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Automation of Animal Feeders Using NODEMCU ESP8266 and Smartphone-Based BLYNK APP

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ABSTRACT

Most humans today have used smartphones or smartphones, and besides that, humans also have pets where these pets require routine care, such as feeding the pet and others. We as humans sometimes when are not available or unable to care for our pets. Therefore the author raises the title "Automation of Animal Feeding Using Nodemcu Esp8266 and Smartphone-Based Blynk App". This research uses Research and Development methods or research and development. The source of data used in previous studies was Pet Feeder and direct observation for making the author's tool using the ADDIE method (Analysis, Design, Development, Implementation and Evaluation). Based on the observation of the finished results of the tool, it was concluded that the tool can work smoothly and show results to pets in the form of regular pet feeding schedules and with the right portions.

Keywords: *Tools, Blynk App, ESP8266, HX711*

Introduction

Technological progress is very rapid, ranging from technology supporting human life to technology that can help daily human work [1]. Automation technology benefits physical and non-physical work, for example, in industries that have implemented automation, such as using robots to make or build a product. This automation benefits humans in working on a task [2]. Automation of technology can get consistent results. In addition to the industry, automation technology has been used for personal purposes, such as in homes that have a variety of automation, such as to control the house automatically with certain conditions and others, such as a robot that can clean floors automatically [3][4][4].

Most humans have pets like cats, dogs, birds and other animals [5]. Pets are the responsibility of the owner. Like any other living creature, pets need care and food to survive [6]. As humans and people responsible for these pets, we sometimes do not have free time to take care of and even feed our pets.

This study aims to create a tool that is used to feed pets automatically and has a monitoring feature so that the food available to our pets is always under monitoring. In designing and developing this tool, the author uses a Wemos D1 Mini microcontroller based on the ESP8266 chip. This microcontroller as a processing tool or as the brain of this tool, while for other modules that will be used in this tool itself in the form of an ultrasonic sensor HC-SR04 which will later be used to measure the contents of food storage and an HX711 along with a loadcell that functions to measure the weight of food containers and which Finally, a servo motor that functions as a mechanism to remove food from the food storage area to the food container.

The results of this research will produce a tool, with the tool is expected to be used and help daily human work, especially in caring for or feeding pets.

Research Methods

Planning Tools

Hardware Design is the design of hardware devices on the tool, and the beginning of this hardware design begins with making circuit diagram blocks in order to find out the overall working system of the tool starting from input, process, and output. And continued with the installation of component components on the tool to the finishing process. The hardware components used are as follows [7]–[10]:

1. Wemos D1 Mini Microcontroller
   Its function is that with a connection to the internet, it allows this tool to be monitored and controlled over long distances.

2. Ultrasonic Sensor HC-SR04
   Its function is to monitor the contents of food storage container capacity.
3. Servo Motor SG90
   Serves to support the mechanism of removing food from food storage containers.
4. Load Cell & HX711
   Serves to measure weight on food containers
5. Real Time Clock DS3231
   Serves to set the animal feeding schedule based on time
6. Smart Phone
   Smartphones are used as a medium for monitoring and controlling these tools.

Software

Blynk App

This Blynk app will later be able to be used on smartphones using an account that has been created by the developer or can also use the link that will be shared by the smart pet feeder developer, if the user does not want to use the application or install it on his smartphone, then the user can use the web version of Blynk with the same function and access [11]–[13].

Arduino IDE/Visual Studio Code

In addition to the user interface for monitoring and controlling, there is one more interface needed in the process of developing the interface is the IDE (Integrated Development Environment). This IDE is used to enter or write programs to the tool and then upload the programs that have been written. IDEs that can be used to develop are Arduino IDE and Visual Studio Code, where the author will use one of the two IDEs to write and upload program code [14].

The way it works can be modeled by designing a flowchart of a smart pet feeder. The design of the flowchart is shown in Figure 1.

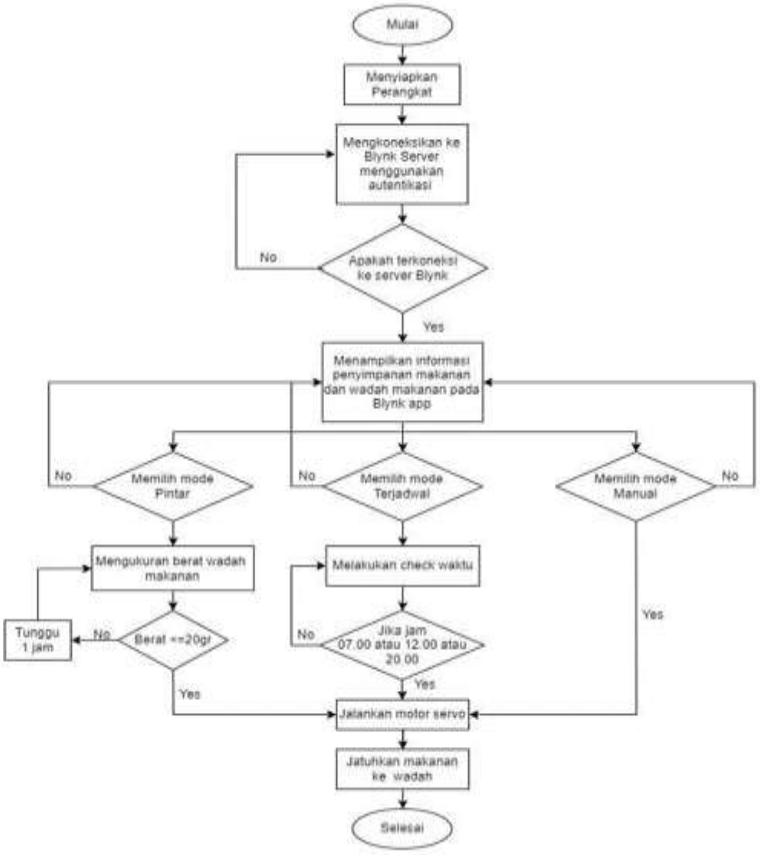

Figure 1 Circuit Flowchart

How the Tool Works

Smart mode, in smart mode will measure the weight of the food container every one hour, if it is thought that the weight of the food container has been less than or equal to 20 grams, it will remove the food into the food container, then will wait for another hour to measure the weight of the food container again [15].

Manual Mode, manual mode is the last mode found in this tool, in this mode does not depend on time or weight on the food container, but the user determines for himself when to release food to the pet food container [16].

Results and Discussion

Measurement Points

In measuring the power supply as the main source needed, in order to be able to know the voltage before the input of the power supply to enter the microcontroller. There are several measurement points that can be seen in figure 2.

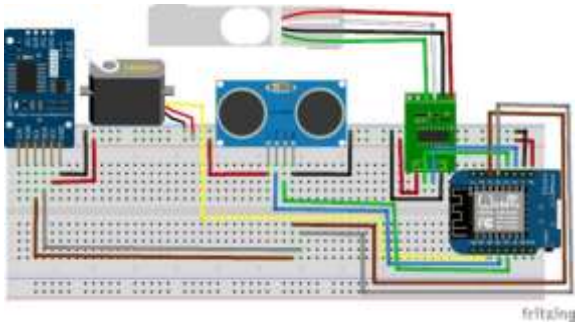

Figure 2. Tool Measurement Points

The overall measurement point can be seen in the figure below:

TP 1 = The measurement point at the PLN source is the input voltage of the transfamator
TP 2 = Measurement point on adapter
TP 3 = Measurement point on wemos
TP 4 = Measurement point on ultrasonic
TP 5 = Measuring point on servo
TP 6 = Measurement point on RTC
TP 7 = Measurement point on loadcell

Measurement Results

Measurements at predetermined points were carried out as many as five times in order to minimize the occurrence of errors and compare the results obtained. Measuring five times will get an average score of [17]–[19]. The measurement results are shown in Table 1.

Position	Point		Measurement Results						
Measurement	Measurement	Unit	1	2	3	4	5	X	Information
	PLN (TP 1)	VAC	218,7	218,6	218,4	218,2	218,5	218,4	Adapter Input
Power Supply	Adapter (TP 2)	VDC	5,08	5,06	5,04	5,03	5,05	5,05	Input Wemos
Wemos	(TP 3)	VDC	5,08	5,06	5,03	5,05	5,07	5,05	Output Wemos
Ultrasonic	(TP 4)	VDC	5,08	5,06	5,03	5,05	5,07	5,05	Output

									Ultrasonic
Servo	(TP 5)	VDC	5,08	5,06	5,03	5,05	5,07	5,05	Output Servo
RTC	(TP 6)	VDC	5,08	5,06	5,03	5,05	5,07	5,05	Output RTC
Loadcell	(TP 7)	VDC	5,08	5,03	5,05	5,07	5,07	5,06	Output Loadcell

Error Percentage

From the results of measurements that have been carried out such as the data above, there is an average value at each measurement point, the value has a function to get the percentage value of error in the measurement. The measurement error is shown in table 2.

Table 2. Error Measurement Results

Measurement Position	Location of Measurements	Data Sheet (Volts)	(Volt Measurement)	Calculation (Volts)	Error (%)
	TP 1	220	218,4	-	-
Power Supply	TP 2	5	5,05		*In Range*
Wemos	TP 3	5	5,05		*In Range*
Ultrasonic	TP 4	5	5,05		*In Range*
Servo	TP 5	5	5,05		*In Range*
RTC	TP 6	5	5,05		*In Range*
Loadcell	TP 7	5	5,06		*In Range*

Ultrasonic Process Trials

The trial was carried out by placing an ultrasonic sesor, on top of the food container in order to detect the feed in the food container. Then get the data results in table 3.

Table 3 Ultrasonic trial results

Experiment	Feeding (Grams)	Fill feed in containers (Grams)	Description on notifications
First try	100	500	morning feed

Second try	100	400	Lunch feed
Third try	100	300	Night feed

The results of ultrasonic testing can be seen in the table above that ultrasonic sensors can detect food waste in food containers without having to look directly at the food container.

Test Run of RTC Process

The trial was carried out to ensure that at the specified time, users will get a notification to the cellphone through the blynk application according to the feeding time shown in figure 3.

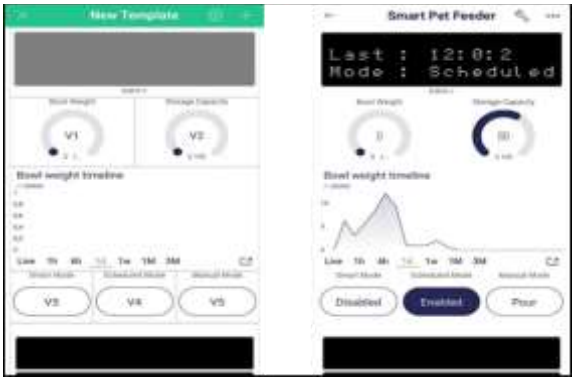

Figure 3 Test Run of RTC Process

LoadCell Process Test Run

This experiment was carried out using bird feed as an object placed in a feed container. The weight of the feed in the container will appear on Blynk and if the weight of the feed in the container is less than 100 grams, then at the next feeding hour the system will fill according to the weight of less than 100 grams. The results of the trial are shown in Table 4.

Table 4 Results of Loadcell process trials

Feeding	Weight in feed container (grams)	Feeding (Grams)
Morning	100	0
Noon	50	50
Night	30	70

Process Test Run of Servo Motor

This mechanical food dispensing is a plate that is placed just below the hole of the food storage and attached to the SG90 servo motor, when assembling this device this plate will be made a hole according to the food storage hole. This disc will work when the hole from the food storage is parallel to the hole in this dish, the food will come out of the storage container to the pet food container. The rotation of the SG90 servo motor will make the position of this dish open and closed according to the conditions that have been determined later. The results of the trial are shown in Figure 4 and Table 5.

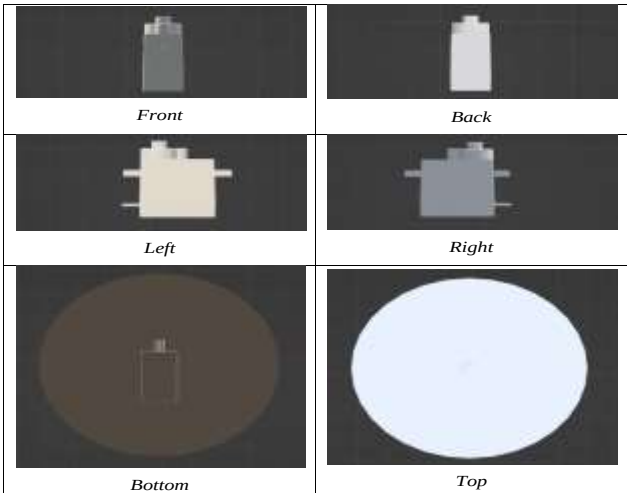

Figure 4 Food Dispensing Mechanism

Analysis

From the results of measurements and calculations that have been made, it can be analyzed as follows.

1. In the measurement of the tool performed, the percentage of error is 0.38%. The percentage of error in the sensor used is 1%, so the tool has worked as expected.
2. Manual mode produces results according to the design on the previous flowchart, which will drop food when the manual mode button is pressed then if the button is released then the dish will close again and record the last feeding time.

Figure 5. Running Manual Mode

If the user is in manual mode, the user must operate directly when he wants to feed his pet, because if it has changed to manual mode, the user cannot move to another mode automatically.

In scheduled mode or scheduled mode the results obtained are in accordance with the predetermined where this tool will dispense food at a predetermined time, as in the example picture below which has been timed, namely at 07.00, 12.00 and 19.00.

Figure 4. Run Scheduled Mode

Conclusion

The tool can work with a predetermined design and also in accordance with the initial purpose of the design of this tool which is to help in caring for the pet. The tool works by making it easier and also maximum users to monitor the tool, it happens because of the notification feature on the Blynk app and also the configuration of notifications on the tool. Tools are used to give pets food automatically and are specialized for dry types of food. To be able to use the tool, users must have an internet network connection, this can be done using a WiFi connection, while for the client or interface with the Blynk app can use a data connection connected to the internet. When you first turn on the tool, the user must choose the mode to run the tool be it manual, smart or scheduled mode.

To run the tool users are recommended to use smart mode, this is because the tool can work completely automatically in this mode, and is also highly recommended for users who have more than one pet or their pets

have a large portion of food. The tool is not recommended for users using manual mode, this is because in manual mode users must operate the tool directly through the Blynk app when they want to feed pets.

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