	3/Done
4..	Manage Student List	5	4	3/Done
5.	Manage Lecturer List	5	4	3/Done
6.	Manage Staff List	5	4	3/Done
7.	Manage Coordinator List	5	4	3/Done
8.	Coordinator Assignment	5	2	1/Done
9.	Open MBKM Batch	5	2	1/Unfinished
10.	Create Announcement	5	2	-/Unfinished

- Sprint 2

The planned sprint goal is "Management of Features for the Needs of MBKM Administrative Documents and Progress Reports" and is carried out for one week. Some unfinished items from the product list in the previous sprint were brought into this sprint 2 to be included in the sprint backlog.

Table 3. Sprint 2 Backlog Item & Story Point

No	Backlog item	Story Points (Effort)	Estimation (Day)	Work Days/Status
1.	Create Announcement	3	1	1/Done
2.	Open MBKM Batch	5	4	3/Done
3.	MBKM Coordinator Assignment	3	1	1/Done
4.	Proposal Submission	5	5	3/Done
5.	Upload Administrative Document Templates	5	3	2/Done
6.	Proposal Review	5	3	2/Done
7.	Recommendation Letter Management	5	3	2/Unfinished
8.	SPTJM Management	5	2	1/Unfinished

- Sprint 3

The Scrum master held the third sprint planning on June 1st, 2023. The sprint goal was "MBKM Administration and Improved Feedback" and was carried out for one week. Unfinished items from the product backlog list in sprint 3 are immediately put back into the sprint backlog.

Table 4. Sprint 3 Backlog Item & Story Point

No	Backlog item	Story Points (Effort)	Estimation (Day)	Work Days/Status
1.	Recommendation Letter Management	8	7	3/Done
2.	Input Acceptance Information at MBKM Partners	5	2	2/Done
3.	SPTJM Management	5	3	3/Done
4.	Open MBKM Batch	3	1	1/Done
5.	Proposal Review	3	1	1/Done
6.	View the List of Students Accepted at MBKM partners	3	1	-/Unfinished
7.	Submit MBKM Student Progress Reports	5	2	-/Unfinished

- Sprint 4

The scrum master held the final sprint planning on June 9th, 2023. The planned sprint goal was "Working on the MBKM Student Implementation/Monitoring Section and Feature Improvements" and was carried out for one week.

Table 5. Sprint 4 Backlog Item & Story Point

No	Backlog item	Story Points (Effort)	Estimation (Day)	Work Days/Status
1	Input Acceptance Information at MBKM Partners	5	3	3/Done
2	Supervisor Assignment	5	2	2/Done
3	Submit MBKM Student Progress Reports	5	2	2/Done
4	Grade Transcript Management	1	1	1/Done
5	View the List of Students Accepted at MBKM partners	3	1	1/Done
6	SPTJM Management	3	1	1/Done
7	Recommendation Letter Management	3	1	1/Done

- Feedback During Sprints

In each sprint phase, the team implements a sprint review to demonstrate the information system to the product owner. Sprint reviews that are carried out for each sprint result in feedback that is given after conducting an application demo.

Table 6. *Sprint Review Feedback*

Sprint	Item Backlog	Feedback
1	MBKM Coordinator Assignment	Coordinators by default are lecturers as heads of study programs and coordinator rights can be assigned by the head of study program to other lecturers within the scope of the same study program, not from the admin.
2	Proposal Review	Assessing lecturers can request changes in grades and assessors are not limited (can be more than 2)
	Open MBKM Batch	MBKM batch field should not be included but only the school year and semester are enough to group opened MBKM activities
3	Recommendation Letter Management	Generating recommendation letters by BAA Faculty does not need to save generated data to the system but gives students access rights to download directly to the client.

Sprint	Item Backlog	Feedback
	SPTJM Management	Generate SPTJM by BAA Institute does not need to save generated data to the system but gives students access rights to download directly also to the client.
	Input Acceptance Information at MBKM Partners	You can only input details of acceptance information at MBKM partners once but the data can still be updated before being assigned to the supervisor.
4	Input Acceptance Information at MBKM Partners	Students who provide acceptance information to MBKM partners cannot edit their data after the supervisor has been assigned by the coordinator.
	Submit Progress Report	Students can edit reports that have been submitted, supervisors can provide feedback on the report
	Proposal Review	The display of the input form when the lecturer is assigned to be an assessor, the display of the form focuses on the lecturer who is the assessor and the standard for assessment limits is set dynamically per study program.
		Provides student process status from the submission process to becoming an MBKM student

Feedback obtained through the implementation of several sprints is the answer that scrum's sensitivity to changes that occur where the focus is on flexibility and adaptation and on a small team scale [13]. All the feedback obtained during the implementation of scrum on the Information System Internship & Independent Campus Independent Study at the Del Institute of Technology is also a sign that there are changes in requirements so that it can be stated that the scrum method is very suitable for dealing with changes that occur every sprint iteration (Mukti, 2022).

RESULTS AND DISCUSSION

Results of Microservice Application

Microservice design is carried out during the sprint and becomes part of the product backlog. The information system built is broken down into several services and each has its own database design. Services are implemented using the ExpressJS framework where all connected services will communicate using the REST API. The services created on this system are user services, socialization services, administration services and implementation services and are implemented using ExpressJS as well as API Gateway. The information system client itself is built using the react framework, namely NextJS, which will send requests and receive responses.
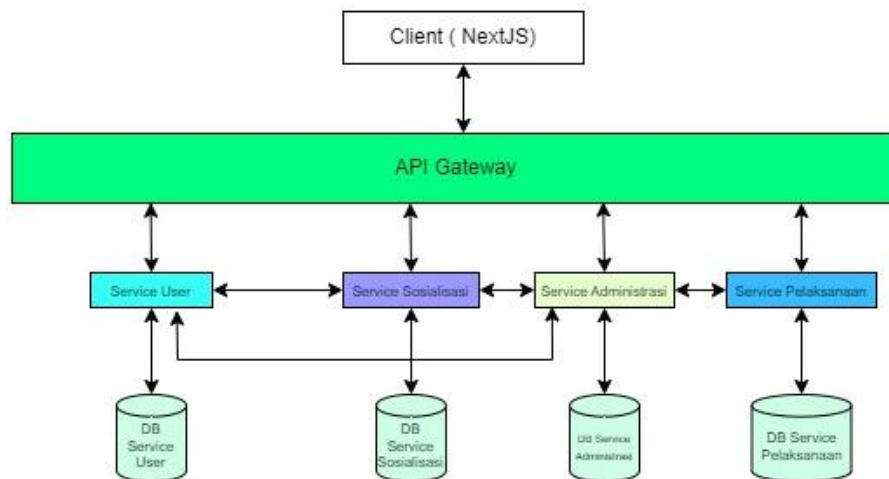
Figure 2. Microservices design

16 main API endpoints are produced which become the liaison between the client and all services. Clients that send requests to each service will pass through the API Gateway where the request will be carried by the API gateway and brought to one of the service endpoints that they want to address and vice versa in terms of sending a response. The resulting API gateway becomes the only gateway layer for clients who send requests to each service where this system only has one access which will eliminate the problem of clients directly connecting directly to all microservices (Laksito, 2019).

System Information Testing

Testing is carried out directly by the development team to check for bugs by adjusting the expected results and actual results. Based on the tests that have been carried out during several sprints, all bugs found in the sprint phase are immediately fixed so as to produce actual results that match the expected results that have been made.

API Testing Result

Testing of all API endpoints that have been created is done manually through the Postman application. API testing is used because the system architecture used is a microservice which for communication itself uses a REST API by utilizing HTTP protocols such as POST, GET, DELETE, and PUT. The tested APIs are */api/auth, /api/current-user, /api/mahasiswa, /api/dosen, /api/staff, /api/admin, /api/pengumuman, /api/batch, /api/proposal, /api/document, /api/sptjm, /api/penilai, /api/mahasiswambkm, /api/transkrip_nilai, /api/bimbingan* dan */api/progress*.

The test involved 5 students who had previously participated in MBKM consisting of 3 students from the Informatics study program, 1 from Information Systems study program student and 1 from Electrical Engineering study program student by providing 7 questions related to the student's process in participating in the program after using this information system using a Likert scale. The Likert scale generally consists of 5 categories, namely strongly agree (5), agree (4), neutral (3), disagree (2) and strongly disagree (1).

Table 7. UAT Evaluation using Likert Scale

No	Question	SA 5	A 4	N 3	D 2	SD 1	Percentage
1.	Do you agree that this information system is easy to use?	3	2	0	0	0	92%
2.	Do you agree that this system provides a feature to get announcements related to the independent campus socialization?	3	1	1	0	0	88%
3.	Do you agree that access to download all these administrative documents is easy to obtain?	3	2	0	0	0	92%
4.	Do you agree that this system helps you to simplify the program implementation process?	3	2	0	0	0	92%
5.	Do you agree that this information system helps to provide information on passing your acceptance data at MBKM partners?	3	2	0	0	0	92%
6.	Do you agree that this MBKM information system makes it easier for you to submit progress reports to your supervisor after you have been assigned to a supervisor?	4	1	0	0	0	96%
7.	Do you agree that the MBKM information system makes the MBKM process more structured and systematic?	4	0	1	0	0	92%

From the scenario of testing the questionnaire above, the results of the total percentage of UAT testing with a total percentage of 7 questions divided by the number of questions (92% + 88% + 92% + 92% + 92% + 96% + 92%) / 7 is 92%. Based on the Likert scale table, it was found that the information system tested by students directly had a percentage of "Very Good" criteria. This shows that the question addressed is regarding the flow of using an information system that helps students in the socialization process so that the implementation goes very well.

CONCLUSIONS

Based on the results of the research that has been done, the authors summarize several conclusions. First, the information system has been built in the form of a structured and systematic website through the selection of Agile-Scrum as the development framework so that it can help students to follow the flow of the MBKM program implementation process. Second, the information system design process has implemented agile-scrum by carrying out the sprint planning, sprint review and sprint retrospective stages which help in adjusting changes in the form of feedback obtained in each sprint iteration carried out where the iterations are carried out 4 times sprint iterations and thirdly, the author conducts a series of tests that have been selected to test the application, namely by means of functional testing and API testing in each sprint as well as user acceptance testing on the user especially the students themselves where the test results show that the system can run very well supported by a UAT evaluation percentage of 92% where the information system is built with several features that can be useful to help the process of implementing *Kampus Merdeka* program at the Del Institute of Technology so that they can be properly automated.

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