Frontiers of Multidisciplinary Exploration
Volume 1, Issue 1, March 2025, Page 01-13
ISSN: 3139-4086

IoT Based Scheduled Pet Feeding Mechanism

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Received 30 Nov 2024, Accepted 1 March 2025, Published online: 12 March 2025

Abstract

In the recent years, the industry of pet has grown more and more, and owners of pets are looking for more creative ways to handle and care for pets. Internet of things (IoT) technology is one such innovation used to bring IoT technology in pet care products. We describe in this paper the design and implementation of an IoT based pet feeder and give the way to feed pet remotely. Overall, the pet feeder includes a hardware system and a software system. It consists of a microcontroller, a motor, a food dispenser and a wi fi module. The software system consists of a mobile application through which pet owners can control the pet feeder, specify the feeding schedule, and track the pet's feeding behaviour. Detailed discussions of how working with large numbers of customers can be scaled, made cost effective, and be easily used, are given to the pet feeder. Finally, the paper discusses the IoT-based pet feeder, which is a workable solution to feeding your pets; especially, if you are a working individual and need such comfort. Such system is having the potential of improving pet care and management and is both easily use and cost effective.

Keywords

IoT Technology, pet care, design and implementation, hardware, software, scalable, cost-effective, easy to use

Introduction

The number of pet owners has been rising, and there are a lot of pet owners who treat their pets as one of the members of their family. Due to the busy lifestyles and stressful working schedules, pet owners may have difficulty dedicating enough time caring for and spending time with their pets. Feeding is one of the important things in pet care and so it becomes hard for pet owners to feed their pets at scheduled interval. Internet of Things (IoT) technology is the advent that offers an opportunity to completely revolutionize the pet care products & services. IoT based pet feeders are innovative solutions for pet owners to deliver their pets and feed

remotely while also being able to monitor their pet's feeding behaviour. Pet owners will find pet feeder function with features ranging from convenience to flexibility, to control.

This paper brings you to the design and implementation of an IoT based pet feeder that lets a pet owner to feed their pet remotely. In general, this research paper intends to advance the nascent field of IoT based pet care products with a viable and new solution to pet feeding. The paper is important because it offers a detailed design and implementation of an IoT based pet feeder, which can serve as a further research and development of IoT based pet care products. Additionally, the research paper notes that IoT based pet feeders can bring positive effects in pet care and management with potential positive effects on the health of pets and pet owners.

2. Objectives

This project aims to design and develop a pet monitoring and feeding system based on IoT (Internet of Things) for the pet owners to feed their pets. The project is to give pet owners a practical and easy method to choose for his animal, although they do not physically stand next to him. It is capable of automatically providing the feed to the pet depending upon a scheduled parameters which the pet will be made aware of by the ringing of a bell. This will also allow these pet owners to make their pets more attentive, active and disciplined.

3. Literature Review

Automatic Pet Feeder Using Internet of Things by Jayaram Kumar Kondapalli, Venkata Ramana Sanepu, Balakrishna Satyam Kothapalli, Shankar Pattabhi, Ram Peketi, Ventaka Datta Naveen Kukatla. An automatic pet feeder uses a NODEMCU microcontroller along with a relays and a water pump and other hardware interface function. The software cde programmed on the microcontroller are used to execute certain tasks (motor rotation and relay activation). With the installation of the Blynk software on the mobile phone, the control of the whole feeder system is centralized there.

Pet feeder automation using Internet of Things; by Adetokunbo, A. Adenwo, Jonathan C. Anyi Anyi and James A Akobadab. Based on this technology of the IoT, this Research paper presents an automated feeder system. Raspberry Pi is used by the system to support remote control, scheduling and intelligent operations. We aim to have this process automated as it usually entails humans, the pet owners, recording where the pets feed and then monitoring whether or not they get fed appropriately. The present system comprises a food feeder which is connected to a microcomputer programmed to control the feeder according to a schedule or one which is accessible remotely. The feeder is controlled by a secure web application hosted in a local server with advanced scheduling features.

IoT-based Pet Feeder by Raed Abdulla, Ahmed Abdelkar Eldebani, Sathish Kumar Selvaperumal, Maythem K. Abbas. The second scheme of the research study is a pet feeder system with two main components namely: measurement and control unit. The feeder monitors the pet's weight and its inside food every hour. According to the 'Smart Pet Food Dispensing

Algorith' in the control unit, the feeder's flow rate is also regulated basing on the energy level of food, and type of cat, and cat's weight.

Santosh Kumar, and Sanjay Kumar Singh's work of animal biometric's use in monitoring of pet animals in smart cities. To monitor pets more specifically dogs, The Research paper proposes an economic system from the pet animal's biometric identifiers. One Shot similarity and distance metric based learning methods are used for extraction of facial features that are then matched, and classified by the proposed recognition approach. The performance of the proposed pet animal recognition system has been tested using identification settings of its effectiveness which yielded a recognition rate of 96.87%.

Smart Pet Feeder by Soumallya Koley, Sneha Srimani, Debanjaba Nandy. The researchers present a prototype to tackle the problems of supplying food and water to the owners pets, e.g. pets in a lockdown situation, when there is a need for the owners to leave them unattended. The prototype thus allows owners to supply food and water to their pets at certain times they designate. It is managed by means of an ATMEGA32 Microcontroller, has a conical made up from reclaimed plywood to store the pet's food, the pet's food is controlled in its flow from a PVC pipe to the pet's bowl through a servo motor.

Automatic Pet Feeder by Pankaj Khatri using Arduino. The Automatic Pet Feeder, based on Arduino, feeds food to the pets at specified times. The Real Time Clock Module in the device helps the users set the feeding time and date as per their pets eating schedule. The device automatically fills or drops the food into the pet's bowl once it is set. The containers are also rotated and food displensed by a servo motor feeding the feeder. And a 4*4 matrix keypad for manual time setting. Depending on how much amount of food has to be served to the pet, the rotation angle and container opening duration can be customized.

3. Methodology and Working

The pet feeder would function in the following way, as shown in Figure.1:

1. Feed: The pet feeder must be either plugged in or use batteries in order to begin functioning.

2. First Time Setup: After turn up the pet feeder should be set up for the first time by pouring the pet food into the food container and set feeding schedule. A control panel on the device or through a mobile app can be used to do this.

3. Feeders: Pet feeder will feed food according to the scheduled feeding times. If the feeding time comes in, the devices wil. also activate the feeding mechanism. The food container would be connected to the feeding bowl and feeding mechanism would dispense the desired feed amount of the pet food.

4. Malfunction Detection: The device will also test to see if the dispensing process has an error or a malfunction. If the food levels are low, there are blockages, or if the feeding

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fails, the device will stop dispensing and display an error on the control panel or mobile app.

5. Repeat: The pet feeder will repeat the dispensing for each timed feeding the food container runs out of food until the scheduled feeding time. The feeding schedule must be reset to continue feeding the pet and at this point the food container needs to be recharge with new food.

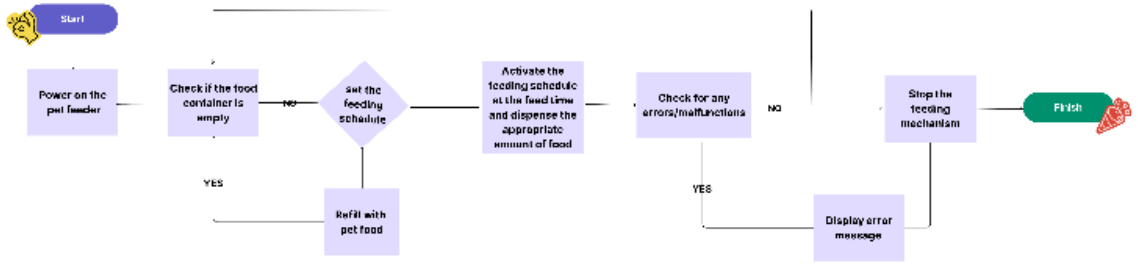


Figure 1. Methodology

Material Required

1. The Arduino Uno R3 is one of the prevailing microcontroller boards to develop electronic projects. It is based around the popular ATmega328P microcontroller that has 14 digital input and output pins (of which 6 can be used as PWM output and 6 as analog inputs), a 16 MHz quartz crystal, a USB connection, and a power jack. This base of the Arduino program interface builder can be programmed with the Arduino IDE, which offers a easy interface for code creation and updating developers.

2. Temporary Circuit: Temporary circuits are easy to build and break down as you make mistakes, without the requirement of soldering. It's in essence a board with a grid of holes that are interconnected to allow electronic components to be placed and connected. Arduino Uno R3 board is commonly interfaced with Breadboard board in order to prototype and test the electronic circuits.

3. In electronic circuits, power supply is necessary for headers in the given electronic circuit. A typical choice for this is a 9V DC power supply which can drive the power jack on the Arduino Uno R3 board.

4. Connecting Wires

5. If used as a variable resistor, the 10 ohm resistance potentiometer is used to control the brightness of the LED.

6. input devices: The two push buttons are used as input devices to want certain actions in the circuit. RNG Bell is an electronic bell used as an alarm and an indication of completion of a process.

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7. A ring bell is an electronic device that makes (or produces) a sound that is like a bell when it is triggered (if activated). It is generally employed as an alarm or the point at which a process concludes

4. Software Simulation

It is called the circuit diagram that describes the hardware breadboard assembling and wiring. This makes sure that the connections have been done correctly and the products have been assembled correctly. Thus the code written for the ESP8266 would control the behavior of the system, namely: feeding schedule, button interactions and display updates.

Working Code

```
#include <LiquidCrystal.h>

#include <Servo.h>

LiquidCrystal lcd(6,7,8,9,10,11);

Servo servo1;

int manualPin = 2;

int buttonState = 0;

int servoPin = 4;

int seconds = 05;

int minutes = 00;

int hours = 00;

void setup() {

  tone(5, 1000, 30);

  pinMode(manualPin, INPUT_PULLUP);

  servo1.attach(servoPin);

  pinMode(servoPin, OUTPUT);

  servo1.write(0);

  lcd.begin(16,2);
```

```
  lcd.setCursor(0,0);
  lcd.print(" Automatic  Pet ");
  lcd.setCursor(0,1);
  lcd.print("     Feeder     ");
  delay(2000);
  lcd.clear();
  lcd.print("By:- Manya ");
  delay(2000);
  lcd.setCursor(0,1);
  lcd.print("  System Ready  ");
  delay(2000);
  lcd.clear();
  tone(5, 2000, 50);
}
void loop() {
  lcd.setCursor(0,0);
  lcd.print("Feeding time in:");
  lcd.setCursor(6,1);
  lcd.print(":");
  lcd.setCursor(9,1);
  lcd.print(":");
  seconds--;
  delay(1000);
  if (seconds < 0) {
```

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```
  minutes--;
  seconds = 59;
 }
 if (minutes < 0) {
  hours--;
  minutes = 59;
 }
 if (hours < 0) {
  hours = 00;
  minutes = 00;
  seconds = 10;
 }
 if (minutes > 9) {
  lcd.setCursor(7,1);
  lcd.print(minutes);
 }
 else {
  lcd.setCursor(7,1);
  lcd.print("0");
  lcd.setCursor(8,1);
  lcd.print(minutes);
  lcd.setCursor(9,1);
  lcd.print(":");
 }
```

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```
if (seconds > 9) {
  lcd.setCursor(10,1);
  lcd.print(seconds);
}
else {
  lcd.setCursor(10,1);
  lcd.print("0");
  lcd.setCursor(11,1);
  lcd.print(seconds);
  lcd.setCursor(12,1);
  lcd.print(" ");
}
if (hours > 9) {
  lcd.setCursor(4,1);
  lcd.print (hours);
}
else {
  lcd.setCursor(4,1);
  lcd.print("0");
  lcd.setCursor(5,1);
  lcd.print(hours);
  lcd.setCursor(6,1);
  lcd.print(":");
}
```

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```
if ((hours == 0) && (minutes == 0) && (seconds == 0)) {
  tone(5, 3000, 3000);
  lcd.setCursor(0,0);
  lcd.print("      It's      ");
  lcd.setCursor(0,1);
  lcd.print("Feeding  Time!!!");
  servo1.write(180);
  delay(3000);
  servo1.write(0);
  lcd.clear();
}
buttonState = digitalRead(manualPin);
if (buttonState == LOW) {
  tone(5, 3000, 1000);
  lcd.setCursor(0,0);
  lcd.print("    OVERRIDE    ");
  lcd.setCursor(0,1);
  lcd.print("(manual feeding)");
  servo1.write(200);
  delay(2000);
  servo1.write(0)
```

This is an Arduino based automatic pet feeder that dispenses at intervals of food. It has a countdown timer displaying the time left on until the next feeding, a ‘feed me’ button and a servo motor that spits out food. Here, we include two libraries which are the LiquidCrystal which helps us to communicate with the LCD display and the Servo which helps us to control

the servo motor. It then defines some variables and pins including the manual feed button pin, the servo motor pin, and the initial countdown timer values for the seconds, minutes and hours.

The code in the setup function configures the LCD display and prints some introductory text, sets the servo motor in standby position and plays some tone to let it know that the system is ready.

The countdown timer is displayed on LCD display and decremented in the seconds, minutes and hours values in the loop function. On zero the servo motor will be triggered to give the food at some given time and the LCD screen will show feeding time. The code also triggers the servo motor to disperse food for lesser period of time when the button is pressed manually. At the end, the loop function continues applying continuously to the countdown timer, waiting for the next feeding time or manual feeding button press.

Mobile Application Code

```
#include <ESP8266WiFi.h>

#include <BlynkSimpleEsp8266.h>

#include <Servo.h>

char auth[] = "YourAuthToken";

char ssid[] = "YourNetworkName";

char pass[] = "YourPassword";

Servo servo;

void setup()

{

  servo.attach(D1);

  servo.write(0);

  Blynk.begin(auth, ssid, pass);

}

void loop()

{

  Blynk.run();
```

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```
}

BLYNK_WRITE(V0) {

  int pos = param.asInt();

  servo.write(pos);

}

BLYNK_WRITE(V1) {

  int feedAmount = param.asInt();

  // Code to control the feeder unit and dispense food

}
```

In this first part of this code we include some libraries that will allow us to connect to the Blynk IoT platform and control the servo motor. Next, we use Blynk authentication token, network credentials, and create a Servo object. In the `setup()` function we set up the servo motor and configure as to where the motor positions to 0. Secondly, we then initialize Blynk connection using `Blynk.begin()` function. We call the `Blynk.run()` function in the lambda of the `loop` function to keep the Blynk connection. It is called whenever the user changes the servo position by using a virtual slider widget in the Blynk app, in the `BLYNK_WRITE(V0)` function. The function very simply reads new position value from the `param` object and sets the servo position with `servo.write()` function. When the user wants to dispense a certain amount of food through using a virtual button widget on the Blynk app, the `Blynk_WRITE(V1)` function is called. The function takes the feed amount that is requested from the `param` dictionary object and controls the feeder unit.

5. Working

1. Feeding Schedule: User defines the time of feeding through an application or a web interface. The specific times at which the system dispensing food to the pet will occur are dictated by this schedule.

2. The ESP8266, functioning as the main controller, discovers it on the internet by means of Wi-Fi. But mostly it communicates with the user interface and will receive the feeding schedule updates.

3. The ESP8266 sends signals via the servo motor connected to the food dispenser. The signals are these which control the servo motor's rotation angle and hence the opening and closing of the food dispenser.

4. On the feeding schedule, the system starts the countdown timer. It also follows the elapsed time to the next feeding event.

5. Visual Feedback: An LCD display is used to provide a visual feedback to the user. It show the countdown timer, and feeding and any other info.

6. Manual feeding or adjustment of the schedule is possible through push buttons. The buttons are pressed, the voltages trigger the servo motor from the ESP8266.

6. Results

The work yields the successful development of an IOT based automatic pet feeder that dispense food at certain intervals of time. The system has the capability to control feeding schedule with the help of and mobile application to dispense food. ESP8266 board has a better world than the Arduino board because of its WIFI features, cheap power consumption, powerful processor and small size. The Nodemcu ESP8266 board has internet connectivity, therefore it is a better choice. Since then, the idea of building an automatic pet feeder had been realized sooner than it had in it's software version. The food has been dispensed accurately at the set intervals and the code has been responding correctly to manual feeding button presses. It has a LCD display and the countdown timer on that display shows real time updates of the feeding schedule, so that people who own pet can also monitor and control their pet's feeding habit. Overall, the intended goal of developing an auto pet feeder with which to feed pets via set intervals has been achieved by the project. There is a whole lot of improvement and future development on the IoT based pet monitoring and feeding system. Some possible paths of future development include:

1. Integrate with machine learning algorithms: The system can be combined with pet behavior machine learning algorithms for handling health and well being of the pet.

2. Voice Recognition: Adding the technology of voice recognition to the system would enable pet owners to speak to their pet remotely.

3. Integration into the system: Some smart sensors like GPS tracking, heart rate monitor, activity trackers may be integrated into the system for more detailed information regarding the pet's condition and physical activity levels.

4. Feeding Based on the Pet's Diet & Schedule: In further development, the system could also be able to feed the pet based on the pet's dietary requirements and schedule.

5. Improvement: Adding the remote access feature to the system will help the pet owners monitor their pets and set up the system from any place in the world.

6. Improvements to the User Interface: Repeatedly, a more user friendly interface of creating the data that the system is creating will improve user experience.

7. Smart Home System Integration: The system can be integrated into smart home systems and can be controlled with the help of voice commands (e.g., Amazon Alexa or Google Home).

Third, the pet monitoring and feeding IoT based system has a great scope for future developments and developments in technology makes it possible to continue improving the functionality of the system and improving capabilities.

7. Conclusion

In this work, an automatic feeding system for pets using IoT was successfully developed which, in addition to feeding them at set times, allows them to be monitored and controlled remotely using a mobile application. The NodeMCU ESP8266 provides a cost-effective and reliable platform with built-in Wi-Fi connectivity, ensuring efficient system performance. The proposed system could accurately automate the pet feeding process while providing convenience for the pet owner by monitoring it in real-time. Additional improvements could involve integrating it with other smart home systems, adding voice commands, implementing advanced health monitoring sensors, and incorporating AI-driven feeding suggestions to improve system functionality and user experience even further.

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