



Bibliometric Analysis: Research Trends of Raspberry Pi-Based Egg Incubators in the Last Ten Years (2013-2022)

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Abstract

Technological developments that continue to increase provide an impetus for scientists to conduct research, One of them is the field of animal husbandry and instrumentation by making Raspberry Pi-based egg incubators. A device that replicates an incubator by keeping eggs at the right humidity uses a Raspberry Pi microcontroller to incubate the eggs. This research objective is to find out how far the development of the number of international publications using the Google Scholar database and to find out the development map of international research publications based on keywords. Data collection by searching Google Scholar with the keywords "Egg Incubator Raspberry pi", "Egg Incubator IoT" in 2013–2022. Trends in the development of international publications analyzed using software in the form of VOSviewer. From the bibliometric analysis carried out, it was found that the system, egg incubator, Raspberry pi, and IoT continues to dominate research on "Egg incubator Raspberry pi". The research will focus on controlling temperature and humidity which is systematized by IoT-based Android to save time, effort and cost. The research results obtained by Bibliometric analysis are not too dominant so that there is still an opportunity to continue research in literature review and become future innovations.

Keywords: Egg Incubator, Raspberry Pi, Temperature and Humidity

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INTRODUCTION

Technological developments that are developing more and more rapidly provide impetus to be able to create innovations, one of which is in the field of animal husbandry by creating an artificial incubator known as an egg incubator which can mimic the behavior of hens during the incubation period (Purwanti et al., 2021). The basic principle of the egg incubator is to process the development of embryos in fertile eggs until the eggs hatch (O.E.ARU, 2017). One way to increase chicken production is by helping chickens to hatch eggs. In the process of hatching chicken eggs, it is divided into two, namely the natural process where the incubation is carried out naturally by the hen (A. Goeritno et al., 2017) and the next method is with a tool that we know as the chicken egg hatching incubator which is an innovation developed with increasingly sophisticated technology. (Noor, 2019).

The use of traditional or natural hatching eggs is considered less effective because the hen is limited in incubating the eggs (La ode et al., 2014). and environmental conditions are also less supportive in the egg incubation process, so that egg hatching machines are needed in the hope of being able to incubate more and have high and practical success (Asmarani et al, 2016). Researchers are trying to make this tool and develop it with the help of a microcontroller to help poultry farmers incubate large numbers of eggs (W.S Mada e al.,

2018). Raspberry Pi based Egg Incubator. This is a device that simulates an incubator by keeping the eggs warm with suitable humidity using the Raspberry Pi platform for egg hatching reasons (Boleli et al., 2016) this device allows the fetus to grow inside the egg until it hatches in the absence of a hen, so the hen can lay another egg. The Raspberry Pi is a low-cost ARM-based computer, the Raspberry Pi is about the size of a credit card that can be used for multiple purposes like a desktop PC. (Ali Fued et al, 2016) Raspberry pi 3 is also recommended for those who want to use the pi in projects with very low power (Ngulum et al., 2019).

The egg incubator project using the Raspberry-Pi was developed in a specific context to support technologies that significantly increase the productivity of smallholder farmers. It is also equipped with a high-tech monitoring system that allows the owner to remotely control the incubator settings via a smartphone, making it more efficient in terms of manpower, time and money. (D. Qosimah, 2017). The purpose of the egg incubator with Raspberry pi microcontroller is to create a livestock environment where the egg hatching process occurs more orderly and safely. Egg incubators are used to keep eggs warm with suitable humidity, from fertile eggs to hatching into chicks using the Raspberry Pi platform as the driving center (Purwanti et al., 2021)

Previously, there had been no bibliometric analysis that reviewed research on the topic "Egg Incubator Raspberry pi" for the past ten years. There are researchers who reviews the Raspberry pi-based egg hatching, which was carried out by Fued Ali et al in 2016 with the article title "Development of an Egg Incubator Using Raspberry Pi for Precision Farming" is one of the researchers who innovated the manufacture Egg Incubators based Raspberry pi (Mala, 2017) The process of hatching eggs has become a major problem in agriculture, especially in small poultry. Statistics show that this problem is one of the main factors that causes huge losses for farmers (Ali Fued, 2016) But previous studies have not carried out research trends regarding the development of "Raspberry pi-based Egg Incubator". The last ten years using Bibliometric analysis. This research is also to optimize my research and final project related to an egg incubator with a Raspberry-pi based microcontroller. The main goal in the egg incubator project is to make a superior egg incubator. Chicken farmers will be more efficient in time and energy.

METHOD

Bibliometric analysis is a scientific technology that recognizes and identifies core research or authors and their relationship to all publications related to a particular subject or scope (Wirzal, Halim, et al., 2022; Wirzal, Nordin, et al., 2022). Analysis with the Bibliometric method will display visually through mapping and the data is needed in an era of developing technological growth rapidly and steadily increasing (Nandiyanto et al., 2020) in Analysis Bibliometrics can be used to evaluate research results by analyzing the productivity of authors and citations in science and technology (Kumar Singh et al., 2014). This study uses VOSviewer to visualize and explore trends. (Husaeni et al., 2022) VOSviewer is capable of building publication maps, which are capable of displaying several ways and functions, such as country mapping, journals, forming keyword maps, and creating maps with a large number of objects and more detail (Baier-Fuentes et al., 2019) This software is selected because it provides easy access and options as well as interactive features for exploring bibliometric data networks, including the number of citations or the relationship between terms and key concept (Shen & Wang, 2020). Bibliometrics is a mathematical and statistical methodology consisting of scientific publications, citations, reports and patent documents (Han j Kang, 2020).

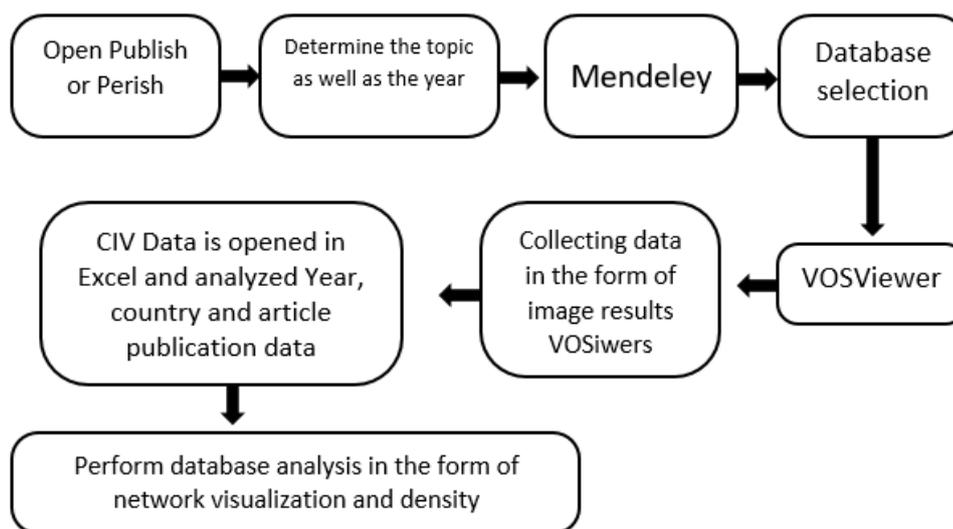


Figure 1 : Flowchart of the research method

Data collection was carried out on April 19, 2022. This study used data from international publications. Data collection was carried out through search. Keywords “Egg Incubator Raspberry pi”, “Egg Incubator IoT” Search for keywords in the period 2013 – 2022 sourced from the Google Scholar database (www.scholar.google.com) in Publis or Perish and then extract data in the form of RIS and CIV (Yanti Dewi et al., 2021). Next, the document will be opened in Mendelay to select the relevant document, then the data will be exported in RIS form. The data that has been stored is then analyzed in VosViewer software for international publication development trends. VOSviwer is able to provide an overview of publication maps, journal maps form keyword maps in the form of map nets with a large number of objects (Efendi et al., 2010). CIV data is opened using Excel to see the development of the year and country for analysis. Using excel to make a graph of the number of topic publications per year. (Gonzalez-zamar 2020).

RESULTS AND DISCUSSION

Number of Publications on the Topic "Egg Incubator Raspberry Pi" in 2013-2022 from the Google Scholar Resource

In this research, keyword search is an important element containing information about the paper to be discussed (Shi J, 2019). Keyword "Egg Incubator Raspberry pi" from Google Scholar produced 798 documents from various types of journals and articles. The 798 documents are the results of publications from 2013 to 2022 in international and national journals. Then selected by Mendeley into 24 documents. Scientific text can be reduced to a set of included words, Keyword analysis allows identification of current or future key research topics based on an analysis of common occurrences. If two terms appear frequently together in one group of works and rarely appear alone in another group, the occurrence is very high (Gonzalez-zamar, 2020).

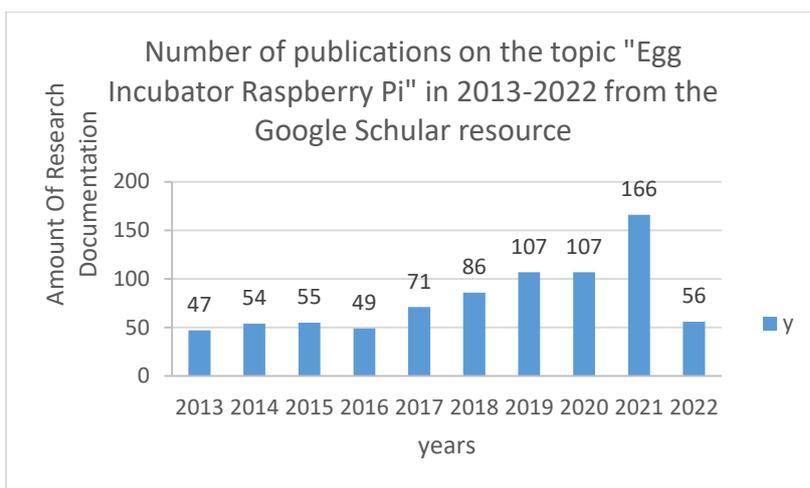


Figure 2. The number of publications on the topic “Egg Incubator Raspberry pi ” in 2013 to 2022 from Google Scholar

From the figure 2, it can be seen that the search with the topic "Egg Incubator Raspberry pi" was carried out on June 13, 2022. The older the year, the more interested or used by researchers. The year 2021 is the highest lift in the search for this topic so that many researchers publish their research results (166 documents). Then 2013 was the lowest number in scientific publications on this topic (47 Documents).

Vosviewers Analysis Results with the Keyword "Egg Incubator Raspberry Pi"

The Network Visualization of Egg Incubator Raspberry Pi

The result of the VOSviewer in the form of network visualization is carried out on all of these documents. The color thickness of the connecting line indicates the strength of the topic field or keyword pair (Efendi et al., 2010).In the network, nodes and words that are more prominent represent the highest occurrences, colors indicate groupings, and lines indicate linkages between keywords (De Moraes et al., 2020).

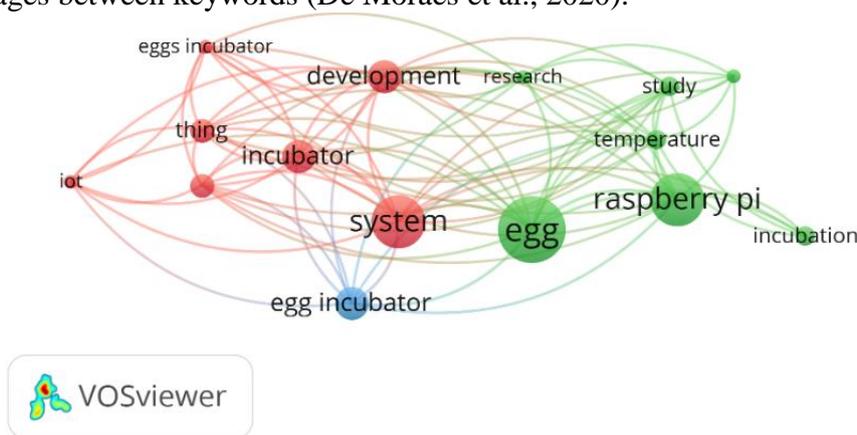


Figure 3. The network visualization of the “Egg Incubator Raspberry pi ” topic during 2013-2022

Judging by the visualization of figure 3 for the topic “Egg Incubator Raspberry pi” lines connecting points or nodes are quite a lot. In the most prominent position are system, egg, Raspberry pi that connect all the dots. Starting from the incubation period to application, there are from mid-2018 to 2020. System, egg, and Raspberry pi are the most popular topics compared to other topics such as IoT, and Temperature, Incubator. From the above data it can be seen that this topic is in great demand recently because of the latest acquired all year. The

keyword "Egg Incubator Raspberry pi " after selection using Mendeley with data as many as 24 documents, does not have enough results, meaning that the use of Raspberry pi for Egg incubator is not widely encountered and most likely could memebuka opportunities to conduct further research. From the results of VosViewers' research by searching for the keyword "Egg Incubator Raspberry pi" the data obtained is not too much, a topic search will be carried out.

The Overlay Visualization of Egg Incubator Raspberry Pi.

The first keyword used is "Egg incubator Raspberry pi", with a period of 10 years and an overlay visualization showing the year each article was published updated with a color gradient from dark blue to light yellow, thus showing historical traces from year to year displayed using the word key/term. The dark blue keywords indicate that they were included in research circa 2018. On the other hand, research with bright yellow terms/keywords concluded that research on these keywords was published in 2020. After conducting an in-depth analysis of each bright yellow keyword/term in the visualization overlay, it will follow the new trend in Raspberry pi Egg Incubator research in the world.

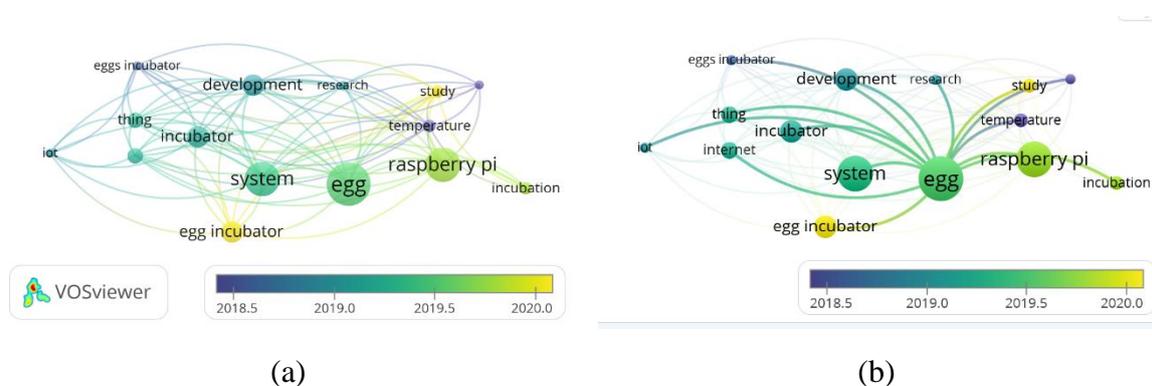


Figure 4 (a). Visualization Overlay topic "Egg Incubator Raspberry pi" during 2013-2022.
(b). Visualization Overlay topic "Egg Incubator Raspberry pi" during 2013-2022.

From the visualization of figure 4 (a) with the topic "Egg Incubator Raspberry pi" during 2013-2022 shows that the data obtained with the word egg, system, Raspberry pi are dominant with green color indicating between 2019 to 2020. Figure 4(b) is an overlay visualization that focuses on the keyword "egg", the keyword is the core of all points and is able to capture all keywords. Keywords that are often used are "egg", "system" and "Raspberry-pi". The overlay visualization above shows that the word is a popular topic compared to other words.

The results of the Visualization Overlay provide insight for researchers to conduct egg incubator research with a focus on trending topics of egg incubators with Raspberry pi. Researchers can provide innovation from topics that are not much sought after, namely the topic "IoT", which can be done with internet of things innovations that are connected to Android or laptops. Researchers can make applications on a cellphone so they can be monitored directly remotely

Vosviewers Analysis Results with the Keyword "Egg Incubator Iot"

The Network and Overlay Visualization of Egg Incubator IoT.

The network and overlays visualization are the output results from the Vos Viewers analysis. the image that is displayed is in the form of nets that are connected between one point to another which will later find the trend of these keywords. Network visualization will display various colors, if the keyword is often found then the point word will have a large

enough point size. A visualization overlay will display an image of the year of an article, the more recent an article is, the point will be yellow and vice versa, if the color shown is dark blue, then the point has a fairly old year.

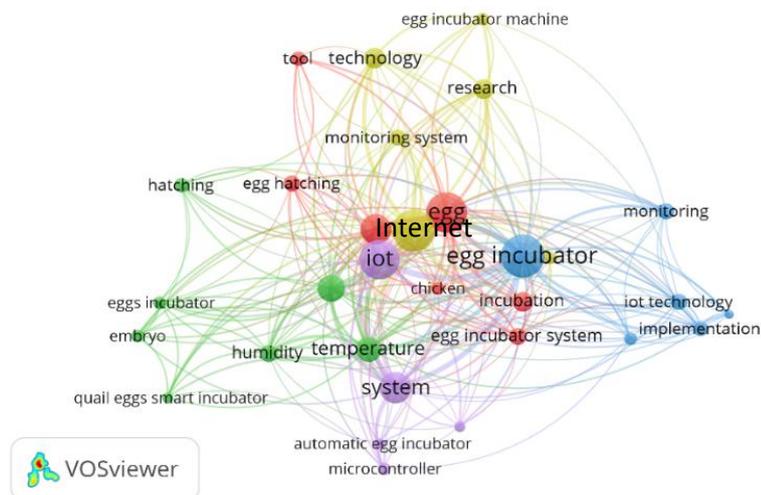


Figure 5. Network Visualization of The “Egg Incubator IoT ” Topic During 2013-2022.

The next keyword search is topic "Egg Incubator IoT" has 996 Google Scholar documents and then selected with mandelady to get 76 documents. The data obtained is more than the topic "Egg Incubator Raspberry-pi", and the net results obtained are also more than the keywords with the previous topic.

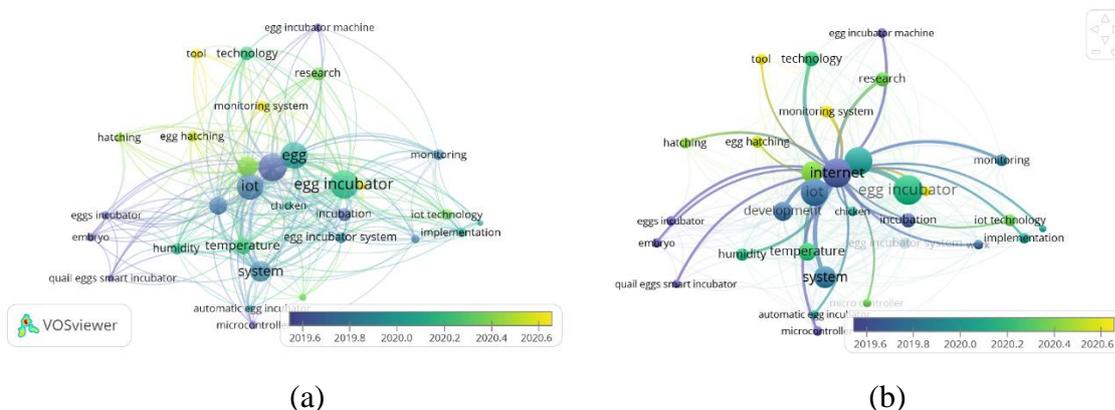


Figure 6 (a). Visualization Overlay topic "Egg Incubator IoT" during 2013-2022. **(b).** Visualization Overlay topic "Egg Incubator IoT" during 2013-2022.

The visualization overlay of figure 6 (a) , then the overall overlay visualization image and in figure 6 (b) is the overlay visualization that focuses on “internet” points. The internet point is the center of all keywords and captures all points. From the visualization image, the lines connecting the points or vertices are quite numerous. In the most prominent position are “IoT”, “egg”, “egg incubator” and “Internet” that connect all the dots. Starting from the incubation period to application, there are from mid-2019 to mid-2020. The Internet, IoT, and Egg Incubator are the most important, so this point is the most popular topic compared to other topics such as monitoring, Humidity, and heatching. From the above data it can be seen that this topic is in great demand recently because of the latest acquired all year. The keyword “Egg Incubator IoT ” after being selected using Mandelady does have enough results, namely about 76 documents meaning the use of IoT for Egg incubator is not much and most likely can open opportunities for further research.

The results of the Visualization Overlay provide insights for researchers to conduct egg incubator research by focusing on trending topics of egg incubators with IoT. Researchers can provide innovation from topics that are not much sought after, namely the topic of "monitoring system" by providing cameras for monitoring and so on to monitor conditions in the incubator room.

The Density Visualization of "Egg Incubator Raspberry pi" and "Egg Incubator IoT".

The Density Visualization is an output from the VosViewers analysis. The image obtained is with a dark blue background color and yellow topic points. The more topic points there are, the brighter the yellow color that comes out

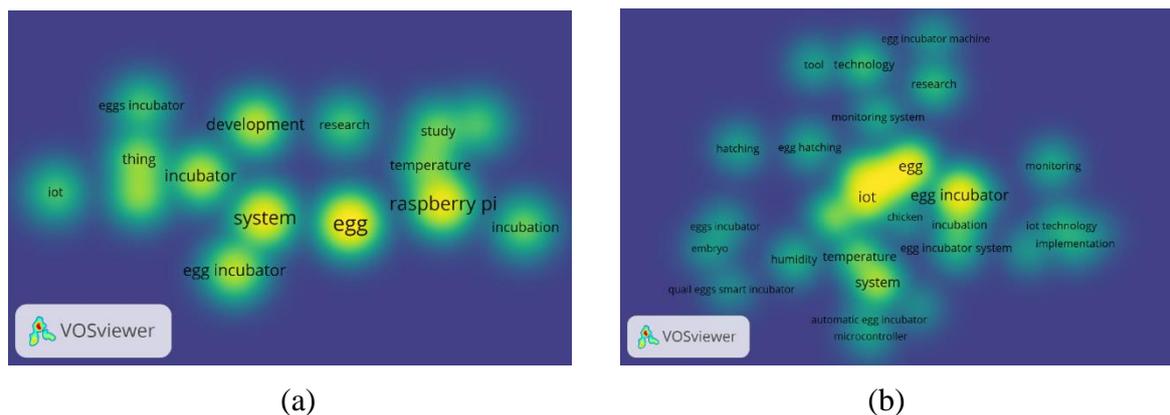


Figure 7 (a). density visualization of the "Egg Incubator Raspberry pi " topic during 2013 – 2022. **(b).** density visualization of the "Egg Incubator IoT " topic during 2013 – 2022

The figure 7 (a) and (b) illustrates the depth of research related to the topic area. Similarly to the topic grid visualization image, the proportion of two colors mixed in the topic density visualization depends on the total item density of a point. The closer the dot color is to the background color, the lower the overall density of the item. Also, it is reasonable to assume that a higher density means that the topic is well developed for study.

The results of bibliometric analysis using vosviewer with the topic of the Raspberry pi egg incubator, by looking at the visualization results that this research is not many researchers who have conducted studies on egg incubators using Raspberry-pi. The article that discusses the Raspberry-pi is little compared to the use of other micro controllers. Therefore researchers are suggested to develop the potential for making egg incubators using Raspberry Pi for a more sophisticated future.

CONCLUSION

From the bibliometric analysis conducted, it was also found that with the keywords "Egg incubator Raspberry pi" and "Egg Incubator IoT" the most dominant are point Internet, Egg Incubator and Raspberry pi. The documents obtained were 24 from the keyword "Egg incubator Raspberry pi" and 76 from the keyword "Egg incubator IoT" documents from the search using publish or perish after being selected with Mendelay at 13 June 2022. The results of Bibliometrics are network visualization images, overlay visualizations and density visualizations. Less dominant topics provide opportunities and opportunities to continue research and innovations that will be carried out. From the results of bibliometric analysis, the egg incubator research project with raspberry pi focuses on controlling temperature and humidity which will be systemized by IoT-based android to save time, energy and money. From bibliometric analysis.

The study is beneficial to delineate a comprehensive research framework and allow future scientists to focus more on specific topics that are rarely explored. From Bibliometrics, we can find out which research is being carried out by looking at trending topics and can be

used for research. Topics that have not been widely practiced can be used as an innovation that can be developed further and can be used as a new invention.

RECOMMENDATION

It is better if the next researcher expands the keywords that will be used on the research topic. Researchers can use Scopus and WoS (Web of Science) to find and collect data. and for research on the raspberry-pi egg incubator it is expected to further develop IoT. Innovations that will be developed can be like providing a camera to check fertile eggs or displaying temperature or humidity through Android-based IoT.

REFERENCES

- A. Goeritno, K. Aldiansyah, M. Aziz, A. Eko, K. Pramuko, and H. Hendrawan, (2017). Implementasi Sistem Kontrol Berbasis Arduino UNO R3 Untuk Sistem Penetasan Telur Ayam, in Seminar Nasional Inovasi Dan Aplikasi Teknologi Di Industri. pp. 1–10.
- Ali, Fuead. Noor A.A (2016). Development Of An Egg Incubator Using Raspberry Pi For Precision Farming. International Journal of Agriculture, Forestry and Plantation, Vol. 2. 40 – 45. ISSN 2462-1757
- Asmarani Kusumawati , Rina Febriany , Shella Hananti , Mufti Sartika Dewi , Ninik Istiyawati (2016). Perkembangan Embrio dan Penentuan Jenis Kelamin DOC (Day-Old Chicken) Ayam Jawa Super” Jurnal Sain Veteriner.34 (1) ISSN : 0126 - 0421
- Baier-Fuentes. H., Merigó. J. M., Amorós. J. E. and Gaviria-Marín. M. (2019). International entrepreneurship: a bibliometric overview. International Entrepreneurship and Management Journal, 15(2), 385-429
- Boleli IC, Morita VS, Matos Jr JB, Thimotheo M, Almeida VR. (2016). Poultry Egg Incubation: Integrating and Optimizing Production Efficiency. Brazilian Journal of Poultry Science. <http://dx.doi.org/10.1590/1806-9061-2016-0292>
- D. Qosimah, (2017).The Improvement Production Chicken Feed by Fermentation and Egg Incubator in Malang District,” J. Innov. Appl. Technol., vol. 3, no. 1, pp. 392–397, 2017, doi: 10.21776/ub.jiat.2017.003.01.7.
- De Moraes L L and Kafure I (2020) RDBCI: Digit. J. Libr. Inf. Sci. 18 e020016
- Efendi D N, Irwandani, Anggraini W, Jatmiko A, Rahmayanti H, Ichsan I Z, and Rahman M M (2010) J. Phys. Conf. Ser. 1796 012096
- González-Zamar M D, Abad-Segura E, Vázquez-Cano E, and López-Meneses E (2020) Electron. 9 1246
- Han J, Kang H, Kim M, and Kwon G H (2020) J. Biomed. Inform. 109 103516
- Husaeni, Dwi. Asep Bayu. (2022). Bibliometric Using Vosviewer with Publish or Perish (using Google Scholar data). ASEAN Journal of Science and Engineering. Vol 2 (1). Hal 19-46. <http://ejournal.upi.edu/index.php/AJSE/>
- Kumar Singh, Jayendra. (2014). A Scientometric Analysis of Indian Journal of Pure and Applied Physics (2006-2010): A Study Based on Web of Science. Research Journal of Library Sciences, Vol.2(1), 7-12, February
- La Ode Nafiu, Muh. Rusdin, and Achmad Selamat Aku.(2014). Daya Tetas Dan Lama Menetas Telur Ayam Tolaki Pada Mesin Tetas Dengan Sumber Panas Yang Berbeda. JITRO VOL.1 NO.1,
- Ngulum, Bahrul. (2019). Rancang Bangun Inkubator Telur Model Rak Geser Berbasis Raspberry pi. Teknik Telekomunikasi, Politeknik Malang. Vol. 3. No. 1
- Nandiyanto, A. B. D., Biddinika, M. K., & Triawan, F. (2020). How bibliographic dataset portrays decreasing number of scientific publication from Indonesia. Indonesian Journal of Science and Technology, 5(1), 154-17

- O. E. Aru. (2017). Development of a Computerized Engineering Technique to Improve Incubation System in Poultry Farms,” J. Sci. Eng. Res., vol. 4, no. 6, pp. 109–119, <http://www.jsaer.com>
- Purwanti, siti. Anita Febriani at.al. (2021). Sistem Pemantauan Suhu Mesin Penetas Telur Menggunakan Raspberry Pi3 Berbasis Internet of Things (IoT). Jurnal Robotika dan Kontrol (JRC). Vol 2. DOI: 10.18196 / jrc.25105
- S. Noor Yulita Dwi. (2019). Optimalisasi Posisi Heater Dan Cooler Terhadap Perubahan Kondisi Suhu Pada Inkubator Tetas Penetas Telur” Jurnal Simetris, Vol 10. No 1. P-ISSN: 2252-4983, E-ISSN: 2549-3108.
- Shi J, Miao W, and Si H (2019) *Sustain.* 11 988
- Shen. X. and Wang. L. (2020). Topic evolution and emerging topic analysis based on open source software. *Information Science*, 5(4), 126-136
- Sruthi, Mala. (2017). Development of Cloud Based Incubator Monitoring System using Raspberry Pi. *I.J. Education and Management Engineering*. Vol 5 Hal 35-44. DOI: 10.5815/ijeme.2017.05.04
- Wirzal, M. D. H., Halim, N. S. A., Nordin, N. A. H. M., & Bustam, M. A. (2022). Metacognition in Science Learning: Bibliometric Analysis of Last Two Decades. *Jurnal Penelitian Dan Pengkajian Ilmu Pendidikan: E-Saintika*, 6(1), Article 1. <https://doi.org/10.36312/esaintika.v6i1.665>
- Wirzal, M. D. H., Nordin, N. A. H. M., Bustam, M. A., & Joselevich, M. (2022). Bibliometric Analysis of Research on Scientific Literacy between 2018 and 2022: Science Education Subject. *International Journal of Essential Competencies in Education*, 1(2), Article 2. <https://doi.org/10.36312/ijece.v1i2.1070>
- W.S. Mada Sanjaya, Sri Maryanti, Cipto Wardoyo, Dyah Anggraeni, Muhammad Abdul Aziz, Lina Marlina, Akhmad Roziqin, and Astuti Kusumorini. (2018). The Development of Quail Eggs Smart Incubator for Hatching System based on Microcontroller and Internet of Things (IoT). *International Conference on Information and Communications Technology (ICOIACT)*.
- Yantidewi, M., Jatmiko, B., Sucahyo, I., Kholiq. A., Lestari, N. A., Deta U. A. (2021). Getting to Know the Last Five Years Trend on Microcontroller Research: A Bibliometric Analysis. *Seminar Nasional Fisika*. doi:10.1088/1742-6596/2110/1/011