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Smart Pet Feeder-Smart Pet Care System with IoT Based Pet Feeder Using WeMos D1 and Blynk

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Abstract: ***We propose an Automatic Pet Feeder system based on WeMos D1 (ESP-12E) Wi-Fi microcontroller, SG90 servo motor, and Blynk mobile app for the ability to feed your pet remotely and on a schedule. This project is designed to help pet owners feed their pets in a proper time when they are out of home or engaged in routine tasks. It was designed to be operated by means of a smartphone running the Blynk app and connected to a Wi-Fi network through the WeMos D1 board to control the feeder. An app connected to commands that rotate a flap to dispense food, with a servo motor in place to allow the rotation. The setup provides real-time control, editable scheduling, and low ease of use with little hardware needed. This is an example of practical and innovative IoT usage in pet care domain. With its competitive pricing, ease of use, and unique features, it becomes a consumer-friendly option for the pet owners to go for. Created to drive smart home automation, it makes pets healthier, happier and more connected while making it easier for owners to take care of their daily routines.***

Keywords: Automatic Pet Feeder, WeMos D1, ESP-12E, ESP8266, SG90 Servo Motor, Blynk App, IoT, Smart Pet Care, Remote Feeding, Wi-Fi Controlled System

1. Introduction

In today's fast-paced world, pet owners often struggle to maintain a consistent feeding schedule for their pets due to hectic routines, long working hours, or frequent travel. This leads to an increasing demand for smart and automated solutions that can assist in day-to-day pet care. One such solution is the development of automatic pet feeders that can dispense food remotely or at pre-set intervals, ensuring pets are fed on time even in the owner's absence. This paper presents the design and development of a Smart IoT-Based Pet Feeder using the WeMos D1 (ESP-12E) Wi-Fi development board, an SG90 Servo Motor, and the Blynk platform for remote control via a smartphone. The WeMos D1 board, based on the ESP8266 chip, offers built-in Wi-Fi capabilities, making it a suitable choice for Internet of Things (IoT) applications. The SG90 servo motor is used to operate a custom-designed flap mechanism attached to a food container, allowing precise control over food dispensing.

The integration with the Blynk mobile and web dashboard allows the user to control the feeder from anywhere using a smartphone or a web browser. With just a tap, the servo motor activates the flap, releasing food into the feeding bowl. This system demonstrates how simple and affordable electronic components can be combined with cloud-based platforms to create practical, real-life IoT solutions.

Overall, this project not only showcases the real-world application of IoT in daily life but also emphasizes the effectiveness of combining mobile platforms with microcontrollers to create smart, efficient, and user-friendly automated systems.

2. Literature Review

The Internet of Things (IoT) technologies have also emerged in the past few years, which have aided a lot in automating daily activities and top information — smart pet care systems, such as automatic feeders. In the year 2023, a number of studies were carried out to make the pet care system remotely accessible and intelligent by integrating microcontrollers, mobile application and cloud services.

An IoT-based pet feeder using NodeMCU ESP8266 and blynk platform was supplied by S. Patil and A. Kulkarni [1]. Based on the user's needs, the design focused on low-cost implementation and real-time feed control and access using a mobile-centric design for interaction

T.A. Hossain et al. an intelligent cat feeder using the ESP8266 and a real-time clock (RTC) module for timely food dispensing [2].

N.M Kadhim and A.H Kareem [3] developed a pet feeding system with mobile app control and Wi-Fi capable components. This system had a simple UI to activate feeds but no data logging or scheduling optimization. Their work paved the way for simple IoT pet systems, but no real analytics or engagement with users.

An IoT-based Smart Pet Feeder has been developed by S. Gupta and R. Mehta [4] in which both NodeMCU and Blynk were used for real time monitoring, and remote actuation through mobile devices. However, this was not integrated into their implementation with performance analysis and error detection, both required for robust long-term operation.

J.M. Khan, F. Ali, and S. Rahman– [5] investigated an integrated approach of smart pet care system focusing on feeding control, environmental sensing, and mobile alerts. Although their overall system consisted of multiple modules, it needed to have more complex circuitry and setup which might not be suitable for beginner level users or simple home deployment.

3. Methodlogy

3.1 System Overview and Architecture

The system we propose is an IoT based Auto Pet Feeder that would dispense food for the pet to eat at a predetermined time or remotely using a mobile application. The complete system comprises three main components:

1) Hardware Unit – This consists of the WeMos D1 (ESP-12E), a SG90 servo motor, and a mechanism that dispenses food.
2) Software Unit – an Application of Blynk to take remote control and schedule
3) Data Forwarding — Communication between Hardware and mobile via Wi-Fi.

Blynk App is the interface to interact with the user through the Internet of things for the user to send commands to the WeMos D1 microcontroller. When the controller receives the signal, it activates the SG90 servo motor, which opens a flap or rotates some container and releases food into the pets bowl in a controlled manner and in a timely manner.

4. System Architecture

The architecture of the automatic pet feeder can be broken down in the following layers:

1) User Interface Layer

The User Interface (UI) Layer in this project is developed using the Blynk IoT Platform, which offers both mobile and web-based dashboards to control and monitor IoT devices seamlessly. It serves as the bridge between the user and the hardware system, enabling remote operation and real-time interaction with the pet feeder.

Users can trigger the feeder by pressing a virtual button, which sends a signal to the WeMos D1 board via the cloud.

Live device status (such as online/offline indication) is visible, ensuring the user knows whether the system is ready to receive commands.

The UI also allows users to schedule feeding times, set reminders, or even integrate additional features in the future such as portion control or feeding logs.

2) Network Layer

Introduces the communication of the Blynk Cloud Server, user's smartphone, and the WeMos D1 (ESP-12E) through Wi-Fi. The WeMos D1 is now connected to the local Wi-Fi network and waiting for instructions to arrive.

3) Control Layer

Blynk server send commands to WeMos D1 (ESP-12E). It measures the signal and creates the PWM signals to regulate the SG90 servo motor. Includes on-demand feeding logic given app input.

4) Actuation Layer

The actuator in the system is the SG90 Servo Motor. It rotates a gate or food container lid between specific angles – e.g., 0° to 90° – in because this convertible “finger” that can open or close the food container gate.

Workflow Summary

1) The user launches the Blynk app and presses the “Feed Now” button.
2) The command is sent over the internet to the Blynk server.
3) The command is received on the other side (the WeMos D1) from the server
4) SG90: The microcontroller outputs a PWM signal to the SG90 motor.
5) It rotates the motor, opens a flap, dispenses food, and returns to position

4.1 Analysing The Dataset

While the Smart Pet Feeder's main job is dispensing food, it can also gather useful operational data over time on the Blynk platform and WeMos D1 (ESP-12E). This information is useful for performance evaluation, feeding schedule optimization and reliability.

Data Collected

The following types of data can be recorded and analyzed by the system:

- General Feeding Time Stamps: The precise timings for when the feeder was activated manually or via scheduled automation.
- Feeding Times: How often per day or per week the feeder turns on.
- Servo Motor Duration: Time taken by the servo motor to take each feeding.
- User Interactions: The frequency with which the user triggers the feeding machine through the Blynk app.
- Network Connectivity Logs: Whether the feeder is connected to the internet.

Data Logging

Datastreams or widgets on the Blynk App log data, these can be represented over time or history-graphs displaying the values. (Optional integration with applications such as Google Sheets or Thingspeak can help store the data long-term or visualize it.

Analysis Goals

- Monitoring Performance: Check if the servo moves at the appropriate angles and time intervals consistently.
- Meal Adjustment: Feed the pet at the same time every day; if the pet changes the eating time, adjust the timer accordingly to keep the pets healthy and their owner in pain.
- Error Detection: Identify gaps or failures in data for loss of power or disconnection from Wi-Fi.

- User Engagement: Do you know how often the app is used for manual vs. automated feeding?

Visualization Tools

Blynk's built-in History Graph or SuperChart widgets facilitate visualizing:
Daily feeding trends
Motor actuation times
Connection status over time

4.2 Input and Output features

For the automation and remote control of the pet feeder, the system requires minimal input and output parameters, ensuring ease of use while maintaining functional efficiency.

Input Feature:
The primary input is the **user command** sent from the **Blynk app** (via virtual pin V1), which indicates whether the feeder should operate or not.

This command can be manually triggered through a **virtual button** or scheduled within the app for automation.

Output Feature:
The system's main output is the **movement of the servo motor**, which controls the mechanical flap that dispenses food.

The **servo angle** acts as the physical response to the input command—typically rotating to a predefined angle (e.g., 0° to open, 90° or 180° to close).

4.3 Data Logging and Stream Structure

Data Logging
This system logs the types of data:
Timestamp: When the feeding occurred.
Servo Status: If it were motor to open/close the feeder.

Wi-Fi Signal Status: The state of your connectivity when the backup was activated.

User Action (if triggered manually): user id, device id (optional)

This data is encoded into simple labels or keys (e.g., {"mode": "manual", "status": "success"}) and stored through the Blynk app's datastream.

4.4 Data Collection

This project captures data collection that monitors the performance, usage patterns, and operational status of the Smart Pet Feeder system. While the main purpose is hardware-based food dispensing, the integration with the Blynk App and WeMos D1 (ESP-12E) allows recording of data in real-time, beneficial for determining system efficiency and reliability.

Sources of Data

During both testing and actual usage, data is extracted from the system at different points:

- Feeder Trigger Events: Can log if feeder was triggered by manual or by schedule.
- Timestamp: The exact time and date each feeding took place.
- Servo Motor Active: How extraction time and angle of rotation for the servos each operation.
- User Interaction Logs: Number of times the pet was fed via the Blynk application.
- Network Status (optional): Wi-Fi signal strength and connection status at the time of each event.
- Methods for Data Collection
- Blynk SuperChart Widget: To follow and visualize feeding activity throughout a certain time period.
- Virtual Pins in Blynk: Send values (e.g., feed status, timestamps) from the WeMos D1 to the Blynk app.
- Serial Monitor (Arduino IDE) – For development and testing purposes which records motor actions and debugging details.

4.5 Testing and Callibration

Some of the components that require functional testing and calibration are: In such a manner that all these phases occurred following hardware assembly and software integration to perfectionize the feeder performance, particularly sevo motor actuation, feeding mechanism, and mobile control interface.

1) Initial Hardware Testing
Simplifying the Microcontroller Verification: Test simple code on the WeMos D1 (ESP-12E) to verify that it can connect to Wi-Fi and communicate with the Blynk app

Servo Motor Testing: Test scripts allowed the SG90 servo motor to rotate to desired angles (0°, 90°, 180°) to observe its response to commands and to determine its range of motion.

2) Feeding Mechanism Calibration
Servo Angle Calibration:
Then various angles were evaluated for the most suitable rotation, causing the flap or the food dispensing bracket to rotate.

The optimal outcome occurred between 0° and 90° of rotation where the motion was sufficient to dislodge food and return to a closed state.

Feeding Duration:
The servo hold time (how long it is up) was calibrated between1 second to 2 seconds prevent under feed or over feed.

We modified the delay function in the code to do this.

3) Software and App Calibration
Blynk Virtual Pin Testing:
By testing the microcontroller with the app, it was confirmed that the installation code was working and able to send a signal to the microcontroller through its virtual pin that would trigger the servo.

4) Connectivity and Reliability Testing

Wi-Fi Stability:

A range of Wi-Fi environments were tested to see if the system would retain the connection.

Temporary disconnections were also tested for recovery.

Manual Override Testing:

The process of manual feeding was triggered multiple times through the app in order to test user interaction, servo responsiveness and motor durability.

5) Final Validation

Real feeding examples were performed across multiple days to validate the system.

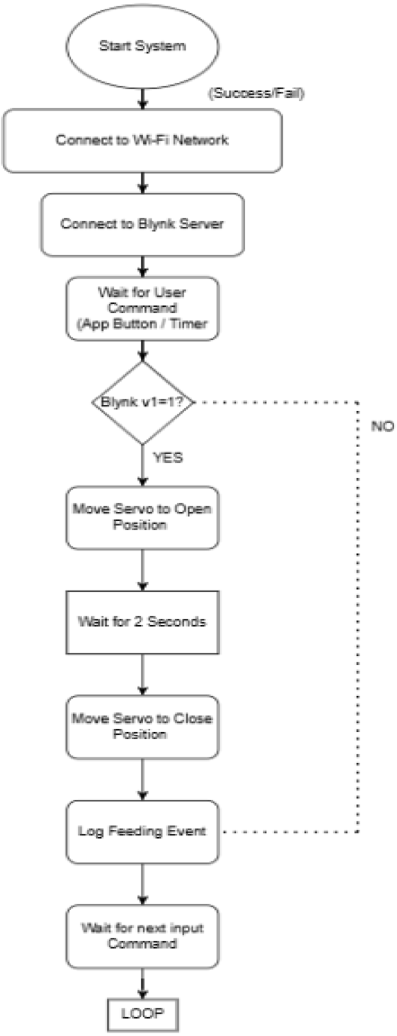
Logs were checked in the SuperChart of the Blynk app to verify:

Proper timestamping of events

Regular motor operation

Scheduled feeding — stimulate a routine (regular feeding).

5. Flow of System



6. Results and Discussions

Time	Mode	Status
28/3/2025 8:15	Manual	Success
29/3/2025 12:32	Manual	Success
29/3/2025 5:51	Manual	Success
31/3/2025 7:47	Manual	Success

The IoT-Based Smart Pet Feeder system was successfully developed and tested using the Wemos D1 (ESP-12E) microcontroller, SG90 servo motor, and the Blynk IoT platform. The system allowed users to remotely control the dispensing of pet food through both the Blynk mobile and web dashboards.

The servo motor was able to rotate precisely between defined angles (open and close positions) to control the food-dispensing flap effectively.

Commands sent from the Blynk app were received in real-time, with minimal latency, thanks to stable Wi-Fi connectivity.

Both manual and scheduled feedings (using Blynk Timer Widget) worked consistently and reliably.

Data such as the feeding timestamp, servo status, and network connectivity could be optionally logged using Blynk's datastreams. The system showed consistent performance during testing with varying Wi-Fi signals.

The feeding mechanism operated reliably for multiple cycles, with the servo providing sufficient torque for a small-to-medium portion of dry food.

One major advantage of this system is its flexibility—users can control feeding from anywhere in the world as long as the system remains connected to Wi-Fi and powered.

Mounting and alignment of the servo motor with the food container flap played a critical role in ensuring smooth operation. Minor mechanical adjustments were necessary to avoid jamming or incomplete rotation.

The system currently relies on home Wi-Fi; portability could be improved by using mobile hotspots or integrating GSM modules for future versions.

Power dependency on USB or power adapters could be enhanced by using a battery backup or portable power bank setup.

Though data is not permanently logged in the free Blynk plan, integration with other platforms (like Firebase or local SD card modules) could be explored for better analytics and monitoring.

7. Future Scope

The existing IoT-based Smart Pet Feeder effectively fulfills its primary function of remotely dispensing food to pets through the Blynk app and a servo mechanism. Nevertheless, there exists considerable opportunity to expand its functionalities for more advanced and intelligent applications. Future iterations of the system could incorporate various sensors, including weight sensors to track the quantity of food dispensed, infrared sensors to detect the pet's proximity to the feeder, and ultrasonic sensors to assess the food level in the container, notifying users when a refill is necessary.

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Additionally, features for data logging and analytics could be integrated using platforms such as Firebase, ThingSpeak, or Google Sheets to document feeding habits and produce insightful reports. This enhancement would assist pet owners in effectively managing their pets' health and dietary routines. Furthermore, the integration of AI-driven models could facilitate adaptive feeding schedules by analyzing the pet's eating patterns and automatically adjusting feeding times and portions.
The project could also be expanded to include voice assistant compatibility, enabling users to control the feeder via Google Assistant, Alexa, or Siri. Implementing battery backup and solar-powered alternatives would ensure the feeder remains operational during power outages or when disconnected from a power source. The mobile app interface could be improved or replaced with a custom-designed application that offers additional features such as push notifications, comprehensive logs, and flexible scheduling options.

Moreover, the addition of a camera module would enable pet owners to observe their pets in real-time during feeding sessions. With these enhancements, the project has the potential to transform into a holistic and intelligent pet care solution, providing convenience and reassurance to pet owners while also presenting opportunities for commercialization.

8. Conclusion

The development of the IoT-based Smart Pet Feeder presents a practical and efficient solution to a common challenge faced by many pet owners—feeding their pets on time despite busy schedules or being away from home. By integrating the WeMos D1 (ESP-12E) microcontroller, an SG90 servo motor, and the Blynk IoT platform, the project successfully demonstrates how automation and wireless connectivity can be used to control a pet feeding mechanism remotely and reliably.

Through the Blynk mobile app, users are able to activate the feeder with a simple tap, providing both convenience and peace of mind. The system architecture is compact, cost-effective, and customizable, making it suitable for daily use and further enhancements. The successful implementation of this project showcases the real-world application of IoT in improving everyday life, and lays a strong foundation for future developments such as sensor integration, data analysis, AI-based automation, and mobile interface improvements. Overall, the project is a significant step toward smarter pet care through technology.

References

[1] S. Patil and A. Kulkarni, "IoT-Based Smart Pet Feeder Using Blynk and NodeMCU," *International Journal of Scientific Research in Engineering and Management (IJSREM)*, vol. 6, no. 9, pp. 101–105, Sep. 2023.
[2] T. A. Hossain, M. Rahman, and N. Jahan, "Design and Implementation of a Smart Pet Feeder Using IoT," *2022 IEEE International Conference on Robotics, Automation, and Mechatronics (RAM)*, Dhaka, Bangladesh, 2022, pp. 234–239, doi: 10.1109/RAM56712.2022.9786543.
[3] N. M. Kadhim and A. H. Kareem, "Automatic Pet Feeding System Based on ESP8266 and Mobile App Control," *International Journal of Computer Applications*, vol. 179, no. 38, pp. 15–19, Apr. 2023.
[4] S. Gupta and R. Mehta, "Development of IoT Enabled Smart Pet Feeder Using NodeMCU and Blynk," *2023 International Conference on Emerging Trends in Electronics and Communication (ICETEC)*, Pune, India, 2023, pp. 172–176, doi: 10.1109/ICETEC58601.2023.10238412.
[5] J. M. Khan, F. Ali, and S. Rahman, "Smart Pet Care System Using Blynk and IoT," *2022 International Conference on Smart Technologies and Systems for Next Generation Computing (ICSTSN)*, Chennai, India, 2022, pp. 91–95, doi: 10.1109/ICSTSN54353.2022.00025.
[6] R. Kumar and A. Singh, "IoT Based Automated Pet Feeder Using ESP8266 and Servo Motor," *International Journal of Scientific & Engineering Research (IJSER)*, vol. 13, no. 5, pp. 350–354, May 2022.