CHATBOT DESIGN USING ARTIFICIAL INTELLIGENCE WITH NATURAL LANGUAGE PROCESSING TO INCREASE CUSTOMER SATISFACTION AT MSME LEVEL

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Abstract

Customer satisfaction is a must, that has to be given by the merchant to the buyer in every transaction, therefore customer satisfaction must be maintained to retain customers in order to continue to gain their trust and loyalty to the goods and services offered. At this time, customer service is always used as a benchmark for customer satisfaction to understand and get information about the products and services offered by the merchant. However, there is a problem where merchants find

it difficult to be able to present information about the products and services offer to the customer, for example if the merchant needs to respond and serve every message that comes in from various different platforms, the merchant will find it difficult and overwhelmed the transaction process that currently happens. This of course will result in customers trust and loyalty and reduce customer satisfaction with the services provided by the merchant. Therefore, comes up the idea of designing a chatbot system using artificial intelligence with natural language processing method that will be used to increase customer satisfaction and simplify deployment process usiing Application Programming Interface integration for the merchant.

Keywords: Artificial Intelligence, Chatbot, Natural Language Processing, Customer Satisfaction

Introduction

The application of computerized tehcnology to improve the quality of service in the field of Micro, Small and Medium Enterprises (MSME) is directly correlative to the level of product sales, the application process can meet the needs of MSMEs in running their daily business. The Majority of MSME businesses use social media platforms such as Facebook, Instagram, Telegram, Whatsapp and as well as using existing marketplaces such as Shopee and Tokopedia and many others digital marketplace to put up a sale the products they offer, social media is also very influential in helping MSME businesses in communicate or strike a deal with customers.

This certainly poses a new challenge for MSME businesses to communicate because of the amount of social media platforms they use as well as the volume of their transactions frequency. This of course makes the communication process between MSME entrepreneurs and customers are unorganized, because entrepreneurs have to respond to messages from customers one by one. If the process of this problem is not immediately addressed, then incoming requests or messages are often ignored and threatened the reputation of the MSME business and lead to reduces customer satisfaction with the communication services offered by the MSME owners.

To overcome the problems that have been described, this study will provide a solution by designing a chatbot platform that has been integrated with social media and existing marketplaces. This is based on the use of Artificial Intelligence technology which is used to process messages input from customers to help communicate more regularly and respond to messages automatically to increase customer service satisfaction.

Study of Literature

Prototyping Methodology

Prototyping is a methodology that evolved out of the need to better define specifications and it entails in building a demo version of the software product that includes the critical functionality. Initial specifications are defined only to provide sufficient information to build a prototype. The prototype is used to refine specifications as it acts as a baseline for communication between project team and project owner. The prototype is not meant to be further developed into the actual software product. Prototypes should be built fast and most of the times they disregard programming best practices.
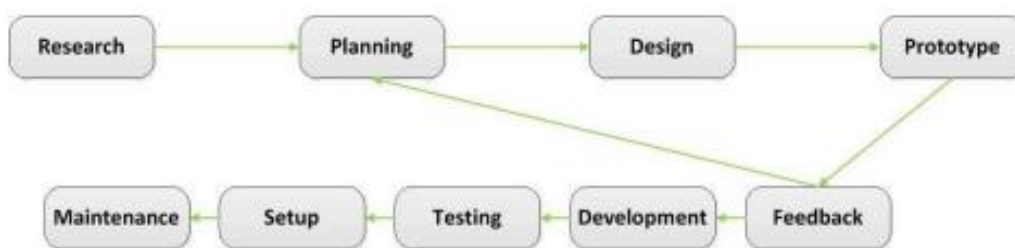
Figure 1 Web API Resource Model

The project owner's feedback is received after the prototype cycle is completed. The Prototyping methodology is suitable for large scale projects which usually impossible to properly define overwhelming requirements before any actual code scripts are performed. Prototyping methodology is also suitable for unique or innovative projects where no previous examples ever or hardly ever exists. [2]

Artificial Intelligence

Artificial intelligence can be defined as a knowledge mechanism that emphasizes the intelligence of the formation and assessment of the tools that make its mechanism, and make the computers to think intelligently. Artificial intelligence technology is studied in various fields such as robotics, computer vision, artificial neural networks, natural language processing, speech recognition and expert systems. [3, 4]

API (Application Programming Interface)

Application Programming Interface (API) is a collection of functions, orders, and protocols that can be used to connect one application with other applications to interact with. Correlate along with the development of the internet, the API can be deployed on the server side and can be used by multiple client side applications that can connect to the server using a specific protocol. APIs can be classified into several categories, this is seen from the abstraction that is described in the system. These categories include:

T a b l e 1

Table 1 API Category [1]

API Category	Description	Example
Operating System	An API used for basic functions that can be performed by a computer. such as process I/O, program execution	API for MS Windows
Programming Languages	An API that is used to expand the capability of executing a programming language	Java API
Application Services	An API that is used to expand the capability of executing a programming language	API for mySAP
Infrastructure Services	Used to access the infrastructure here are computers and peripherals such as storage, applications and others.	Amazon EC2 (Elastic Compute Cloud) for access to virtual computing and amazon S3 (Simple Storage Service) to store large amounts of data.
Web Services	API used to access content and services provided by a web application.	Telegram Bot API

REST APIs

The REST architectural style is commonly applied to the design of APIs for modern web services. A Web API conforming to the REST architectural style is a REST API.
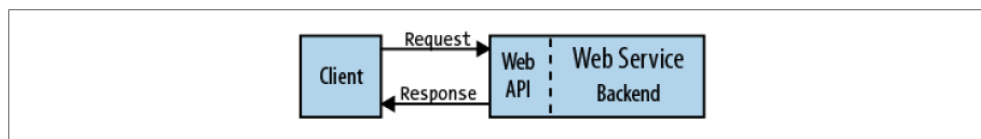

Figure 2 Web API Resource Model

Having a REST API makes a web service "RESTful." A REST API consists an assembly of interlinked resources. This set of resources is known as REST API's *resource model*.

Well-designed REST APIs can attract client developers to use web services. In today's open market where rival web services are competing for attention, an aesthetically pleasing REST API design is a must-have feature. [5, 6]

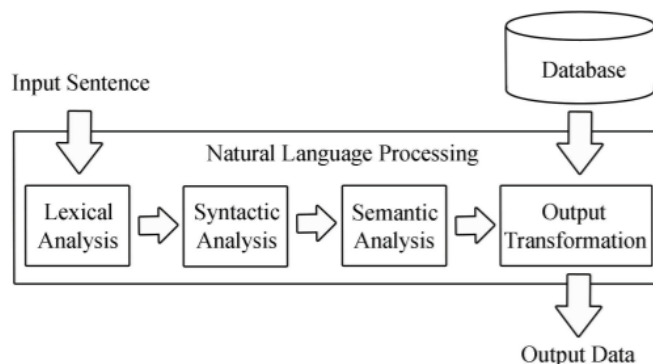### Natural Language Processing

Figure 3 Natural Language Processing Scheme [7]

Natural Language Processing is a theoretical motivated range of computational techniques for analyzing and representing naturally occurring texts data at one or more levels of linguistic analysis for the purpose of achieving human-like language processing for a range of tasks or applications. [8, 9]

Telegram Bot API

Telegram Bot API is an HTTP based interface for accessing telegram bots. Each bot has a personal authorization token which can be used inside of the URL or in a packet header. [10, 11]

A bot can be created by talking to the @botfather with a telegram platform. This requires an existing Telegram account. The @botfather account can be accessed when searching the account using the search feature.

Figure 4 @botfather Account

On figure 4, you can create a new bot account by talking to the @botfather, and the @botfather will respond with some certain command to create the bot.

Webhook

Webhook is an API concept that is very useful for social media applications because it provides other applications with real-time information. Webhook is also a URL link added to the application so that the data sent can be directly received at the same time as the URL link that has been determined. [8]

Chatbot

One of the applications of AI (artificial intelligence) is in the form of a chatbot. Chatbot is a computer program that is programmed to communicate with humans using the human language itself. One of the concrete examples is the Help Bot on Yahoo messenger and ALICE (Artificial Linguistic Internet Computer Entity) [12, 13]

Satisfaction

Satisfaction is the response of customers who have fulfilled their desires. If the service provided matches with the customer expectations, there will be satisfaction and vice versa if the satisfactions obtained by the customer exceeds his expectations, the customer is truly satisfied, they will expand the company reputation.. [14]

Customer Satisfaction

Customer satisfaction can be a standard that the goods or services produced by the company have been well received by the customer. [15, 16]
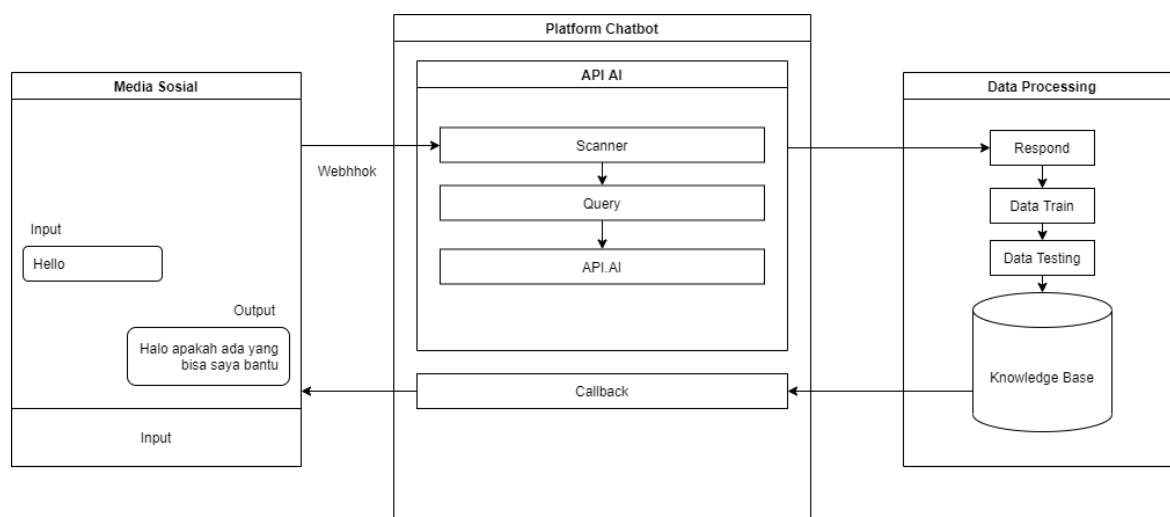
Research Methods

Figure 5 The research method of chatbot program architecture with artificial intelligence using the natural language processing method

The figure above is a method of designing a chatbot program architecture that has been integrated with social media platforms such as Telegram and the natural language processing service, known as API.AI. The components used in this chatbot platform are Telegram social media platform and API.AI. Input from customers will be stored and processed in a cloud database which will later be written as a Knowledge Base.

The architecture will be executed by API.AI through webhook, social media platforms will interact with each other with the chatbot program that will be designed. The webhook will ask for a request in the form of text which will then be processed by the scanner and continued through a listener and identified by API.AI to find out the intent of the request sent via input from the customer, then the request will be sent through the response to be used as a data train to train the response from customer input and then the data will be reprocessed as testing data which will be entered into the knowledge base as reference material and chatbot reference to reply to input from customers.

For example, a customer sends a message to the chatbot to ask if the product is still available by typing the sentence: "Hello, is this clothing product still available?". In order to respond to the sentence, the chatbot program will process the sentence by taking a few words that become triggers to respond to the message sent. And the trigger in the sentence can be described as follows:

"Hello, is this clothing product still available?" The trigger of the sentence is the word "product", the word that will be used as a trigger to take from data that has been processed into a knowledge base which in the end the bot will respond to messages according to the data taken from the database.

System Planning

In this digital era, the term digital market is being used as a marketplace for transactions purpose for the community as a source of income and as a source of

buying needs. The number of transactions that occur in the digital marketplace has exceeded the number of transactions that occur in the offline market.

In the transaction process on the digital market, interactions often occur between buyers and sellers, from the matter of the buying and selling process, transaction confirmation, to answers to frequently asked questions (FAQ) by customers.

This interaction sometimes takes more time and resources, the effort that needs to be spent of course depends on the volume of buying and selling carried out on a product or market. The greater the volume, the greater the number of interactions that need to be carried out by the seller. This problem will certainly be complicated if solved manually. Therefore, this study provides a solution using Chatbot, which is a technology that combines Artificial Intelligence with Natural Language Processing into one unit. By using the open-source API.AI, making access to the creation of this chatbot unit is certainly easy for sellers to overcome this problem.
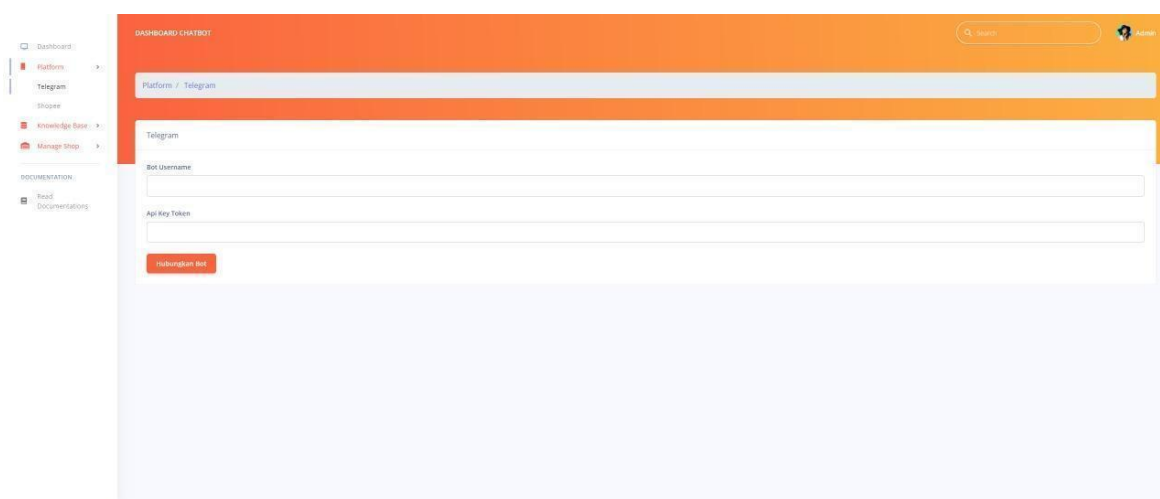

Figure 6 Page to do API Integration

This page integrates the Data Processing Unit with the social media's API, by inputting the Username and Token from the chatbot that has been built. After that, the chatbot will be connected and will display data from the message delivery column with customers in the form of messages sent by customers and messages that have not been replied by the chatbot. This is the beginning of the Business Process that occurs from the seller's perspective.
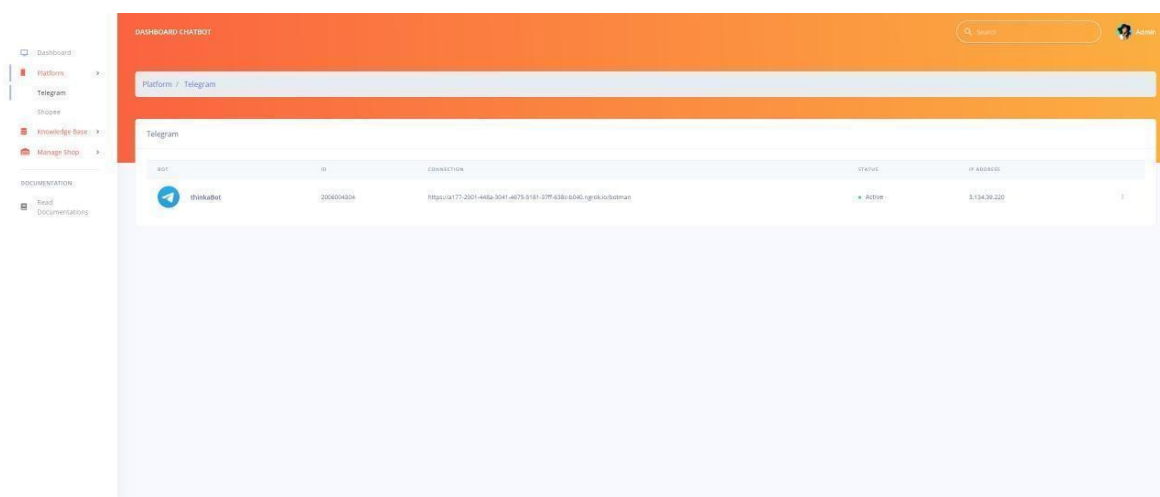

Figure 7 Social Media API Display Page linked to AI API

Figure above shows the display of API's Social Media page that has been integrated by API.AI. In this case, Telegram is used as a medium in a case example where one of the clients asks a question to the seller, but the seller is busy outside the control of social interaction.

Figure 8 Page Set Chatbot Response

In Figure 3, the seller or the chatbot Admin can set what response the chatbot gives when API.AI extracts keywords and matches them to the knowledge base contained in the Processing Unit. On this page Admin can change, delete, and add new dictionaries into the Data Processing knowledge base.
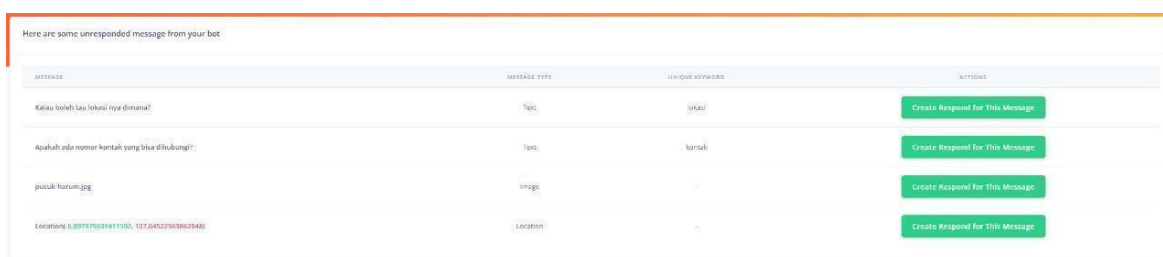

Figure 9 Unavailable and detected Dictionary Display page

Learning or expanding the knowledge base of this system is carried out specifically by the Admin when there is new data known by API.AI and offered to the Admin what response will be input, what type of data is obtained, and what unique keywords are newly obtained.
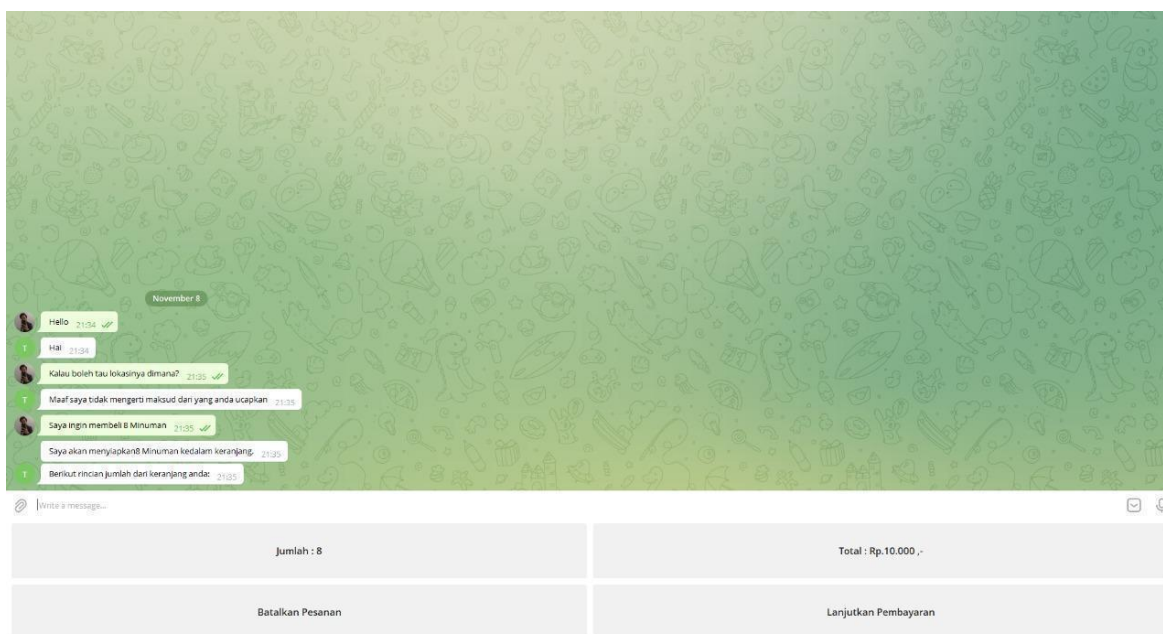

Figure 10 Examples of client interactions with chatbots

When the Client sends a text to the chatbot account, where this account is connected to the Telegram API, the text sent will be relayed to API.AI and scanned in

the data processing. This process is carried out on the API.AI token owned by the Admin. This process is carried out on the API.AI cloud server, at this stage the processing of text sent by the client is matched with the existing dictionary in the knowledge base with the rule-base grammar matching algorithm. As explained in figure 1, data that does not match the knowledge base will be responded to by the bot as a message that has not been understood by the bot. If the data sent matches the data contained in the knowledge base, the Bot will respond to the Client with the appropriate reply message on the knowledge base API.AI.

Conclusion

From the results of the study conducted, it can be concluded that the use of chatbots can increase the interaction between sellers and buyers, as well as increase customer satisfaction with the customer services provided, thus giving the impression of the availability of sellers who are always present for buyers. Of course this will increase the reputation of the seller and the sale of products that have been provided by the seller. The intensity of chatbot communication with buyers will be maintained, and increase the competitiveness of sellers in the digital marketplace. In the business process competition that occurs in the digital market, the readiness of the seller to computerize the business processes carried out is crucial, to maintain the relationship between the seller and the buyer.

References

1. KUSUMA, A.D., *USE OF TELEGRAM BOT ON TELEGRAM MESSENGER WITH WEBHOOKS METHOD FOR INFRASTRUCTURE LENDING SYSTEM AT UIN MAULANA MALIK IBRAHIM MALANG. FACULTY OF SCIENCE AND TECHNOLOGY, 1-72.* 2019.
2. Cooling, J.E. and T.S. Hughes. *The emergence of rapid prototyping as a real-time software development tool.* IET.
3. Rohman, F.F. and A. Fauzijah, *Design an expert system application to determine the types of developmental disorders in children.* Media informatika, 2008. **6**(1).DOI: https://doi.org/10.20885/informatika.vol6.iss1.art1.
4. Sengodan, V.C., N. Thiagarajan, and I.P. Raajendiren, *Evaluating the efficacy of platelet rich plasma injection for the treatment of chronic plantar fasciitis.* Journal of Natural Science, Biology and Medicine, 2020. **11**(2): p. 135.
5. Kobusińska, A. and C.-H. Hsu, *Towards increasing reliability of clouds environments with restful web services.* Future Generation Computer Systems, 2018. **87**: p. 502-513.DOI: https://doi.org/10.1016/j.future.2017.10.050.
6. Sengupta, P., A. Sharma, and N. Das, *Is there any benefit of integrating computer-assisted learning with conventional teaching format in pharmacology to demonstrate the effects of different drugs on mean arterial blood pressure in an anesthetized dog?: A comparative study.* Journal of natural science, biology, and medicine, 2017. **8**(2): p. 181.
7. Tapsai, C., P. Meesad, and H. Unger, *An Overview on the development of Thai natural language processing.* Information Technology Journal, 2019. **15**(2): p. 45-52.
8. Zukerman, I. and D. Litman, *Natural language processing and user modeling: Synergies and limitations.* User modeling and user-adapted interaction, 2001. **11**(1): p. 129-158.DOI: https://doi.org/10.1023/A:1011174108613.
9. Suryarao, P.S., et al., *Comparison between oral health status of institutionalised and home stay disabled children in western Maharashtra region.* Journal of Natural Science, Biology and Medicine, 2020. **11**(2): p. 179.
10. Perevodchikov, E., *NATURAL LANGUAGE PROCESSING AND CHAT BOT IMPLEMENTATION. Technology, 5-40.* 2019.
11. Susanto, A.D., et al., *The prevalence and related risk factors of obstructive sleep apnea in heart failure patients at the indonesian referral hospital for respiratory diseases.* Journal of Natural Science, Biology and Medicine, 2020. **11**(2): p. 164.
12. Wallace, R., *The elements of AIML style.* Alice AI Foundation, 2003. **139**.

13. Patil, H.V. and V.C. Patil, *Comparative study of procalcitonin and C-reactive protein in patients with sepsis.* Journal of Natural Science, Biology and Medicine, 2020. **11**(2): p. 93.

14. Nassar, H., G. Moshi, and H. Mitomo, *THE IMPACT OF PSYCHOLOGICAL BARRIERS IN INFLUENCING CUSTOMERS'DECISIONS IN THE TELECOMMUNICATION SECTOR.* International Journal of Managing Public Sector Information and Communication Technologies, 2013. **4**(4): p. 1.

15. Rahmat, R. and H. Haryono, *Analysis of the Effect of Servqual, Satisfaction and Trust on Customer Loyalty of Internet Banking Service Users by Using the Structural Equation Modeling Method (Case Study: Bank "X").* ITS Jurnal Journal of Science and Arts, 2013. **2**(2): p. D153-D158.

16. You, S.-H., M.-Y. Yoon, and J.-S. Moon, *Antioxidant and Anti-inflammatory Activity Study of Fulvic Acid.* Journal of Natural Science, Biology and Medicine, 2021. **12**(3).