ISSN 2355-0082

IJNMT

International Journal of New Media Technology

VOLUME 9 No. 1

Engineering | Vol.9 | No.1 | Page 1-34 | June 2022 | ISSN 2355-0082

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ISSN 2355-0082

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Tangerang, Banten - 15811
Indonesia
Phone. (021) 5422 0808
Fax. (021) 5422 0800
Email : ultimacomputing@umn.ac.id

IJNMT (International Journal of New Media Technology) is a scholarly open access, peer-reviewed, and interdisciplinary journal focusing on theories, methods and implementations of new media technology. Topics include, but not limited to digital technology for creative industry, infrastructure technology, computing communication and networking, signal and image processing, intelligent system, control and embedded system, mobile and web based system, and robotics. IJNMT is published regularly twice a year (June and December) by Faculty of Engineering and Informatics, Universitas Multimedia Nusantara in cooperation with UMN Press.

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ISSN 2355-0082

FOREWORD

Greetings!

IJNMT (International Journal of New Media Technology) is a scholarly open access, peer-reviewed, and interdisciplinary journal focusing on theories, methods and implementations of new media technology. Topics include, but not limited to digital technology for creative industry, infrastructure technology, computing communication and networking, signal and image processing, intelligent system, control and embedded system, mobile and web based system, and robotics. IJNMT is published regularly twice a year (June and December) by Faculty of Engineering and Informatics, Universitas Multimedia Nusantara in cooperation with UMN Press.

In this June 2022 edition, IJNMT enters the 1st Edition of Volume 9. In this edition there are five scientific papers from researchers, academics and practitioners in the fields covered by IJNMT. Some of the topics raised in this journal are: Optimization of Process Variables in 3D Printing on Dimensional Accuracy Using Nylon Filaments, The Design of Microcontroller Based Early Warning Fire Detection System for Home Monitoring, Bibliographic Computer Science Indexing Review with Disease Covid 19, Implementation of OCR and Face Recognition on Mobile Based Voting System Application in Indonesia and Analysis Sentiment Cyberbullying in Instagram Comments with XGBoost Method.

On this occasion we would also like to invite the participation of our dear readers, researchers, academics, and practitioners, in the field of Engineering and Informatics, to submit quality scientific papers to: International Journal of New Media Technology (IJNMT), Ultimatics : Jurnal Teknik Informatics, Ultima Infosys: Journal of Information Systems and Ultima Computing: Journal of Computer Systems. Information regarding writing guidelines and templates, as well as other related information can be obtained through the email address ultimaijnmt@umn.ac.id and the web page of our Journal here.

Finally, we would like to thank all contributors to this June 2022 Edition of IJNMT. We hope that scientific articles from research in this journal can be useful and contribute to the development of research and science in Indonesia.

June 2022,

Fenina Adline Twince Tobing, S.Kom., M.Kom.
Editor-in-Chief

ISSN 2355-0082

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Optimization of Process Variables in 3D Printing on Dimensional Accuracy Using Nylon Filaments

Optimasi Variabel Proses Pada 3D Printing Terhadap Akurasi Dimensi Menggunakan Filamen Nylon

Hasdiansah[1],
[1] Mechanical Engineering Department, Politeknik Manufaktur Negeri Bangka Belitung,
, [1]phiannttarah@yahoo.co.id

Accepted 17 December 2021
Approved 06 April 2022

Abstract—Manufacturing process over the past 50 years has led to very rapid and continuous progress in the manufacturing industry, one of the manufacturing processes that has progressed is 3D printing technology. The type of filament used in this research is nylon filament. This study aims to obtain optimal process parameters for dimensional accuracy. The method used in this study is the Taguchi L_{27} OA method. The process parameters used are nozzle temperature, bad temperature, layer thickness, flowrate, printing speed, overlap, infill density, infill speed, wall thickness. The results showed that the optimal process parameters are nozzle temperature(256°C), bad temperature(96°C), layer thickness(0.2mm), flowrate(90%), printing speed(30mm/s), overlap (10%),

Keywords: 3D printing; Accuracy; Dimensions; Nylon; Parameter;

Over the last 50 years, the manufacturing process has resulted in rapid and continuous progress in the manufacturing industry [1]. One of the progressive manufacturing processes is 3D printing technology, which is rapidly developing in the manufacturing industry [2]. 3D printing has numerous applications, one of which is the production of finished products such as mugs and bowls of various shapes. However, it has a flaw in the product printing process that is related to dimensional accuracy in this case. As a result, the final product is still not in accordance with the desired design because the product's size has decreased or increased in comparison to the desired size. In connection with these shortcomings, it is necessary to have the right process parameters on a 3D printer to get a product or printout with good dimensional accuracy. [3].

Several studies on the process parameters of this 3D printer have been carried out by researchers. Research on the effect of process parameters on tensile strength and dimensional accuracy using nylon filament using the Taguchi L9 OA method shows that the most influential process parameter on dimensional accuracy is Layer thickness [4]. The best process parameters use a nozzle temperature of 90℃, bed temperature of 55℃, and a layer thickness of 0.2 mm [3]. Research on the effect of process parameters on dimensional accuracy using nylon filaments obtained the parameters that most affect the response to the dimensional accuracy of 3D printing nylon 6 products showing different results on the four dimensions, layer thickness parameter is the most influential factor on the response of LO and WO dimensions with the value of the percent contribution of 42.0802% and the value of the percent contribution of WO is 18.9439% while for the dimensions w and T the most influential parameters are generated by the nozzle temperature parameter with the contribution value of w of 60,1022% and the value of the contribution of T of 43.3853% [5]

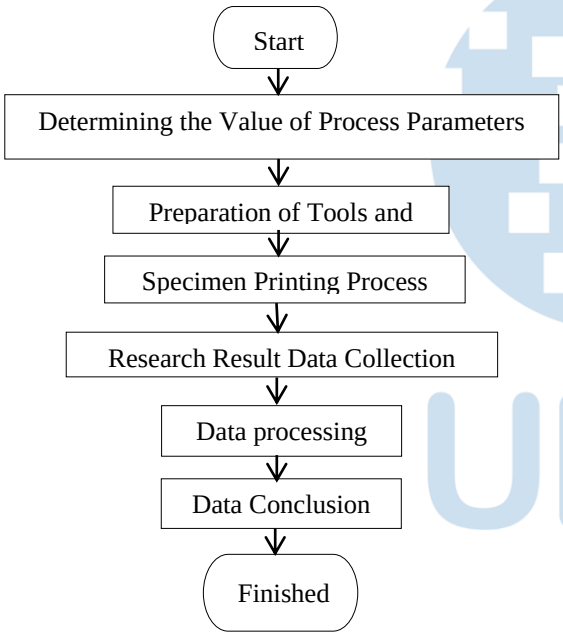
Research on the effect of process parameters on dimensional accuracy using PLA filaments shows that to achieve good dimensional accuracy, a smaller layer thickness is needed, a lower extrusion temperature and infill percentage, and a hexagonal infill patter [6]. Dimensional accuracy research using filament Eflex the most dominant parameter is layer thickness from parameter settings flowrate, layer thickness, nozzle temperature, printing speed, overlap, and fan speed [7].

According to the research, this study was carried out to optimize the 3D process parameters by focusing on nine process parameters, namely Nozzle

Temperature(°C), Bed Temperature(°C), Layer Thickness(mm), Wall Thickness (mm), Flowrate(percent), Print Speed(mm/s), overlap(percent), infill density(percent), infill speed(mm/s) with Taguchi L27 OA method using nylon filament for dimensional accuracy. Using predetermined process parameters, this study aims to obtain the most optimal process parameters for dimensional accuracy of nylon nylon filament

METHOD

This study uses nylon filament because it has the advantages of being strong and flexible, high impact resistance, does not cause unpleasant odors when printing, and has high abrasion resistance, so it will be very good if used for ready-to-use products. With the experimental method used to obtain the most optimal process parameters for dimensional accuracy. The stages of the research process are shown in the flow chart in Figure 1.



Picture 1 Research Flowchart

1.1 Determining Process Parameters

The process parameters consist of experimental factors and levels, the selection of these factors and levels is based on a literature review. The factors used in this research are Nozzle Temperature(°C), Bed Temperature(°C), Layer Thickness(mm), wall thickness (mm), Flow rate(%), Print Speed(mm/s), overlap(%), infill density (%), and infill speed (mm/s), as well as the level used can be seen in Table 1.

Table 1 Level Value and Process Parameter

Code	Factor	Level		
		1	2	3
A	Nozzle Temperature(°C)	256	258	260
B	Bed Temperature(°C)	95	98	100
C	Flowrate(%)	90	95	100
D	Printing Speed(mm/s)	25	30	35
E	Layer Thickness(mm)	0.2	0.24	0.28
F	Wall Thickness (mm)	0.8	1.0	1.2
G	Overlap(%)	5	10	15
H	Infill Density(%)	20	25	30
I	Infill Speed(mm/s)	20	25	30

After the level values and process parameters are determined, the next step is to design the factorial of the Taguchi L27 OA (Orthogonal Array) method using analysis software. The results of the factorial design are presented in Table 2.

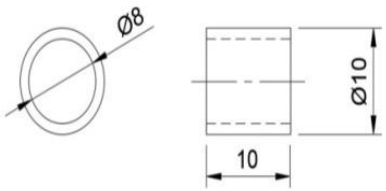
Table 2 Taguchi L27 OA Factorial Design

No	A	B	C	D	E	F	G	H	I
1	256	90	0.20	90	30	5	20	25	0.8
2	256	90	0.20	90	35	10	25	30	1.0
3	256	90	0.20	90	40	15	30	35	1.2
4	256	95	0.24	95	30	5	20	30	1.0
5	256	95	0.24	95	35	10	25	35	1.2
6	256	95	0.24	95	40	15	30	25	0.8
7	256	100	0.28	100	30	5	20	35	1.2
8	256	100	0.28	100	35	10	25	25	0.8
9	256	100	0.28	100	40	15	30	30	1.0
10	258	90	0.24	100	30	10	30	25	1.0
11	258	90	0.24	100	35	15	20	30	1.2
12	258	90	0.24	100	40	5	25	35	0.8
13	258	95	0.28	90	30	10	30	30	1.2
14	258	95	0.28	90	35	15	20	35	0.8
15	258	95	0.28	90	40	5	25	25	1.0
16	258	100	0.20	95	30	10	30	35	0.8
17	258	100	0.20	95	35	15	20	25	1.0
18	258	100	0.20	95	40	5	25	30	1.2
19	260	90	0.28	95	30	15	25	25	1.2
20	260	90	0.28	95	35	5	30	30	0.8
21	260	90	0.28	95	40	10	20	35	1.0
22	260	95	0.20	100	30	15	25	30	0.8
23	260	95	0.20	100	35	5	30	35	1.0
24	260	95	0.20	100	40	10	20	25	1.2
25	260	100	0.24	90	30	15	25	35	1.0
26	260	100	0.24	90	35	5	30	25	1.2
27	260	100	0.24	90	40	10	20	30	0.8

In Table 2 it is used for the G-code manufacturing process and then used for printing dimensional accuracy test specimens. This specimen will be printed with three replications for each specimen.

1.2 Preparation of Tools and Materials

The tools used in this research are the Anycubic 4max 3D Printing machine which is used to print test specimens, the Asus brand laptop which is used to run the software that will be used in the research, the slicing software to get the G-code, dry box filament is used to dry the filament during the experiment. the printing process, a micrometer with an accuracy of 0.001 mm was used to measure the test specimen, and the material used was nylon filament with a diameter of 1.75mm and black.



Picture 2 Dimensions and Shape of Test Specimen

1.3 Object of research

The object of research carried out on a 3D printer is a specimen with object dimensions10mm x 10mm as shown in Figure 2. Specimen Designusing CAD software in STL format then processed in slicing software to get G-code which will be saved to the SD card and then inserted into the 3D printer

1.4 Product Dimension Measurement

Printed specimens are measured to determine the dimensional accuracy of the finished product. Measurement of the dimensions of this specimen using a micrometer with an accuracy of 0.001 mm. The dimensions measured are the Outside Diameter of the Specimen with measurements at three different points.

2. RESULTS AND DISCUSSION

The results of printing specimens with three replications in each specimen using the Taguchi L27 OA factorial design method in Table 2 will be shown in Figure 3.

Figure 3 Printed Specimens

The specimen from this printing was measured for the accuracy of the dimensions of the outer diameter of the specimen, which was 10mm with the measurement positions at three different points using a micrometer with an accuracy of 0.001 and the results of the position measurements were averaged which will be shown in Table 3 which will then be processed in the analysis software.

Table 3 Results of Measurement of the Outside Diameter of the Specimen

EXP. No.	Outside Diameter			
	Preliminary data	Replication 1	Replication 2	Average
1	9,806	9,834	9,834	9,834
2	9,793	9,799	9,799	9,799
3	9,742	9,813	9,813	9,813
4	9,922	9,887	9,887	9,887
5	9,928	9,871	9,871	9,871
6	9,952	9,893	9,893	9,893
7	9,981	9,929	9,929	9,929
8	9,984	9,914	9,914	9,914
9	9,953	9,924	9,924	9,924
10	9,958	9,967	9,967	9,967
11	9,971	9,968	9,968	9,968
12	9,982	9,962	9,962	9,962
13	9,985	9,991	9,991	9,991
14	9,986	9,982	9,982	9,982
15	9,911	9,985	9,985	9,985
16	9,965	9,977	9,977	9,977
17	9,975	9,967	9,967	9,967
18	9,966	9,976	9,976	9,976
19	9,976	9,986	9,986	9,986
20	9,985	9,972	9,972	9,972
21	9,943	9,970	9,970	9,970
22	9,944	9,978	9,978	9,978
23	9,927	9,972	9,972	9,972
24	9,950	9,969	9,969	9,969

25	9,988	9,974	9,974	9,974
26	9,966	9,956	9,956	9,956
27	9,979	9,967	9,967	9,967

The Taguchi method is used to process measurement data in order to obtain optimal process parameters that affect the dimensional accuracy test results. The data is processed using analysis software in which the values in Table 3 are entered, and the measurement data is entered into the analysis software to obtain the Mean Plot and S/N Ratio results with "smaller is better" quality because the smaller the deviation, the better the dimensional accuracy.

Figure 4 and Table 4 show the results of the analysis software calculation on the accuracy of the dimensions of the outside diameter of the specimen, while Figure 5 and Table 5 show the S/N Ratio.

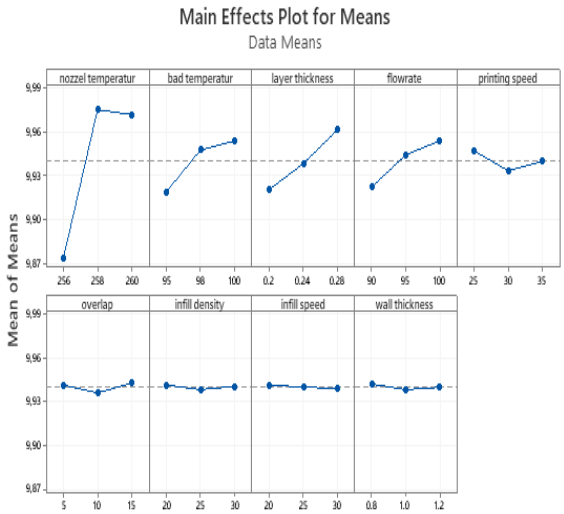


Figure 4 Graph of the Mean Plot Outer Diameter of the Specimen

Table 4 Results Mean Plot Outside Diameter of Specimen

Response Table For Mean					
Factor	Level			Delta	Rank
	1	2	3		
A	9,874	9,975	9,972	0.101	1
B	9,919	9,948	9,954	0.035	3
C	9,921	9,938	9,961	0.041	2
D	9,922	9,944	9,954	0.031	4
E	9,947	9,933	9,940	0.014	5
F	9,941	9,936	9,943	0.007	6
G	9,941	9,938	9,941	0.003	8
H	9,941	9,940	9,939	0.002	9
I	9,942	9,938	9,940	0.004	7

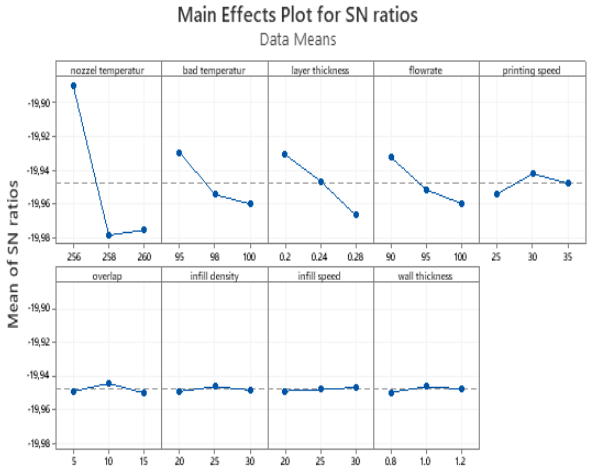


Figure 5 Graph of S/N Ratio of Specimen Outside Diameter

Table 5 S/N Ratio Outside Diameter of Specimen

Respons Table For Signal to Noise Ratios					
Factor	Level			Delta	Rank
	1	2	3		
A	-19.89	-19.98	-19.98	0.09	1
B	-19.93	-19.95	-19.96	0.03	3
C	-19.93	-19.95	-19.97	0.04	2
D	-19.93	-19.95	-19.96	0.03	4
E	-19.95	-19.94	-19.95	0.01	5
F	-19.95	-19.94	-19.95	0.01	6
G	-19.95	-19.95	-19.95	0.00	8
H	-19.95	-19.95	-19.95	0.00	9
I	-19.95	-19.95	-19.95	0.00	7

Based on Figure 6 and Table 5 the value of the S/N Ratio with “smaller is better” quality indicates that the optimal parameter values and successively affect the accuracy of the dimensions of the outer diameter of the printed object specimen, namely nozzle temperature (256°C), layer thick ness(0.2mm), bad temperature(96°C), flowrate(90%), printing speed(30mm/s), overlap(10%), wall thickness (1.0mm), infill density(25%), and Infill speed(30mm/s).

3. CONCLUSION

Based on the results of the measurement of the outer diameter of the printed object specimen in Table 3 and the results of the analysis software data processing, it can be concluded that the optimal process parameter values for the accuracy of the dimensions of the outer diameter of the specimen are nozzle temperature (256°C), bad temperature (96°C), layer thickness(0.2mm), flowrate(90%), printing speed(30mm/s), overlap(10%), infill density(25%),

and Infill speed(30mm/s), and wall thickness (1.0mm).

For further research, it can be added or used more process parameters and levels, because the more parameters or levels used, the optimal parameter values for dimensional accuracy found, the better.

I. REFERENCES

[1] Attaran, M. (2017). The rise of 3-D printing: The advantages of additive manufacturing over traditional manufacturing. *business Horizons*, 677-688.

[2] Basavaraj, C. K., & Vishwas, M. (2016). Studies on Effect of Fused Deposition Modelling Process Parameters on Ultimate Tensile Strength and Dimensional Accuracy of Nylon. *IOP Conf. Ser.: Mater. Sci. Eng.*, 149.

[3] Benny Haddli Irawan, R. H. (2019). "Pengaruh Temperatur Nozzle dan Based Plate. *Jurnal Teknologi dan Riset Terapan (JATRA)*.

[4] Hasdiansah, Masdani, Feriadi, I., & Pristiansyah. (2020). Optimasi ParameterProses Terhadap Akurasi Dimensi PLA Food GradeMenggunakan Metode Taguchi. *National Coference of Industry, Engineering and Technology*, A175-A186.

[5] Lauwers, B., Klocke, F., Klink, A., Tekkaya, A. E., & Reimund. (2014). Hybrid process ini manufacturing. *CIRP Annals*, 561-583.

[6] Noor, S. (2019). Analisis Pengaruh Parameter Proses 3D Printing Material Nylon 6 Terhadap Respon Akurasi Dimensi dan Kekuatan Tarik Menggunakan Metode Taguchi. 53-92.

[7] Pristiansyah, Hasdiansah, & Sugiyarto. (2019). Optimasi Parameter Proses 3D Printing FDM Terhadap Akurasi Dimensi Menggunakan Filament Eflex. *jurnal Teknologi Manufaktur* , 2089-5550.

[8] Qattawl, A. A. (2018). Investigating the effect of fused deposition modeling processing parameters using Taguchi design of experiment method. *Jurnal of Manufacturing Processes, 36*, 164-174.

[9] Ramdhani, H. (2019). Perancangan dan Pembuatan Prototipe Struktur Rahang Bawah Manusia Pada Mesin Printer 3D. 4.

[10] Rwei, S.-P., Tseng, Y.-C., Chiu, K.-C., Chang, S.-M., & Chen, Y.-M. (2013). The crystallization kinetics of Nylon 6/6T and Nylon 66/6T copolymers. *Thermochimica Acta*, 37-45.

[11] Setiawan, S. Y. (2019). Pengaruh Temperatur Terhadap Kekuatan Tarik dan Tekan Pada Proses Ekstrusi di Mesin Printer . *Universitas Sumatra Utara*

[12] Soejanto, I. (2009). Desain Eksperimen Dengan Menggunakan Metode Taguchi. 273.

[13] MatterHackers–*How To Succed When 3D Printing With Nylon*, diakses 2 April 2021, < How To Succeed When 3D Printing With Nylon | MatterHackers >

[14] Simplify3D, *Ultimate Materials Guide – 3D Printing With Nylon*, diakses 2 April 2021, <https://www.simplify3d.com/support/materialsguide/nylon/>

ISSN 2355-0082

The Design of Microcontroller Based Early Warning Fire Detection System for Home Monitoring

Hery[1], Calandra A. Haryani[2], Aditya R. Mitra[3], Andree E. Widjaja[4]
[1,2,3,4] Information System, Universitas Pelita Harapan, Tangerang, Indonesia
[1]hery.fik@uph.edu,
[2]calandra.haryani@uph.edu,
[3]aditya.mitra@uph.edu,
[4]andree.widjaja@uph.edu

Accepted 18 December 2021
Approved 09 March 2022

***Abstract* — Fire is a type of disaster that can occur anytime and anywhere as a result of any accidental or intentional causes. Without exception, houses are also very vulnerable to fire. To anticipate the catastrophic effects of fire that can destroy houses, advanced technology, such as the Internet of Things (IoT) can be utilized to detect the smoke and fire. This study aims to design an early warning fire detection system for home monitoring using smoke detection sensors based on Arduino microcontroller together with NodeMCU ESP8266. This early warning fire detection system is expected to function by notifying homeowners when detecting the presence of smoke in their homes. With the aid of this detection system, the issue of potential damage, death, or material loss caused by fire can be significantly reduced. The results and testing of the designed system will be discussed in the paper.**

Index Early warning fire detection system, home monitoring, Arduino, NodeMCU ESP8266

I. INTRODUCTION

A. Background and Purpose

Disasters such as flooding, earthquake, tsunami, typhoon, and fires can occur anywhere and anytime. Fire particularly, is a type of disaster that may be caused by accident or deliberate action which can also occur at anytime and anywhere, including in the house. According to Indonesian Central Bureau of Statistics (*Badan Pusat Statistik*), throughout 2018 there were 552 cases of housing fires in the DKI Jakarta region alone. This number increased to 1898 cases in 2020 [1]. Based on the aforementioned data, it can be inferred that the residential fires becomes more common in recent years. As for the cause of the fire, there are several factors, such as: short circuit in electrical installations, exploding gas stoves, cigarette butts, and others. In general, a fire is known if the fire has started to grow or the smoke has started to blacken or has billowed out of the building. From several cases of a house fire, the fire usually started in the kitchen due to a gas leak. This fact is supported by the statistics provided by the DKI Jakarta government that, in 2020, 180 cases of residential fires were caused by gas leaks [2].

The impact of house fire might be very devastated, catastrophic, and even deadly especially to humans if they are still inside the house when the fire broke out. Hence, it is very crucial to have an advanced Information Technology in the form of Internet of Things which is able to detect fire disaster as early and accurately as possible. To date, the use of current technology such as Internet of Things (IoT) can be very beneficial to anticipate potential disasters caused by fire. Fire can be anticipated with an immediate detection, for instance using a smoke detection. The presence of smoke can serve as an early indicator of the presence of fire in a room. In addition, indicators that have the potential to cause fires are gas leaks, so that homeowners can know if a gas leak occurs. In general, there are two indicators of gas leakage that should be taken into account, namely LPG (liquified petroleum gas) leakage and CO (carbon monoxide) leakage. Due to this potential leaks, detecting smoke and gas in a room in the house at any time requires a fire early detection system with the ability to notify homeowners immediately with ongoing situations. In this study, the early warning fire detection system was designed and developed using smoke detection sensors based on the Arduino UNO microcontroller together with Node MCU ESP 8266.

B. Literature Review

Internet of Things (IoT) is a technology that allows ones to connect machines, equipment and other

physical objects with network sensors and actuators to obtain data and manage its own performance. In other words, IoT is everything about objects that are connected to the Internet. This technology is allowing machines to collaborate and even act on new information that is obtained independently [3]. The term IoT itself refers to a concept that aims to broaden the benefits of continuously connected Internet connectivity. IoT generally consists of three parts: network, sensors, and usage application. Several communication technologies can be used to support the connection device to IoT. IoT has been considered as the latest technology in the internet world, where this technology will become a technology trend in the future. To date, IoT has expanded and become the leading platform for communication devices. It is estimated that the amount IoT users will increase massively where the economy grows significantly [3].

Fire Detector. Detection is a process of examining something using certain methods and techniques. Detection can be applied in various problems including fire detection system. This particular type of system can detect the occurrence of fire [4]. Generally, a fire detector refers to a device whose main function is to detect the presence of initial fire in order to prevent it from becoming larger. With the help of early warning fire detection system, fire fighting can be done immediately. In turn, this may minimize the loss risk from the very beginning. Fire detection system works on the presence of smoke, heat, and fire. Based on those elements, fire detector is basically divided into three types, namely: Smoke Detector (smoke detector) is a device that serves to detect smoke. When the detector detects smoke, it will immediately send a signal to activate fire alarm sounds; Heat Detector, which detect changes in thermal energy (heat) caused by the presence of fire; Flame Detector, that detects the presence of flames and available in three types, namely optical sensors, ionisation, and thermocouple [5]. Fire detector used in this research is MQ-2 (as seen in Figure. 1).

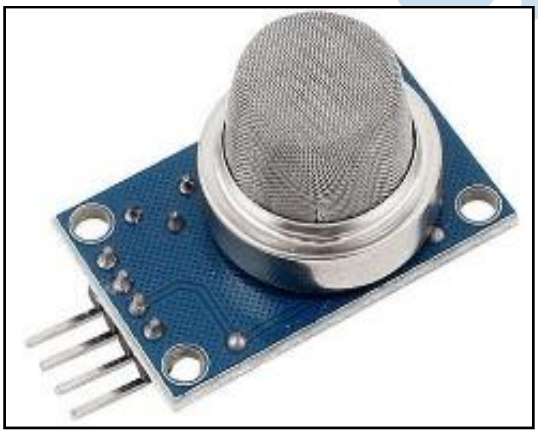


Fig. 1. MQ-2 Sensor

MQ-2 is a particular sensor that functions to detect the concentration of substances in the air. Few types of substance concentrations that can be captured by MQ-2, among other things are, Liquified Petroleum Gas (LPG), Carbon monoxide (CO), and smoke [6]. The following are the thresholds of the parameters used: Liquified Petroleum Gas (LPG) is gas produced from oil refineries and gas refineries whose main components are propane and butane gas of approximately 99% and the rest is liquified pentane gas. The composition ratio of propane (C_3Hg) and butane (C_4H_{10}) is 30:70. This LPG is included in the category of flammable gas. LPG is a gas that is circulated in the market by Pertamina with a pungent smell, non-toxic but if inhaled more than 1,000 ppm it can cause fainting and death. To prevent fires caused by LPG, the LPG gas concentration value must be below 1.8%, if the LPG gas concentration value is 1.8%-10% in the air, it can cause fires and explosions. The amount of 1.8%-10% is equivalent to 18,000 PPM to 100,000 PPM. Therefore, the fire detection system must be set below the safe limit of gas content which is less than 1.8% in order to overcome the potential for fires [7]. Meanwhile, according to ISPU (Air Pollution Standard Index) No. KEP107/KABAPEDAL/11/1997 article 9 states that the standard index number and category for carbon monoxide (CO) gas in normal clean air is with a concentration size between 0-50 ppm [8]. Besides, based on the Air Quality Index (AQI) Basics for smoke indicators, the level of smoke density in normal air is 0-50 ppm [9].

Arduino is a microcontroller device that is generally used to automate human work. Arduino consists of two main elements: Arduino board on which the sensor components used are plugged in, and the software, called the Arduino Integrated Development Environment (IDE). Using this IDE one can write any program code to make Arduino work as wanted [10]. The use of Arduino is increasing in number along with the need of microcontroller devices that are affordable and are also supported by the trend of job automation using devices that can be controlled through mobile applications [11]. In the meantime, the homeowners have begun to make use smart home for facilitating their daily routines at home. Research conducted by Jabbar and Kawitkar [11] showed that Arduino devices can be used to build smart home applications that are able to automatically manage some electronic devices located inside the house through a network connection. Apart from affordability, Arduino also has several advantages, namely [10]: to support for multi-platform technology; large user community; and ease of use in terms of programming (coding).

Node MCU ESP 8266 is an embedded chip designed for Wi-Fi based communication [6]. This chip has TTL and GPIO serial outputs. ESP8266 can be used independently alone (standalone) or combined with other controllers such as microcontrollers. ESP 8266 can act as a client to a WiFi router, so that when configuring a name setting is needed, access point and password. This chip can also be considered as an IoT platform that is distributed as an open source. It consists of hardware in the form of System On Chip ESP8266 manufactured by Espressif System [6]. In addition, the firmware used, uses scripting

programming language. The term NodeMCU literally universal which refers to the firmware used than the NodeMCU hardware development kit can interpreted as the board or the Arduino board ESP8266. Hence, due to its advantages, as well as the possible applications, it is very promising to use Arduino based devices to design early warning fire detection system for home monitoring. Figure 2 depicts the diagram of ESP 8266 hardware.

My Structure Query Language (MySQL) is one of Database Management Systems (DBMS) that is widely known among database programmers, database administrator and software developers. People are familiar also with other DBMS such as Oracle, MS SQL, and Postgre SQL. MySQL functions to process databases using SQL language. According to [12] MySQL is the most popular and the most widely used DBMS. On the other hand, Java is a widely known programming language, as well as a platform. As a programming language, Java is known as a high level programming language. Java is easy to learn, especially for programmers who are already familiar with C / C ++. Java is an object-oriented programming language which has been considered as the paradigm of future programming language. As a programming language, Java is designed to be reliable and secure. Java is also designed to be able to run on all platforms and various devices [13].

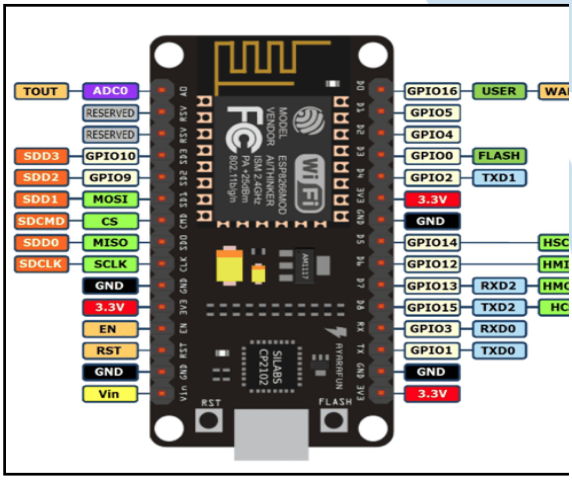


Fig. 2. Node MCU ESP 8266

Android is an operating system for Linux-based cellular phones. Android provides an open platform for developers to create their own applications to run on various types of mobile devices [14]. Meanwhile, by using the prototyping system development method, the analysis, design and implementation stages are repeated to produce a complete working system. After conducting analysis and initial design, system implementation is carried out and produces a prototype system. This prototype system will then be evaluated by users to obtain valuable feedbacks from them. These feedbacks will be taken into consideration and its analysis result will be used to provide a basis to form a prototype on the further steps. This iterative process continues until all parties including analysts, users, and sponsor agree with the prototype result [15].

Push notification is an event based mechanism for sending information to client mobile devices. Considered and adjusted use of push notifications can improve the user experience where these push notifications provide information to the user without the user's knowledge or effort. Push notifications can show alerts or generate sounds to notify users of the latest updates. In the research, the push notification process was carried out using a google service, namely Firebase Cloud Messaging [16].

Firebase Cloud Messaging (FCM) formerly called Google Cloud Messaging (GCM), is a free cloud service from Google that allows app developers to send notifications and messages to users across a variety of platforms, including Android, iOS and web applications. FCM allows software developers to send push notifications for their applications to end users through an application programming interface (API). Push notifications are popular on mobile devices because they conserve battery life, unlike pull notifications, which continually poll the developer's server for new information and can drain a device's battery life. With push notifications, the cloud service acts on behalf of the app and only connects to the mobile device when there are new notifications [17]. FCM Architectural Overview is shown in the image below (Fig 3).

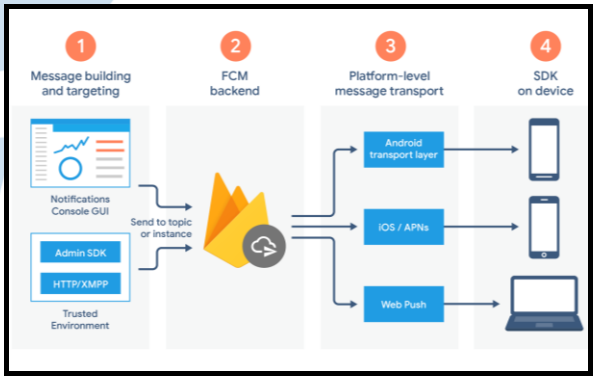


Fig. 3. FCM Architectural Overview (Source:https://firebase.google.com/docs/cloud-messaging/fcm-architecture)

Related Works. Several researchers have conducted some studies pertaining to fire detection and monitoring related topic. In the literature, we found at least six (6) papers associated with the aforementioned topic. These six academic papers will be briefly discussed here. First paper was written by Muhammad Dhedy Dwi Putra and Dwi Pramudita [18], in which the development of detection system API based on Internet of Things for home use was comprehensively discussed. Specifically, the objective of their research was to design an IoT-based fire detector to prevent house fires. They used prototyping method in designing their system. The developed system was expected to

overcome or prevent fires in residents' homes and provide information to homeowners who were using smart-phones, as well as fire alarms so that the residents or the people around the house would know that the house had caught fire, in so doing the residents could evacuate their belongings and could also help extinguish the fire in their homes. Their system was claimed to have a 90% success rate, based on black box testing method.

Second paper was written by Herwin Hutapea and Yano Roy Setiawan [19]. The purpose of their research was to design and build an integrated fire alarm system using Arduino, as the main controller. In addition, they also used supporting components such as smoke sensors and heat sensors which were installed in several places that functioned as fire detection. The exhaust fans would light up when the smoke sensor was active to remove smoke from the room. Their system was also equipped with a buzzer that functioned as a warning alarm when the sensor was active, an LCD display that functioned as monitoring system during normal conditions, and when the sensor was active, it displayed the address where the source of the fire occurred. In general, the goal of their research was to make it easier and faster to act on the location of the occurrence of fire detection so that the process of extinguishing and evacuating could be carried out as effective and efficient as possible.

Third paper was written by Haris Isyanto, Deni Alamnda, and Helmy Fahmiansyah [20]. In their study, a fire early detection system was specifically designed using IoT to provide phone notifications and share location to Smartphone in real-time via GPS. The design of their system used a fire sensor, smoke sensor and temperature sensor. In addition, the Ublok Neo 6M GPS module had a special function to send email to share the location of the fire using a GSM SIM 800L module. The Blynk app was utilized to monitor the sensors and send some notifications that appeared on the Smartphone. Based on the testing results, their system had a success rate of 90% for fire alarms, smoke sensors were 91%, temperature sensors were 100%, and call response times were 90%.

Fourth paper was written by Artansyah Rahmatan Putra, Triuli Novianti, and Tining Haryanti [21]. The main objective of their research was to develop an IoT prototype of fire detection system and light controlling. For more detailed explanations, the developed system combined fire and electrical short circuit monitoring systems and lighting control in the home with Smartphone controls that could remotely control and tell whether the lights on the Smartphone were on or off. The system was designed to detect an electrical short circuit and therefore automatically disconnect the power supply. To detect the presence of fire automatically using a fire/fire sensor, the system would be able to detect a fire, read the light intensity using infrared rays on the sensor, and if a fire was detected, a notification would appear on the Smartphone. Furthermore, their study used Arduino uno, esp8266 WiFi module and blynk app (as the controller). Moreover to control the lights, the Blynk app also used to remotely control whether the lights are on or off.

Fifth paper was written by Rizqi Sukma Kharisma and Ardi Setiyansah [22]. In this paper, they described the development of fire early warning system using fire sensors, a microcontroller, and also a SMS gateway. The fire early location framework was constructed utilizing smoke, heat, and gas sensors based on SMS system. This framework was utilized to provide data about fire discovery as soon as possible to secure against fire catastrophes. With their framework, the potential and hazard of fire could be diminished. Their framework was further utilized to recognize potential fires that happen in the housing area. Moreover, they did some experiments to test the system that included smoke testing, temperature testing, gas testing, and SMS message testing reactions from different telecommunication providers.

The sixth paper was written by Tatik Juwariay, Sugeng Prayitno, and Akalily Mardhiyya [23]. In the paper, they reported the design of early warning fire detection for preventing housing fires based on ESP8266 and Blynk apps. The purpose of their research was to design an Arduino-based fire early detection system, gas sensor, fire sensor, ESP8266 and a notification system based on the Blynk application on a Smartphone. Their designed system consisted of hardware circuit Arduino Mega2560 microcontroller, an MQ6 gas sensor, a fire sensor and an ESP8266 board as an embedded chip based on WiFi communication. The ESP8266 module was used as a client for the WiFi router. The function of this module was to send and receive information data between the microcontroller and the Smartphone. In the meantime, The Blynk library and the Blynk application support communication as a graphical user interface on Android Smartphone.

II. METHOD

The research method used in this research is described as follows. At first, the literature review study was conducted to determine the design of Arduino Uno technology for IoT implementation and to find supporting theories needed to provide proper ground for this research. A feasibility study was then carried out to find out whether this system is feasible to develop or not, including to review the benefits resulting from the application of the system to be designed and developed. Among various available methods, prototyping method was selected for designing and developing an early warning fire detection system for home monitoring.

III. RESULTS AND ANALYSIS

A. The Flowchart System

To provide an overview of how the system functions, the following figure depicts the flowchart of the developed system (Fig. 4).

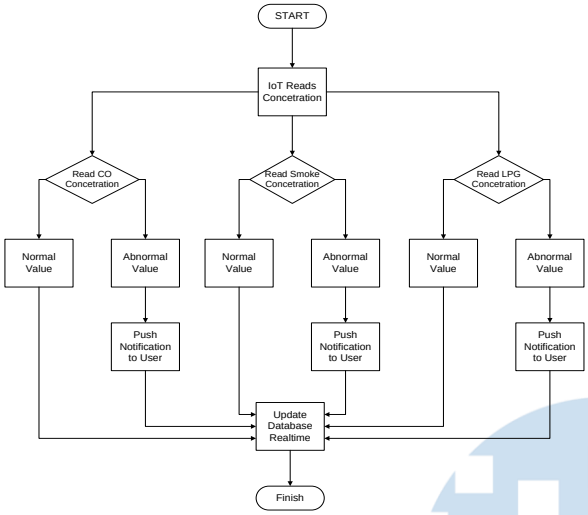


Fig. 4. The Flowchart System

From the flowchart it can be seen that IoT will always be in standby state to be able to read the concentration indicators for fire detection including smoke, LPG and CO gas. Each concentration indicator will be measured, whether it exceeds the normal limit or not. If it exceeds the limit, the system will notify the homeowner as a potential fire alarm. All data collected from parameter measurements will be stored in the existing database for further processing.

B. The System Design

The general mechanism of the fire detection system for home monitoring is illustrated in the Figure 5.

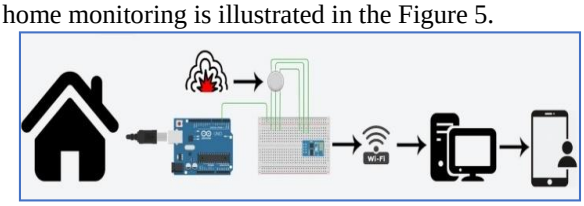


Fig. 5. The System Mechanism

The followings are the explanations on how the early warning fire detection system is designed. The design of this system can be seen consecutively in Figure 6 and 7.

- Early warning fire detection system for home monitoring in the form of a smoke detector sensor (MQ-2) assembled in Arduino is installed in a house.
- Smoke Detector will capture the value of the concentration of certain gases in the air. All concentration values captured are to be stored in a database, via an ESP 8266 device connected to WiFi network.
- When the gas concentration value is above the normal limit which has the potential for fire in the form of a gas leak, the system will provide warning information to the user.
- Information received by homeowners help them to immediately check the various potential fires that may occur.

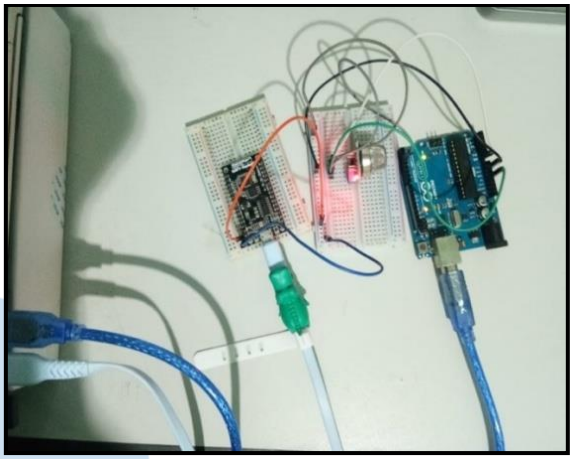


Fig. 6. The Design of Early Warning Fire Detection System (A)

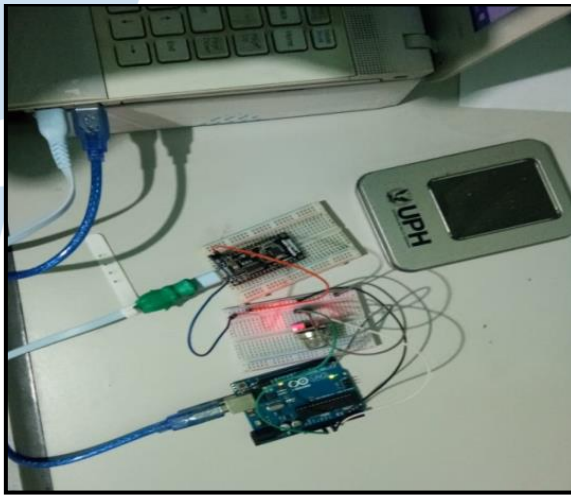


Fig. 7. The Design of Early Warning Fire Detection System (B)

C. System Implementation

The ESP8266 microcontroller-based early warning fire detection system for home monitoring uses Arduino IDE software, and the application for Android smart phones was written in JAVA and Android Studio IDE. The ESP8266 microcontroller was used in this research due to the following properties: its high durability with stable performance in industrial environments, its wide operating temperature range that supports WiFi, and its compactness in a small

package with a microprocessor 32-bit Tensilica, a standard digital peripheral interface, switch antenna, RF balun, power amplifier, low noise receiving amplifier, filter, and power management module [24]. Moreover, this microcontroller also has a power-saving architecture, which results in low power consumption. In particular, the gas-sensitive material used in the MQ2 gas sensor is stannic or tin oxide, formulated as SnO_2, a material with low electrical conductivity in clean air. The results of the implementation of this early warning fire detection system are summarized in Table 1.

TABLE I. The System Implementation Results

Duration (seconds)	Substance Type (ppm)		
	LPG	CO	Smokes
0-15	10	50	30
16-30	30	80	100
31-45	50	140	30
46-60	100	170	20

At the time of implementation, it was detected that during 46-60 seconds, the LPG value reading was 100 ppm, CO was 170 ppm and the smoke was 20 ppm. Based on the concentration of substances present, the fire detector sensor is able to detect the potential for a fire to occur at home. To prevent fire, the ESP 8266 device is connected to the WiFi network, and then the device will send a notification to the homeowner so that he/she can immediately check his/her house to avoid a fire disaster. The example warning notification to homeowner can be seen in Figure 8.

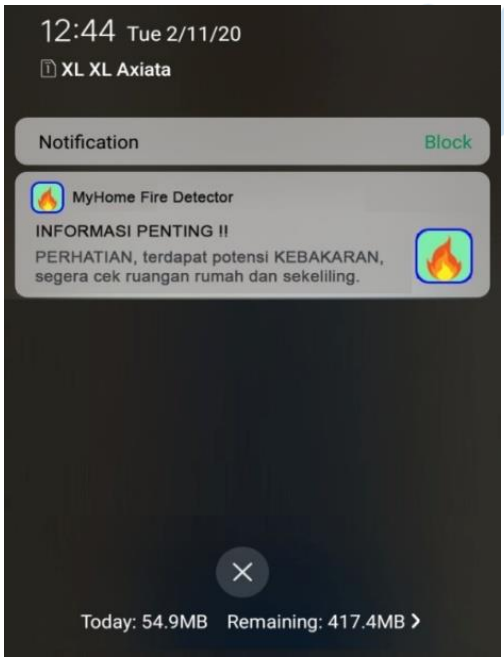


Fig. 8. The Warning Notifications to Homewoners

IV. Discussions

A. Testing Results

In this study, there are three (3) indicators used as a determinant of whether there is a potential fire in a home, i.e. the content of LPG, CO and smoke. The testing of the early warning fire detection system for home monitoring was performed in a designed environment with a known LPG gas leak. The leak was directed to the fire detector sensor at a distance of 30 cm. The tests were conducted in ten (30) attempts to determine the ability of the system to detect potential fires that occurred. A snapshot of the test results of fire detection system is shown in Figure 9. While the detailed version of the test results can be seen in the table attached in the appendix at the end of this paper.

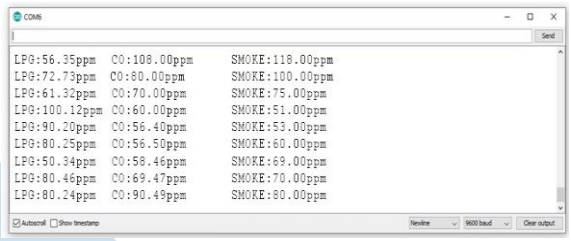


Fig. 9. The snippet of test results

After thirty (30) attempts, it was found that twenty five (25) attempts succeeded in detecting existing substances, and successfully sending information to homeowners. There was five failed trial due to interrupted Internet connection experienced by the NodeMCU ESP8266 which resulted in unsuccessful notification delivery.

B. Conclusions

The results of this study indicate that the Internet of Things (IoT) application in form of the early warning fire detection system based on the Arduino ESP8266 microcontroller is very beneficial for homeowners. For instance, whenever there is a possibility of a fire in their home, the homeowner will be notified as early as possible through the system. In doing so, our early warning fire detection system will make homeowners aware of fires which in turn can prevent the possibility of larger fire occuring. In addition, the test results show a detection success rate of 83%. However, as for future research, it is recommended to consider a more sensitive smoke detection sensor with a capability of detecting gas concentrations in a wider area. Besides, the quality of the Internet connection should be well guaranteed also in support of achieving a high level of success in delivering notifications to homeowners. As a final note, this fire detection system must be housed in a fireproof box for the sensor and IOT devices to function properly.

ACKNOWLEDGMENTS

We would like to thank LPPM Universitas Pelita Harapan, for supporting our research with the research grant no: P-015/FIK/V/2019.

REFERENCES

[1] Biro Pusat Statistik, "Jumlah Peristiwa Kebakaran Menurut Benda yang Terbakar dan Kota Administrasi di Provinsi DKI Jakarta," URL: https://jakarta.bps.go.id/indicator/27/627/1/jumlah-peristiwa-kebakaran-menurut-benda-yang-terbakar-dan-kota-administrasi-di-provinsi-dki-jakarta.html [Accessed: March 3, 2022]

[2] Jakarta.go.id, "Kejadian Kebakaran di DKI Jakarta Tahun 2020," URL: https://statistik.jakarta.go.id/kejadian-kebakaran-di-dki-jakarta-tahun-2020/ [Accessed: March 3, 2022]

[3] M.P.T. Sulistyanto, D.A. Nugraha, N. Sari, N. Karima, and W. Asrori, "Implementasi IoT (Internet of Things) dalam Pembelajaran di Universitas Kanjuruhan Malang," SMARTICS Journal, Vol. 1, No.1, pp. 20-23, 2015.

[4] R. Angeline, S. Adithya, and A. Narayanan, "Fire Alarm System Using IOT," International Journal of Innovative Technology and Exploring Engineering (IJTEE), Vol. 8, No. S3, pp. 110-112, 2019.

[5] F.P. Himawan, U. Sunarya, and D.A. Nurmantris, "Perancangan Alat Pendeteksi Asap Berbasis Mikrokontroller Modul GSM, Sensor Asap, dan Sensor Suhu," E-proceeding of Application System, Vol 3, pp. 1963, 2017.

[6] R. Permana, M. Rumani, and U. Sunarya, "Perancangan Sistem Keamanan dan Kontrol Smart Home Berbasis Internet of Things," E-proceeding of Engineering, Vol. 4, pp. 4015-4022, 2017.

[7] Tarmizi , Sri Mulyati Latifah, "Analisa Kegagalan Tabung Gas Lpg Kapasitas 3 Kg" Jurnal Riset Industri Vol. VI No. 1,, pp. 61-74, 2012.

[8] Kepala Badan Pengendalian Dampak Lingkungan Nomor : KEP-107/KABAPEDAL/11/1997. URL: http://luk.tsipil.ugm.ac.id/atur/sda/KEP-107-KABAPEDAL-11-1997ISPU.pdf [Accessed: March 5,2022]

[9] Air Quality Index (AQI) Basics. URL: https://www.airnow.gov/aqi/aqi-basics/ [Accessed: March 5,2022]

[10] L. Louis, "Working Principle of Arduino and Using It as a Tool for Study and Research," International Journal of Control, Automation, Communication and Systems (IJCACS), Vol. 1, No.2, pp. 21-29, 2016.

[11] Z.A. Jabbar and R.S. Kawitkar, "Implementation of Smart Home Control by Using Low Cost Arduino and Android Design," International Journal of Advanced Research in Computer and Communication Engineering, Vol. 5, No. 2, pp. 248-256, 2016.

[12] R. York, "Beginning JavaScript and CSS Development with jQuery," New York: Wiley Publishing Inc., 2011

[13] A.S Rosa and M. Shalahuddin, "Rekayasa Perangkat Lunak: Terstruktur dan Berorientasi Objek," Bandung: Informatika, 2014.

[14] N.H. Safaat, "Pemrograman Aplikasi Mobile Smartphone dan Tablet PC Berbasis Android," Bandung: Informatika, 2012

[15] A. Dennis, B.H Wixom, and D. Tegarden, "Systems Analysis and Design with UML," 4th Ed., New York: Wiley, 2012.

[16] Monica Wangsaputra, Kusno Prasetya, Hery, Andree E. Widjaja, "Pengembangan Aplikasi Dengan Fitur Push Notification Untuk Mendukung Pendistribusian Informasi Di Fakultas." Seminar Nasional Sistem Informasi Indonesia, 1 Nopember 2016.

[17] D, Lee., "Designing the Multimedia Push Framework for Mobile Applications," International Journal of Advanced Science and Technology, Vol. 32, pp.117-124. 2011.

[18] M.D.D. Putra and R. Pramudita, "Sistem Deteksi API Berbasis Internet of Things pada Rumah," Media Jurnal Informatika, Vol. 13, No. 2, pp. 64-69, 2021.

[19] H. Hutapea and Y.R. Setiawan, "Rancang Bangun Sistem Alarm Kebakaran Terintegrasi Berbasis Arduino," Jurnal Kajian Teknik Elektro (JKTE), Vol. 6, No. 1, pp. 37-59, 2021.

[20] H. Isyanto, D. Almanda, and H. Famiansyah, "Perancangan IoT Deteksi Dini Kebakaran dengan Notifikasi Panggilan Telepon dan Share Location," Jurnal Ilmiah Teknik Elektro (JETRI), Vol. 18, No. 1, pp. 105-120, 2020.

[21] A. R. Putra, T. Novianti, and T. Haryanti, "Prototipe Sistem Pendeteksi Kebakaran dan Kontroling Lampu Berbasis Internet of Things," Jurnal Ilmiah Computing Insight, Vol. 2, No. 2, pp. 60-68, 2020.

[22] R. S. Kharisma and A. Setiyansah, "Fire Early Warning System Using Fire Sensors, Microcontroller, and SMS Gateway," Journal of Robotics and Control (JRC), Vol. 2, No. 3, pp. 165-169, 2021.

[23] T. Juwariyah, S. Prayitno, and A. Mardhiyya, "Perancangan Sistem Deteksi Dini Pencegah Kebakaran Rumah Berbasis ESP8266 dan Blynk," Jurnal Transistor Elektro dan Informatika (TRANSISTOR EI), Vol. 3, No. 2, pp. 120-126, 2018.

[24] Espressif Systems LTD, "ESP8266," URL: https://www.espressif.com/en/products/socs/esp8266 [Accessed: March 4, 2022]

ISSN 2355-0082

Bibliographic Computer Science Indexing Review with Disease Covid 19

[1]Andrianingsih Andrianingsih, [2]Tri Wahyu Widyaningsih, [3]Meta Amalya Dewi
[1]Department of Information System, Universitas Nasional,Indonesia
[2]Department of Informatics Engineering, Tanri Abeng University, Indonesia
[3]Information Systems, BINUS Online Learning, Bina Nusantara University, Indonesia
[1] andrianingsih@civitas.unas.ac.id,
[2]tri.widyaningsih@tau.ac.id,
[3]meta.dewi@binus.edu

Accepted 12 March 2022
Approved 08 June 2022

Abstract - Researchers in conducting their research use the search using the homepage of the publication, according to expertise, collaboration in research, and research interests. And at this time the Covid 19 pandemic, became a trending topic for researchers, in various scientific fields. This study classifies based on publications located on the homepage source namely Scopus and Google Scholar, by analyzing the following topics, namely Natural Language Processing, Text Mining, Remote Sensing, and Sentiment Analysis using Name Entity Recognition to detect and classify named entities in text and using occurrence and link strength methods. The results showed science index literature about diseases Covid 19, obtained that Scopus has the most equitable percentage, has a good occurrence and link strength among the five scientific fields, namely Natural Language Processing 23.81%.33%, Text Mining 19.05%%, Remote Sensing 0 %, Sentiment Analysis 57.14 % then Google Scholar Natural Language Processing 51.35%, Text Mining 0 %, Remote Sensing 48.65 %, Sentiment Analysis 0 %

Index Terms: Information Extraction; Bibliographic indexing; Disease Covid 19

I. I. INTRODUCTION

Coronavirus disease (COVID 19) was first discovered in Wuhan China at the end of 2019 [1]. This type of virus is highly contagious and spread rapidly in various parts of China but also in Japan, Thailand, and South Korea in less than 1 month through respiratory droplets and close contact [2]. This is a significant threat to the global health of millions of lives worldwide [3] causing acute respiratory system disorders so it was officially declared by the World Health Organization (WHO) as a global pandemic on March 11, 2020 [4]. Of course, this pandemic has caught the world's attention because of its uncontrolled spread causing a spike in cases to increase [5]. It was reported that as of April 30, 2020, there were 3.2 million confirmed cases with a total of 227,847 deaths in 185 countries [6]. Because the spread of this virus is very high and uncontrolled, a large number of studies have been carried out and have been published [7] for free to speed up research and assist the government in responding to the crisis [8]. Therefore, it is important to evaluate the literature with quantitative and qualitative values to obtain literature patterns. and identify gaps and use the results.

Unstructured data in the form of entities, relations, objects, events, and many other types are a process extracted from Information Extraction, to improve the data analysis in the form of entities, objects, relations, and the perspective of streaming data is very different from static data. Static data does not have any connection between the dynamic time of initial processing and subsequent processing. Publication from researcher's academic contains rich information, which enables many applications such as academic search bibliographic and citation analysis.

This research was conducted with bibliometric analysis of scientific publications that become useful tools to know the process of generation and development of knowledge, as well as to evaluate the quality of the field of science and the impact it brings in the academic area [9]. Besides, bibliometric analysis can be used to find out the mapping of research from the research that is being done, already done as well as future opportunities [10].

The purpose of this research is to find out the mapping of research into several scopes of technology by discussing several parameters of topics concerning Natural Language Processing, Text Mining, Remote Sensing, and Sentiment Analysis published during the pandemic. The research mapping process is carried out by the stages of the object selection process, calculating the objects interacting, and the normalization process, creating maps and displaying maps, and evaluating the map [11]. Vosviewer is used to display bibliometric map visualizations downloaded from the page: www.vosviewer.com. Bibliometric map views are visualized with Vosviewer based on author or journal name with co-citation data, or based on keywords with co-occurrence data with label map display, sketch and density, and clusters [12] Clusters in maps from Vosviewer are presented with color differences. Each parameter is operated by a clustering algorithm that can be changed so that more or fewer clusters are generated [13].

II. RESEARCH METHOD

A. Data Sources and Methods

Bibliometrics is the utilization of factual strategies to dissect books, articles, and other distributions. Bibliometric strategies are habitually utilized within the field of library and data science. The sub-field of bibliometrics which concerns itself with the investigation of logical distributions is called scientometrics. Scientometrics may be a sub-field of informetric. Major investigation issues incorporate the estimation of the effect of investigation papers and scholar diaries, the understanding of logical citations, and the utilization of such suggestions for something idea in approach and administration settings.

This bibliometric data collection is done from Scopus and Google Scholar, and total data analyzed as many as a total of 2991 papers indexed with the keyword "Coronavirus with …[topic]" or "Covid 19 with…[topic]". Given the similarity of virus types before, restrictions are made on data retrieval while pandemic with the search categories used is topics, titles, and abstracts. Analysis of research trends using Vosviewer software with weighting method used is occurrence to see a lot of research on the topic and link strength to show the connectedness between research topics. Both methods analyze data based on abstraction and author.

The use of named entity recognition in the publisher homepage has problems and complexities that are generally the same as those in English, especially if using a machine learning approach. Fundamental differences exist when rule-based methods are used for completion or using hybrid model approaches between rule-based and machine learning. This approach will use unsupervised learning so that it does not require labeled data for the learning process.

The stages of the process of the proposed method are as follows:

Data preparation for sequential pattern mining: In this step are prepared sentences that have named entities in it to be able to be degenerate paternal at each appearance of the entity. To avoid the amount of pattern produced, the pattern extraction process is limited to 5 words before and after the appearance of the entity.

Sequential Pattern Mining: In this step, an algorithm will be applied to the existing learning data to produce the desired pattern.

Pattern Marching and Candidate Extract: Datasets for testing are prepared for custom testing with the resulting pattern. The results will be sorted according to the level of confidence and support.

Candidate Pruning: This process is carried out to improve the accuracy of the named entity produced.

B. Citation Mapping Result

Mapping is a process that allows one to identify knowledge elements and their configurations, dynamics, interdependencies, and interactions. Knowledge mapping is used for technology management purposes, which include the definition of research programs, decisions regarding technology activities, the design of knowledge base structures, and the creation of education and training programs. A Quotation Outline such as the citation mapping could be a graphical representation that appears the quotation connections (cited references and citing articles) between a paper and other papers utilizing different visualization apparatuses and procedures. The citation mapping instrument from Web of Information tracks an article's cited and cited by references through two eras. So citation mapping is a graphical representation that shows the citation relationships (cited references and citing articles) between a paper and other papers using various visualization tools and techniques. The citation mapping tool from Web of Knowledge tracks an article's cited and cited by references through two generations.

1. Search Web of Science Core Collection and select a record
2. Click on the link **View Citation Map** link
3. Choose Forward, Backward, or Forward and Backward, plus 1 or 2 generations
4. Click **Create Map** button.

In a paper conveyed earlier this year, Malcolm Tight examines the theoretical considerations around commonalities inside the approaches of communities of sharpening and Becher's insightful tribes and districts. He conducts a co-citation examination of Higher Instruction ask approximately journals; centering on maker characters and ranges, subjects, theories and examinations, methodologies and procedures, appearing as a basic diagrammatical representation of his descriptive demonstrating. Comparable thoughts of 'citation mapping' have been investigated someplace else, particularly inside the typical sciences, and a shape has as of late been displayed in the citation and journal database ISI Web of Science. And Instinctively Originator W. Bradford Paley's visualization of 800,000 coherent papers livelihoods maker citations to explore the intercontinental between science perfect models.

Related to bibliometrics, science mapping is a method of visualizing a field of science. This visualization is done by creating a landscape map that can display topics from science [14]. Information visualization is a vital portion of information science, and it is utilization d in two fundamental parts of the information science cycle: at the starting of the introduction of information investigation and within the conclusion amid the result introduction. Indeed, even though the visualization procedures are the same, these two stages have diverse objectives. Information investigation begins from numbness and tries to get the information, to find covered-up realities, designs, or exceptions. Result introduction begins with information and tries to communicate the message in the clearest and most viable way conceivable. Hence, indeed although they share the same procedures, the objective and the beginning point are diverse.

In the downloaded text records from Scopus and Google Scholar, we performed the metadata analysis for data extraction. This included extraction of title, author, year, and computer science of topic.

The morphological analysis allowed tagging of data potential use. Various issues with Covid 19 disease were encountered while tagging the data, which are described as follows:

Author field: Computer science part with Covid 19 topic names are usually made up of two or three parts. It is not always clear which indicator criteria for disease Covid 19. A definition was created in Covid 19 disease names, but the punctuation mark (,) was not given: review, role, outbreak, diagnosis, approach, detection, chest x-ray, and pneumonia

Types of documents in the database, we found the following types of documents Computer Science with Covid 19 disease:

- Scopus
- Google Scholar

For each type of document, we identified the mandatory fields, and other field values occurring in the database. The information extraction algorithm and the retrieval logic were based on these field values. A Sample of mandatory fields for each document is tabulated in Table 1.

Table 1. List of documents with total record paper

No.	Bibliographic Indexing	Quantity	Year	Title	Keyword	Abstract	Topic
1	Scopus	738	2020	√	√	√	√
2	Google Scholar	4000	2020	√	√	√	√

Based on the data table above obtained a total of 4738 articles, where Scopus obtained 738 (15.57%) and Google Scholar 4000 (84.42%) the three are accessed through API Publish or Perish with the resulting type in the form of conference and article as shown in the image below:

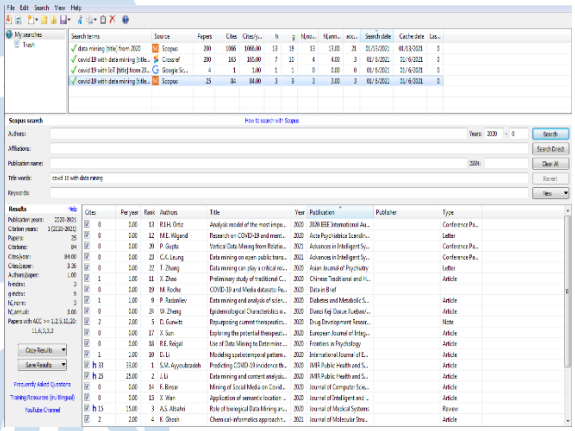


Fig. 1. Access Scopus and Google Scholar data through the Publish or Perish API

The results of the article data in table 1 above are then imported one by one into Vosviewer with txt format and compiled, inserted the title of the five fields of science filtered with topics related to Covid 19 and then carried out weighting using occurrence and total link strength which is then presented in the table below:

Table 2. Article 5 computer topic areas on google scholar

Keyword	Paper	Link	Total Link
NPL for Covid 19	1000	976	976
Text Mining for Covid 19	1000	432	4737
Remote Sensing	1000	2228	6180
Sentiment Analysis	1000	1284	4603

II. ARTICLE'S MAPPING

A. Google Scholar

1.1 NLP for Covid 19

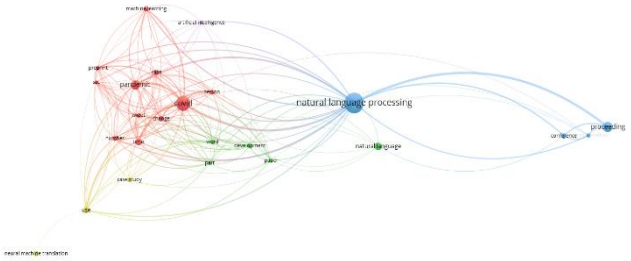


Fig. 2. Map visualization link topics NLP for covid 19

Vosviewer analysis showed the connectedness of the NLP field resulting in 4 clusters based on color differences in figure 2 that were related to natural language, artificial intelligence, and machine learning. In this mapping, it can be concluded that there is no research link between NLP with Text Mining, Remote Sensing, and Sentiment Analysis.

1.2 Text Mining for Covid 19

The field of Text Mining has different research links to the NLP field with 3 clusters in red, green, and blue that are closely related topics around text, system, and classification. So it can be concluded that there are still text mining research opportunities with drug, risk, and country, as well as with 3 other fields, which are visualized in figure 4 below:

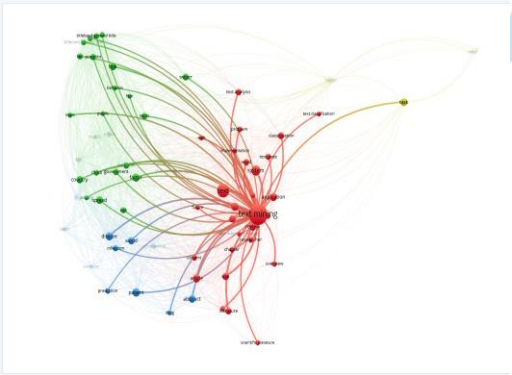


Fig. 3. Text mining for covid 19 field topic link visualization map

1.3 Remote Sensing for Covid 19

Fig. 4. Remote sensing for covid 19 field topic link visualization map

Vosviewer produces a research mapping analysis into 5 clusters with red, blue, green, and yellow and displays a strong correlation with information in purple, including topics of accuracy, change, factor, an erratum.

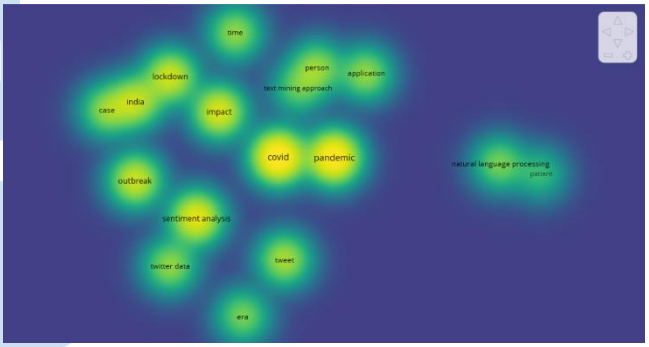


Fig. 5. Sentiment Analysis for Covid 19 field visualization map

In the field of sentiment analysis, the map displays very strong relationships including topics of neural networks, sentiment classification, models, papers, text, and algorithms.

B. Scopus

The second analysis was carried out on article data on Scopus with the following data:

Table 3. List of Articles on Scopus

No.	Field of Computer Science	Number of Papers
1	Natural Language Processing	138
2	Text Mining	200
3	Remote Sensing	200
4	Sentiment Analysis	200

The visualization in the table above can be seen in Figure 6 which is a network visualization and Figure 7 shows the density visualization.

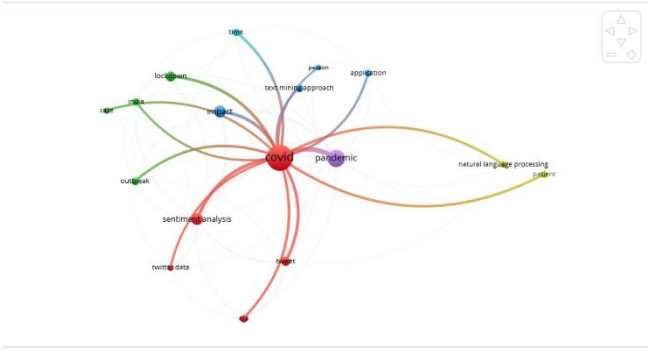


Fig. 6. Network Visualization on Scopus Articles

In the picture above the topic of covid has a strong network with pandemics and there is a network with Twitter data, sentiment analysis, outbreak, and impact, and there is a correlation with the text mining approach and with natural language processing.

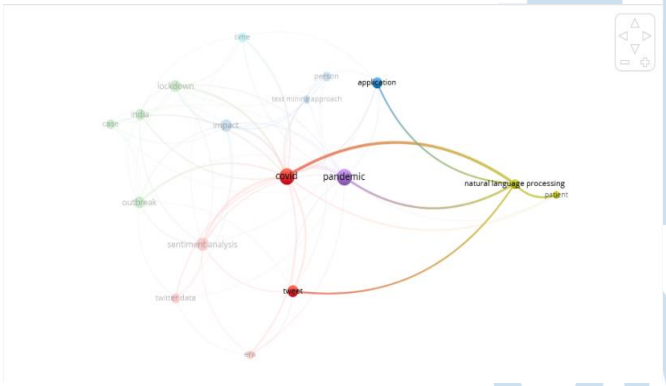


Fig. 7. Density Visualization of Scopus Articles

Figure 7 above shows a density map which is the result of an analysis using all articles on the development of covid 19 research for the fields of Natural Language Processing, Text Mining, Remote Sensing, and Sentiment Analysis on Scopus, both related and unrelated. And it turns out that the visualization results show that there are still few with the information that the red is the closer it is, and the green is the less often it is done.

2.1 NLP search for covid 19 on Scopus is accessed via API Publish or Perish can be seen in the image below

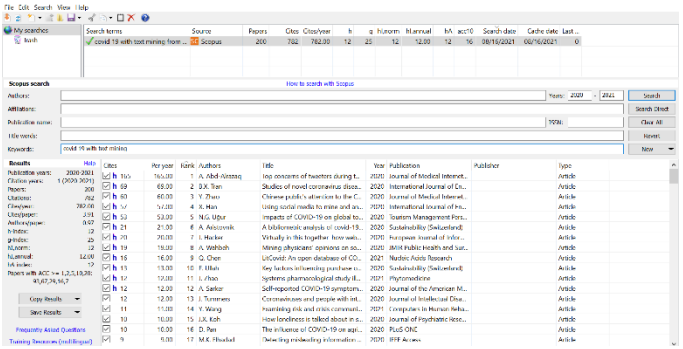


Fig. 8. Access NLP on Scopus through the Publish or Perish API

Fig. 9. Research visualization map on Scopus

On the topic of the NLP field, it has several links to 5 other studies, including covid, tweets, and the NLP application itself. It can be concluded that there are still many research opportunities in the NLP field, especially related to the COVID 19 pandemic.

2.2 Text Mining

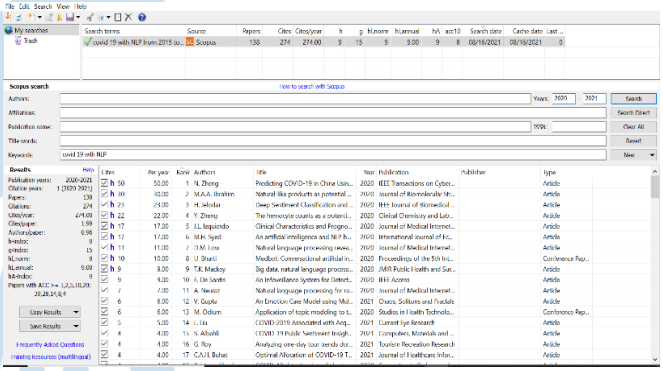


Fig. 10. Access Text mining on Scopus through the Publish or Perish API

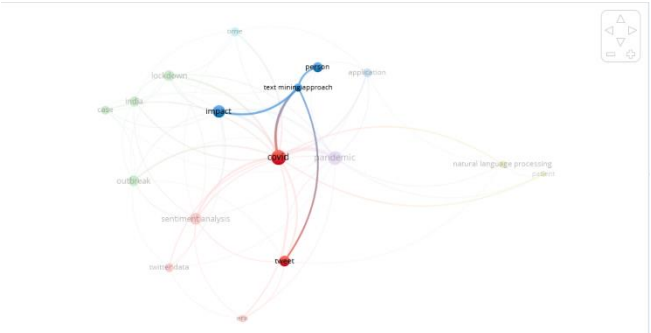


Fig.11. Map visualization link topic text mining field on Scopus

Figure 9 above shows that Text Mining research has the strongest link with the topic of covid dan tweet. There are only 2 clusters, namely the red cluster with the topic of covid and tweets and the blue cluster with the topic of impact and person. This topic still has enormous research opportunities, especially related to covid 19.

2.3 Sentiment Analysis

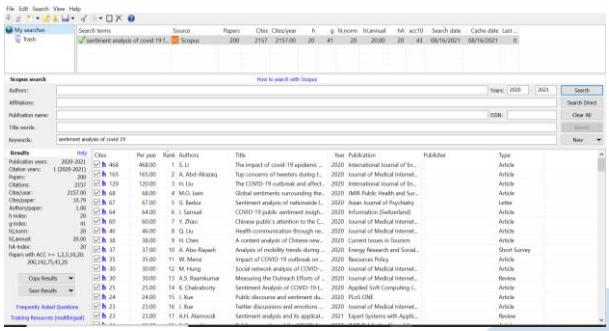


Fig. 12. Access sentiment analysis on Scopus through the Publish or Perish API

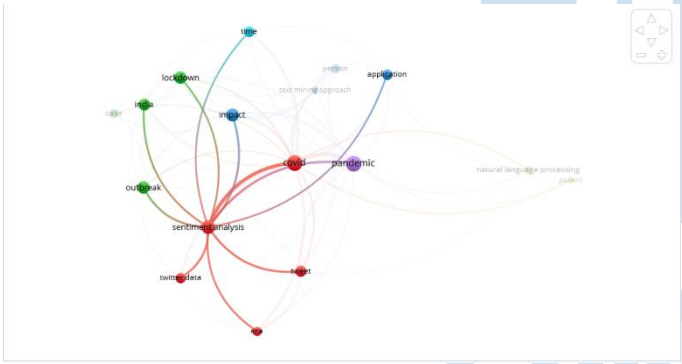


Fig. 13. Map visualization link topic sentiment analysis field on Scopus

This topic has links to other research, with the strongest link strength on Twitter data, tweets, covid, and its applications. There are 4 clusters, namely the red cluster with the topic of covid, tweet, Twitter data, and era, the green cluster with the topic of the outbreak, India, lockdown, the blue cluster with the topic of impact and application, and there is 1 pandemic topic in the purple cluster.

Table 2. Analysis of Scholar and Scopus

Computer Science Topic	Google Scholar		Scopus	
	Number of topic links	%	Number of topic links	%
Natural Language Processing	19	51,35%	5	23.81%
Text Mining	0	0%	4	19,05%
Remote Sensing	18	48,65%	0	0%
Sentiment Analysis	0	0%	12	57,14%
Total Link	37	100%	21	100%

IV. CONCLUSION

The analysis was carried out on Scopus and Google Scholar data sources for several scientific fields with the topics of Natural Language Processing, Text Mining, Remote Sensing, and Sentiment Analysis. The keywords used are about covid 19 which is related to the four scientific fields. By using Occurrence and Length Strength, it is concluded that at Google Scholar the most research related to Covid 19 is on the topic of Natural Language Processing and Remote Sensing, so there are still many research opportunities for the topic of Text Mining and Sentiment Analysis. Meanwhile, in Scopus, the most research related to Covid 19 is the topic of Sentiment Analysis, Natural Language Processing, and Text Mining, so there are still research opportunities on the topic of Remote Sensing.

REFERENCES

[1] Wu T, Ge X, Yu G, Hu E. Open-source analytics tools for studying the COVID 19 coronavirus outbreak. medRxiv 2002:A. [doi: 10.1101/2020.02.25.20027433]

[2] Ren L-L, Wang Y-M, Wu Z-Q, Xiang Z-C, Guo L, Xu T, et al. Identification of a novel coronavirus causing severe pneumonia in human: a descriptive study. Chin Med J. 2020; published online February 11. DOI: 10.1097/CM9.0000000000000722.

[3] Zhou Y, Chen L. Twenty-Year Span of Global Coronavirus Research Trends: A Bibliometric Analysis. Int J Environ Res Public Health. 2020;17(9):3082.

[4] Hayat Ouassou, Loubna Kharchoufa, dkk The Pathogenesis of Coronavirus Disease 2019 (COVID 19): Evaluation and Prevention July 2020 Journal of Immunology Research Vol 2020 (New Insights into Immune-based Diagnosis,

Therapy, and Prophylaxis for Infectious Diseases 2020):7 DOI: 10.1155/2020/1357983

[5] Cucinotta, D.; Vanelli, M. WHO Declares COVID 19 a Pandemic. *Acta Biomed.* **2020**, *91*, 157–160. [CrossRef] [PubMed]

[6] John Hopkins University and Medicine. Covid 19 Dashboard by the Center for Systems Science and Engineering at John Hopkins University. Available online: https://coronavirus.jhu.edu/map.html (accessed on 26 April 2020).

[7] Bhattacharya S, Singh S. Visible Insights of the Invisible Pandemic: A Scientometric, Altmetric and Topic Trend Analysis. arXiv preprint arXiv:200410878. 2020.

[8] Commission on a Global Health Risk Framework for the Future. *The Neglected Dimension of Global Security: A Framework to Counter Infectious Disease Crises*; National Academies Press: Washington, DC, USA, 2016.

[9] Capobianco-uriarte M, Casado-belmonte P, Mar G, Ter E. 2019. A Bibliometric Analysis of International. DOI: 10.3390/su11071877

[10] Indah Hartati, dkk, Analisa Bibliometrik Publikasi Ilmiah Bertema Biorefineri Biomassa Berlignoselulosa, Inovasi Teknik Kimia. Vol. 5, No.1, April 2020, Hal 42-49, ISSN 2527-614X, e-ISSN 2541-5891

[11] N. J. V. Eck, Methodological Advances in Bibliometric Mapping of Science, Utrecht: Erasmus University Rotterdam, 2011.

[12] Van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2), 523–538.http://doi.org/10.1007/s11192-009-0146-3

[13] Leydesdorff, L., & Rafols, I. 2012. Interactive Overlays: A New Method for Generating Global tbh Maps from Web-of-Science Data. Journal of Informetrics, 6, 318– 332

[14] Royani, Y., Bachtar, M., Tambunan, K., Tupan, Sugiharto. 2013. Pemetaan Karya Tulis Ilmiah LPNK: Studi Kasus LIPI dan BPPT (2004-2008). Journal Dokumentasi dan Informasi, 34 (1) Juni

[15] [15] N.J.V. Eck, Waltman Ludo. 2020. Vosviewer Manual version 1.6.16, Universiteit Leiden, CWTS Meaningful metrics,

ISSN 2355-0082

Implementation of OCR and Face Recognition on Mobile Based Voting System Application in Indonesia

Inggrid Fortuna[1], Yaman Khaeruzzaman[2]
[1,2]Department of Informatics, Universitas Multimedia Nusantara, Tangerang, Indonesia
[1]inggrid.fortuna@student.umn.ac.id
[2]yaman.khaeruzzaman@umn.ac.id

Accepted 10 June 2022
Approved 5 July 2022

***Abstract*—Elections are a form of democratic practice in Indonesia. Every 5 years an election will be held to elect a president. People who have been able to take part in the election will come to the polling station (TPS) to channel their voting rights. However, this conventional method proved ineffective because some people who were unable to attend due to certain situations, for example; traveling out of town, did not want to queue, and experienced illness or physical disability. Therefore, this study aims to design and implement an online voting system based on Android as an alternative to conventional elections and digital transformation in the voting method in Indonesia. The system will use Optical Character Recognition technology by firebase ml-kit to read Identification Number on the Identity Card and face recognition technology to compare the faces of voters during registration and during online elections. The Face Recognition system is implemented using Multi-task Convolutional Neural Network to detect faces and using Tensorflowlite to translate the facial model provided by the FaceNet model. The Result of Research shows the success of the OCR system is 96.67% and the accuracy of face recognition is 100%. The accuracy of OCR ml-kit and face detection using Multi-task Convolutional Neural Network and Face Recognition using tensorflowlite and FaceNet models proved to be 100% successful.**

Index Terms— *Android**; face recognition; faceNet; mobile app; optical character recognition;* **tensorflowlite**

I. INTRODUCTION

General elections in Indonesia still use conventional elections where people have to come directly to the polling station (TPS) to vote by bringing their ID card. Based on the results of the interviews, several interviewees also stated that they could not vote because they were unable to attend the TPS.

The problem faced according to the interview was that there were several conditions that did not allow the interviewees to go to the TPS, so they could not vote. The reasons based on the interviews are traveling out of town, not wanting to queue, and experiencing illness or physical disability. This causes some people not to participate in the people's party which is held every 5 years.

This causes an increase in the number of abstentions in Indonesia. The abstention rate reached 23.30% in the 2004 presidential election, 27.45% in 2009, 30.42% in 2014, and 19.24% in 2019 [1] as shown on Fig. 1.

No.	Pemilu	OPP	Tingkat Partisipasi Politik (%)	Golput (%)
1.	1955	118	91,4	8,6
2.	1971	10	96,6	3,4
3.	1977	3	96,5	3,5
4.	1982	3	96,5	3,5
5.	1987	3	96,4	3,6
6.	1992	3	95,1	4,9
7.	1997	3	93,6	6,4
8.	1999	48	92,6	7,3
9.	Pileg 2004	24	84,1	15,9
10	Pilpres I	24	78,2	21,8
11	Pilpres II	24	76,6	23,4

Fig. 1. Source : PPs UNIS Tangerang 2001, Kompas diolah

Thus, this problem needs to be solved with a solution to create a system that could facilitate people to choose from home without having to go to a polling station. This system can allow people to choose as long as they are connected to the internet. People who could not go to TPS can be visited by the General Elections Commission (KPU) who will bring this mobile application so that people can still take part in elections even though they are unable to attend on TPS. This is certainly more practical than bringing the ballot box and ballot papers to the voters' residence.

Although the conventional selection is still relevant to use, there are several disadvantages in this method, such as higher - cost, time and security inefficiencies. Conventional elections require the cost of printing ballots and other costs. In addition, there is a long process from voting to counting ballots and it takes quite a lot of time. For security, there is still a percentage of human error or fraud occurring during vote counting. One alternative way to solve this problem is through online voting.

II. Related Work

The difference between previous research and current research, can be seen in table 1.

TABLE I. Latest Research vs Recent Research

Latest Research		Recent Research
Oka N.H, et all, 2018	Using Student ID Card to login with Optical Character Recognition (OCR) without face recognition	The app could extract data from ID Card using OCR
Siti S. A, et all, 2020	ID Card was used as registration using OCR with Template Matching Correlation without face recognition	Using OCR and regular expression to extract ID Number and using face recognition
Noha E. E, et all, 2013	Face detection using Gabor Filter with accuracy of 93,5 % for the Voting app	E-Voting app using Multi-task Cascaded Neural Network to detect faces with accuracy of 100%
Ahmadi I. Lubis, 2018	The system could detect faces with the accuracy 88% using Kairos Face Recognition Libraries	The system could recognize faces with the accuracy of 100% with tensorflowlite and FaceNet

In analyzing and designing this mobile-based application, it is necessary to study the literature that supports the research. The theoretical basis and sources of this literature study are in accordance with the topic of discussion.

A. *E-Voting*

E-voting is a voting and counting votes in general elections using electronic devices [2]. There are some conditions that has to be fulfilled by e-voting [3]:

- People who can participate in elections are people who are legally entitled to vote.
- Selection can only be made once for each person.
- Other people's choices must not be known by other parties.
- Voters may not be duplicated.
- Other people's choices may not be changed without that person's knowledge.
- Each person can ensure that his/her voice has been entered into the vote tabulation.
- Each person can find out who has voted and who did not vote.

B. *ML kit Firebase*

According to Google Firebase, ML Kit is a Mobile SDK that brings Google's machine learning expertise to Android and iOS apps in a powerful and easy-to-use package. ML Kit provides a handy API that can help users use custom TensorFlow Lite models in mobile apps.

Fig. 2 shows several features of the ML Kit that can be used to recognize text, detect faces, identify famous buildings, scan barcodes, label images and identify text language. On device or in the cloud, the various APIs for ML Kit can run and process data quickly and work even when there is no network connection.

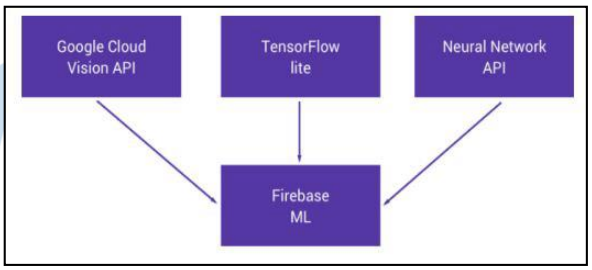


Fig. 2. Diagram MLKit [4]

C. *Face Detection and Recognition*

Face Recognition is a human face recognition system that can be used in the field of security system such as room entry access, location monitoring surveillance, and individual identity searches in police databases. In addition, face recognition is also used in identifying criminals, developing security systems, processing images and films, and human computer interaction. Face Recognition is also a Computer Vision activity to identify and verify a person based on their photo. Face recognition consists of 4 stages; detection, alignment, feature extraction and matching as shown in Fig. 3.

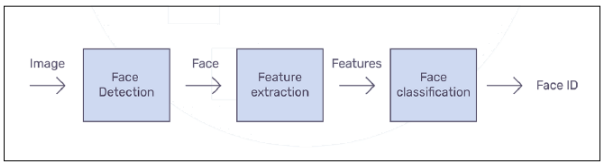


Fig. 3. Face Recognition Pipeline [5]

D. Tensorflow

Based on the tensorflow.org [6], Tensorflow is a computational framework for modeling machine learning that provides various toolkits that allow modeling at the level of abstraction the user wants. In addition, Tensorflow also helped create a neural network which is an artificial network similar to the human brain on a large scale [7]. Tensorflow has two components:

1. Protocol Buffer(.pb) which contains graphics and models to run the tested model.
2. The runtime that runs the graph.

E. Multi-task Cascaded

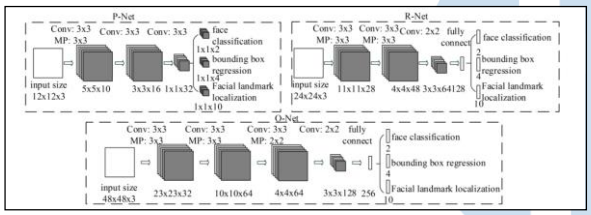


Fig. 4. MTCNN Architecture [8]

Multi-task Cascaded Convolutional Neural Network(MTCNN) is one of the Deep Convolutional Neural Network methods used to recognize or detect faces. There are 3 separate networks on MTCNN as shown in Fig. 4:

1. Proposal Network (P-Net)

   In this network, each image will be searched by the 12x12 kernel to search for faces horizontally to the bottom corner of the image.

2. Refine Network (R-Net)

   Similar to P-Net, on the R-Net network, the image will be searched for faces horizontally. However, on this network, faces will be detected using a 24x24 kernel

3. Output (O-Net)

   On this network, the image will be searched by the 48x48 kernel to detect faces.

F. FaceNet

FaceNet is a face recognition system developed by Google researchers with high accuracy results. In its implementation, Deep Convolutional Neural Network will extract facial features into vectors. This vector is also called Vector Embedding which is generated. The vector can map the similarity of faces. FaceNet uses the Deep CNN model in the form of ZF-et or Inception [9].

FaceNet will be implemented in the mobile device-based E-Voting application at the feature learning stage. The vectors are generated by FaceNet consists of 128 elements or Face embedding classified using the Linear Support Vector Machine (SVM) which will classify the facial identity of vector embedding.

Face Embedding is a vector representing the extracted features of the face. Next, these features will be compared with the vectors generated for other faces. Vectors that are close to zero may be the same person, while other vectors that are far away may be different people. The classification model developed will take the input face embedding and predict the identity of the face. The FaceNet model will generate an embedding for a specific face image and be used as part of the classification itself. In addition, FaceNet models pre-process faces to create embedding faces that can be stored and used as input for the classification model.

G. Eucledean Distance

The Euclidean Distance method is one of the techniques used to determine the degree of similarity or dissimilarity using the distance method between two vectors. The following is the Euclidean formula, which is the root of the square of the difference between 2 vectors.

$$d(p,q) = \sqrt{\sum_{i=1}^{n}(q_i - p_i)^2} \qquad (1)$$

d = Euclidean distance
p, q = two dots in n-space Euclidean
qi, pi= Euclidean vector, starting point of vector
n = n-space

The Euclidean distance is always greater than or equal to zero. If the measurement result is zero, then the two vectors are identical. However, if the measurement result is high, the two vectors are not identical [10].

H. Optical Character Recognition

Optical Character Recognition (OCR) is the recognition of alphanumeric characters from handwritten characters or files or images into editable text. OCR, according to Yadav (2013) is a process to convert scanned printed or handwritten documents into ASCII characters, namely machine-readable characters.

I. Precicion, Recall and Accuracy

Precision is the level of accuracy between the information requested by the user and the answer given by the system. Meanwhile, recall is the success rate of the system in retrieving information. In addition, in pattern recognition, the term accuracy is also known, namely the level of closeness between the predicted value and the actual value.

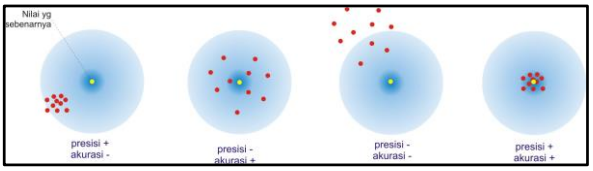


Fig. 5. Accuracy vs Precicion

III. IMPLEMENTATION

The OCR system and facial recognition will be implemented in the online voting application as seen in the design that has been made previously.

1. Optical Character Recognition, the data on the ID card will be read through by Optical Character Recognition to extract identity numbers. This data can be read because it uses regular expression or regex that fulfills the data characteristics. Regex is a formula for finding the pattern of a sentence/string. For example, the Population Identification Number (NIK) written on the National Identity Card (KTP) can be validated using regex. According to government regulations in PP-No-37-year-2007 article 37 states that NIK has a length of 16 digits with details of the first 6 digits being the regional code of the province, district/city, and sub-district. The second 6 digits are the date, month, year of birth. But for women plus 40 for the date of birth. Then the last 4 digits are sequence values only. Therefore, the regex on the ID card can be set to 16 digits. This regex will be implemented in OCR in the E-Voting application.
2. Face Recognition, face verification provides security that residents are valid in making elections. Faces will be detected using MTCNN which consists of 3 layers, namely P-Net, R-Net, and O-Net. The face detection results will then be processed by tensorflowlite which is a bitmap translator using the FaceNet model. The result will then be converted to a byte array to produce vectors or face embedded. The vectors of these two faces will be measured using the Euclidean formula to determine whether the two faces are identical or not.

A. *Flowchart*

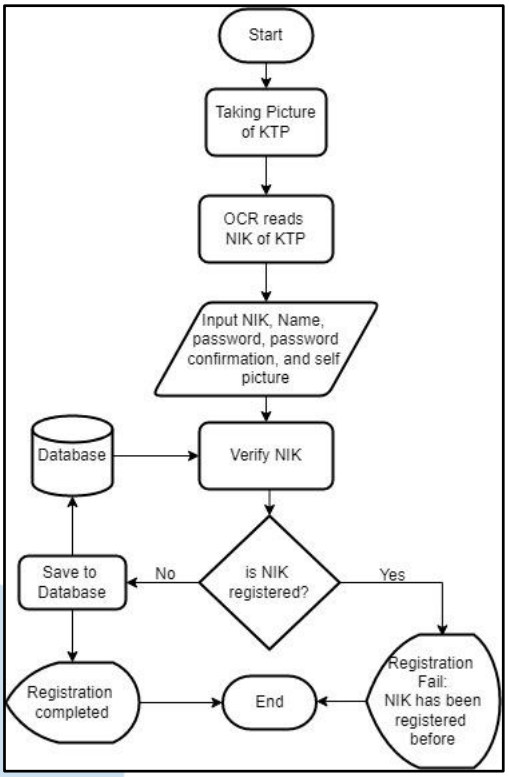


Fig. 6. Register Flowchart

In Fig. 6, you can see the registration flow that will be carried out when the user first uses the application. Users need to enter their NIK, name, password, password confirmation and a photo of themselves. The data will then be stored in Firebase. In Fig. 7, the process of voting flow as shown consists of face verification. If the face does not match the photo at the time of registration, the user cannot make a selection. Conversely, if the face has been verified according to the photo at the time of registration, then the user is directed to the selection.

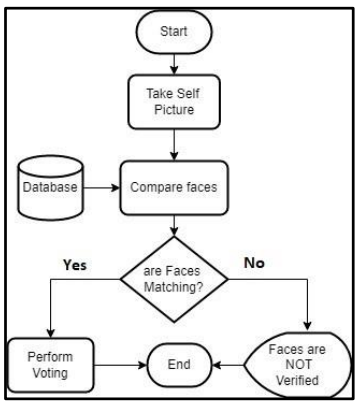


Fig. 7. Voting Flowchart

B. *Application Design and Interface*

The system is based on Android mobile application as seen on Fig. 8, Fig. 9, Fig 10, and Fig. 11. The user must register their Identity Card (KTP) to login. Optical Character Recognition will extract the Identity Number (NIK) from the ID Card picture and then pass the value to the register page, where user has to fill in several inputs. User also needs to take a selfie picture in the process of registration. After obtaining the picture, user will be taken to the face matching section before voting activity.

Fig. 8. KTP registration

Fig. 9. Registration

Fig. 10. Face Comparison

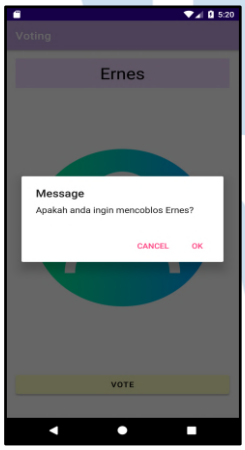


Fig. 11. Perform Voting

C. *Optical Character Recognition*

Fig. 12 shows the initialized photo path processed by the firebase, when the user has uploaded or taken a photo of his ID card.

```
fun startOCR() {
    FirebaseApp.initializeApp( context: this)
    val detector = FirebaseVision.getInstance()
        .onDeviceTextRecognizer
    val image = FirebaseVisionImage
        .fromFilePath(this, uriPath)
```

Fig. 12. Photo Path to Firebase Vision Image

Fig. 13 shows the Regular Expression of NIK on KTP in the system which functions to detect the National Identity Number (NIK) after the text has been successfully detected. The Regular Expression is represented by "[0-9]{16}" which is a pattern of 16 digits.

```
for (blockText in firebaseVisionText.textBlocks) {
    Timber.d(blockText.text)
    val regexKtpPattern = "[0-9]{16}"
    val pattern = Pattern.compile(regexKtpPattern)
    val matcher = pattern.matcher(blockText.text)
    if (matcher.find()) {
        textoutput.text = matcher.group()
        var bundle = Bundle()
        bundle.putString("nik",matcher.group())
        val c = Intent( packageContext: this, Regis::class.java)
        c.putExtras(bundle)
        startActivity(c)
    }
}
```

Fig. 13. Regular Expression of NIK

D. *Face Recognition*

Fig. 14 shows the face detection function with bitmap parameters consists of the image to be detected and minFace-Size which is the minimum image size of a face in pixels. Processing speed will be faster if the parameter minFaceSize is larger. The result that will be given is the position of all detected faces along with facial landmarks.

```
//    paramater:
//    bitmap:gambar yang akan diproses
//    minFaceSize: pixel gambarnya.(semakin besar nilainya,
//    semakin cepat waktu deteksi)
//    return:
//    face frame

    fun detectFaces(bitmap: Bitmap, minFaceSize: Int):
            Vector<Box> {
        val t_start = System.currentTimeMillis()
        //1. PNet mencari kandidat bounding box
        var boxes = PNet(bitmap, minFaceSize)
        square_limit(boxes, bitmap.width, bitmap.height)
        //2. RNet
        boxes = RNet(bitmap, boxes)
        square_limit(boxes, bitmap.width, bitmap.height)
        //3. ONet
        boxes = ONet(bitmap, boxes)
        //hasilnya adalah bounding box
        Log.i(TAG,  msg: "[*]Mtcnn Detection Time:" +
                (System.currentTimeMillis() - t_start))
        lastProcessTime = System.currentTimeMillis() - t_start
        return boxes
    }
```

Fig. 14. Detect Faces

First of all, the interpreter tflite of assets folder will be initialized and loaded into android in FaceNet class. Next, to get the face vector, the bitmap needs to be resized via the resizedBitmap function with filtration. After that the bitmap will be converted to Byte buffer. Then, the Tflite Interpreter will run the FaceNet Model to generate a face vector as shown in fig. 15. Calculate the Euclidean distance between 2 faces to find the degree of similarity.

```
//jalankan FaceNet Model
private fun run(bitmap: Bitmap): Array<FloatArray> {
    var bitmap = bitmap
    bitmap = resizedBitmap(bitmap, IMAGE_HEIGHT, IMAGE_WIDTH)
    convertBitmapToByteBuffer(bitmap)
    val embeddings = Array( size: 1) { FloatArray( size: 512) }
    tflite!!.run(imgData, embeddings)
    return embeddings
}
```

Fig. 15. Run FaceNet Model

The result of the run function is that the vectors of the two faces will be compared with the distance using the Euclidean formula as mentioned in the literature. If the distance between these two vectors is close to 0 then the two faces are identical. If the distance between these two vectors is away from 0, then the two faces are different. The code is shown in Fig. 16.

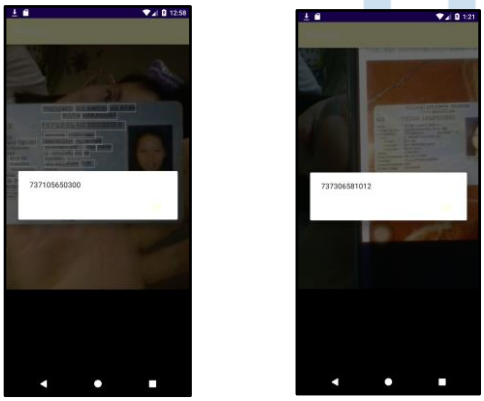
```
fun getSimilarityScore(face1: Bitmap, face2: Bitmap): Double {
    val face1_embedding = run(face1)
    val face2_embedding = run(face2)
    var distance = 0.0
    for (i in 0 until EMBEDDING_SIZE) {
        distance += ((face1_embedding[0][i] - face2_embedding[0][i]) *
                (face1_embedding[0][i] - face2_embedding[0][i])).toDouble()
    }
    distance = Math.sqrt(distance)
    return distance
}
```

Fig. 16. Get Similarity

IV. ANALYSIS

A. *Testing Optical Character Recognition on Identity Card Data*

KTP data that has been successfully read by OCR would be given a box mark right in the NIK section. If data is not detected, an error notification will appear on the application screen as shown on Fig. 17.



(a) Detection 1 (b) Detection 2

Fig. 17. NIK Detection by OCR

Through the emulator camera, the photo of the ID card will be taken and processed by OCR. The photo was taken during the day with quite dim lighting. However, the NIK data can be read perfectly. NIK detection has several references that are used in the data collection process to determine the level of accuracy of the Optical Character Recognition(OCR) ID card. Photo distance is one of the references used.

TABLE II. THE RESULT OF NIK DETECTION BY OCR

Respondent	Distance (cm)		
	5	10	15
1	✓	✓	✓
2	✓	✓	✓
3	✓	✓	✓
4	✗	✗	✗
5	✓	✓	✓
6	✓	✓	✓
7	✓	✓	✓
8	✓	✓	✓
9	✓	✓	✓
10	✓	✓	✓
11	✓	✓	✓
12	✓	✓	✓
13	✓	✓	✓
14	✓	✓	✓
15	✓	✓	✓
16	✓	✓	✓
17	✓	✓	✓
18	✓	✓	✓
19	✓	✓	✓
20	✓	✓	✓
21	✓	✓	✓
22	✓	✓	✓
23	✓	✓	✓
24	✓	✓	✓
25	✓	✓	✓
26	✓	✓	✓
27	✓	✓	✓
28	✓	✓	✓
29	✓	✓	✓
30	✓	✓	✓

Note: ✓ Detected, Correct result
✗ Detected, Incorrect result

The result of reading NIK data on different distances is recorded on the table 2. Based on the test, the level of precision and accuracy of the OCR in reading NIK data reached 96.67%.

$$Precision = \frac{TP}{FP + TP} = \frac{29}{30} \times 100\% = 96.67\%$$

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} = \frac{29}{30} \times 100\% = 96.67\%$$

B. *Testing Face Recognition*

In Fig. 18, both faces where the first picture used glasses, while in the second picture the respondent did not wear glasses. The similarity number used the Euclidean formula, which is 15.21 (rounded up by 3 digits after the comma). In the Euclidean theory mentioned in the literature, if the result is close to zero, then the two faces are identical. So it can be concluded

that the results of the comparison of the two faces are identical.

Fig. 18. An Example of the Test

In this research, the same face and different faces are tested to define the threshold number to determine either the faces are identic or not. The lowest Euclidean distance generated is 6.93 which is the same face without any attribute in the bright light. The highest Euclidean distance is 28.052 which is different persons' faces with eyeglasses in the bright light. Therefore, the application used the threshold value of Euclidean distance is 17 (rounded of 17.491)

$$Threshold = \frac{6.93 + 28.052}{2} = \frac{34.982}{2} = 17.491$$

Table 3 is the test result of face recognition by 30 respondents with different attributes used and the light condition.

TABLE III. THE RESULT OF FACE RECOGNITION

Respondent	Condition		Euclidean Distance
	Attribute	Lighting	
1	None	Dark	15.210
2	None	Bright	8.000
3	Mask	Bright	8.800
4	Eyeglasses	Dark	11.490
5	Eyeglasses	Dark	12.720
6	Eyeglasses	Dark	9.350
7	None	Bright	6.931
8	Mask and Eyeglasses	Bright	13.028
9	Mask	Bright	8.170
10	Mask	Bright	8.661
11	None	Dark	15.656
12	None	Bright	13.955
13	None	Bright	13.867
14	None	Dark	6.950
15	None	Dark	14.854
16	None	Dark	14.140
17	None	Bright	8.930
18	None	Bright	11.548
19	None	Bright	10.128
20	None	Bright	17.806
21	None	Dark	15.700
22	None	Bright	15.836
23	None	Bright	15.540
24	None	Dark	14.958
25	None	Dark	17.000
26	None	Dark	14.840
27	None	Bright	16.623
28	None	Bright	13.415
29	None	Bright	12.227
30	None	Bright	10.257

Since all of the tests done by all respondents generate Euclidean Distance are less than or equal the threshold (17), therefore the level of precision and the overall accuracy in the data in table III reached 100%.

V. CONCLUSION

Mobile-based E-voting application development could implement Optical Character Recognition and Face Recognition. The data on the KTP read by OCR during registration. This data can be read because it used regular expression or a regex that met the characteristics of the data, namely the 16-digit ID card in the form of an integer. Then, before voting, the user would verify the face as an evidence that the residents are valid in making the election. Faces would be detected using Multi-Task Convolutional Neural Network (MTCNN) which consists of 3 layers; P-Net, R-Net, and ONet. The face detection results would then be processed by tensorflowlite which is a bitmap translator using the FaceNet model. The result would then be converted to a bytearray to produce vectors or face embedded. The vectors of these two faces would be measured using the Euclidean formula to determine whether the two faces are identical or not. The result of OCR data detection accuracy is 96.67% in 30 respondents. Meanwhile, the accuracy of face Recognition using MTCNN reached an accuracy of 100% in sufficient lighting. Testing on the application also shows the success of testing the components needed for the E-voting application. So it can be concluded that all the E-Voting requirements designed in this study have been met.

The suggestions for further research are:

1. Improved accuracy of reading NIK data by optical character recognition by using a more appropriate regular expression by following the pattern of city/district code, date of birth and 4-digit serial number found on the KTP.

2. Improved facial recognition accuracy even when photos are taken in low light conditions.
3. Design items from the E-Voting application can also be further developed with news features or portfolios from prospective candidates.
4. Improved features in the application to conduct more than one election such as in simultaneous elections (President / Vice President), DPD, DPR, DPRD I, DPRD II) and tiered elections such as party elections or candidates for people's representatives.

REFERENCES

[1] B. News, "Lembaga survei: Jumlah golput di Pilpres 2019 paling rendah sejak 2004," 2019. [Online]. Available: https://www.bbc.com/indonesia/indonesia-48130161

[2] F. N. D. Edi Priyono, "E-VOTING: URGENSI TRANSPARANSI DAN AKUNTABILITAS," Seminar Nasional Informatika (SEMNASIF), vol. 1, no. 5, pp. 3–4, 5 2010.

[3] Schneier B, Applied Cryptography, Second Edition: Protocols, Algorithms, and Source Code in C. John Willey Sons,Inc, 1996.

[4] Hitherejoe, "EXPLORING FIREBASE MLKIT ON ANDROID: INTRODUCING MLKIT." [Online]. Available: https://joebirch.co/uncategorized/exploring-firebase-mlkit-onandroid-introducing-mlkit-part-one/

[5] L. Dulˇci´c, "Face Recognition with FaceNet and MTCNN." [Online]. Available: https://arsfutura.com/magazine/face-recognition-with-facenetand-mtcnn/

[6] Tensorflow, "Tensorflow." [Online]. Available: https://www.tensorflow.org/

[7] E. Uri, "Real time face recognition with Android + TensorFlow Lite." [Online]. Available: https://medium.com/@estebanuri/real-timeface-recognition-with-android-tensorflow-lite-14e9c6cc53a5

[8] Z. L. Kaipeng Zhang, Zhanpeng Zhang, "Joint Face Detection and Alignment using Multi-task Cascaded Convolutional Networks." [Online]. Available: https://arxiv.org/ftp/arxiv/papers/1604/1604.02878.pdf

[9] J. P. Florian Schroff, Dmitry Kalenichenko, "FaceNet: A unified embedding for face recognition and clustering," Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition 2015, vol. 1, no. 1, pp. 1–10, 2015.

[10] Tibco.com, "Eucledian Distance." [Online]. Available: https://docs.tibco.com/pub/spotfire/7.0.0/doc/html/hc/hceuclideandistance.htm

ISSN 2355-0082

Analysis Sentiment Cyberbullying in Instagram Comments with XGBoost Method

Muhamad Riza Kurniawanda[1], Fenina Adline Twince Tobing[2]
[1,2]Program Studi Informatika, Fakultas Teknik dan Informatika Universitas Multimedia Nusantara, Tangerang, Banten, Indonesia
[1]muhamad.kurniawanda@student.umn.ac.id
[2]fenina.tobing@umn.ac.id

Accepted 10 June 2022
Approved 5 July 2022

***Abstract*— Technological developments make social media widely used by the general public, which causes negative impacts, one of which is cyberbullying. Cyberbullying is an act of insulting, humiliating another person on social media. A system that can detect cyberbullying because of the large amount of information circulating on social media is impossible for humans to visit. One suitable method to solve this problem is Extereme Gradient Boosting (XGBoost). XGBoost was chosen because it can run 10 times faster than other Gradient Boosting methods. The process of changing sentences into vectors uses the TF-IDF method. The TF/IDF method is known as a simple but relevant algorithm in doing words on a document. XGBoost accepts input in the form of vectors obtained from the TF-IDF process. In this research, there are 1452 comments which will be broken down into training data and testing data. By using XGBoost and TF-IDF methods, the accuracy is 75.20%, precision is 71%, recall is 87%, and F1-score is 78%.**

Keywords*— *Cyberbullying; Extreme Gradient Boosting Term; Frequency Inverse Document Frequency;

I. INTRODUCTION

Social media is an online media, where users can easily participate, share, and create content for blogs, social networks, wikis, forums and virtual worlds [1]. Social media can be a place for positive or negative interactions. One negative example of social media is cyberbullying. Cyberbullying is an activity intentionally to send electronic text messages to other users with the aim of knowing, harassing, threatening, and disturbing [2].

According to Ditch The Label, which is an anti-bullying donation organization, Instagram is a social media that is often used to carry out cyberbullying. This is based on a survey of 10,020 teenagers from England with an age range of 12 to 20 years, from the survey results 42 percent of respondents claimed to have been victims of cyberbullying on Instagram [3]. Polda Metro Jaya said that there are at least 25 cyberbullying problems that are reported every day. In 2018 the Indonesian Child Protection Commission said the number of child victims of bullying reached 22.4%. The high value was triggered by the large number of internet consumption among children [4].

Previous research conducted in 2019 concluded that in classifying cyberbullying comments using the Support Vector Machine, the accuracy value was 76.77% [5]. In his research, it is suggested that further research on the classification of cyberbullying comments can use other classification methods. One other classification method is the XGBoost method. The XGBoost algorithm has higher accuracy and performance than the Support Vector Machine algorithm [6]. XGBoost can have better performance than the Support Vector Machine because XGBoost is a tree ensemble method that has been optimized both system and algorithmically [7].

There is a similar study regarding the implementation of XGBoost on sentiment analysis in Facebook social media in 2020 which resulted in 74.8% accuracy, 50% precision, 48% recall, and 49% F1 Score [8]. In addition, XGBoost which uses TF-IDF feature extraction has slightly better accuracy and precision performance than Count-Vectorization feature extraction [9].

II. LITERATURE

A. *Cyberbullying*

Cyberbullying is a form of violence perpetrated by groups or individuals who use electronic media [10]. The forms of violence are mocking, insulting, intimidating or humiliating. Examples of cyberbullying behavior include threatening via e-mail, insulting in the comments section of social media, and posting disgraceful photos of someone [11].

B. *Text Classification*

Text Classification or text classification is the process of labeling documents based on the contents of the document. Text classification can be done in two ways, namely manual and automatic. Classification of

texts manually takes a lot of time and money but to get more accurate results, linguists must interpret the texts they want to classify and categorize them. Text classification automatically applies machine learning, natural processing, making it faster and more cost-effective. In general, automatic text classification is divided into 3 groups, namely the first rule-based automatic text classification, machine learning, hybrid [12].

The first step in doing machine learning-based text classification is feature extraction to represent text into numeric vectors. Furthermore, the numerical vector will be used by the system to classify based on the correct label [13].

C. Sentimen Analisis

Sentiment analysis is the process of determining one's emotions or opinions, the process is expressed in the form of text and can be divided into positive emotions or negative emotions [14]. Sentiment analysis refers to various natural language processing, computational linguistics, and text mining. This analysis aims to analyze the views, sentiments, evaluations, attitudes, judgments, and emotions of speakers or writers related to certain topics, products, and services, organizations, individuals or activities [15].

D. Preprocessing

Preprocessing is a data mining technique that involves transforming raw data into a format that is easy to understand for computers. The data preprocessing step is needed to solve various types of problems, including data noise, data redundancy, and missing data [16]. The stages in doing preprocessing can be seen in Fig.1.

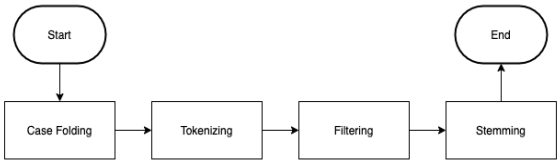


Fig. 1. Preprocessing flow

- Case folding is the process of converting all letters in a document or sentence into lowercase. Case folding is used to facilitate the search [17].
- Tokenizing is a process of cutting text into words based on the constituent text [3]. With the aim of eliminating all punctuation or symbols that are not letters.
- Filtering is the process of removing irrelevant words with sentiment adjectives if they stand alone [18].
- Stemming is the process of removing affixes and leaving only the base words [19].

E. Term Frequency – Inversed Document Frequency (TF-IDF)

Term Frequency - Inverse Document Frequency (TF-IDF) is the process of assigning weight to each word in a document. The TF-IDF method sorts words based on the word that appears the most [3]. Term Frequency focuses more on words that often appear in documents, while Inverse Document Frequency focuses more on counting words that often appear in a document that are considered unimportant general words [19].

$$TF(t) = \frac{jumlah\ kemunculan\ term\ t\ dalam\ dokumen}{jumlah\ term\ dalam\ dokumen} \quad (1)$$

$$IDF(t) = \log\left(\frac{jumlah\ seluruh\ dokumen}{jumlah\ dokumen\ yang\ mengadung\ term\ t}\right) \quad (2)$$

$$W(t) = TF(t) * IDF(t) \quad (3)$$

Where TF(t) is the Term Frequency value of term t, IDF(t) is the Inverse Document Frequency value of term t, and W(t) is the weight of a term.

F. Extreme Gradient Boosting

XGBoost is one of the boosting variants. XGBoost can run 10 times faster than other Gradient Boosting implementations, so many researchers have used it for classification and regression in many cases such as seller prediction, customer behavior prediction, ad prediction, and web text prediction [20].

Boosting is an ensemble technique where a new model is added to correct the mistakes made by the previous model. Models will be added sequentially until there are no further improvements. The ensemble technique uses a tree ensemble model which is a collection of classification and regression trees. The ensemble technique approach sums the predictions from several trees into one [21]. It aims to take each predictor sequentially and model it based on the residual error from the previous model. The initial process when the dataset is entered is to create an initial model using the dataset that has been selected. Then the initial prediction value and residual error from the initial model are obtained using equations 4 and 5. Equation 4 is used to make the initial model, while equation 5 is used to make subsequent models.

$$h_0(x) = mean(Y) \quad (4)$$

$$\hat{Y} = Y - h_0(x) \quad (5)$$

Where $h_0(x)$ is the initial predictive value of the first model and Y is the value of the residual error of the initial model. After that, the second model will be formed using the residual error of the initial model so that the predictive value of the second model is obtained. Then the third model will be formed using the residual error of the initial and second models so that the predictive value of the third model is obtained. This process will keep repeating as many times as n_estimator that has been set. This algorithm is called Gradient Boosting which aims to minimize errors when creating new models [22].

Just like boosting, XGBoost creates a set of decision trees in which the model will depend on the previous model. The first model in XGBoost will be weak in initializing the predicted value, then update the weights on each model that is formed so as to produce a strong predictive value. The predicted value of each model will be added up and then entered into Equation 6 to minimize the objective function [23].

$$L^{(t)} = \sum_{i=1}^{n} l\left(y_i, \hat{y}_i^{(t-1)} + f_t(x_i)\right) + \Omega(f_t) \quad (6)$$

Where n is the number of models to be used, l is a function to measure the difference between the predicted target y_i and $\hat{y}_i$, $f_t(x_i)$ is the new model built. While is a function Ω to make the model avoid overfitting [23]. Equation 6 is used when used to find the overall value.

G. Performance Evaluation

The method used in evaluating the performance of the model used is the confusion matrix. Each component in the confusion matrix shows the number of predictions made by the model classifying it correctly or incorrectly [24]. Fig. 2 is an example of a confusion matrix with 2 binary classifications.

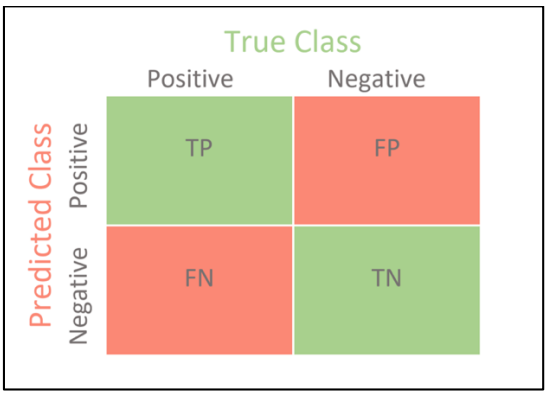


Fig. 2. Confusion matrix binary classification [24]

In Fig. 2 there are 4 main components, namely TP (True Positive) is the number of positive data that is predicted correctly, TN (True Negative) is the number of negative data that is predicted correctly, FP (False Positive) is the number of negative data that is predicted incorrectly, FN (False Negative) is the number of positive data that is predicted incorrectly. Based on these four components we can look for Accuracy, Precision, Recall, and F1 score. Equation 7 is a formula for finding the Accuracy value, Accuracy is the ratio of the level of how accurate the system can predict correctly.

Equation 8 is a formula for finding the Precision value, Precision is the ratio of the number of correctly predicted positive data divided by all positive predicted positive data. Equation 9 is a formula to find the value of Recall, Recall is the ratio of positive category data which is predicted to be positive correctly by the system. Equation 10 is a formula to find the value of F1 score, F1 score is the average comparison of Precision and Recall [24].

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} \quad (7)$$

$$Precision = \frac{TP}{TP+FP} \quad (8)$$

$$Recall = \frac{TP}{TP+FN} \quad (9)$$

$$F1 = \frac{2\ x\ Precision\ x\ Recall}{Precision + Recall} \quad (10)$$

H. Social Media

Social media is a medium used to interact online that allows humans to communicate with each other without being limited by space and time [25]. Users can share information with each other through text, images, video, and audio. Social media can also be used as a means to build a public profile so that it is increasingly known by others [26].

I. Instagram

Instagram is an application for sharing photos and videos, users can share their moments to the public, users can also comment on posts in the form of photos or videos from other users. Instagram has become so popular that it is used by its users to make Instagram a means of building a public profile [26]. Fig. 3 is the result of a survey conducted by the Global Web Index, Instagram is ranked 3rd with a percentage of 86.6% of users with an age range of 16 to 64 years [27].

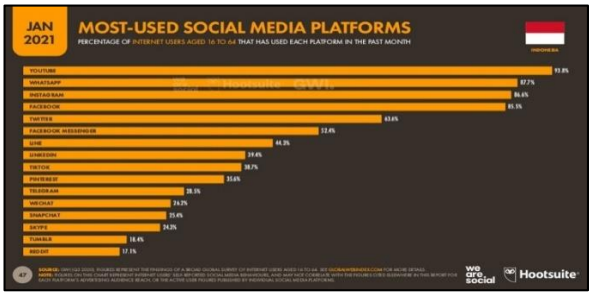


Fig 3 Results of Surveys of Frequently Used Social Media in Indonesia [27]

III. Results and Discussion

A. Dataset

The dataset used in conducting training and testing uses other studies [28][19]. The total number is 1552 comments containing 685 negative comments and 867 positive comments.

```
df.head()
```

	Id	Sentiment	Instagram Comment Text
0	1	negative	<USERNAME> TOLOL!! Gak ada hubungan nya kegug...
1	2	negative	Geblek lo tata...cowo bgt dibela2in balikan.....
2	3	negative	Kmrn termewek2 skr lengket lg duhhh kok labil ...
3	4	negative	Intinya kalau kesel dengan ATT nya, gausah ke ...
4	5	negative	hadewwwww permpuan itu lg!!!!sakit jiwa,knp ha...

```
df2.head()
```

	comment	label
0	Rahasianya apa kok teteknya bisa gede begitu? ...	0
1	Punya aku sudah diperbarui nih	1
2	Yang belakang seksi	1
3	Mau jadi apa indonesia	0
4	Teteknya lumayan ah, nggak tutup-tutup gelas amat	0

Fig 4. process of merging two datasets

Figure 4 shows the process of merging two datasets. The two datasets are combined into a new DataFrame named df_merge. df_merger will store comments from DataFrame df and df2 into the Comments column and store labels from DataFrame df and df2 into the Sentiment column.

B. Performance Evaluation

There are 4 scenarios carried out to determine the best configuration to classify the comments of cyberbullying. First, testing with a comparison of the train set and test set with a ratio of 70:30 and 80:20. Second, testing with downsampling. Third, testing with Grid Search Cross Validation. Fourth, testing by comparing the Cyberbullying Instagram Comment dataset and Cyberbullying Celebrity Comments dataset.

The first test, the train set and test set with a ratio of 70:30 got an F1-score of 61% and a recall value of 48%

Table 1. The test results of the comparison of the train set and test set with a ratio of 70:30

Dataset	Accuracy	Precision	Recall	F1	Label
Combined Dataset	72,94%	83%	**48%**	**61 %**	Negative
		70%	92%	79%	positive
	Average	76%	70%	70%	

The train set and test set with a ratio of 80:20 got an average F1-score of 66% and an average score of 66%. recalls 53%.

Table 2. The test results of the comparison of the train set and test set with a ratio of 80:20

Dataset	Accuracy	Precision	Recall	F1	Label
Combined Dataset	76,29%	88%	**53%**	**66%**	Negative
		72%	95%	82%	Positive
	Average	80%	74%	74%	

Based on the test results, the comparison of the train set and test set with a ratio of 80:20 shows better performance than the test using a ratio of 70:30. However, the comparison of the train set and test set with a ratio of 80:20 still has a weakness to avoid predicting bullying comments that are actually non-bullying, it can be seen in the recall value of 53%.

In the second test, data trimming was carried out on comments labeled positive because comments labeled positive and comments labeled negative were not balanced. Train sets and test sets with a ratio of 70:30 that have been downsampled get an F1-score of 75% and a recall value of 83%

Table 3. The results of the downsampling test use a comparison of the train set and test set with a ratio of 70:30

Dataset	Accuracy	Precision	Recall	F1	Label
Dataset Gabungan	72,70%	69%	**83%**	**75%**	Negative
		79%	62%	69%	positive
	Average	74%	73%	72%	

Train sets and test sets with a ratio of 80:20 that have been downsampled get an F1-score of 78% and 87% recall value.

Table 4. The results of the downsampling test use a comparison of the train set and test set with a ratio of 80:20

Dataset	Accuracy	Precision	Recall	F1	Label
Combined Dataset	75,20%	71%	**87%**	**78%**	Negative
		83%	64%	72%	positive
	Average	77%	75%	75%	

In this scenario, the test comparison of the train set and test set with a ratio of 80:20 that has been downsampled has better performance than the test with a ratio of 70:30 that has been downsampled.

In the third test, the train set and test set with a ratio of 70:30 that have been downsampled get an F1-score of 75% and a recall value of 81%

Table 5. Grid Search Cross Validation test results using a comparison of the train set and test set with a ratio of 70:30 that has been downsampling

Dataset	Accuracy	Precision	Recall	F1	Label
Combined Dataset	72,44%	69%	**81%**	**75%**	Negative
		77%	64%	70%	positive
	Average	73%	72%	72%	

The train set and test set with a ratio of 80:20 that have been downsampled get an F1-sampling value. score 84% and recall value 77%. The purpose of the third test is to get hyper parameters.

Table 6. Grid Search Cross Validation test results using a comparison of the train set and test set with a ratio of 80:20 which has been downsampling

Dataset	Accuracy	Precision	Recall	F1	Label
Combined Dataset	75,20%	71%	**84%**	**77%**	Negative
		81%	66%	73%	positive
	Average	76%	75%	75%	

In the fourth test, when using the Cyberbullying Instagram Comments dataset with a comparison of the train set and the test set with a ratio of 80:20, the average F1-score was 80% and the recall value was 82%.

Table 7. The results of testing the Instagram Cyberbullying Comments dataset using a comparison of the train set and test set with a ratio of 80:20

Dataset	Accuracy	Precision	Recall	F1	Label
Combined Dataset	80%	79%	**82%**	**80%**	Negative
		82%	78%	79%	positive
	Average	80%	80%	80%	

Then, testing using the Cyberbullying Selebgram Comments dataset, a comparison of the train set and the test set with a ratio of 80:20, got an average F1-score of 57% and a recall value of 45%.

Table 8. The results of testing the Cyberbullying Celebrity Comment dataset using a comparison of the train set and test set with a ratio of 80:20

Dataset	Accuracy	Precision	Recall	F1	Label
Combined Dataset	72,51%	80%	**45%**	**57%**	Negative
		70%	92%	80%	positive
	Average	74%	73%	70%	

IV. Conclusion

The implementation of the Extreme Gradient Boosting algorithm for the classification of cyberbullying comments has been completed in the form of a web application. The results of the trial by using the F1-score and recall values for negative labels as a reference in selecting the best model, the best model was obtained when using a comparison of the train set and test set with a ratio of 80:20 which had been downsampling with the default parameter XGBoost. The results obtained are 75.20% accuracy, 71% precision, 87% recall, and 78% F1-score.

There are factors that cause performance to decline, namely because there are some non-standard words. This happens because the dataset used is a collection of comments from Instagram social media. So there are some words that are not standard or there is an error in typing. This causes the stemming and filtering processes to run less than optimally.

Based on the research that has been done, the following are suggestions for further research. Using other classification methods such as Decision Trees, Random Forest Classifier or Naïve Bayes Classification. Then enlarge the dataset for classification, with the enlargement of the dataset is expected to get better performance. Then use the word embedding method. Word embedding is able to detect the similarity of words semantically, by measuring based on the distance between vectors. It is hoped that with this, the resulting performance can be better because words that have similar meanings can be classified as one group.

REFERENSI

[1] Cahyono, A. S., 2016. Pengaruh Media Sosial Terhadap Perubahan Sosial Masyarakat di Indonesia. *Jurnal Publiciana*, 9(1), pp. 140-157.

[2] Mulya, Y. A., 2017. *Psikilogi UIN: Tingginya Angka Rasio Peningkatan Cyberbullying di Indonesia.* [Online] Tersedia di: http://psikologi.uin-malang.ac.id/?p=3904 [Diakses 9 Mei 2021].

[3] Muthia, D. A., 2018. KOMPARASI ALGORITMA KLASIFIKASI TEXT MINING UNTUK ANALISIS SENTIMEN PADA REVIEW RESTORAN. *Jurnal PILAR Nusa Mandiri*, 14(1), pp. 69-74

[4] Putra, E. N., 2019. *Merunut lemahnya hukum cyberbullying di Indonesia.* [Online] Tersedia di: https://www.aminef.or.id/merunut_lemahnya_hukum_cyberbullying_di_indonesia/#:~:text=Data%20kasus%20cyberbullying%20di%20Indonesia,bullying%20mencapai%2022%2C4%25. [Diakses 21 Februari 2021].

[5] Darson, E., 2019. mplementasi Metode TF-IDF dan Support Vector Machine pada Aplikasi Pendeteksi Komentar Bersifat Bullying. *Jurnal Universitas Multimedia Nusantara.*

[6] Gaye, B. & Wulamu, A., 2019. Sentimental Analysis for Online Reviews using Machine learning Algorithms. *International Research Journal of Engineering and Technology (IRJET)*, 6(8), pp. 1270 - 1275.

[7] Morde, V., 2019. *XGBoost Algorithm: Long May She Reign!*. [Online] Tersedia di: https://towardsdatascience.com/https-medium-com-vishalmorde-xgboost-algorithm-long-she-may-rein-edd9f99be63d [Diakses 26 Februari 26]

[8] Pamungkas, E., 2020. Implementasi Extreme Gradient Boosting pada Sentiment Analysis dalam Social Media Facebook. *Jurnal Universitas Multimedia Nusantara.*

[9] Saifullah, S., Fauziah, Y. & Aribowo, S. A., 2021. Comparison Of Machine Learning For Sentiment Analysis In Detecting Anxiety Based On Social Media Data. *Jurnal Universitas Pembangunan Nasional Veteran Yogyakarta.*

[10] UNICEF, 2020. *Apa itu dan bagaimana menghentikannya - UNICEF.* [Online] Tersedia di: https://www.unicef.org/indonesia/id/child-protection/apa-itu-cyberbullying [Diakses 24 Februari 2021].

[11] KEMENDIKBUD, 2021. *Kemendikbud: Apa itu Cyber Bullying.* [Online] Tersedia di: https://biroumumpbj.kemdikbud.go.id/web/berita-apa-itu-cyber-bulliying.html [Diakses 16 September 2021].

[12] Rahayu, C. & Andi, 2020. *Klasifikasi Teks - MTI.* [Online] Available at: https://mti.binus.ac.id/2020/09/03/klasifikasi-teks/ [Diakses 24 Februari 2021].

[13] Huilgol, P., 2020. *Bag-of-Words (BoW) and TF-IDF for Creating Features from Text.* [Online] Available at: https://www.analyticsvidhya.com/blog/2020/02/quick-introduction-bag-of-words-bow-tf-idf/ [Diakses 26 Maret 2021].

[14] Amrullah, A. A. dkk., 2016. REVIEW ATAS ANALISIS SENTIMEN PADA TWITTER SEBAGAI REPRESENTASI OPINI PUBLIK TERHADAP BAKAL CALON PEMIMPIN. *PROSIDING SEMINAR NASIONAL MULTI DISIPLIN ILMU & CALL FOR PAPERS UNISBANK*, Volume 2, pp. 1-14.

[15] Dhande, L. L. & Patnaik, G. K., 2014. Review of Sentiment Analysis using Naive Bayes and Neural Network Classifier. *International Journal of Scientific Engineering and Technology Research*, 3(7), pp. 1110-1113.

[16] Gunawan, B., Pratiwi, H. S. & Pratama, E. E., 2018. Sistem Analisis Sentimen pada Ulasan Produk Menggunakan Metode Naive Bayes. *Jurnal Edukasi dan Penelitian Informatika*, 4(2), pp. 113-118

[17] Valatehan, L., Fachrurrozi, M. & Arsalan, O., 2016. Identifikasi Kalimat Pemborosan Menggunakan Rule Based Reasoning. *ANNUAL RESEARCH SEMINAR 2016*, 1(2), pp. 205-208.

[18] Hasan, F. N. & Wahyudi, M., 2018. ANALISIS SENTIMEN ARTIKEL BERITA TOKOH SEPAK BOLA DUNIA MENGGUNAKAN ALGORITMA SUPPORT VECTOR MACHINE DAN NAIVE BAYES BERBASIS PARTICLE SWARM OPTIMIZATION. *Jurnal AKRAB JUARA*, 3(4), pp. 42-55.

[19] Luqyana, W. A., Cholissodin, I. & Perdana, R. S., 2018. Analisis Sentimen Cyberbullying pada Komentar Instagram dengan Metode Klasifikasi Support Vector Machine. *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, 2(11), pp. 4704-4713.

[20] Chen, T. & Guestrin, C., 2016. XGBoost: A Scalable Tree Boosting System. *Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, Volume 16, pp. 785-794.

[21] Sholahuddin, A. & Abdullah, A. S., 2021. Extreme gradient boosting (XGBoost) method in making forecasting application and analysis of USD exchange rates against rupiah. *Journal of Physics: Conference Series*, 1722(1), pp. 1-16.

[22] Handayani, A., Jamal, A. & Septiandri, A. A., 2017. Evaluasi Tiga Jeis Algoritme Berbasis Pembelajaran Mesin untuk Klasifikasi Jenis Tumor Payudara. *Jurnal Nasional Teknik Elektro dan Teknologi Informasi (JNTETI)*

[23] Syukron, M., Santoso, R. & Widiharih, T., 2020. PERBANDINGAN METODE SMOTE RANDOM FOREST DAN SMOTE XGBOOST UNTUK KLASIFIKASI TINGKAT PENYAKIT HEPATITIS C PADA IMBALANCE CLASS DATA. *Jurnal Gaussian*, 9(3), pp. 227-36

[24] Mohajon, J., 2020. *Toward Data Science: Confusion Matrix for Your Multi-Class Machine Learning Model.* [Online] Tersedia di: https://towardsdatascience.com/confusion-matrix-for-your-multi-class-machine-learning-model-ff9aa3bf7826 [Diakses 30 Maret 2021].

[25] Dwiyono, P., 2019. Representasi Maskulinitas Dalam Media Sosial (Analisis Semiotika Pada Akun Instagram @DAILYMANLY), Malang: UMM Institutional Repository.

[26] Shafita, R., 2018. STUDI DESKRIPTIF KUANTITATIF PENGARUH MEDIA SOSIAL INSTAGRAM DENGAN MINAT WISATAWAN TERHADAP PARIWISATA DI YOGYAKARTA (Studi Kasus di PT. BKS Tour ServicesPeriode Oktober – November 2017), Yogyakarta: Repositori Universitar Mercu Buana Yogyakarta.

[27] Kemp, S., 2021. *DATAREPORTAL: DIGITAL 2021 INDONESIA.* [Online] Available at: https://datareportal.com/reports/digital-2021-indonesia [Diakses 4 Juni 2021].

[28] Andriansyah, M. dkk., 2017. Cyberbullying comment classification on Indonesian Selebgram using support vector machine method. *IEEE*.

[29] Rustian, R. S., 2012. *Apa Itu Sosial Media.* [Online] Available at: http://www.unpas.ac.id/apa-itu-sosial-media/ [Diakses 2 Juni 2021].

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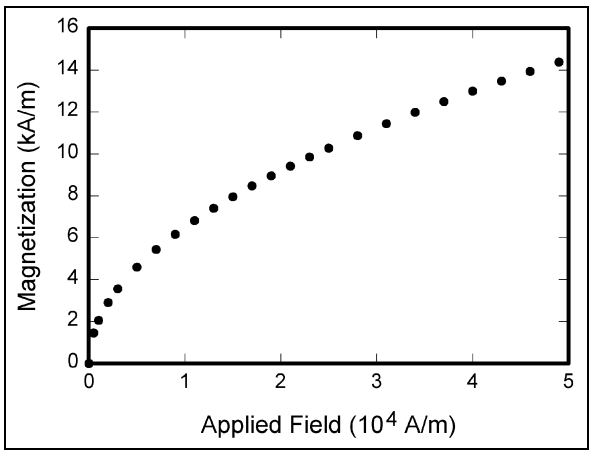

Fig. 1. Example of a figure caption

V. Conclusion

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

Appendix

Appendixes, if needed, appear before the acknowledgment.

ACKNOWLEDGMENT

The preferred spelling of the word "acknowledgment" in American English is without an "e" after the "g." Use the singular heading even if you have many acknowledgments. Avoid expressions such as "One of us (S.B.A.) would like to thank ... ." Instead, write "F. A. Author thanks ... ." You could also state the sponsor and financial support acknowledgments here.

References

The template will number citations consecutively within brackets [1]. The sentence punctuation follows the bracket [2]. Refer simply to the reference number, as in [3]—do not use "Ref. [3]" or "reference [3]" except at the beginning of a sentence: "Reference [3] was the first ..."

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For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

[1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529-551, April 1955. (*references*)

[2] J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

[3] I.S. Jacobs and C.P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G.T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271-350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev., in press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

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