The Telegram notification system for improving library services Universitas Negeri Semarang

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Abstract

The pandemic period limits every activity, including library services, causing the communication distance between users and librarians to widen. Users often forgetting to return books, so the fines accumulated, and often forget and lose borrowed books. The communication distance between librarians and library users can be narrowed through an automatic reminder system to remind users of important information regarding fines, services, and others. This study aimed to know the Telegram notification system for improving library services. Universitas Negeri Semarang also supports the use of Telegram as a notification system. This study applied the Research and Development (RnD) method in The Senayan Library Management System (SLiMS) development, supported by an integration method using Middleware Integration. The use of the paired t-test in this study showed that this reminder mechanism successfully informed library members of the time limit for borrowing books and late fees. A significant relationship exists between before and after the installation of Telegram as a useful reminder system to avoid the accumulation of fines by customers. This reminder system was also beneficial to avoid users accumulating fines, it can be seen that the number of users who are late in returning books is decreasing as the notification system is implemented. Good communication between librarians and customers through an information system intermediary improves user service.

Keywords: Senayan Library Management System; Library automation system; Library notification system

Sistem notifikasi Telegram untuk peningkatan layanan perpustakaan di Universitas Negeri Semarang

Abstrak

Masa pandemi membatasi setiap kegiatan termasuk pelayanan perpustakaan yang menjadikan jarak komunikasi antara pengguna dan pustakawan melebar. Pengguna kerap kali lupa dalam mengembalikan buku sampai dendanya berangsur-angsur, pengguna juga tak jarang melupakan dan menghilangkan buku yang dipinjamnya. Jarak komunikasi antara pustakawan dan pengguna perpustakaan dapat dipersempit melalui sistem pengingat otomatis untuk mengingatkan kepada pengguna akan informasi penting terkait denda, layanan, dan sebagainya. Tujuan penelitian ini adalah untuk mengetahui sistem komunikasi Telegram dalam peningkatan layanan perpustakaan. Universitas Negeri Semarang turut mendukung penggunaan aplikasi Telegram sebagai sistem notifikasi. Metode penelitian menerapkan metode Reseach and Development (RnD) dalam pengembangan Senayan Library Management Sistems (SLiMS) yang didukung metode integrasi menggunakan Integrasi Middleware. Penggunaan uji-t berpasangan dalam penelitian ini menunjukkan bahwa mekanisme pengingat ini berhasil memberi tahu anggota tentang batasan waktu untuk meminjam pustaka dan biaya keterlambatan. Hubungan signifikan terjadi antara sebelum dan sesudah pemasangan Telegram sebagai sistem pengingat yang bermanfaat untuk menghindari penumpukan denda oleh pelanggan. Penyediaan fitur notifikasi Telegram telah memberikan manfaat bagi peningkatan pelayanan perpustakaan, terlihat bahwa jumlah pengguna yang terlambat dalam pengembalian buku lebih berkurang seiring implementasi notifikasi pada sistem. Komunikasi yang baik antara pustakawan dan pelanggan dengan perantara sistem informasi, merupakan salah satu bentuk peningkatan layanan yang diberikan kepada pelanggan.

Kata Kunci: Senayan Library Management System; Sistem otomasi perpustakaan; Sistem notifikasi perpustakaa

INTRODUCTION

The use of information technology to provide services has grown very widespread recently. This strategy is premised on the ease with which information systems may be accessed and used as a business tool. Senayan Library Management System (SLiMS) is a free and open-source software tool widely used in Indonesia. SLiMS not only assists in the creation of a book inventory but also records borrowings conducted by library users. According to Aswari, Kristiawan, and Fitria (2020), more than 389 libraries in Indonesia utilize SLiMS as a supporting application in libraries.

It is critical to recognize that many internet users utilize content management systems (CMS) to launch their systems (Csontos & Heckl, 2020). The Library Management System (LMS) is a Content Management System (CMS) that focuses on information management in a specific repository or repository system. CMS's fast expansion has resulted in many users embracing the system (Fragulis, Papatsimouli, Lazaridis, & Skordas, 2021).

Regardless of how well things move, there are always specific concerns that need to be addressed. One such problem arises when a different organization manages a business process from the one used. The problems that arose in the library system were visible during the Covid-19 pandemic. Many borrowers do not return their books or even lose the books they borrow. This condition results in accumulated user fines. This accumulation of fines often results in other systems being hampered. The number of fines due to library patrons increases every day due to the long list of accumulated delays. This condition will continue until the library items are returned to the library. As a result of this increase in debt, it can be concluded that the institution's administration is not effective (Zulfaris, Mustafa, Mahussin, Alam, & Daud, 2020).

The bottleneck of this system requires the improvement of business processes. The business process proposed by the researcher is the system notification business process. Business procedures are closely related to the sustainable management of company operations (Budiman & Akhlis, 2021; Priefer, Rost, Strüber, Taentzer, & Kneisel, 2021). It is hoped that adding a business process in the form of this notification can break the system's bottleneck, and the business's continuity can run.

According to Aswari et al., (2020), a digital library is a system that comprises a variety of services and information items that allow users to access these information objects via digital devices. The following features are included in Cleveland's definition of digital libraries: digital libraries are libraries that resemble traditional libraries and offer both digital and traditional collections, as well as media collections, in the digital age (Raharto, Fawaati, & Nilasari, 2021). According to Azwar (2012), a good library management system is an integrated system that includes all the processes of library activity. The researchers see the improvements in library services in the circulation service, which are included in the sub-billing service section. Even though the operator/librarian whom the library has given the authority and responsibility to develop menus is not at fault, the accumulation of a list of late returns of library materials by users in the SLiMS database at the Universitas Negeri Semarang appears to demonstrate one of SLiMS's weaknesses.

Since SLiMS is open-source software, librarians are encouraged and required to modify existing menus to suit the needs of their local library. The notification menu for the delay in returning library materials is expected to inform users about their loans. So that the amount of the fine can be informed quickly, therefore, institutions must priorities efforts to improve services to the academic community.

Researchers are attempting to enhance the user experience by combining the menus currently accessible in SLiMS with the Unnes academic information system (SIKADU), paired with telegram-based automatic push notifications. The adoption of Push Notifications is anticipated to decrease delays in returning library items, which leads to the accumulation of fines by users. According to Bidargaddi, Pituch, Maaieh, Short, and Strecher (2018), push notifications are a kind of self-monitoring that can modify users' negative behaviors. The usage of push alerts might alter consumers' motivation and requirements (Budiman & Akhlis, 2021). Therefore, aim this research is to know the Telegram notification system for improving library services.

RESEARCH METHODS

We used research and development (RnD) research methodologies to improve present products at this study. The research and Development (RnD) method is the most successful in conducting technology development research (Sugiyono, 2017). This literature proposed a research and development process used in the technique's development. The procedural model utilized in this study was developed using the phases of software development as a reference. Some of the methods that have been implemented shown in figure 1 include potential and issue analysis, data collection, product design, design validation, design revision, user testing, and product revisions. In the following paragraphs, each of the author's steps is detailed.
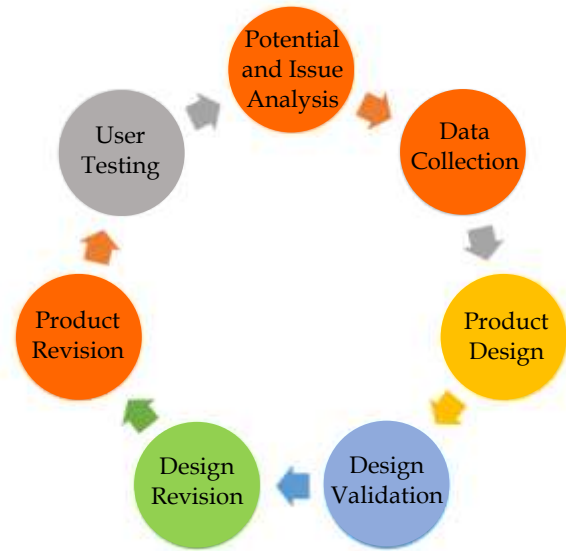

Figure 1. RnD cycle
Source: Adaptation from Borg and Gall (1983)

As the name suggests, RnD contains a series of research and development processes for the product or service that you want to create. The organization's main goal is to launch an original product or service optimally. Likewise, researchers who want to improve SLiMS services by adding notification features via Telegram need to apply this RnD research method. The hope is that the products made are useful.

The author seeks the best potential to apply to the problem of accumulating delays in returning libraries. In this case, the author employs a fishbone diagram to discover the best answer to these difficulties. Based on linked factors, fishbone diagrams can indicate the root cause of an issue (Coccia, 2017; Coccia, 2020).

According to the fishbone diagram in figure 2, there are several problems from the user's perspective. It is discovered that some users lend each other their membership cards (KTM), followed by the circulation librarian's lack of foresight in observing the suitability between users and the cards they use to borrow library materials. This condition frequently leads to the user failing to return the borrowed library materials. The borrowed library membership card owner fails to remind his friend who uses his card to borrow library materials, resulting in a delay in returning the collection, which results in the emergence of fines, the number of which increases with the number of days of delay. This carelessness will result in fines and damage to the user. The library does not adequately utilize the late warning function featured in this system due to users' various delays in returning library items and the librarian's lack of expertise in maximizing the operation of SLiMS. Even if it is utilized, it should be used without being created to meet the demands of the library.

It is the implication of the user's ignorance in borrowing library materials, such that they ignore the deadline for returning the collection they have borrowed in terms of tools. Because of this misunderstanding, the user does not prolong the borrowing time of library items even after the lending period has ended. The librarian does not monitor the list of late returns in the system to quickly follow up by alerting the user.

The preceding is the reason for the issues created by the environmental side and the cause of the problems caused by the policy side. Due to the outbreak of Covid-19, the government's adoption of Studying from Home and Working from Homemade physical activities carried out in circulating services in the library was impossible for customers to access. The great distance between the user and the library also contributes to the issue. In addition, the library has not created a remote service system for delivering and collecting library goods borrowed by users. However, there is promise in the fishbone that has been created, particularly the policy of using Telegram as an official information provider. This information will be automatically provided to late return users until the borrowed library materials are returned.

The researchers collect supporting data for design planning after identifying the potential and issues to be tackled. The author conducts interviews with librarians and users in order to collect data. According to Hasanah (2016), interviews are among the research's earliest and most essential data gathering strategies.

When students misplace loaned library materials, they do not immediately notify the library. Users are subject to a fine calculated per day from the end of the return period, even if they report it, the library will extend the borrowing period, allowing them to locate lost library materials or, if they are lost, to immediately replace them with the same book to avoid being penalized; however, if they do not report it, they will be penalized.

Furthermore, students who are ready to graduate are impeded by the process of collecting penalties since they will be unable to finish the graduation ceremony if they have not been paid. If they borrowed library items that were lost, they must first replace them and pay any penalties before getting a library-free certificate.

The students would petition authorities for a waiver of the cost of the user disagreed with the amount of the fine he was forced to pay. The library's leadership will be obsessed with drafting a recommendation letter to reduce the number of fines that must be paid. Consequently, obtaining library-free material needed to register for graduation will be impeded.

The author develops two types of designs: system architecture design and system display design. The architectural design includes Middleware integration, which connects the Telegram system to the SLiMS system. Middleware Integration is a software system that offers runtime services for communication, application integration execution, monitoring and operations. The author also uses the Low Fidelity Prototyping approach to design system display. This low-fidelity prototype methodology is one of the most basic and easy prototyping approaches. The low-quality prototype is meant to attract the user's attention to the text rather than the decorative embellishments. By focusing just on the content of the task flow, the mechanism may be seen more clearly.

According to Nugraha, Sumardi, and Hamdu (2017), design validation is a series of actions conducted with professionals or people who are well-versed in related topics to test the quality of a design. Consequently, this validation method is carried out cooperatively by librarians (those who understand the library system) and IT professionals (people who really work and are in the IT field). The design evaluation process is carried out collaboratively by the research team and the librarian to discover the best solution to the problem.

The author's prototype is then modified once validated with users (librarians) and IT specialists. If it is determined that the initial design was correct, the design revision phase is bypassed, and the product is tested immediately. Design modifications will be made if design defects or deficiencies in the initial design.

The author and research team tested the prototype on a staging or pre-production server before moving on with the project. This staging server is utilized throughout the product testing phase to avoid problems arising on the live system. The testing method should not be carried out on a live server; instead, a staging server should be set up to prevent duplication and data errors in the operating system.

The testing method is also carried out using Blackbox functional testing. Testing in a Blackbox provides an overall view of how well a system functions. According to Supriyono (2020), the steps involved in Blackbox testing are test case definition, which may be done using a graphical user interface or a text editor. A test case library is a collection of test cases that may be reused across several test runs; running test cases, implementing result assessment techniques, and documenting test findings are all critical activities. Enhance the usability of the Blackbox Test by collecting test data and producing test results. The author created the following functional testing instrument.

The system is uploaded to the production server and available for usage in a production environment. It is determined that the system is ready for production and that no problems have

been identified. An error may occur during the development stage, and products generated on the staging server are updated during the debugging stage.

Table 1
Blackbox testing instruments

Test case	Test scenario	Expected results
Sending telegram notifications to borrowers	Open the circulation menu, and open the current loan menu tab.	Telegram message sent to the borrower
Sending notifications of fines and delays en masse	Open the delay list menu; press send telegram notification	Messages are sent en masse to every borrower who is late in returning to the library
Individual delivery of fines and delays	Open the delay list menu, search for the borrower's name, and click send fine notification.	Message sent to borrowers who have outstanding fines
Sending notifications a utomatically to borrowers	The system sends asynchronou sly every time there is a loan	Message sent to the borrower before the loan deadline ends

Source: Universitas Negeri Semarang, 2021

Iterations of this product revision approach will be done based on the need for future error repair in the product design. Now is an excellent time to verify the borrower data status to determine whether the required positive value has

been reached. The SLiMS database is requested to construct the loan table with helpful test information. In this study, two months were spent gathering data, for two months, before and after the introduction of Telegram as a notification system. The previously gathered data is averaged using telegram software, compared with data acquired before and after installation of the notice, and the conclusions are displayed in graphical form.

Statistical analysis will determine whether the data is normally distributed; initially, the researcher will decide whether the data is normally distributed. The normality test with Skewness and Kurtosis is commonly used to assess whether the normalcy graph of the data is overly skewed, flat, or packed in the center. According to Masrokhah and Suciningtyas (2016), skewness and kurtosis have an additional benefit in that they allow us to alter data depending on the values we obtain, which Kolmogorov Smirnov does not. As a result, the normality test with Skewness and Kurtosis, which is frequently employed to measure data skewness, has gained widespread acceptance.

A second test is performed after evaluating whether or not the data is supplied regularly. The examiner used the paired t-test to determine the average if the data were normally distributed; however, if the data was not normally distributed, the researcher used the Mann Whitney test, commonly known as the U-test. This test was done to determine whether the data was normal or abnormal.

After the efficiency of the built-in notification system has been verified, the product revision step is carried out as follows. This iterative product revision process is committed to providing the best

product quality to the consumer.

Before it was implemented, each of the procedures leading up to it was assessed in conjunction with a broad collection of authors, including academics, information technology professionals, and librarians. The type of information sought by researchers is quantitative data generated by reducing the number of delays in the Universitas Negeri Semarang library automation system rather than qualitative data.

RESULTS AND DISCUSSION

Product designs created to reduce loan delays fall into two categories: system architecture design using Linked REST APIs (LRA), Middleware Integration and display design with low fidelity prototypes. As shown in figure 3, the general design of the Telegram application developed at Universitas Negeri Semarang is based on the concept of middleware integration. Middleware integration is a technique of connecting software using intermediate programs. Its purpose is to allow numerous applications to be linked together. In contrast to point-to-point integration, this concept allows for simultaneous integration with several applications.

Point-to-point integration in figure 2 is connected by Linked REST APIs (LRA). Serrano, Stroulia, Lau, and Ng (2017) claim that middleware LRA can use the semantic description of Linked REST APIs to automate calling and constructing these

APIs in software applications and reduce the manual work required by software developers. According to LRA Middleware, distributing notices may be done automatically, without the need for the user to intervene. Telegram as a notification system has been utilised in several applications at the Universitas Negeri Semarang. Academic information systems, financial information systems, personnel information systems, and other service systems are among the applications that have adopted the telegram directive. Researchers used Telegram as a notification mechanism in this SLiMS-based library automation system since it is thought to be adequately effective.

The User interface display design for the telegram message system was created using low fidelity prototypes. The ease of use and simplicity of a low-fidelity prototype offers the advantage of focusing the attention of users participating in the design process on the application's workflow rather than additional displays that serve merely as adornment. According to Gerber and Carroll (2012), developing low-quality prototypes encourages developers to focus on creating a large number of wireframe interfaces rather than one perfect design. The way developers work is also greatly affected, emphasising concept development rather than polishing old ideas. The following outcomes were produced as a result of the researchers' Low Fidelity prototype design:
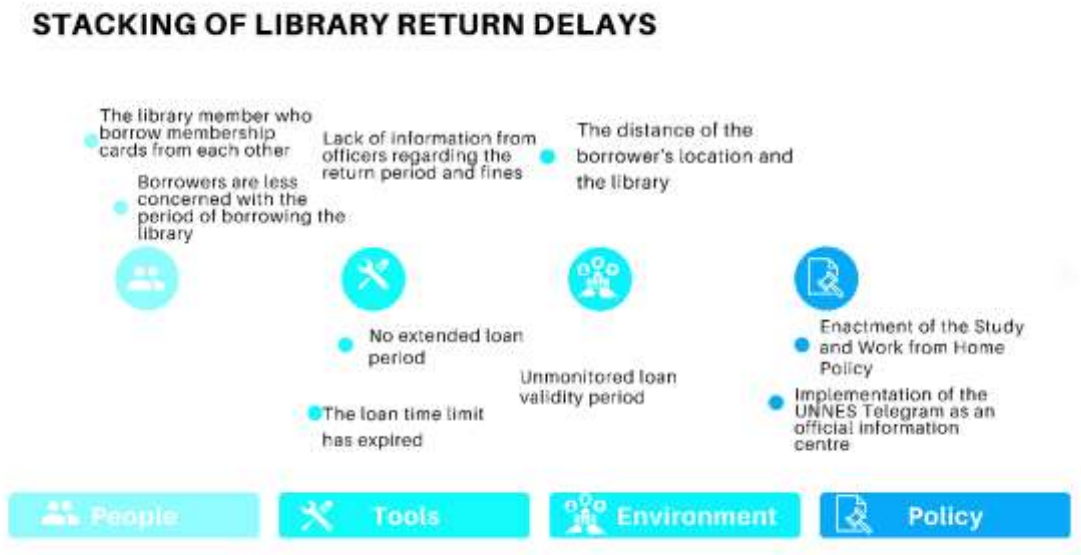
Figure 2. Fishbone stacking of library return delays
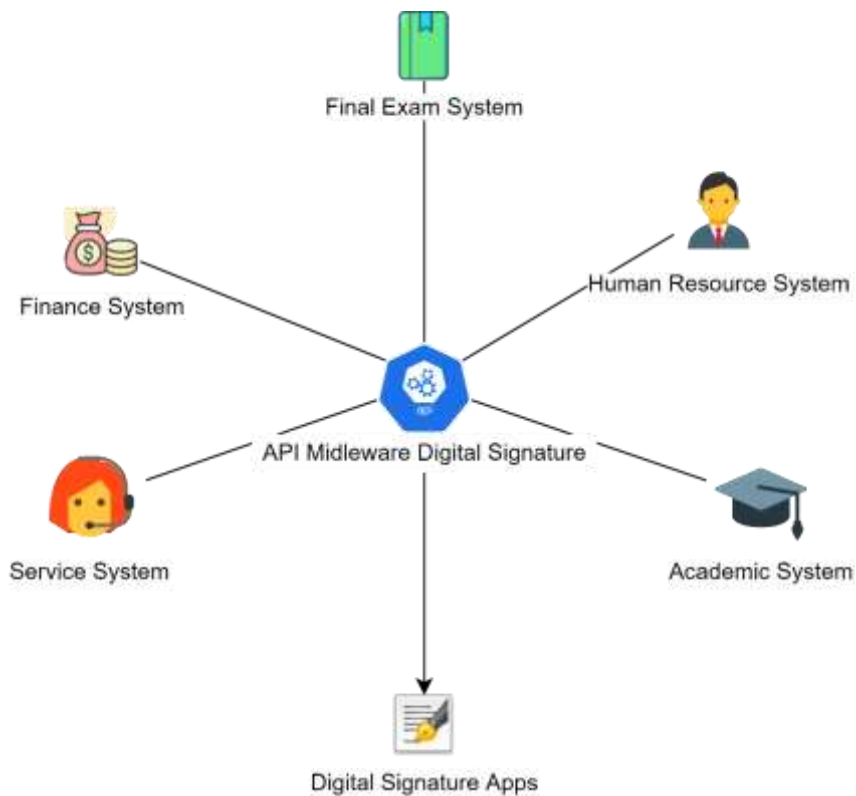Source: Universitas Negeri Semarang, 2021

Figure 3**.** The Architecture of middleware integration telegram apps in UNNES
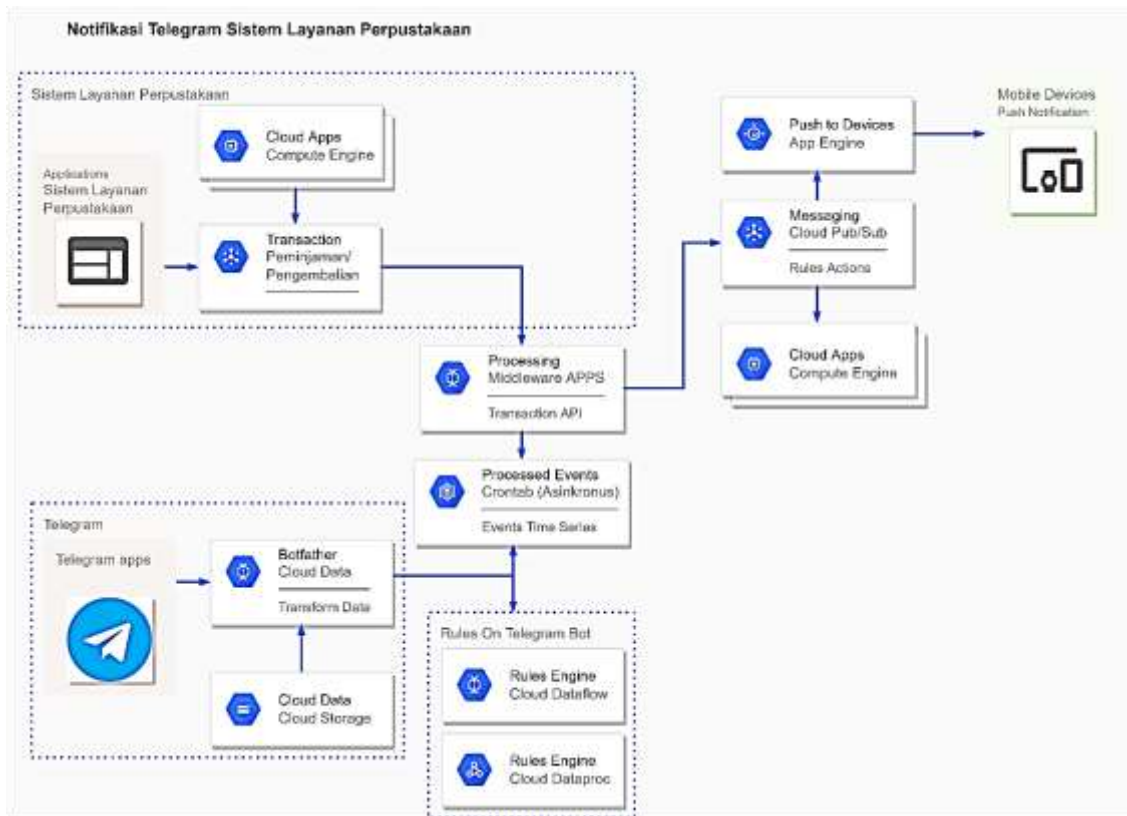Source: Universitas Negeri Semarang, 2021

Figure 4. Telegram and SLiMS apps integration architecture
Source: Universitas Negeri Semarang, 2021

The user (librarian) performs a design validation procedure based on the design created. There is no modification of the design because all librarians agree on it. As a result, the researchers built the system in line with the design created; the development was by the low fidelity prototype design created.

The application integration step is also carried out utilising Telegram by adding an asynchronous task every 24 hours. This asynchronous job aims to make system performance lighter because alerts are only delivered once a day. Asynchronous tasks enable developers to build automated functions that are repeated regularly and easily. This capability substantially facilitates automatic checking and submission while significantly reducing manual operations. The integration architecture of the Telegram and SLiMS applications at the Universitas Negeri Semarang in sending

push alerts is shown in figure 4. The data provided to the middleware creates notifications from the telegram integration.

Product trial is the next stage in the R&D research process. Product trials done by researchers use a system that has been functionally tested via black-box testing. Black-box testing reveals application features such as look, function, and compatibility of functionalities with customer-requested business processes. Table 1 lists the instruments used for Blackbox testing.

The outcomes of the complete Blackbox testing, suggest that the results were positive. From Blackbox testing, all application functionality is running well and successfully. As long as there are no functional issues in the software, the product revision stage can be skipped.

Borrower data from the database is computed to see if it fulfills the assumption of normality. The data

computation is performed using the Skewness and Kurtosis normalcy test.

Table 2
Data table of number of SLiMS borrowers

Week	Month	Number of borrowers	Not on time	%
			15	3
1	March	46		2
			27	5
2	March	53		0
			23	5
3	March	42		5
			17	4
4	March (before)	39		4
			16	3
1	April	48		3
			11	3
2	April	37		0
			17	3
3	April	46		7
			24	5
4	April	42		8
			6	1
1	May	46		3
			9	1
2	May	53		7
			11	2
3	May	42		7
			7	1
4	May (after)	39		8
			5	1
1	June	48		0
			8	2
2	June	37		2
			10	2
3	June	46		2
			8	1
4	June	42		9

Source: Universitas Negeri Semarang, 2021

The researcher was able to complete his R&D study project through trial use. Researchers conducted the usage experiment, keeping track of loan statistics and the number of customers who made timely loan repayments. Since the beginning of May, the following data has been collected from the SLiMS database. This data is utilised by Universitas Negeri Semarang and has been transmitted via telegram notifications.

It is computed using the skewness and kurtosis formulae from the data in table 2. The given data is normally distributed if the values of the skewness sample and the kurtosis sample are between -2 and 2. Researchers use the following formula to calculate normalcy values when utilising the Skrewnes and Kurtosis methods.

Skrewnes Population:

$$m_3 = \frac{(x_i - \bar{x})}{n}; m_2 = \frac{(x_i - \bar{x})}{n}$$
$$g_1 = \frac{m_3}{m_2^{\sqrt[3]{2}}}$$

Skewness Sample

$$G_1 = \frac{\sqrt{n(n-1)}}{n-2} \cdot g$$

Kurtosis Population:

$$m_4 = \frac{(x_i - \bar{x})^4}{n}; m_2 = \frac{(x_i - \bar{x})^2}{n}$$

Kurtosis

$$\alpha_4 = \frac{m_4}{m_2^2}$$

Excess Kurtosis:

$$g_2 = \alpha_4 - 3$$

Kurtosis Sample:

$$G2 = \frac{n-1}{(n-2)-(n-3)} \cdot \lfloor (n+1)g_2 + 6 \rfloor$$

Where:

m_x = Moment to x against average
x_i = i − th observation value
$\bar{x}$ = average value
n = amount of data (observation)
g_i = skewnes population
G_i = Skewnes Sample
g_2 = kurtosis population
G_2 = kurtosis Sample

The skewness and kurtosis values were calculated using the data in table 3. The skewness value was 0.312, and the kurtosis value was -0.576, suggesting that the data in table 3 were normally distributed. The result from time inaccuracy produces a skewness value of -0.582 and a kurtosis value of -0.722 so that the timing of the data becomes normal.

The paired t-test is used to continue the computation based on the previous step's two parametric or normal data points. Before conducting any statistical testing, it is required to develop a hypothesis, which is as follows:

$H_0 =$ There is no substantial difference between using telegram alerts to borrow books from the Universitas Negeri Semarang library.

The data tested by the researcher is the ratio of the number of borrowers and returners who are not on time; the results obtained by the researchers from the t-test are as follows:

Table 3
t-test Statistic result

	Before	After
Mean	42,375	18,45866
Variance	120,2679	28,50439
Observations	8	8
Pearson Correlation	0,446322	
Hypothesized Mean Difference	0	
df	7	
t Stat	6,885876	
P(T<=t) one-tail	0,000117	
t Critical one-tail	1,894579	
P(T<=t) two-tail	0,000234	
t Critical two-tail	2,364624	

Source: Results research, 2021

The following conclusions may be drawn from the calculations above. The average before utilising Telegram as a notification medium is 42,375, whereas

after using Telegram notification, it is 18,459. The number of observation samples utilised is eight, resulting in a drop in the fraction of late users in returning library materials. A degree of freedom (df) of 8-1 equals 7. Furthermore, a descriptive Pearson correlation of 0.446 indicates a link between the data before and after. It is known that the t stat is 6.886 based on these results. The result is the same as it was in the paired t-test material.

The hypothesis is a two-way hypothesis, which means it has two tails. The t table result is 2.365, with a p-value of 0. 000234. Since the p-value is less than alpha 5%. Alternatively, by inspecting the |t count| > t table, the decision is Reject H0. H0 is rejected, implying a substantial difference between telegram notifications and borrowing books from the Universitas Negeri Semarang library. Based on the positive t-test results, the researcher concludes that there will be no more repeating cycles in the R&D research being conducted.

Based on the study data shown above, it is clear that implementing a reminder system can benefit borrowers. The notification system continues to notify users of late returns in order to ensure that the amount of books borrowed is returned on time. Of course, this benefit is not only fit to the borrower, but it also reduces the loan waiting time, allowing other individuals who wish to borrow books alternately.

CONCLUSION

Researchers' attempts to improve library services, such as the provision of a telegram notification feature, have benefitted users of library services. In line with the findings of a Blackbox functionality test done by researchers, the

telegram notification feature built utilising Middleware Integration has been proved to be functional. Researchers analysed and compared data gathered before and after the telegram notification deployment to compare data collected before and after the deployment of the telegram notification. According to the study's findings, there are statistically significant differences between the period before and after the installation of telegram alerts. According to the data, there is a drop in the number of customers who do not return borrowed library items on time. Although this research may be turned into a telegram bot service, it could also be turned into a FAQ (frequently asked questions) service for library services, which was previously only available as a telegram notification. Consequently, the telegram bot will be able to answer all of the frequently asked inquiries about library services.

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