

Design of an Internet of Things-Based automatic cat feeding control device (IoT)

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ABSTRACT

The automation era has been a big step in human civilization. The use of automation technology combined with an internet connection, or IoT, has helped a lot in everyday life. In one example, feeding cats is a problem when the owner is busy working or traveling for more than two days. However, having a cat feeding device is automatically a solution to this problem. This research created an automatic cat feeding device using the NodeMCU ESP8266 microcontroller base, which has a WiFi module installed. When it is paired with an HCR04 ultrasonic sensor to measure the feed height, it will send a message to the MQTT application on the smartphone if the remaining feed in the cat food container is at a certain height or is almost finished. The Blynk application manages this tool, which provides a widget to help monitor, change feeding times, view feeding statistics, and view the last feeding time and date. The black box testing method is used to test this tool so that it functions properly.

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1. INTRODUCTION

Having a pet is one way to reduce stress levels for some people (Saputro et al., 2020) (Antari & Febrianti, 2022). Therefore, many families or workers who live alone choose to keep pets, where the stress level of workers continues to increase along with the increasing number of tasks that must be completed at the company where they work (Mukhtar, 2021) (Simanullang & Situmorang, 2020) (Indrastuti, 2020). The pet that many people choose is a cat. Cats have been intermingled with human life since at least 5,000 years BC, with the discovery of cat skeletons on the island of Cyprus. Since 3,500 BC, Ancient Egyptians have used cats to keep mice or other rodents away from barns that store crops. Currently, cats are one of the most popular pets in the world. The reason many cats are kept is because they look cute, and their behavior is funny and adorable to play with. However, there are times when the owner is busy working, let alone leaving town for several days. Sometimes it is difficult to take care of their cats, especially when feeding them. The impact will be very fatal because cats can fall ill due to a lack of food intake. Cats are at risk of developing hepatic lipidosis, which causes fat to accumulate in the cat's liver because the liver works too hard to convert the fat in the body into energy (Hartuti et al., 2013). Ideally, the schedule for feeding cats in Bekasi pet shops twice a day is categorized as very good (Riesti Retno Arimurti et al., 2023).

This is in accordance with the statement by the American Society for the Prevention of Cruelty to Animals that feeding cats twice a day functions to reduce hunger between meals and minimize behavioral problems related to food. The right time for feeding should be at the right time, namely, in the morning at 08.00 and in the afternoon at 17.00. Feeding must also be paid attention to, especially in providing the portion or amount of food that will be given to pets (Pérez-Camargo,

2004). IKRAF SMART FEEDER is a tool that provides food to pets, which is usually manual or automatic. This tool will function automatically when the time has been entered according to what has been set, and it can also be moved manually according to the wishes of the owner. This tool also makes it easier for us to find out the remaining pet food available. The Ikraf Smart Feeder can be controlled remotely via the internet via the Blynk application, which sends commands to dispense food (Yanuartono, Soedarmanto Indarjulianto*, Irkham Widiyono, Hastari Wuryastuty & Raharjo, Hary Purnamaningsih, Guntari T. Mulyani, 2018). Explains that "Blynk is a server service used to support Internet of Things projects (Doshi et al., 2019)." According to the internet of things (IoT) is a structure where objects and people are provided with exclusive identities and the ability to move data over a network without requiring two directions between humans and humans, namely source to destination or human to computer interaction. Based on the description above, the Ikraf Smart Feeder, which is based on the IoT from being able to be controlled remotely, we can also adjust the feeding schedule automatically via a smart device that we hold at all times. (Internet of Things), is a solution to the problem. Apart from being able to be controlled remotely, we can also adjust the feeding schedule automatically via a smart device that we hold at all times. So cats can get food efficiently and on time. The benefit of this research is that by completing the design of this automatic pet feeder tool, it will make it easier for pet animal keepers, especially cats, who are currently still constrained by time problems to always monitor animal food and drink (Bazzi et al., 2019). This tool will also display accurate data from the readings of the sensors that will be used. It makes it easier and controls regular and scheduled feeding. Provides virtual access to monitor cats remotely anytime and anywhere. It becomes a supporting infrastructure for controlling feed and monitoring pets when the owner is not at home (Setiadi & Abdul Muhaemin, 2018). The design of this automatic cat feeder ensures regular food provision for cats without requiring human intervention. The following are the general workings of an automatic cat feeder. The owner fills the container with dry food. The owner sets the feeding schedule and portions via the control panel or smartphone application. At the specified time, the motor will drive the feeding mechanism to dispense the regulated amount of feed into the bowl. If the tool is connected to the application, the owner will receive notifications every time a feed is given. The sensor will monitor the amount of remaining feed and provide notification if the feed needs to be refilled. By using automatic feeders, cat owners can ensure their cats get regular food even when they are not at home.

2. RESEARCH METHOD

Research Phase

Research methodology includes the sequences carried out in a study. The research methodology aims to make the research more conceptual, structured, and focused so that each stage can be seen to achieve its achievements in accordance with the expected objectives of the research (Wilyanto et al., 2019).

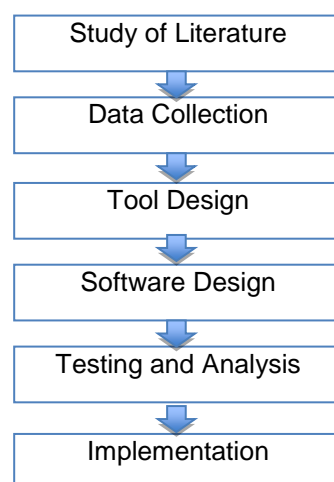


Figure 1. Research stage diagram

In Figure 1 above are the stages in system design, where the initial stage is collecting references regarding the object of research, namely cats, finding out about cats' eating habits and how much cats eat in one feeding. After that, they move on to designing the tool, namely using the NodeMCU microcontroller, and then enter the interface application design stage using Blynk so that it can be controlled by users from anywhere connected to the internet network (Setiadi & Abdul Muhaemin, 2018).

Testing automatic cat feeding is important to ensure that the device functions properly and suits your cat's needs. The following are the steps for carrying out a cat feeding trial:

Manual feeding via the control panel or application to ensure the feeding mechanism is working properly. Check whether the amount of feed that comes out matches the settings. Let the tool work according to the schedule that has been set. Monitor the first feed to ensure the tool functions as expected. Make sure the food comes out at the specified time and in the right amount according to the number of cats and age of the cat.

Observe the cat's reaction when the device provides food. Make sure the cat is comfortable and can easily take food from the bowl. Check whether there are problems such as clogged food, too much or too little food coming out, or whether the device does not work at the set time. Adjust the device settings accordingly, need. You may need to change the schedule, portion size, or check the mechanism of the appliance if there are technical problems. Make sure to refill the feed container before it runs out and clean the tool regularly to keep it hygienic and functioning properly.

Internet of Things (IoT) IoT

The concept leverages the internet as a tool for all interactions between actors. IoT refers to billions of interconnected devices, which can be called "Smart Objects" or "Smart Things." With IoT, all activities are made easier and more efficient online. IoT is the core of the new generation of the information technology industry. The impact of IoT on the evolution of the internet towards a next-generation intelligent environment relies heavily on the integration of IoT with cloud computing (Junaidi, 2015). When IoT is connected to the cloud, a large amount of data that has been collected from many places can be processed and analyzed to make meaning of the information for the end-user (Setiadi & Abdul Muhaemin, 2018).

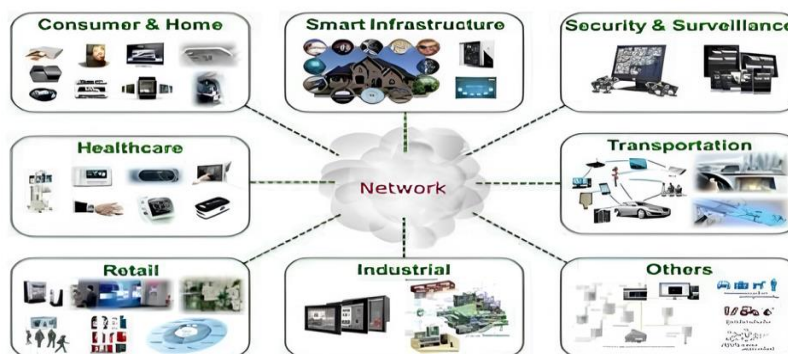


Figure 2. IoT concept

In his research entitled "Remote Control of Rice Irrigation Systems Based on the Internet of Things (IoT)," the author defines the Internet of Things as a concept that is used to expand the usefulness of continuously connected internet connectivity, along with remote control capabilities, data sharing, etc. Foodstuffs, electronics, any equipment, and collections, including living objects, are all connected to local and global networks via embedded sensors and are always 'ON' (Hidayat et al., 2018). The Internet of Things (IoT) is a concept or scenario where an object has the ability to transmit data over a network that does not require human-to-human or human-to-computer interaction. IoT has developed through the convergence of wireless technology, micro-electromechanical systems (MEMS), and the internet. "A Thing" in the Internet of Things can be interpreted as a subject, for example, a human with a heart implant monitor (Karyadi, 2023), a farm animal with a biochip transponder, or a car equipped with a built-in sensor to alert drivers when the tire pressure is low. So far, IoT is closely related to machine-to-machine (M2M) communication in the fields of manufacturing, electricity, oil, and gas. Products are produced using an intelligent

system, or "smart system." Even though this concept was not popular until 1999, IoT has been in development for several decades. The first internet device, for example, was a Coke machine at Carnegie Mellon University in the early 1980s. Programmers can connect to the machine via the internet, check the machine's status, and determine whether or not there is a cold drink ready for them without having to go to the machine. The term IoT became known in 1999, when it was first introduced in a presentation by Kevin Ashton, cofounder and executive director of the Auto-ID Center at MIT (O'Grady & O'Hare, 2017).

The workflow in a feeding control system for cats can be divided into several steps. Motion sensors or other sensors detect the presence of cats around the feeder. If necessary, the system regulates the amount of feed to be given. This can be done by controlling the dispenser or other mechanism to deliver the right amount of feed (Mulyono Akmal, 2019).

3. RESULTS AND DISCUSSIONS

Based on the data obtained from research and data collection, it can be used as a reference in developing the monitoring system that will be designed. The data used in this research comes from previous research references and data obtained at the Faculty of Agriculture, Kuantan Singingi Islamic University. This data can then be processed to create a system. Based on the analysis of the current system, a new system can be proposed, namely a soil moisture and temperature monitoring system using soil sensors. This system is generally in the form of an electronic circuit. This electronic circuit functions to provide information sent from the readings of the soil moisture sensor embedded in the seed sowing site and the DHT11 sensor for detection. Every time the soil humidity changes to reach the minimum humidity, the Arduino will automatically activate the relay and turn on the plant waterer, watering the plants until they reach the maximum humidity. If the humidity has reached its maximum, the relay will turn off (Emmalia A, 2018). The general design of the proposed system can be seen in Figure 4.1 below:

Electronic Circuits

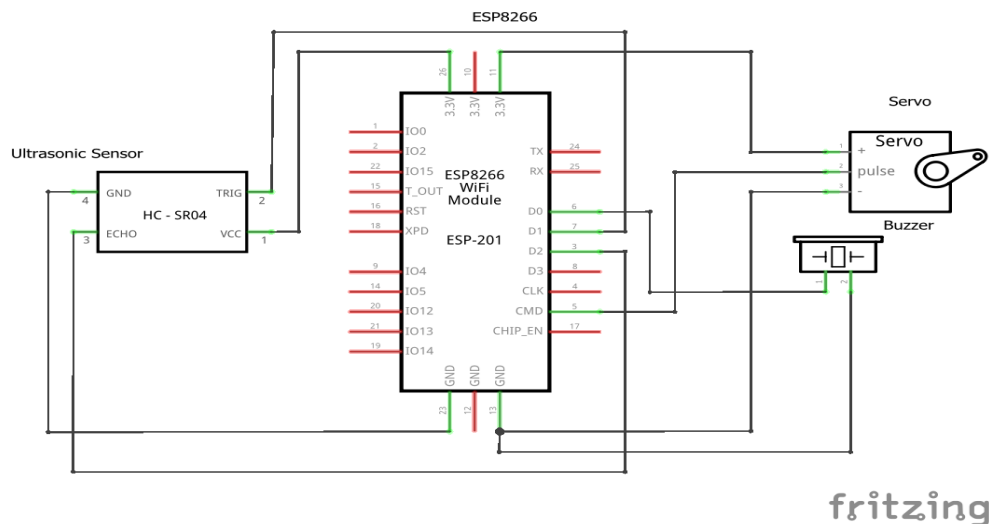


Figure 3. Electronic circuits

In the circuit above, WeMos D1 R1 is connected to a PIR sensor that functions as a movement detection input, and then there is a resistor as an LED resistance that is used as an indicator for each PIR sensor 1 and 2. There is also a buzzer, which functions as an alarm (Kusuma & Mulia, 2018). Servo motors are an important component in automatic cat feeding devices because they can provide precise control to dispense the right amount of feed at a set time. Servo motors are used to drive the feeding mechanism with high precision. The advantage of servo motors is their ability to move to a certain position and hold this position with high accuracy, which is very important for controlling the portion of food given. The controller regulates the servo motor based on input from the timer or commands from the smartphone application. This controller ensures the servo motor moves to the right position at the right time. Design a feeding mechanism

that will be driven by a servo motor. This mechanism must be able to dispense feed smoothly and consistently. Determine the initial and final position of the servo motor according to the amount of feed that will be released. Use a potentiometer for position feedback so that the servo motor can move to the desired position with precision.

Flowchart of How it Works

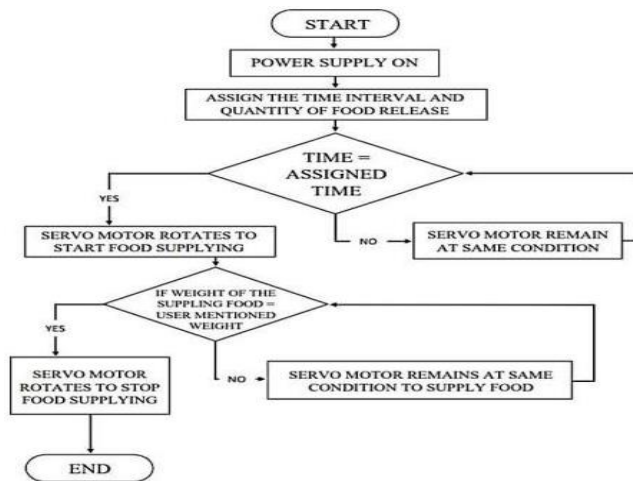


Figure 4. Work flowchart

Ultrasonic sensors can be used in automatic cat feeding devices to detect the level or amount of food remaining in the container. The use of this sensor helps ensure that the feed does not run out without the owner realizing it, so that the owner can refill the feed on time. Ultrasonic sensors work by sending ultrasonic sound waves and measuring the time it takes for these waves to bounce back after hitting an object (in this case, cat food). Based on the measured time, the sensor can calculate the distance between the sensor and the feed surface. Install the ultrasonic sensor at the top of the feed container at an angle that allows ultrasonic waves to reflect from the feed surface. Connect the ultrasonic sensor to the microcontroller. For HC-SR04, connect the trig and echo pins to the digital pins on the microcontroller, and connect the VCC and GND pins to the power source. Program the microcontroller to provide notification (via buzzer, LED, or smartphone app) when the measured distance exceeds a threshold, indicating that the feed needs to be replenished.

User Interface

```

Peet_Feeder_Alena.ino
1
2 // Fill-in information from Blynk Template
3 #define BLYNK_TEMPLATE_ID "TMPLaHMAAz44"
4 #define BLYNK_DEVICE_NAME "Pet Feeder"
5
6 #define BLYNK_FIRMWARE_VERSION "0.1.0"
7
8 #define BLYNK_PRINT Serial
9 //#define BLYNK_DEBUG
10
11 #define APP_DEBUG
12
13 // Uncomment your board, or configure a custom board in Settings.h
14 //#define USE_SPARKFUN_BLYNK_BOARD
15 //#define USE_NODE_MCU_BOARD
16 //#define USE_NITTY_CLOUD_BOARD
17 //#define USE_NEMOS_D1_MINI
18
19 #include "BlynkEdgent.h"
20 BlynkTimer timer;
21
22 #include <HCSR04.h> //Library HCSR04
23 HCSR04 hc(14,12); //trig pin D5 , echo pin D6)
24
25 float TinggiSensor = 12; //Tinggi pemasangan sensor
26 float TingkatPakan = 0; //Tingkat Pakan
27
28 unsigned long Tsekarang;
29 unsigned long TAKhir;
30
31 #include <Servo.h> //Library Servo
    
```

Figure 5. Arduino editor view

Smart Feeder Application

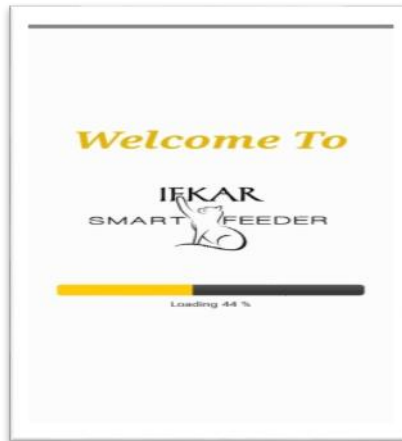


Figure 6. Loading screen smart feeder application

The loading screen on a smart feeder application is a temporary page that appears when a user opens an application or performs certain actions that require time to load or process information. The main function of the loading screen is to provide a better user experience by providing an indication that the application is carrying out certain processes, for example retrieving data from the server, processing commands, or loading the application's main page (Fernanda & Wellem, 2022). This loading screen is equipped with indicators such as rotating animations or progress bars to show that the application is in the process of doing something. This provides visual feedback to the user that the application is still running and not deadlocked. Some loading screens may also display a message or brief information explaining the process in progress, such as "Retrieving the latest feeding data" or "Setting up feeding schedule" (Efendi, 2018). This can be an opportunity to display branding elements of the application, such as the logo or application theme colors, so that it remains consistent with the visual identity. Ideally, loading screens should not take too long to avoid user frustration. The smart feeder application must be designed in such a way that the process of loading information or performing other actions can be completed quickly. Loading screens should be consistent with the overall design of the application, including the type of font, color, and graphic style used. This helps create a more seamless and coordinated user experience. Even though the loading screen is a temporary page, care needs to be taken to ensure that it still provides a friendly and unobtrusive user experience, for example, by ensuring that animations or progress indicators are not too flashy or confusing. By paying attention to the things above, the loading screen on the smart feeder application can improve the quality of the user experience and ensure that the user feels comfortable and informed while the application process is running (Wandi Al-hafiz, 2020).

Blynk

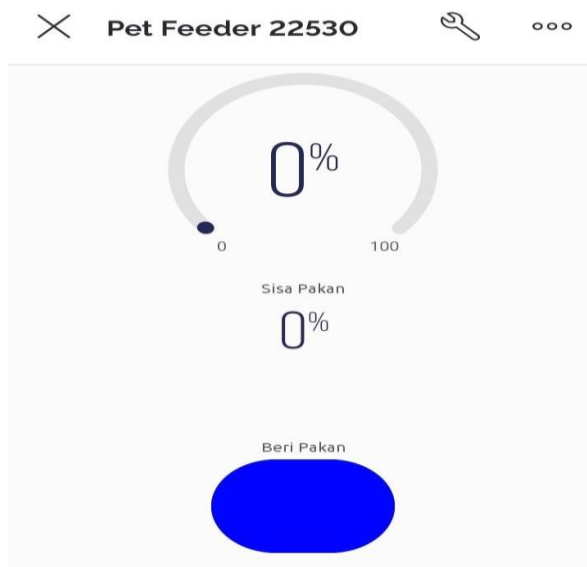


Figure 7. Monitoring cat feed

To provide an explanation of the graphics of a smart feeder, we need to understand the context of use and the data typically involved. Smart feeders are devices used to feed pets automatically by utilizing technology. The graphs associated with smart feeders can include several types of data. These graphs display the amount of food consumed by the pet over a certain period of time. The X-axis usually represents time, while the Y-axis represents the amount of food (in grams or other units). This graph shows the level of food remaining in the feeder (Doni Kurniawan, Yaddarabullah, 2018). The X-axis represents time, while the Y-axis represents the percentage or amount of food available. This graphic illustrates a pet's eating habits. For example, the times when animals eat more often can be displayed in the form of a histogram or line chart. If the smart feeder is equipped with a notification or alarm feature, this graph can show the number of notifications given in a certain period, for example, when food is running low or when feeding is unsuccessful. This graph may be a line chart showing the decrease in the amount of food over time. If the feeder is refilled every week, the graph will show a sudden increase in refill days (Wilyanto et al., 2019).

Display of the feeding menu and remaining feed status



Figure 8. Monitoring applications for feeding and leftover feed

The home page of a smart feeder application is typically designed to provide users with easy and intuitive access to automatically control and monitor their pet's feeding. The following are some elements that may be present on the main page of a smart feeder application: Feeding Status: Information about the last time the pet was fed and whether food was given or not. Feeding Schedule, Display the pet's feeding schedule or routine, including the time and number of portions. Feeding Settings is a feature for setting and changing feeding schedules, as well as other settings such as the number of food portions. Notifications, Information or notifications if there are important things related to pet feeding, such as warnings if food is running low or warnings if there are problems in the feeding process, Monitoring and History Access to previous feeding history, including records of time and the amount of food given. Connection Status: information about the smart feeder device's connection to the network or application, as well as the status of battery power or other resources (Karim et al., 2017).

4. CONCLUSION

The Blynk application will display the amount of feed available. Underneath, there is also a button to open the servo cover, which will then be able to control the fish feed cover. From the results of experiments carried out in the two modes above using the Automatic Pet Feeder tool, it can be concluded that users can regulate the amount of food well. When feeding by pressing a button on the application on a mobile device, there is a delay due to signal transmission in the network. So the program settings for this mode need to be adjusted according to needs. It should be emphasized that in this research, it is assumed that the equipment is in a room with a stable wifi network. System development, especially on system connectivity that uses a wifi module, is better to use a connection via GSM Shield because the availability of wifi connections in the area is still small and difficult. If using GSM Shield to get connectivity only uses a GSM card whose network can be used anywhere.

Developing an automatic cat feeding device requires a combination of technological innovation and understanding the needs of cats and their owners. Integrate a camera to monitor cats while they eat, ensure they are getting enough food, and detect health problems such as loss of appetite. Use an airtight lid to protect the feed. keeps it fresh and prevents contamination by insects or moisture.

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REFERENCES

- Antari, I., & Febrianti, I. (2022). Pengaruh Animal-Assisted Therapy Terhadap Tingkat Stres: Literature Review. *Prosiding Seminar Nasional Multidisiplin Ilmu*, 4(1), 88–98.
- Bazzi, C. L., Jasse, E. P., Graziano Magalhães, P. S., Michelon, G. K., de Souza, E. G., Schenatto, K., & Sobjak, R. (2019). AgDataBox API – Integration of data and software in precision agriculture. *SoftwareX*, 10, 100327. <https://doi.org/10.1016/j.softx.2019.100327>
- Doni Kurniawan, Yaddarabullah, G. S. (2018). Implementasi Internet of Things pada Sistem Irigasi Tetes dalam Membantu Pemanfaatan Urban Farming. *The 7 Th University Research Colloquium*, 106–117.
- Doshi, J., Patel, T., & Bharti, S. K. (2019). Smart Fanning using IoT, a solution for optimally monitoring fanning conditions. *Procedia Computer Science*, 160, 746–751. <https://doi.org/10.1016/j.procs.2019.11.016>
- Efendi, Y. (2018). Internet Of Things (Iot) Sistem Pengendalian Lampu Menggunakan Raspberry Pi Berbasis Mobile. *Jurnal Ilmiah Ilmu Komputer*, 4(1), 19–26. <https://doi.org/10.35329/jiik.v4i1.48>
- Emmalia A, J. dedy irawan. (2018). IMPLEMENTASI IoT PADA REMOTE MONITORING DAN CONTROLLING GREEN HOUSE. *Jurnall MNEMONIC*, 1(1), 56–60.
- Fernanda, R., & Wellem, T. (2022). Perancangan Dan Implementasi Sistem Pemberi Pakan. *Jurnal Teknik Informatika Dan Sistem Informasi*, 9(2), 1261–1274.

- Hartuti, R. S., Adam, M., & Murtina, T. (2013). Kajian Kesejahteraan Kucing yang Dipelihara Pada Beberapa Pet Shop Di Wilayah Bekasi, Jawa Barat. *Medika Veterinaria*, 8(1), 37–42.
- Hidayat, M. R., Christiono, C., & Sapudin, B. S. (2018). PERANCANGAN SISTEM KEAMANAN RUMAH BERBASIS IoT DENGAN NodeMCU ESP8266 MENGGUNAKAN SENSOR PIR HC-SR501 DAN SENSOR SMOKE DETECTOR. *Kilat*, 7(2), 139–148. <https://doi.org/10.33322/kilat.v7i2.357>
- Indrastuti, S. (2020). *Manajemen sumberdaya manusia stratejik*. UR Press.
- Junaidi, A. (2015). Internet Of Things, Sejarah, Teknologi Dan Penerapannya : Review. *Jurnal Ilmiah Teknologi Informasi*, IV(3), 62–66.
- Karim, F., Karim, F., & Frihida, A. (2017). Monitoring system using web of things in precision agriculture. *Procedia Computer Science*, 110, 402–409. <https://doi.org/10.1016/j.procs.2017.06.083>
- Karyadi, D. (2023). Comparison of investor detection algorithm in internet of things based home security systems. *Jurnal Mandiri IT*, 12(2), 72–81.
- Kusuma, T., & Mulia, M. T. (2018). Perancangan Sistem Monitoring Infus Berbasis Mikrokontroler Wemos D1 R2. *Konferensi Nasional Sistem Informasi 2018*, 1(1), 1422–1425.
- Mukhtar, A. (2021). *Stres Kerja dan Kinerja di Lembaga Perbankan Syariah*. Penerbit NEM.
- Mulyono Akmal, M. (2019). Simulasi Alat Penjaring Ikan Otomatis Dengan Penggerak Motor Servo Continuous, Sensor Jarak Hc-Sr04 Dan Tombol, Menggunakan Arduino Mega. *Jurnal Ilmiah Ekonomi Dan Bisnis*, 12(1), 39–47.
- O'Grady, M. J., & O'Hare, G. M. P. (2017). Modelling the smart farm. *Information Processing in Agriculture*, 4(3), 179–187. <https://doi.org/10.1016/j.inpa.2017.05.001>
- Pérez-Camargo, G. (2004). Cat Nutrition: What Is New in the Old? *Compendium on Continuing Education for the Practicing Veterinarian*, 26(SUPPL), 5–10.
- Riesti Retno Arimurti, A., Rohmayani, V., Artanti, D., Daesusi, R., Alvian, M., & Leni Anggraeni, V. (2023). Peran Penting Pemilik Kucing Terhadap Kesehatan Kucing Peliharaan Di Wilayah Tambaksari, Surabaya. *JDISTIRA (Jurnal Pengabdian Inovasi Dan Teknologi Kepada Masyarakat)*, 3(2), 181–186.
- Saputro, M. I., Rivaldi, A., Sibuea, S., & Julfia, F. T. (2020). Alat Pemberi Makan Hewan Peliharaan Otomatis Berbasis Teknologi Internet Of Things (IoT). *Vol*, 6, 62–71.
- Setiadi, D., & Abdul Muhaemin, M. N. (2018). PENERAPAN INTERNET OF THINGS (IoT) PADA SISTEM MONITORING IRIGASI (SMART IRIGASI). *Infotronik : Jurnal Teknologi Informasi Dan Elektronika*, 3(2), 95. <https://doi.org/10.32897/infotronik.2018.3.2.108>
- Simanullang, R., & Situmorang, P. C. (2020). *Managemen stres di tengah dampak Covid-19*. Guepedia.
- Wandi Al-hafiz, N. (2020). PERANCANGAN SISTEM PENYIRAMAN TANAMAN OTOMATIS MEGGUNAKAN ARDUINO. *JURNAL TEKNOLOGI DAN OPEN SOURCE*, 3(2), 245–260.
- Wilyanto, E., Noertjahyana, A., & Lim, R. (2019). Perancangan dan Pembuatan Automatic Pet Feeder Menggunakan Arduino dan Mobile Apps. *Jurnal Infra*, 7(1), 3–6.
- Yanuartono, Soedarmanto Indarjulianto*, Irkham Widiyono, Hastari Wuryastuty, S., & Raharjo, Hary Purnamaningsih, Guntari T. Mulyani, I. T. (2018). Health Examination of Cat in Yogyakarta. *IGKOJEL: Jurnal Pengabdian Masyarakat*, 4(1), 53–54.