

Pet Feeder Using Blynk Platform And Website

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Abstract— *The main issue with having cats is their feeding. This happens since many people are busy yet still want to have a cat as it is a low-maintenance animal. In fact, many cat owners are so busy with their activities away from home that they are unable to feed their cats when they are hungry. This study proposes the development of automated cat feeding technologies to address this issue. In this study, the pet feeder will be remotely controlled through Blynk and the website. The microcontroller used is based on Arduino and connects to the Blynk platform via mobile devices by downloading apps. Website can also handle this tool via a laptop or personal computer (PC). Both services allow pet owners to remotely regulate meal schedules, food portions to be served, and food supply. The results showed that the developed application and Internet of Things provide information on pet feeding schedules, which has an impact on controlling cat weight.. In TIPHON Quality of Service testing, the throughput results are 667.7 mbps, indicating it is in poor category, and the delay is 85 ms, indicating it is in a good category.*

Keywords — *automated pet feeding machine, Arduino, Blynk, website, IoT*

I. INTRODUCTION

Indonesia is an agricultural country, one of which supports the horticulture industry, which is an important aspect in the national economy. The number of individuals who live and work in the agriculture industry demonstrates this effect. West Java, for example, is a cool-climate region with several mountains appropriate for plantations, such as spinach, lettuce, mustard greens, and kale, and West Java is the major kale grower. Based on data from the Indonesian Ministry of Agriculture, specifically data for 2019, 56,229 tons, 2018, 58,228 tons, and 2017, 51,383 tons, there were relatively big changes in harvest seen in the year of observation, ranging from 2000 tons to 6000 tons [1].

Kale is a popular vegetable in Indonesia, particularly in West Java, which has a tropical climate. This plant is coming from the tropic regions, mainly Africa and Asia [2]. Kale is a vulnerable vegetables and unstable. Due to this unpredictability of kale supply, the fluctuating yield can lead to volatile market pricing. Weather sensitivity, limited resources such as producers, planting expertise, infrastructure, land availability, the impact of fertilizers, and climate change can all contribute to fluctuating yields. Therefore, the agricultural system of smart farming for

growing Kale must be revitalized. Previously, a global system schema using Internet of Things (IoT) for Kale's farming was proposed. Then, that research technique upgraded with the current research technique, which employs a Machine Learning System to support Kale cultivation through smart farming.

The Internet of Things is a form of computing system in which little electrical devices equipped with sensors can detect their surroundings. Smart agriculture or smart farm is feasible to apply. The use of the Internet of Things to farming can save labor and money, improve temperature and humidity control, and collect more precise information about plant development variables [3]. MySQL, one of the most widely used Relational Database Management System solutions, is well known for its benefits. MySQL is also known for executing queries faster than other RDBMS systems [4]. In order to maximize the utilization of data in a database, Machine Learning can be used to investigate data usefulness for commercial purposes. Machine learning is the study and development of an algorithm that can learn and predict data using a computer system employing supervised learning or unsupervised learning techniques. This concept is acquiring the data model in various forms, depending on the machine's requirement and learning objective [28]. This technique will typically execute a model validation process on each learning process. Instead of following procedural instructions from the computer program, the learning algorithm predicts or determines the future by applying the model obtained from the sample dataset. This technique enables the machine to learn and increase its efficiency by learning from a sample dataset or the surroundings.

In this Thesis, a design architecture is formulated to create an ideal growth prediction model for kale, especially in the seedling phase. This research is based on three final projects published internally, the smart farm concept followed by an Internet of Things-based automation system [5]. MySQL database for raw data storage [6]. Machine learning techniques to develop models [7]. Finally, an integrated system is adopted, and combining concepts have been defined to create a seamless data set.

II. BASIC CONCEPT

A. Internet of Things

Kevin Ashton, a digital innovation expert, created the phrase "Internet of Things" in 1999 as the title of a corporate presentation he gave at his employer, Procter & Gamble[4]. Kevin Ashton came up with the idea of putting an Radio Frequency Identification (RFID) sensor network technologies will go up to meet this new challenges[4]. The Internet of Things (IoT) is a recent communication paradigm that envisions a near future in which the objects of everyday life will be equipped with microcontrollers, transceivers for digital communication[5]. Iot can also be interpreted by connecting the things of daily life to the internet. By using IoT can control an object by using the platform of a mobile computing.

B. Blynk

Blynk is an IoT platform that allows users to operate electronic devices from a far using its iOS and Android apps[6]. Blynk will be connected with a microcontroller in order to communicate with the pet feeder. The Blynk program is opened by double clicking the app's icon on the smartphone. Blynk app has a number of features that allow users to track their power use. It has value display or labeled value widgets for data visualization from data sensors, as well as a notification widget where users can be notified via notification when their electricity consumption has exceeded the energy usage limit, while also viewing a graph of average energy consumption over time using the Super Chart widget.

C. Arduino IDE

The Arduino Integrated Development Software (IDE) is a piece of software that allows you to create sketches for microcontroller devices. The Arduino IDE is classified as an integrated program development software because it provides a menu-based interface for various displays. Arduino demonstrates the mistake and accuracy of directly writing computer code [8].

D. Website

Website has two properties there is a dynamic and static website. Static websites are usually used in hospitals, hotels, and other company profiles where only the website owner can update the website. This website requires a code reset to update the page. Meanwhile, a dynamic website has the means to add, edit and delete displayed media. This website does not require a code reset to change the page. Search engines, networking, and social media, e-commerce usually use dynamic websites because it needs to update flexibly.

E. Hypertext Preprocessor

Hypertext Preprocessor (PHP) is a popular general purpose programming language that is well suited to web development and can be integrated in HTML[10]. On June 8, 1995, programmer Rasmus Lerdorf released "Personal Home Page Tools (PHP Tools) version 1.0" as a suite of scripts for maintaining his website[10]. These were expanded in version 2 in 1997, and in version 3 the following year, the name was altered to a recursive acronym "PHP: Hypertext Preprocessor"[10].

F. PostgreSQL

PostgreSQL is an open source object relational database system (ORDBMS). There is a special extension called PostGIS that integrates various geographic functions and supports geographic objects. The PostGIS implementation is based on a "lightweight" geometry, and the indexes are optimized to reduce disk and memory usage. The PostgreSQL database interface language is standard SQL[22].

G. Laravel Framework

Laravel is a free, open-source PHP web framework, created by Taylor Otwell and intended for the development of web applications following the model view controller (MVC) architectural pattern. Some of the features of Laravel are a modular packaging system with a dedicated dependency manager. The laravel framework is easy to understand and powerful, the framework itself provides authentication, routing, session manager, caching, IoC container and tons of most commonly used component, also amazing database migration tools and integrated unit testing support, all these tools give developers the ability to build complex applications[11].

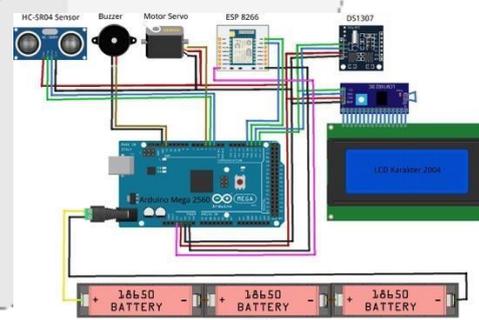
H. Hypertext Markup Language

The language used to produce web page documents is called HyperText Markup Language (HTML). HTML is a markup language, which means it is a method for identifying and defining the various components of a document, such as headers, paragraphs, and lists. It is not a programming language. The markup identifies the underlying structure of the document[12].

I. JavaScript jQuery

Brendan Eich invented Javascript in 1995 as a computer language that allows interactive web pages and is an important element of online applications[13]. jQuery is a Javascript library or JavaScript framework. jQuery has the motto "write less, do more"[14]. That proves the lines of javascript programs in jQuery are shorter compared to the lines of the javascript program itself[15].

J. Pet Feeder



Pet feeders are pet cutlery that shaped a bowl. The development of pet feeders is getting sophisticated. Based on the type of pet feeder divided by two, manual pet feeder and automatic pet feeder. Manual pet feeder means using human resources directly. Some manual pet feeders use a button for the feed from food storage by press the button, and some poured from origin place such us plastic or jars

use measuring spoon. In comparison, an automatic pet feeder is pet cutlery that does not use human resources directly. Besides feeding the food automatically, an automatic pet feeder can set the time, and food portions also control remaining food supplies in storage.



Figure 1 ESP8266

ESP8266 is used to communicate data from an Arduino to an IoT platform, where the user may access it. Wi-Fi module with TCP/IP protocol integration and self-contained SOC. Because it has its own program code, ESP8266 can easily supply wifi when connected to an Arduino board. It acts as a link between a wi-fi network and an existing microcontroller[16].

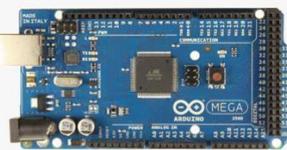


Figure 2 Arduino Mega 2560

Arduino Mega 2560 is a circuit board with an Atmega 2560 microcontroller chip and has the finest quantity of pins among all other Arduino types. The feature of using Arduino Mega may be very suitable for making projects which have a huge space capacity in the circuit. Larger memory capacity as compared to other varieties of Arduino makes Arduino Mega suitable for projects that use many modules at once [17].



Figure 3 Loadcell

A load cell is a transducer that senses force and produces an electrical signal as a result. It has strain gauges in a Wheatstone bridge design to detect resistance values[18].

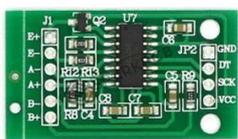


Figure 4 HX711 Module

The HX711 module, usually called the Load Cell module, operates as a weight detector on the weight sensor (Load Cell) in terms of weight measurement. The HX711 component of the Load Cell Module type functions as an output signal amplifier from the Load Cell and HX711 Module, which converts analog data into digital data or more commonly known as analogue-digital Converter (ADC) connecting the Load Cell Pin module to the Arduino

MEGA 2560, which functions as a microprocessor[18]. In theory, the load cell sensor senses the mass load and then converts the analog voltage from the load cell sensor into digital data via the HX711 Module. The HX711 module is shown in Figure 4.



Figure 5 Ultrasonic Sensor

An ultrasonic sensor is a device used to determine the distance between two objects. The distance measured is about 2-450 cm. This gadget communicates the read distance via two digital pins. This ultrasonic sensor operates by transmitting reflected sound waves which can be used to determine the presence or distance of an item with a certain frequency and to calculate the time in microseconds taken. It is called an ultrasonic sensor because it detects the distance of an object using ultrasonic waves (ultrasonic sound)[19].



Figure 6 Realtime Clock

The Real Time Clock sensor is a device that provides real-time information and is used to keep track of the current time. The RTC device displays the date, time, and year, as well as the month, which is automatically adjusted[20].



Figure 7 Liquid Crystal Display

A Liquid Crystal Display (LCD) is an electrical type display board that displays characters, writing, letters, and numbers. LCD function on the idea of capturing and reflecting light from the front-lit or transmitting light from the backlit[21].



Figure 8 Servo Motor

A servo motor is one that is controlled and regulated by pulses. There are three positions on the servo motor 0 degrees, 90 degrees, and 180 degrees. The servo motor shaft must be connected to a mechanism so that its movement can be adjusted[21].



Figure 9 Buzzer

Buzzer is an electrical component. It converts electrical waves into vocal vibrations. Buzzer are made up of coils connected to a diaphragm that are then fed electricity to turn them into electromagnets. Each movement of the coil causes the diaphragm to move back and forth, causing the air to vibrate and produce sound[19].

III. SYSTEM DESIGN

A. General Description of the System

Pet feeders are expected to make it easier for animal owners to feed animals and can reduce mortality caused by obesity or underreating. This pet feeder is designed to be controlled remotely using blynk platforms and websites. Blynk is a platform that can install in the app store and play store but needed login first, after login will be directed to the menu available in the pet feeder. while the website can be used inside the laptop by logging in and presenting the same three features as blynk platform.

B. Work Flow of the System

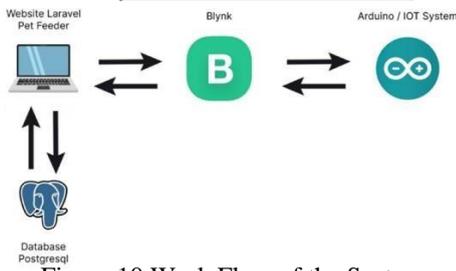


Figure 10 Work Flow of the System

An Arduino sends and receives data into the Blynk app. Send and receive data into a website (laravel) using blynk app and blynk api (with token) and a website (laravel) sending and receiving data into a postgresql database.

C. Data Structure on The Blynk Database System

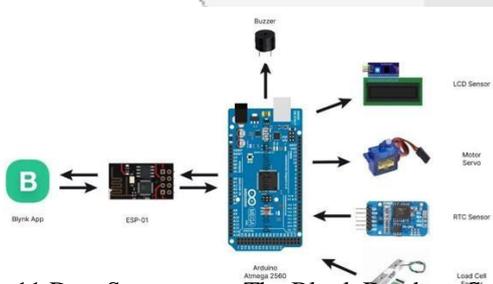


Figure 11 Data Structure on The Blynk Database System

It can be explained that the buzzer receives data from Atmega (in the form of sound), while the LCD sensor receives data from Atmega and displays the data in written form. The servo motor receives data from the atmega and

displays the data in the form of rotation/rotation. The RTC sensor sends time data to the atmega. Loadcell sends out feed weight data to Atmega. ESP-01 sends and receives data to Atmega for inclusion in Blynk

D. Flowchart Blynk Application

In figure 11 explains how blynk works on smartphones. When blynk opened there will be 3 menu options namely Login, Create new account and Login with facebook.

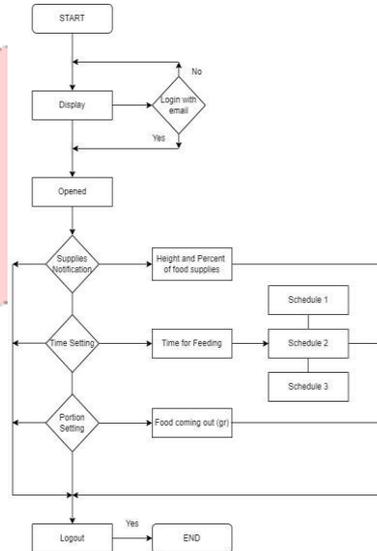


Figure 12 Flowchart Blynk Application

After logging in using email, the owner will be immediately presented with 3 features in the platform blynk. The first menu is notification settings that will display the warnings that will be transferred to the buzzer by generating an alarm sound . The second menu is a time setting that is to set animal feeding times using the Real Time Clock (RTC). The last menu is a portion setting to regulate the weight of food needed based on weight of animals. After all the menus successfully in the setting do logout to end blynk setting.

E. Website Flowchart

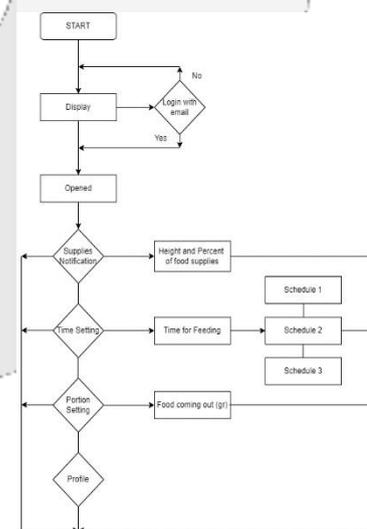


Figure 13 Website Flowchart

In figure 12 all it takes in using a website is browse. When login into the website will directly expose the user to the feature menu available in the pet feeder. The menu in the website is the same as the menu in Blynk. The difference is only in accessing it if blynk only can use on smartphone, while the website only can use on laptop. The website exactly show the displays of pet feeder menu. After completing all data collection, the website will store the data that has been set up. Then the application can be closed.

F. Functionality Testing

This section will explain functionality testing, where this test is carried out to test every feature on the system, namely login, register, Supplies Notification Page, Time Setting Page, Portion Setting Page, and Profile Page running well with the IoT tool system that has been designed.

In this section, hardware testing will be described, hardware testing is carried out to determine whether the function of the device that has been designed is functioning properly.

G. Hardware Testing

In this section, hardware testing will be described, hardware testing is carried out to determine whether the function of the device that has been designed is functioning properly.

H. Blynk Testing

This section will explain the blynk testing, where this test is to see the results of the implementation of the blynk application that has been made and see the results of testing each feature in the blynk application.

I. Throughput

This measure counts the number of successful delivery of information from the ESP8266 to the MySQL database in the desired run time. The analysis will be done using Wireshark. Throughput is visualized with a line chart, where the input data will be stored in Microsoft Excel. The measurement scenario is divided into nine sessions, where one session is equal to one hour of observation time.

J. Packet Loss

In this section, packet loss is a packet lost in a network. This packet loss test is carried out when transferring data from the blynk app to ESP8266 and from ESP8266 to the blynk app.

K. Delay

As with throughput, these performance parameters are analyzed using Wireshark. The measurement also uses the same scheme, where the calculation is divided into nine sessions. This parameter calculation aims to obtain the time required for the system to cover the distance between the ESP8266 and the MySQL database via a localhost connection.

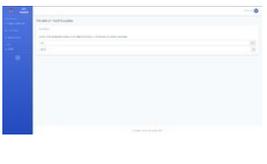
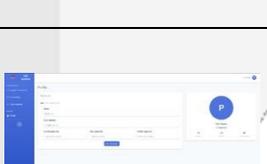
IV. RESULT AND ANALYSIS

A. Implementation Website Interface

The interface is a view that has been applied from the design that has been made. The results of the

implementation of the website interface that have been created are described in table 1 below:

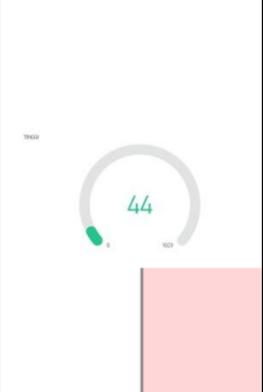
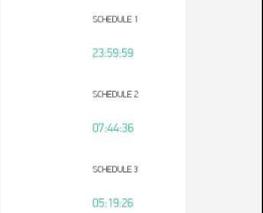
Table 1 Implementation Website Interface

No	Figure	Features	Description
1.		Login Website	Login function to enter the website using email and password
2.		Register Website	Register page to register an account into the application
3.		Supplies Notification Page	Inventory notification page to monitor feed status and for out-of-feed feeding.
4.		Time Setting Page	Time setting page to set the meal schedule in the application
5.		Portion Setting Page	Portion setting page to set the meal that comes out based on the weight of the animals.
6.		Profile Page	Profile page to manage personal data of registered account

B. Implementation Blynk Application

The blynk application is an application that has been implemented from the design that has been made. The results of the implementation of the blynk application that have been made are described in table 2 below:

Table 2 Implementation Blynk Application

No	Figure	Features	Description
1.		Gauge (height parameter)	Functions as a measure of food waste contained in storage and the value of this parameter is taken from the ultrasonic sensor
2.		Gauge (Weight parameter)	Serves as a measure of the weight of food that comes out of storage to where the animal feeds. The value of this parameter is taken from the weight sensor
3.		Time Input	Serves as a scheduler or schedule for feeding
4.		Text Input	Serves as a regulator of the classification of the amount of food that will come out based on the animal's weight
5.		Notification	Functions as an empty storage reminder or a live system marker

C. Testing Hardware

Tests are carried out to determine the function of the devices used are working properly, such as Arduino ATmega 2560, LiquidCrystal_I2C Sensor, RTC_DS1307, ESP8266 and Servo Motor.



Figure 14 Hardware Design

Furthermore, hardware testing is carried out whether it is successful or not. The following is table 4.3 of the hardware test results:

Table 3 Testing Hardware

Hardware	Indicator	Scenario	Status
Arduino Atmega 2560	The indicator light on the Arduino is lit and can run the program	Connecting to a laptop and running the program	Success
Sensor LiquidCrystal_I2C	Lcd can be lit and display writing	Connecting the lcd sensor pins to the Arduino atmega and configuring the posts to be displayed on the lcd	Success
RTC_DS1307	The light on the sensor indicator lights up and can detect the pre-configured clock	Connect real time clock sensor pins to Arduino atmega and configure date and time	Success
ESP8266	The light on the indicator lights up and can connect to the	Connect the sensor pin with esp8266 to Arduino atmega and connect the	Success

	internet network via wifi	sensor to the internet network via wifi	
Motor Servo	Servo to open a food place	Servo motor rotates to an angle of 50° and Back to 0°	Success

D. The Quality of Service Test

This test is carried out to determine the quality of the network when sending and receiving data into a system. The parameters tested are Throughput and Delay.

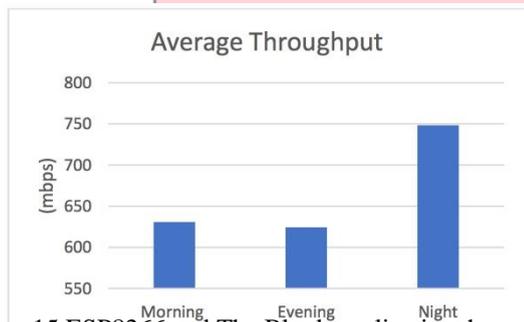


Figure 15 ESP8266 and The Blynk application throughput test graphs

The observed throughput this test was carried out 3 times with 5 trials for each test and the testing time was in the morning, evening and night. The result of average morning throughput is 630.6 mbps, the result of average evening throughput is 624.4 mbps and the result of average night delay is 748.2 mbps. According to the TIPHON standardization based on the results obtained, the result 5 of the test has poor category because it has 1 indeks.

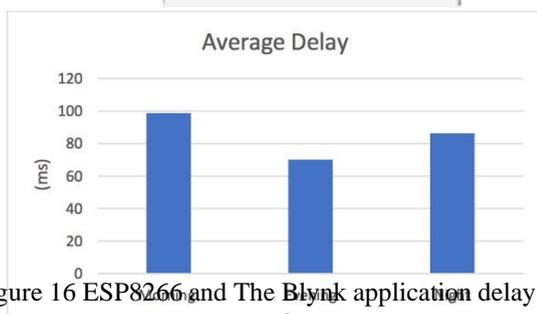


Figure 16 ESP8266 and The Blynk application delay test graphs.

This was carried out 3 times, with 5 trials for each test, and the testing times were in the morning, evening, and night. The result of the average morning delay is 98.7559822 ms, the average evening delay is 70.1745731 ms, and the average night delay is 86.27447167 ms. According to the TIPHON standardization based on the results obtained, the result of the test has a perfect category because it has 4 index.

Table 4 Packet Loss

Time	Packet Loss (%)
Morning 1	0
Morning 2	0
Morning 3	0
Morning 4	0
Morning 5	0
Evening 1	0.240384615
Evening 2	0
Evening 3	0
Evening 4	0
Evening 5	0
Night 1	0.249376559
Night 2	0
Night 3	0
Night 4	0
Night 5	0

This test was carried out 3 times with 5 trials for each test, and the testing times were in the morning, evening, and night. There are two times that packet loss causes the quality of the internet. To view packet loss by typing `tcp.analysis.ack_lost_segment`, apply a display filter and the code to show packet loss that did not arrive.

V. CONCLUSION

Based on the results and analysis that have been carried out in this study, it can be concluded that the application and IoT that have been designed will provide information about pet feeding schedules and weight control in pets, which will be classified as pets. The amount of food that will come out and information on the rest of the food storage. In QoS testing according to the TIPHON standard, the result of average morning throughput is 630.6 mbps, the result of average evening throughput is 624.4 mbps and the result of average night throughput is 748.2 mbps, that's he result of the test has poor category because it has 1 indeks. The result of the average morning delay is 98.7559822 ms, the result of the average evening delay is 70.1745731 ms and the result of the average night delay is 86.27447167 ms, which means it is classified as a good category with index 3. The packet loss result is in the first evening test and first night test, and the result is 0.240384615% and 0.249376559%

The shortcomings of the system in this study that can be used as research material in the future are monitoring and controlling pet feed supplies only using Blynk platform and website and pet feeder still using a local host and the website still using API Blynk.

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