Automatic Pet Feeder with Solar PV System

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Abstract. Everything that has been done within the scope of this research is aimed towards designing a device with a solar voltage source, that is capable of directly and automatically feeding a pet animal by adhering to the schedule and conditions predetermined by the user. The design utilizes the ESP8266 Wi-Fi module as a controller that receives weight data about the pet’s food inside a container. The Arduino also controls a servo that opens the container based on the parameters set by the user via a Blynk app in a smartphone. This system includes a relay to switch from a wall socket adapter power supply to a battery connected to a solar panel. The obtained results satisfy the purpose of the research. The device was able to operate well using the utility grid and it can last for two hours solely on a 12 V 6Ah lead-acid battery. The device is 100 % accurate in adhering to the user’s schedule, responding with an average delay time of 1.4375 seconds between the Blynk application to the ESP8266 system.

Keywords: Solar energy, Automatic feeding, ESP8266, Blynk, Lead-acid Battery

1. Introduction

Every human in a society have a hobby in their spare time. One such hobby is to have a pet [1]. For a human to have pet, is very useful, because it satisfies the human social needs, and it gives many other benefits, such as clearing stress, discard boredom, and train responsibility [2]. Therefore, the health of pets is important, through routine checking of their health and ensuring a healthy food and regularly fed. But the pet owner, especially who live in a big town, do not have time to feed their pet. Based on literature, the pets-eating’s schedule is the same with us, i.e. at 8 AM and 5 PM. Therefore, this schedule is a bit cumbersome for the pet’s owner [3]. Therefore, there is a need for an automatic pet’s feeder machine, that able to solve the pet’s owner problem in feeding their pets.

A research on Cat Automatic Feeder Based on Modul GSM SIM900A and Arduino, has been done by [4], and also Automated Food and Drink Giver For Cat Scheduled-Based Microcontroller by [5] and “Robot Chow: Automatic Animal Feeding with Intelligent Interface to Monitor Pets” by [6]. These three researchers’ objective is to automate the feeding process of their pets, such that the pets can have their food at regular time. With that three references, we design a device with an automatic feeder, equipped with Internet of things for connectivity, and powered by PV Solar Panel. This device will also use a microcontroller that can provide animal’s food, as scheduled, and it can also provide a real-time feeding time, using a command input button at a smartphone.
2. Research Methodology

Figure 1 shows the overall block diagram of this pet’s feeder system. The novel idea in this Pet’s Feeder System is the ability to use Solar Energies, so that at noon, if the sun is shining, then this system is fed by Solar energies. And in any case of solar energy shortage, a relay will switch to a line utility system, so that the microcontroller still gets the power they needed to operate.

Figure 1 Block Diagram of Pet’s Feeder

Figure 2 shows the flow-charts describing how this Pet’s feeder system works in term of software flows.

Figure 2 Flow Chart Pet Feeder
3. Experimental Results

Figure 3 shows the prototype for this Pet Feeder System. There are two parts for this Pet Feeder prototype. The first one is a tube’s holder structure, that holds the pet’s food inside. The release mechanism is done using a servo motor, which is controlled by an Arduino’s board. The second part is a cube box, that holds in place, the LCD, the power supply, the tube’s food and the electronics’ parts. The Blynk software is shown also in figure 3 (right side). It has been designed with the ability to create two feeding’s scheduling time. And it also has a button “Feed Now” to give command for the servo motor to open.

![Figure 3 - Hardware and Blynk Software Prototype of Pet Feeder System](image)

Table 1 shows the time it takes to charge the battery from 12.4 to 14.2 volts. A multimeter and a stopwatch are the instruments to measure voltage and time, respectively.

Table 1 - Charging Time of The Battery

| No. | Time [hour] |
|-----|-------------|
| 1   | 5           |
| 2   | 5           |
| 3   | 6           |
| 4   | 5           |
| 5   | 6           |
| 6   | 6           |
| 7   | 8           |
| 8   | 10          |
| 9   | 6           |
| 10  | 7           |

Average Time: 6.4

Table 2 shows the available time of the battery to deliver its charge to the system, without support from the line utility system.
Table 2 - Usage Time of The Battery

| No. | Time [days] |
|-----|-------------|
| 1   | 2.3         |
| 2   | 2.3         |
| 3   | 2.3         |
| 4   | 2.3         |
| 5   | 2.3         |
| 6   | 2.3         |
| 7   | 2.3         |
| 8   | 2.3         |
| 9   | 2.3         |
| 10  | 2.3         |

Table 3 shows a successful rate of 100% feeding instruction, from the software side of Blynk to the Pet’s Feeder System.

Table 3 - Software Blynk shows 100% result success rate in feeding the Pets.

| Date      | Time  | Result (tick symbol means servo open as commanded) |
|-----------|-------|---------------------------------------------------|
| 18-08-2020| 08:00 | √                                                 |
|           | 17:00 | √                                                 |
| 19-08-2020| 08:00 | √                                                 |
|           | 17:00 | √                                                 |
| 20-08-2020| 08:00 | √                                                 |
|           | 17:00 | √                                                 |
| 21-08-2020| 08:00 | √                                                 |
|           | 17:00 | √                                                 |
| 22-08-2020| 08:00 | √                                                 |
|           | 17:00 | √                                                 |
| 23-02-2019| 08:00 | √                                                 |
|           | 17:00 | √                                                 |
| 24-12-2019| 08:00 | √                                                 |
|           | 17:00 | √                                                 |
| 25-12-2019| 08:00 | √                                                 |
|           | 17:00 | √                                                 |
| 26-12-2019| 08:00 | √                                                 |
|           | 17:00 | √                                                 |
| 27-12-2019| 08:00 | √                                                 |
|           | 17:00 | √                                                 |

While figure 4 shows the weight sensor output compared to other scale measurement. The results show minor difference between HX711 sensor and the commercial scale product, which is used as a reference.
4. Conclusions
This Pet’s Feeder System works as designed, by automatically fed the animal using Blynk software and microcontroller system along with weight’s sensor, the LCD output display, and the servo motor as the actuator. Even though, this Pet’s Feeder System is in prototyping state, it has used the PV panel as a secondary voltage’s source, so that this system can be powered independently from power utility, as long as the battery capacity is available and the sun shines throughout the day.

The ability to switch between two power-sources adds the novelty design of this system. The system will choose PV panel voltage source as its main source if the battery’s capacity is not below 50%. And it only uses the power utility when the battery’s capacity is below 50%.

The Blynk application can communicate with Nodemcu-ESP8266, in a real time. This connectivity feature adds flexibility in spaces’ control and in ease of monitoring ability.

Acknowledgement
This work is supported by Research and Technology Transfer Office, Bina Nusantara University as a part of Bina Nusantara University’s International Research Grant entitled “Off Grid PV System For Rural Area With No Electricity” with contract number: No.026/VR.RTT/IV/2020 and contract date: 6 April 2020.

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