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Telegram Bot as a Data Collection Tool for Progress Reports in Area Mapping Progress Monitoring System

Apriela Trirahma

Section of Data Processing Integration, BPS - Statistics of Kepulauan Bangka Belitung Province

apriela@bps.go.id

Abstract

In the Area Mapping Project (Preparation for the 2020 Population Census), there is monitoring and collecting data process on the progress of activities in the field. There are weaknesses in data collection on the progress of activities in the field; The manual recapitulation of progress reporting makes the progress data not displayed in real-time, the SMS Gateway is often interrupted, and progress data collection through the monitoring website is less effective if reported directly by field officers. Telegram Bot is used as a data collection tool for field progress reports on Area Mapping activities to overcome these weaknesses. This study aims to prove that Telegram Bot can be used as a real-time data collection tool, has good performance, and is acceptable to users. Telegram Bot is integrated with Monitoring Website into one system and database in this research. This system uses PHP, Yii2, and MySQL, and communication between the web server and Telegram Server uses the webhook method. Based on the Black Box test results, all functions in this system run as expected. The average bot response time was 7.72 seconds for images and 2.25 seconds for text data in the performance test. In the usability test, Telegram Bot obtained a SUS Score of 66 and an NPS of 12.195. These results show that Telegram Bot can be used as a real-time data collection tool, has good performance, and is well accepted by users.

Keywords: chatbot, instant messaging, data collection tool, monitoring system, surveyor, real-time

1. Introduction

The success of the Area Mapping Project is critical because the result of this activity is a statistical work area map for the 2020 Population Census field officers. This mapping activity was carried out in all Kepulauan Bangka Belitung Province regions down to the smallest administrative Local Area Unit known as Rukun Tetangga (RT). This mapping activity deployed 491 field officers, 115 supervisors, and seven regional instructors. Field officers and supervisors worked in 6469 RT, 391 villages, 47 sub-districts in 7 Regencies/Municipality. Due to the enormous task area and many officers, a monitoring system for the progress of field activities was needed. From the data on progress reports by field officers, BPS can monitor the performance of each officer and can quickly identify any problems that occur in the field; therefore, they can immediately resolve the problems [1].

The data collection method on progress reports of activities carried out in BPS - Statistics of Kepulauan Bangka Belitung Province activities is a manual recapitulation, and there is a progress monitoring

system. Manual recapitulation is carried out by directly contacting BPS by telephone, email, or official letter announcing the delivery of activity progress reports. Usually, the BPS – Statistics of Regencies/Municipality will send a progress report using a file, such as excel. This method causes the progress of activities to be not real-time and requires time to collect complete progress reports. This method is still used for certain activities that do not require real-time progress reports. The second method is collecting progress report data through a web monitoring system. BPS - Statistics of Kepulauan Bangka Belitung Province has created systems such as (1) SMS Gateway with Web Monitoring in 2015 s.d. 2017, and (2) Web Monitoring in 2015 until now. Web monitoring is still the primary tool for monitoring and collecting progress report data.

Based on the evaluation meeting results of survey activities using the SMS gateway as a data collection tool for activity progress reports (2017) at BPS - Statistics of Kepulauan Bangka Belitung Province, the SMS Gateway has weaknesses, including an unstable SMS Engine, with frequent stop services and overloads. That trouble caused SMS not received, resulting in

numerous complaints from officers. SMS Gateway also requires a local server, which must continuously be operated to run the SMS Engine. SMS Gateway also requires a GSM modem, GSM Simcard, and credit. Therefore, it requires additional resources and budget for modem and costs for SMS. Reporting using SMS Gateway can only use text data types with limited characters. People begin to switch to using social media like SMS and telephone because it is influenced by some factors [2]. Social media are where people can communicate and interact through the internet using online messengers such as WhatsApp, Telegram, and Line. If reporting uses online messenger, it can report text, image, video, audio, and files. Compared to SMS, Telegram is much efficient in time latency [3].

Based on the interviews with the Chief of Section of Networking and Statistics Reference - Statistics of Kepulauan Bangka Belitung Province as the person in charge of Area Mapping Project, data collection on activity progress using monitoring website can collect reports faster than a manual recapitulation. Report data collected is also not only in the form of text. It can be in files, such as photos or files supporting evidence of activities. However, the data that appears on monitoring websites are often not real-time. BPS – Statistics of Regencies/Municipality staff as data input operators for progress reports prefer to input progress reports if large amounts of data are coming in from the field. Therefore, it is better if field officers carry the activity progress reports; thus, the data is real-time. However, there is another consideration. Monitoring Website requires authentication and several steps to input data, making it less effective when accessed directly by field officers. Thus far, Website Monitoring can only be accessed and inputted by BPS – Statistics of Regencies/Municipality staff or supervisors.

A solution is needed to overcome all the problems of collecting progress data to optimize the benefits of the Progress Monitoring System. Chief of Section of Networking and Statistics Reference hopes that field officers can report real-time progress in the progress monitoring system for the mapping project. It is necessary to send supporting evidence of field progress, such as photos from the completed map. In this study, Telegram Bot can be a solution to overcome these problems. Telegram Bot will be used as a data collection tool for progress reports.

Telegram is a free messaging application. The Telegram API is open to developers, free, has complete documentation and real-time communication. The Telegram application can be used on various mobile devices, such as smartphones or tablets with Android, iOS, and Windows Mobile OS. Telegram can also be used on a desktop or notebook, with the Telegram Desktop Application installed on Windows, macOS, and Linux OS. Telegram can also be used in a browser,

using Telegram Web [4] (like WhatsApp Web). Telegram is a cloud-based messenger [5]. All communication data is stored on the Telegram Server; thus, it does not use storage from the user's device, unlike WhatsApp, which often consumes the user's device storage.

Many and various studies have used Telegram Bot, including assessing English speaking and listening skills with the mobile application telegram [6], Telegram Bot for automation of Academic Information services with the forward chaining method [7], paperless office interfaces [8], and notifications from sleepy drivers detection [9]. Research on assessing English speaking and listening skills with the mobile application telegram [6] uses Telegram Bot as media to take the assessment test and send the audio. Telegram Bot for automation of Academic Information services with the forward chaining method [7] uses the Telegram Bot to acquire academic information of campus, such as the latest news of academic or lecturer attendance information. The paperless office interface (PLO) study [8] uses the Telegram Bot as an interface to access existing paperless office systems. Research on detecting sleepy drivers using smartphones [9] can directly send personal information from sleepy drivers on the Telegram application using Telegram Bot as a Sender to the driver's group or family. From the previous studies above, there has been no research that uses Telegram Bots as a data collection tool for progress reports inputted by field officers and at the same time as a means to review report data by supervisors on the Area Mapping Project. In this study, Telegram Bot was used to simplify the progress reporting process and accelerate the movement of progress report data on the Monitoring Website because field officers directly input data via Telegram Bot.

This research aims to prove that Telegram Bot can be used as (i) a real-time data collection tool that has good performance and (ii) is acceptable to users. In this research, the Progress Monitoring System of Area Mapping Project was created by integrating the Monitoring Website as a dashboard of progress and Telegram Bot as a data collection tool for progress reports. Telegram Bot was built using the PHP Programming Language and used a MySQL database. Web Monitoring was built using the PHP framework, namely Yii2, and used a MySQL database. Telegram Bot and Web Monitoring use the same web server and database. Telegram server and Web Server communicate using webhook methods. After the Area Mapping Project was completed, all progress report data were entered into the Progress Monitoring System using the Telegram Bot by field officers will be processed, and the performance of the Telegram Bot was evaluated. Then usability tests were carried out for Telegram Bot and Monitoring Website users to obtain

the SUS Score and NPS. SUS Score and NPS are used to determine whether Telegram Bot is accepted and liked by users as a data collection tool.

The benefits of this research are (1) to assist Section of Networking and Statistics Reference in monitoring the progress of Area Mapping Project by building a system consisting of Monitoring Website and progress data collection tools that are free, easy to use, and have good performance. (2) The next benefit is to prove that Telegram Bot can be used as a tool for field data collection, such as for surveys or censuses, which involve many people and cover a wide area. Even with a limited budget, field data collection activities can use Telegram Bot for free as a data collection tool integrated with the existing Monitoring Website.

2. Research Method

This research method is made in a flow chart that contains the research objectives and the steps to achieve that goal. The flow chart of the research method is shown in Figure 1.

The method used in the development of this Progress Monitoring System, namely the Rapid Application Development (RAD) method [10], consists of four phases as follows: (1) the requirements planning phase, (2) the user design phase, (3) the construction phase, and (4) the cutover phase.

Data was collected for system requirements by conducting interviews with the Section Chief of Networking and Statistics Reference. This interview discussed the business process of the Area Mapping Project, the problems faced, and users' needs in the Progress Monitoring System. This interview will be analyzed for system requirements, which will be used in system design.

The system design uses Use Case Diagrams to describe actors and what actors can do on the system on each Monitoring Website and Telegram Bot. The actors are Field Officers, Supervisors, Regional Instructors, and BPS - Statistics of the Islands of Bangka Belitung Province. Field officers are BPS partners who are contracted for Area Mapping Project. The Supervisors consist of BPS partners as well as Regional BPS employees. Regional Instructors and BPS Province are employees of BPS – Statistics of Regencies/Municipality and BPS - Statistics of the Islands of Bangka Belitung Province. The Progress Monitoring System consists of Monitoring Website integrated with the Telegram Bot. Telegram Bot can be accessed by actors using Telegram Messenger. Black Box testing is carried out to test whether all the functions of the Telegram bot are working.
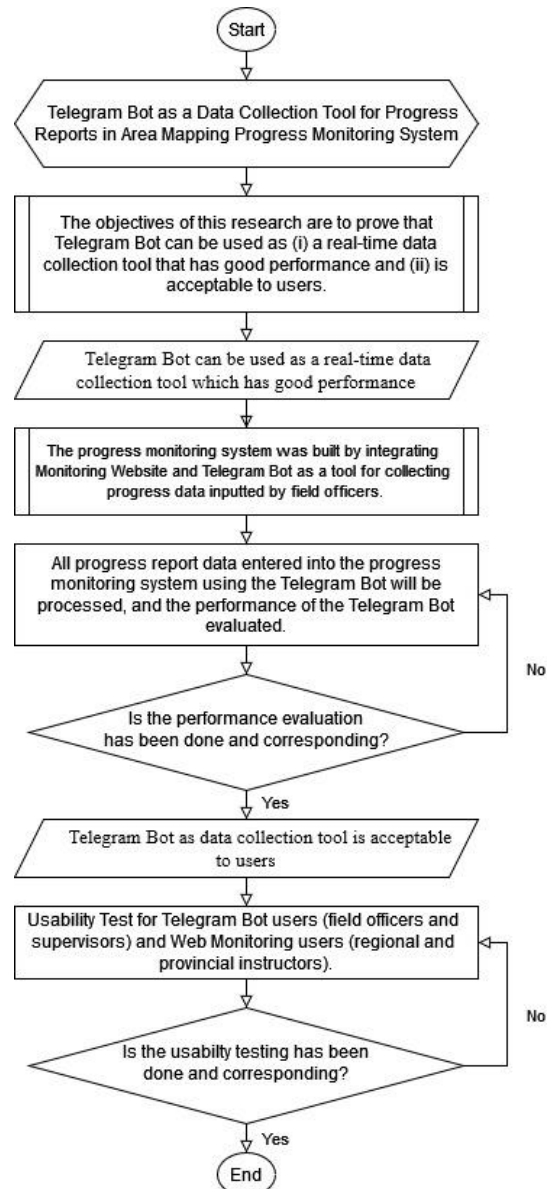

Figure 1. Flow chart of research methods

After the Progress Monitoring System had been built and Black Box testing had been carried out, the Progress Monitoring System was implemented for the Area Mapping Project, which took place April 22 to May 22, 2019, and review of mapping work until June 2019. All Field officers and Supervisors would input data progress reports using the Telegram Bot in Telegram Group, and Supervisors and Regional Instructors would also review the progress report data using the Telegram Bot. Regional Instructors and BPS - Statistics of the Islands of Bangka Belitung Province would monitor all progress reports data entered into the system through the Monitoring Website.

After the Area Mapping Project is complete, an evaluation of this Progress Monitoring System is carried out with performance tests and usability tests.

The purpose of this evaluation is to show the performance of the Telegram Bot as a well-performing real-time data collection tool, acceptable and useful for users. For performance evaluation, all Telegram group chats data in the form of incoming progress report data will be exported and processed to obtain delivery time data from users and response times from Telegram Bots. This data will be used to test the performance of the Telegram bot.

Then a usability test will also be conducted using the SUS and NPS online questionnaires using the Google Form. Respondents from this usability test are Area Mapping Progress Monitoring System users. The online questionnaire link was sent to all Telegram Bot users, namely 491 Field Officers, 115 Supervisors, and 7 Regional Instructors. The online questionnaire link was also sent to all Monitoring Website users, namely 7 Regional Instructors and 1 BPS - Statistics of the Islands of Bangka Belitung Province. All responses from the usability test would be processed, and the value obtained to see whether the system created and used was useful and acceptable to users.

3. Result and Discussion

The system requirements planning stage begins with collecting data by interviewing the Chief of Section of Networking and Statistics Reference. From the results of the interviews, actors who will be in contact with the system include Field Officers, Supervisors, Regional instructors, and BPS - Statistics of Kepulauan Bangka Belitung Province. In making the map, Field Officers brought paper maps containing satellite layers to draw the boundaries of RT and Village/Sub-district. Field Officers also brought Smartphones with the Android GIS application installed to take pictures and take coordinates of each area boundary and area infrastructure. Field Officers also have to fill out documents containing the estimated population and number of houses in each RT. After the map is made, all the coordinates are taken, and the documents are completed, Supervisor will review the officers' work. Correct work will be accepted, while incorrect work will be returned to the officer for correction.

The results of the Field Officers work are the LKM Document and the WB Map. Then the work results are submitted to and reviewed by the Supervisor. The results of the Supervisor's work are RS Documents, RD Documents, and WA Maps. Then the work results are submitted to and reviewed by the Regional Instructor. The progress of this process is needed and is expected to be monitored through the Progress Monitoring System. Furthermore, a question and answer forum between Field Officers and Supervisors to Regional Instructors is also needed. This collection of questions and answers will later become knowledge sharing of problems and solutions between regency/municipality.

At the user design phase, the design was built based on the results of the requirements planning phase. The system built consists of 2 parts, namely Website Monitoring, and progress report data collection. Data collection on progress reports was carried out by 491 Field Officers, 115 Supervisors, and 7 Regional Instructors from 7 regencies/municipalities. Due to the numerous officers and supervisors, Telegram Groups were created for each regency/municipality to control progress report data collection by Field Officers and Supervisors. Each group contains a Telegram Bot, Field Officers, Supervisors, Regional Instructors, and Section of Networking and Statistics Reference. Telegram bot will receive commands in the form of users' chats containing progress report data and review results, and then the data is stored in the database.

Communication between Telegram Bot and Monitoring Website is needed for Telegram Bot to save reports to Monitoring Website. The communication method that will be used is the webhook method. The Telegram Bot script is placed on the same server. It uses the same database as Monitoring Website; thus, the Bot can validate progress report data, store report data, and provide feedback or responses under the data conditions in the Monitoring Website database to the Field Officer or Supervisor. The webhook method is chosen because it is real-time, live 24/7, and can provide small latency and handle several requests simultaneously during communication [11]. The system architecture design can be seen in Figure 2.
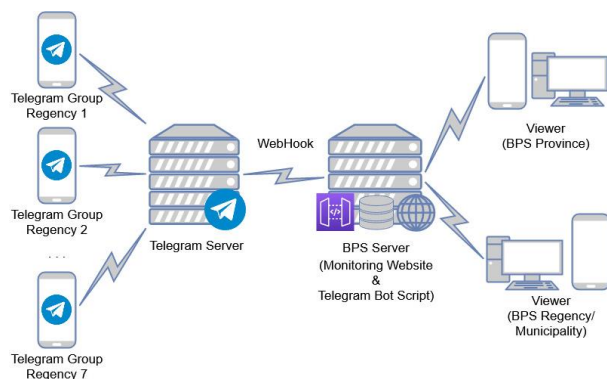

Figure 2. Progress Monitoring System Architecture

A list of functions to be built on the Progress Monitoring System is made based on user requirements. In this study, each WB Map, WA Map, LKM, RS, and RD Documents progress were reported and reviewed by the user with their respective formats or command for the Telegram Bot. In the following discussion, the figure or table will be used as one sentence and abbreviated as LKM, WB, WA, RS, and RD. In this research, Rukun Tetangga (RT) as administrative area will called Satuan Lingkungan Setempat (SLS). SLS means smallest area unit. This research displays only the Telegram Bot and

Monitoring Website's main functions: collection and review of progress report data and Q&A. User registration, assigning Field Officers and Supervisors teams, and other functions are not discussed in this study, as illustrated in Figures 3 and 4.
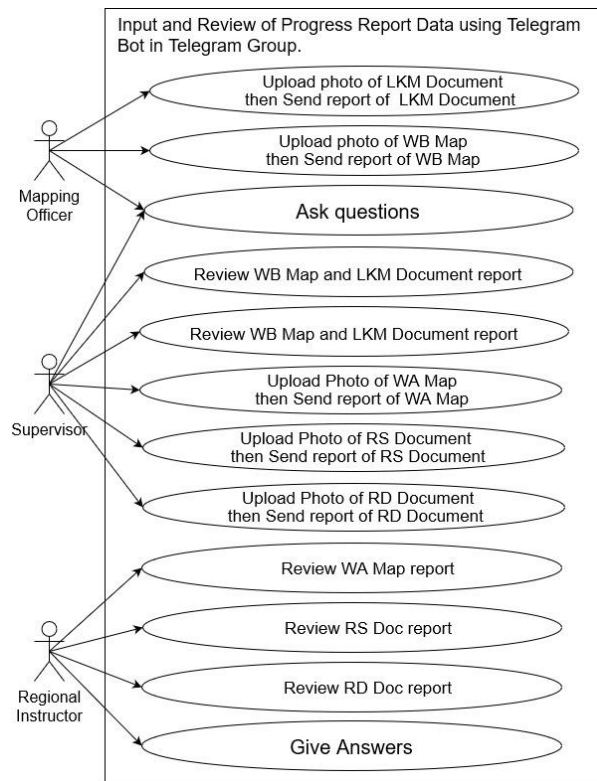

Figure 3. Use Case Diagram for Telegram Bot of Progress Monitoring System
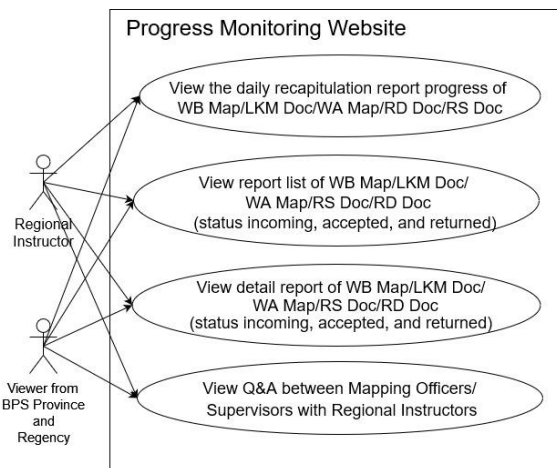

Figure 4. Use Case Diagram for Monitoring Website of Progress Monitoring System

All progress report data, reviews, and questions and answers are sent using a report format containing the bot command and report text. This format is useful; therefore, the Report can be saved and responded to by Telegram Bot. The reporting method is that the Field Officer or Supervisor uploads an image containing a photo of LKM, WB, WA, RS, or RD documents to the Telegram group of each regency/municipality. Then the image is replied with the report format. If the reporting method and the report format are correct, the progress report data will be saved, and the Telegram Bot will respond that the Report is received. Vice versa, if the report format is wrong, the Bot will send an error response. All formats of each Report, review, and frequently asked questions can be seen in Table 1.

Table 1. Design of the report format to be carried out by Field Officers, Supervisors, and Regional Instructors in the Telegram Group chat room and the Telegram Bot chat room

| No | Report Format | Function | By | Data Type | | At Group | At Bot |
				Text	Img		
1	/wb census_bloc_code	Report	Officer	✔	✔	✔	
2	/lkm sls/nonsls_code	Report	Officer	✔	✔	✔	
3	/wa village_code	Report	Supervisor	✔	✔	✔	
4	/rs village_code total_sls total_nonsls	Report	Supervisor	✔	✔	✔	
5	/rd village_code total_sls total_nonsls	Report	Supervisor	✔	✔	✔	
6	/cekwb accepted/returned notes	Review	Supervisor	✔			✔
7	/ceklkm accepted/returned notes	Review	Supervisor	✔			✔
8	/cekwa accepted/returned notes	Review	Regional Instructor	✔			✔
9	/cekrs accepted/returned notes	Review	Regional Instructor	✔			✔
10	/cekrd accepted/returned notes	Review	Regional Instructor	✔			✔
11	/tanya question	Question	All	✔		✔	
12	/jawab answer	Answer	Regional Instructor	✔			✔

In the construction phase, Monitoring Website is built with the Yii2 Framework with a MySQL databaseYii2 that can simplify application development in the construction phase. Yii2 uses an MVC base; thus, application developers can more easily modify each part without affecting the others [12]. Telegram Bot is built using the PHP programming language and communication with Monitoring Website using the webhook method via the HTTPS protocol on the BPS – Statistics Indonesia server.

There are three ways to evaluate the system in the cutover phase: before implementation with Black Box testing and after implementation with performance testing and usability system testing using the System Usability Scale (SUS) questionnaire and Net Promoter Score (NPS). Black Box testing uses 12 test scenarios to test whether the results of these scenarios are valid. This test is carried out to detect possible errors from the application that can occur [13]. Therefore, if all possible errors from the application are resolved, the system is most likely running as expected, and no fatal errors occur when used. Performance testing is done

by looking at the response speed of the Telegram Bot to the bot command input from the user. Performance testing is done to see how reliable and stable the performance of the Telegram Bot and Monitoring Website Server is. The SUS test uses ten questions with a Likert scale of 1 (Strongly Disagree) - 5 (Strongly Agree), as well as the NPS test with one question with a scale of 1 (Absolutely Impossible) - 10 (Very Likely). The two test their respective use of Telegram Bot and Monitoring Website. There is no actual sample size for SUS testing. However, it is stated to have sufficient validity if the minimum number of respondents is between 16 ± 4 [14]. The questions on the SUS and NPS questionnaires can be seen in Table 2.

Table 2. Questions on the SUS and NPS questionnaires

Question
System Usability Scale
1. I think that I would like to use this system frequently
2. I found the system unnecessarily complex
3. I thought the system was easy to use
4. I think that I would need the support of a technical person to be able to use this system
5. I found the various functions in this system were well integrated
6. I thought there was too much inconsistency in this system
7. I would imagine that most people would learn to use this system very quickly
8. I found the system very cumbersome to use
9. I felt very confident using the system
10. I needed to learn many things before I could get going with this system
Net Promoter Score
1. How likely are you to recommend this system to your colleagues?
2. What improvements do we need to make to bring this system or future systems score closer to ten?

Following the design phase, a Telegram Group for each regency/municipality, Telegram Bot Script, and Monitoring Website were created and hosted on a BPS server. The user's chat room and Telegram Bot and its functions can be seen in Figures 5 to 8. The contents of the message (report progress) using Indonesian. In this system, Telegram Bot is named PemetaBot.

After all the functions on the Telegram Bot are made, a Black Box test is carried out with 12 scenarios. These consisted of four scenarios for each type of progress report, three scenarios for each type of review, and five scenarios for Q&A. There is a region code validation process on each progress report; thus, if the region code is wrong, it will be responded as an error by the Telegram Bot. Black Box test results can be seen in Table 3. The original contents of the Bot's Response used Indonesian, but it was translated into English in this research.

Figure 5. Field Officer is reporting the WB Map via Group (Left). Telegram Bot sends a report message to the Supervisor for review (Right).
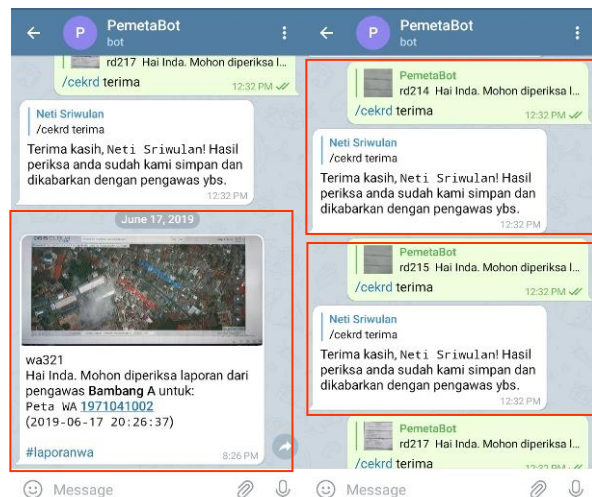

Figure 6. Telegram Bot sends a WA Map report message to the Regional Instructor for review (Left). The Regional Instructor sends the review result with the status accept (Right).

Figure 7. Field Officers or Supervisors are sending questions via Group (Left). Telegram Bot sends a question to the Regional Instructor, and then the Regional Instructor answers (Right).
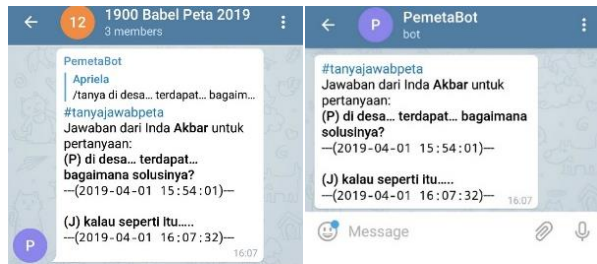
Figure 8. Telegram Bot forwards Regional Instructor's Answers to the Group (Left). Telegram Bot also forwards the Regional Instructor's answer to the asker (Right).

Table 3. Black Box test results on Telegram Bot

Scenarios and Results	
Scenario 1	
Field Officers and Supervisor reported by replying to photos, correct format, and correct area code on Telegram groups	
Expected results	**Actual Result**
• Format validation: succeeded	• Format validation results: no error.
• Region code validation: succeeded.	• Region code validation result: no error.
• Saved reports.	• Report saved to database.
• Bot's response: "Thank you, <name> We have saved your report and will be reviewed!"	• Bot's response in group: "Thank you, <name> We have saved your report and will be reviewed!"
• Bot sends messages to the Supervisor/Regional Instructor: Photo Documents and messages: `LKM/WB/WA/RS/RD ID Report Hi Supervisor/Regional Instructor. Please review the Report from the Field Officer/Supervisor for LKM/WB/WA/RS/RD documents Region Id <time> #reportlkm/wb/wa/rs/rd`	• Supervisor/Regional Instructor receive message from Bot: Photo Documents and messages: `LKM/WB/WA/RS/RD ID Report Hi Supervisor/Regional Instructor. Please review the Report from the Field Officer/Supervisor for LKM/WB/WA/RS/RD documents Region Id <time> #reportlkm/wb/wa/rs/rd`
Conclusion of Scenario 1: Valid	
Scenario 2	
Field Officers and Supervisor reported by replying to photos, correct command, but wrong format on Telegram groups	
Expected results	**Actual Result**
• Format validation: failed.	• Format validation results: error.
• Report failed.	
• Bot's response: `ERROR: the format of the LKM/WB/RS/RD/WA report does not match. Format: /LKM or /WB or /RS or /RD or /WA <space> region code <space> Number of SLS <space> Number of Non SLS Region Id <time> #reportlkm/wb/wa/rs/rd`	• Bot's response in group: `ERROR: the format of the LKM/WB/RS/RD/WA report does not match. Format: /LKM or /WB or /RS or /RD or /WA <space> region code <space> Number of SLS <space> Number of Non SLS Region Id <time> #reportlkm/wb/wa/rs/rd`
Conclusion of Scenario 2: Valid	
Scenario 3	
Field Officers and Supervisor reported by replying to photos, correct format, but wrong region code on Telegram groups	
Expected results	**Actual Result**
• Format validation: succeeded.	• Format validation results: no error.
• Region code validation: failed.	• Region code validation result: error.
• Report failed.	• Bot's response in group:
• Bot's response: `ERROR: region code is not registered. Make sure your village code is correct. Make sure the village code matches your regency. Format: /LKM or /WB or /RS or /RD or /WA <space> region code <space> Number of SLS <space> Number of Non SLS`	`ERROR: region code is not registered. Make sure your village code is correct. Make sure the village code matches your regency. Format: /LKM or /WB or /RS or /RD or /WA <space> region code <space> Number of SLS <space> Number of Non SLS`
Conclusion of Scenario 3: Valid	
Scenario 4	
Field Officers and Supervisor reported without replying to photos, correct format, and correct/wrong area code on Telegram groups	
Expected results	**Actual Result**
• No validation because the reporting method was wrong.	• No response from Bot
• No response from Bot	
Conclusion of Scenario 4: Valid	
Scenario 5	
Supervisor dan Regional Instructor sent reviewed result by replying to report message with the correct format on Telegram Bot chat room	
Expected results	**Actual Result**
• Validation type of Report: succeeded.	• Validation type of Report result: no error.
• Format validation : succeeded.	• Format validation result: no error.
• Result of reviewed saved.	• Result of reviewed saved to database.
• Bot's Response: `Thank You, <name> We have saved the results of your review and reported it to the Field Officer / Supervisor.`	• Bot's Response in Bot Room: `Thank You, <name> We have saved the results of your review and reported it to the Field Officer / Supervisor.`
• The Bot sends the message of the review results to the reporter: **If Accepted:** `Results review report LKM/WB/WA/RS/RD from Supervisor/Regional Instructor <name>: Document LKM/WB/WA/RS/RD <region code> (time of report sent). Review Result: Accepted (time of review sent).` **If Returned:** `Results review report LKM/WB/WA/RS/RD from Supervisor/Regional Instructor <name>: Document LKM/WB/WA/RS/RD <region code> (time of report sent). Review Result: Returned.`	• Reporter The Bot receive message of the review results from Bot: **If Accepted:** `Results review report LKM/WB/WA/RS/RD from Supervisor/Regional Instructor <name>: Document LKM/WB/WA/RS/RD <region code> (time of report sent). Review Result: Accepted (time of review sent).` **If Returned:** `Results review report LKM/WB/WA/RS/RD from Supervisor/Regional Instructor <name>: Document LKM/WB/WA/RS/RD <region code> (time of`

Notes:… (time of review sent). Field Officers, please correct and send back the Report at group, by: 1. upload photo of document LKM/WB/WA/RS/RD that revised. 2. reply photo and type command /lkm or /wb or /wa or /rs or /rd <space> region code.	report sent). Review Result: Returned. Notes:… (time of review sent). Field Officers, please correct and send back the Report at group, by: 1. upload photo of document LKM/WB/WA/RS/RD that revised. 2. reply photo and type command /lkm or /wb or /wa or /rs or /rd <space> region code.

Conclusion of Scenario 5: Valid

Scenario 6

Supervisor dan Regional Instructor sent reviewed result by replying to report message but the wrong type of Report on Telegram Bot chat room

Expected results	Actual Result
• Validation type of Report: failed. • Review failed. • Bot's Response: ERROR: the format of review and type of Report **does not match**. Make sure to send a review format according to the content of the Report you are review. The format sent: **/cek …** while the Report that review is …….	• Validation type of Report result: error. • Bot's Response in Bot room: ERROR: the format of review and type of Report **does not match**. Make sure to send a review format according to the content of the Report you are review. The format sent: **/cek…** while the Report that review is …….

Conclusion of Scenario 6: Valid

Scenario 7

Supervisor dan Regional Instructor sent reviewed result without replying to report message with the correct format on Telegram Bot chat room

Expected results	Actual Result
• No validation because the reporting method was wrong. • No response from Bot	• No response from Bot

Conclusion of Scenario 7: Valid

Scenario 8

Field Officers and Supervisor asking with correct question format on Telegram Group

Expected results	Actual Result
• Format validation: succeeded. • Question saved. • Bot's Response: Thank You <name>. We have saved your questions! • Bot send message to Region Instructor: <ID question> Question from <name> - <group name> (time of question sent) <Question content … > #questionofmaps	• Format validation: no error. • Question saved to database. • Bot's response in group: Thank You <name>. We have saved your questions! • Region Instructor received send message from Bot: <ID question> Question from <name> - <group name> (time of question sent) <Question content … > #questionofmaps"

Conclusion of Scenario 8: Valid

Scenario 9

Field Officers and Supervisor asking with wrong question format on Telegram Group

Expected results	Actual Result
• Format validation: failed. • The question failed to send. • Bot's Response: ERROR: question format is wrong. Format: /Question <space> question content" #questionofmaps	• Format validation: error. • Bot's response in group: ERROR: question format is wrong. Format: /Question <space> question content

Conclusion of Scenario 9: Valid

Scenario 10

Regional Instructor answered the question by replying to the question message from Telegram Bot with correct answer format on Telegram Bot chat room

Expected results	Actual Result
• Format validation: succeeded. • Answer saved. • Bot's Response: Thank You <name>, we have saved your answer and sent to group <group name>! • Bot sends the message to Field Officer/Supervisor and Group: #questionanswaremaps Answer from Regional Instructor <name> for question: (Q) question content <Time of question sent> (A) Answer content <Time of answer sent>	• Format validation result: no error. • Answer saved to database. • Bot's response in group: Thank You <name>, we have saved your answer and sent to group <group name>! • Field Officer/Supervisor and Group received the message from Bot: #questionanswaremaps Answer from Regional Instructor <name> for question: (Q) question content <Time of question sent> (A) Answer content <Time of answer sent>

Conclusion of Scenario 10: Valid

Scenario 11

Regional Instructor answered the question by replying to the question message from Telegram Bot but wrong answer format on Telegram

Expected results	Actual Result
• Format validation: failed. • Answer failed to send. • Bot's Response: ERROR: answer format is wrong. Format: /Answer <space> answer content	• Format validation result: error. • Bot's Response in Bot's chat room: ERROR: answer format is wrong. Format: /Answer <space> answer content

Conclusion of Scenario 11: Valid

Scenario 12

Regional Instructor answered the question without replying to the question message from Telegram Bot with correct answer format on Telegram Bot chat room

Expected results	Actual Result
• No validation because the reporting method was wrong • No response from Bot	• No response from Bot

Conclusion of Scenario 12: Valid

Based on the Black Box test results, if the progress report data is sent according to the format, the data will be stored in the database and displayed on the

Monitoring Website. Both progress report data are in the form of text and photos of supporting evidence. Telegram Bot also responds to commands with conditions according to the validation results. That means that all the functions of the Telegram Bot can work properly.

Monitoring Website can only be accessed by Regional Instructors, BPS Regency/Municipality, and BPS-Statistics of Kepulauan Bangka Belitung Province. The appearance of the Monitoring Website and its functions can be seen in Figures 9 to 11.

Figure 11. Dashboard of Monitoring Website

Figure 9. List of Incoming Progress Reports and Review Result Status

Figure 10. Details of Incoming Progress Reports and Report Documents
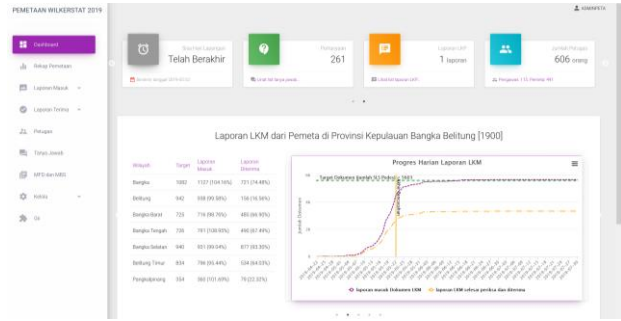
Performance testing is carried out by exporting chat in JSON from each Telegram Group, from progress reports chat during field officer in training to progress reports chat during the project. All report times and Telegram Bot response times from the Report and Question chat are processed. The time format uses the yyyy-mm-dd hh:mm:ss or 2019-05-30 11:03:01. The results of performance testing can be seen in Table 4.

Table 4. The results of performance testing by looking at the response time from the Telegram Bot

		Reports	Question
Total Chat		11,608 reports	232 question
Response Time	Average	7.72289 seconds	2.543103 seconds
	Max	138 seconds	7 seconds
	Min	2 seconds	1 second
	Median	5 seconds	2 seconds
	Modus	5 seconds	2 seconds

The response speed depended on the type of data sent. Reports with data type image and text require an average response time of 7.72 seconds. Meanwhile, the question function, which only used the text data type, required an average response time of 2.54 seconds. The response time range was affected by the BPS server condition. There was a time when the BPS server was down; thus, the response time of the Telegram Bot was 11,110 seconds or 3.08 hours. This condition was excluded from the test data processing because it was exceptional.

In the Usability System testing, the SUS and NPS questionnaires were distributed to all Field Officers, Supervisors, Regional Instructors, and BPS Province using Google Form. Forty-one people responded, consisting of one BPS Province, seven Regional Instructors, 22 Supervisors, and 11 Field Officers. The calculation results consist of a Telegram Bot assessment and a Monitoring Website assessment. Since the minimum number of respondents was between 16 ± 4 [14], the SUS score was valid because 41 people responded to the online questionnaire.

SUS score was calculated from each question from each respondent of Odd-numbered questions. The score obtained from the value given by the respondent will be reduced by 1. For the Even-numbered questions, the score was obtained from the value of 5 minus the value given by the respondent. The SUS score per respondent was obtained from the sum of the question scores, which were then multiplied by 2.5 [15]. The overall SUS score was obtained from the average SUS score of all respondents.

Table 5. SUS Score on Telegram Bot and Monitoring Website

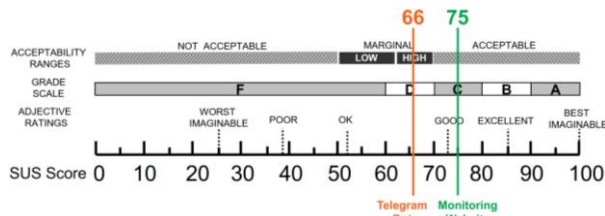|	Telegram Bot	Monitoring Website
Number of Response	41	8
Number of users	613	8
SUS Score	**66**	**75**
Max Score	93	95
Min Score	35	60
Median Score	65	75
Modus Score	60	75

Figure 12. Interpretation of SUS Score Telegram Bot and Monitoring Website according to Bangor [16]

The SUS score calculation results can be seen in Table 5, Telegram Bot gains 66, and Monitoring Website gains 75. According to Bangor [16], the interpretation of these scores can be seen in Figure 12. From these results, Monitoring Website is more accepted by users than Telegram Bot. Telegram Bot is quite feasible, although it needs improvements to the application or treatment for users, such as training in using a more precise system; thus, users can accept Telegram Bot.

In Net Promoter Score (NPS), user types are divided into Promoter, Passive, and Detractor [17]. The Promoter is enthusiastic users who continue to use the system and voluntarily refer the system to others. The score given ranges from 9-10. Passive is satisfied users with the system but not enthusiastic, and if there is a better system, they will likely switch to it. The score given ranges from 7-8. The Detractor is the user with a bad experience with the system and is likely to spread negative news about the system. The score given ranges from 0-6. The calculation of NPS can be seen from Formula 1.

$$NPS = \%\text{Promoter} - \%\text{Detractor} \quad (1)$$

NPS is the reduction from the percentage of the Promoter to the percentage of Detractor. The calculation results of the NPS Telegram Bot and Monitoring Website can be seen in Table 6.

Table 6. NPS Score on Telegram Bot and Monitoring Website

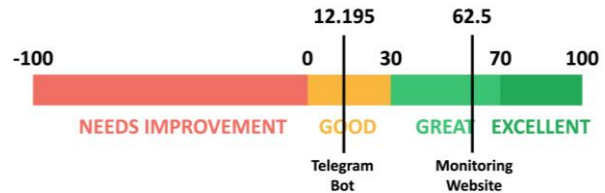|	Telegram Bot	Monitoring Website
Number of Response	41	8
Number of users	613	8
Promoter	26,83 %	75 %
Passive	58,54 %	12,5 %
Detractor	11,63 %	12,5 %
NPS Score	**12,195**	**62,5**

Figure 13. Interpretation of NPS Telegram Bot and Monitoring Website; according to Grigore [18]

From the calculation results, Telegram Bot obtained an NPS of 12.195, and Monitoring Website obtained an NPS Score of 62.5. According to Grigore [18], the interpretation of NPS can be seen in Figure 13. NPS on Telegram Bot is between 0 and 30, which is a good category. However, it requires a system improvement; thus, Passive users can switch to Promoter. NPS on Monitoring Website is higher than 30. This result shows that the system is good and gains more satisfied users than dissatisfied users to use the Monitoring Website.

The NPS follow-up question of "What improvements do we need to make to get the system close to a ten score" is used to capture users' complaints and wishes. The goal is to enable Passive users to switch to the Promoter. A summary of the user's answers can be seen in Table 7.

Table 7. Summary of Criticisms and Suggestions for Improvement

No	Criticisms and Suggestions
Telegram Bot	
1	Less practical because we have to memorize the region code.
2	The appearance and working method must be made easy so that it is easy to understand and use.
3	Bot in WhatsApp because of many WhatsApp users.
4	There needs to be a FAQ feature.
5	There needs to be a user-friendly search feature.
6	The number of messages in a telegram group is too large, so it requires scrolling too far to find messages sent by officers that have not been read so that the number of messages in a telegram group per team can be simplified.
7	Ease of answering the Field Officer questions, which sometimes does not answer the Telegram Bot.
Monitoring Website	
1	Monitoring and features are more user friendly and more comfortable to understand and use.
2	The system can be implemented for updating activities online area master file.
3	There is a need for video tutorials that are integrated with the system so that new users can understand them more easily.
4	There needs to be a Region selection feature in the system for

	upload purposes with the region list drop-down menu.
5	Add download facilities to the smallest level.
6	Need to increase Access speed when opening a map.

4. Conclusion

A Progress Monitoring System for Area Mapping Project using the Monitoring website and Telegram Bot as a data collection tool for progress reports has been built, implemented, and evaluated. Three kinds of tests were carried out: the Black Box during system development, performance test, and usability test when the area mapping project was completed. Therefore, the test data is actual data generated from field activities.

The test results show that Telegram Bot can be used as a real-time data collection tool, has good performance, and is acceptable to users. Because Telegram Bot is accessed through the Telegram messaging application, which can be used on all smartphone devices, field officers can directly access and input field progress report data easily. Telegram Bot is also easy to build and can be directly integrated with existing Website Monitoring without additional costs.

For further research regarding the use of telegram bots, telegram bots are used for photo or video documentation collection tools integrated with the gallery website and speeding up the quick count system by using telegram bots to collect data of the recapitulation results from the field.

References

[1] US Census Bureau, 2018. *2020 Census Detailed Operational Plan for: 16. Enumeration at Transitory Locations Operation (ETL).* Version: 1.0. Washington, DC: US Census Bureau.

[2] Lubis, A. R., Lubis, M., & Azhar, C. D. 2019. The effect of social media to the sustainability of short message service (SMS) and phone call. *Procedia Computer Science*, 161(July), 687–695. https://doi.org/10.1016/j.procs.2019.11.172

[3] Saad, M., Sarnon, M., Shahad, R., Shukri, M., & Hussain, A. 2015. Pump Operation Monitoring and Notification (PuMa) via Telegram Social Messaging Application. *International Journal on Informatics Visualization Smart*, 1(3), 57–60.

[4] Telegram, 2020. *Telegram Applications* [Online] Tersedia di : https://telegram.org/apps/ [Accessed 11 November 2020]

[5] Telegram, 2020. *Telegram FAQ* [Online] Tersedia di : https://telegram.org/faq/ [Accessed 11 November 2020]

[6] Wardhono, Agus, and Stephen Spanos. 2018. Assessing English Speaking and Listening Skills With the Mobile Application Telegram. Indonesian EFL Journal: Journal of ELT, Linguistics, and Literature 4 (2), 147-74. http://ejournal.kopertais4.or.id/mataraman/index.php/efi/article/view/3636.

[7] Rianto, R., Rahmatulloh, A. and Firmansah, T.A. 2019. Telegram Bot Implementation in Academic Information Services with The Forward Chaining Method. Sinkron : Jurnal dan Penelitian Teknik Informatika. 3, 2 (Mar. 2019), 73-78. DOI: https://doi.org/10.33395/sinkron.v3i2.10023.

[8] B. N. Prastowo, N. A. S. Putro, and O. A. Dhewa, 2019. PLO User Interface based on Telegram Bot. *IJCCS (Indonesian Journal of Computing and Cybernetics Systems),* vol. 13, no. 1, pp. 21-30. DOI: https://doi.org/10.22146/ijccs.29089

[9] C. Huda, F. A. Bachtiar, and A. A. Supianto, 2019. Reporting Sleepy Driver into Channel Telegram via Telegram Bot. In: Brawijaya University, *International Conference on Sustainable Information Engineering and Technology (SIET).* Lombok, Indonesia, 28-30 September 2019. IEEE: IEEE Xplore.

[10] Muftinisa, Rosalina, R. Ginanjar, R. B. Wahyu, and N. Hadisukmana, 2018. Development and Implementation of Fixed Asset Management System. In: APTIKOM, *International Conference on Informatics and Computing, ICIC 2017.* Jayapura, Indonesia, 1-2 November 2017. IEEE: IEEE Xplore. DOI: 10.1109/IAC.2017.8280591.

[11] Setiaji, Hari & Paputungan, Irving. 2018. Design of Telegram Bots for Campus Information Sharing. IOP Conference Series: Materials Science and Engineering. 325 012005.10.1088/1757-899X/325/1/012005.

[12] Latif, U. K., & Kusumasari, T. F. 2018. Comparison Between Yii Frameworks and Laravel in 3 Different Version for Viewing Large Data of Shipyard Industry in Indonesia. *International Journal of Innovation in Enterprise System*, 2(01), 13–18. https://doi.org/10.25124/ijies.v2i01.12

[13] Supriyono, S. 2020. Software Testing with the approach of Black Box Testing on the Academic Information System. *International Journal of Information System and Technology*, 3(2), 227–233.

[14] Alroobaea, R., & Mayhew, P. J. 2014. How many participants are really enough for usability studies? Proceedings of 2014 *Science and Information Conference, SAI 2014, August*, 48–56. https://doi.org/10.1109/SAI.2014.6918171

[15] Kurniawan, E., & Syahputra, A. K. 2020. Usability Testing on The Asahan Covid-19 Web Portal using System Usability Scale (SUS). *International Conference on Social, Sciences and Information Technology*, 4509, 131–140.

[16] Bangor, Aaron, Philip Kortum, and James Miller, 2009. Determining what individual SUS scores mean: Adding an adjective rating scale. *Journal of usability studies*, vol 4, no. 3, pp 114-123.

[17] Baehre, S., O'Dwyer, M., O'Malley, L., & Lee, N. 2021. The use of Net Promoter Score (NPS) to predict sales growth: insights from an empirical investigation. *Journal of the Academy of Marketing Science*, 2021. https://doi.org/10.1007/s11747-021-00790-2

[18] Grigore, 2020. *What is a Good Net Promoter Score? (2020 NPS Benchmark)* [Online] Tersedia di: https://www.retently.com/blog/good-net-promoter-score/ [Accessed November 11 2020]