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Development of Automatic Pet Feeding System using IoT

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ABSTRACT: The development of an Automatic Pet Feeding System using IoT involves creating a system that allows pet owners to remotely feed their pets through the internet. This innovative technology aims to address issues like overeating and obesity in pets while providing convenience to pet owners. The system typically includes a mobile application for control, sensors for automation, and the ability to dispense predetermined amounts of food and water to pet bowls. Various research studies have been conducted to enhance these systems, focusing on components like microcontrollers, relays, water pumps, and other hardware equipment. The future scope of this technology includes improvements such as adding cameras for monitoring pets while feeding and enhancing functionalities for better pet care and condition maintenance. Overall, IoT-based pet feeders offer a modern solution for pet owners to manage their pets' diet efficiently even when they are away from home.

KEYWORDS: Pet Feeding, IoT system, ESP Module, RTC DS 1307.

I. INTRODUCTION

An Automatic Pet Feeding System (APFS) is a device designed to automate the process of feeding pets by dispensing food at predetermined intervals or in response to certain triggers. These systems typically consist of a food storage container, a mechanism for dispensing food, a timer or programmable schedule, and sometimes additional features such as portion control, monitoring sensors, and connectivity options.

The food storage container holds the pet food, which is dispensed either by gravity or through a mechanical mechanism such as a rotating drum or conveyor belt. The timer or programmable schedule allows pet owners to set specific times for feeding, ensuring that their pets receive their meals consistently even when the owner is not present.
Some APFS models come with sensors to monitor food levels, detect the presence of pets, or track feeding activity. This information can be useful for ensuring that pets are getting enough food, detecting any changes in their eating habits, or alerting the owner when it's time to refill the food container.

The integration of Internet of Things (IoT) technology into various aspects of daily life has led to the development of innovative solutions for addressing everyday challenges. One such area that has benefited from IoT advancements is pet care, where the use of connected devices has transformed how pets are fed and monitored. In this context, the development of an Automatic Pet Feeding System (APFS) utilizing IoT technology represents a significant step forward in enhancing the convenience, efficiency, and effectiveness of pet feeding practices.

Traditionally, pet feeding has relied on manual processes, where pet owners are responsible for ensuring that their pets receive their meals at regular intervals. However, this approach can be challenging to maintain, especially for individuals with busy schedules or multiple pets. Moreover, the lack of oversight can result in inconsistencies in feeding times, portion sizes, and overall dietary management, potentially leading to health issues for pets.

The emergence of IoT technology has revolutionized pet care by enabling the creation of smart, interconnected devices that can automate and optimize various aspects of pet feeding and monitoring. By leveraging IoT principles, APFS can offer a range of features and functionalities that go beyond traditional feeding systems, including precise portion control, customizable feeding schedules, real-time monitoring, and remote management capabilities.

In this paper, we explore the development of an APFS using IoT technology, focusing on the design, implementation, and potential applications of such a system. We discuss the hardware components, software architecture,

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communication protocols, and user interfaces involved in creating a smart pet feeding solution. Additionally, we examine the benefits, challenges, and considerations associated with integrating IoT technology into pet care devices.

II. LITERATURE REVIEW

Research on automatic pet feeding systems underscores the critical need for precision and reliability in dispensing accurate portions, ensuring optimal nutrition for pets.

S. Subaashri ,et al. [1] Pets need special treatment and special care. Due to nowadays busy lifestyle, this task is not as simple as it used to be. The goal of this work is to introduce, design and implement a smart pet system. The interaction between human and physical devices and devices in the real world is gaining more attention and requires a natural and intuitive methodology to employ. According to this idea and living well, life has been a growing demand. Thus, how to raise pets in an easy way has been the main issue recently. This study examines the ability of computation, communication, and control technologies to improve human interaction with pets by the technology of the Internet of Things.

Harshini Manimaran et.al.[2]This paper proposes the use of technology to tackle the issues being faced by pet owners. Pet owners who are working individuals and live alone face a huge problem, they are not able to feed their pets on time. The method approached to solve this issue was to construct an IoT-based Automatic Pet feeder, it is one of the new technologies used for feeding pets and maintaining the diet of their pets by feeding them on time. It is built with Raspberry Pi 3B+ as its core. The automatic pet feeder will automatically dispense a predetermined amount of food and water to the bowl as per the settings made by the owner.

A.O. Aransiola et.al.[3] Most pet's owners cannot stay at home to feed their pets several times a day or impatience in feeding them due to their busy schedules. This paper is an automatic pet feeder system which feeds pet with food and water at predetermined time interval. The feeder system has a battery backed-up DS 1307 real time clock that is set to the current time and the feed dispensing time. At the set time, the feed is dispensed until its weight measured with a load cell reaches the preset weight value based on the consumption level of each pet. The system also dispenses water to the pet at the specified time. The firmware of the system was developed in C language using a MikroC ® development environment. The experimental results obtained The automatic pet feeder system has highly made pet feeding easy and cost-effective.

Vineeth S .et.al. [4] The paper has a project design aimed at which pet owners can feed their pet even without their presence or Interferences, like older versions of pet feeder. This system makes use of the Digital Image Processing technique for implementation. In the project, if RFID Receiver detects the pet, the Camera captures the pet's image and processes it. If the image is matched with the stored data, a servo motor and solenoid valve will be activated to dispense food and water, respectively.

Sunil K. et.al.[6] The goal of this work is to introduce, design and implement a smart pet system. The interaction between human and physical devices within the globe is gaining more attention and it requires a natural and intuitive methodology to use. According to this idea and living well, life has been a growing demand. Thus, the way to raise pets in a straightforward way has been the most issue recently. This study examines the flexibility of computation, communication and control technologies to enhance human interaction with pets by technology of the internet of things. This work addresses the advance through the pet's application of the flexibility of location-awareness, and to assist pet owners raise their pet on the activity and eating control easily.

IV. METHODOLOGY

The automatic pet feeding system is very interesting invention for the animals which is essential for modern scenario. This project uses the NodeMCU microcontroller is used to controller all over controller like mobile app with wifi and feeding quantity. The app will make sure the required quqntity as per time duration for the pet and servo motor will make sure to fill certain amount of pet food as per the time duration.

3.1 Components

ESP32 Wi-Fi Module
Servo Motor
RTC DS 1307

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3.2 Hardware Specification

ESP32 Wi-Fi Module

Specification	Details
Module Name	ESP32Wi-Fi Module
Chipset	Espressif ESP32
Wi-Fi Standards	802.11 b/g/n
Operating Voltage	3.3V
Operating Current	Average: 80mA, Peak: 170mA
Flash Memory	4MB
Clock Frequency	80MHz
Wireless Range	Up to 100 meters (open space)
Data Rate	802.11b: 1-11 Mbps, 802.11g: 6-54 Mbps, 802.11n: Up to 150 Mbps
Wi-Fi Modes	Station, Access Point, Station+Access Point
GPIO Pins	17 (General Purpose Input/Output)
Analog Input Pins	1 (10-bit ADC)
Digital Input Pins	17 (including GPIO and special pins)
Antenna	On-board PCB antenna
Security	WEP, WPA/WPA2, WPA-PSK/WPA2-PSK, WPS
Firmware	ESP32 AT Firmware
Dimensions	14.2mm x 14.2mm
Weight	Approximately 1.5g
Programming Language	C/C++ (Arduino IDE support)
Power Consumption	Standby: < 1mW, Active: 15mA - 300mA
Certifications	FCC, CE, IC

SERVO MOTOR

Specification	Details
Motor Type	DC Brushed Motor
Operating Voltage	Typically 4.8V - 6V (can vary depending on model)
Stall Torque	Variable, usually specified in kg-cm or oz-in
Operating Speed	Variable, typically specified in sec/60° or RPM
Operating Temperature	Typically -10°C to +50°C
Weight	Varies depending on size and model
Dimensions	Varies depending on size and model
Gear Type	Plastic or metal gears
Rotation Range	Typically 180° or 360°
Control Interface	Pulse Width Modulation (PWM)
Control Signal	Typically 5V PWM signal (can vary)
Operating Current	Varies depending on load and voltage
Dead Band Width	Typically around 5µs

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Specification	Details
Feedback Type	Potentiometer
Mounting	Various mounting options available

RTC DS 1307

Specification	Details
IC Name	DS1307 Real-Time Clock
Manufacturer	Maxim Integrated
Operating Voltage	5V
Clock Accuracy	±2 ppm from 0°C to +40°C
	±3.5 ppm from -40°C to +85°C
Timekeeping Current	500nA (typical)
Operating Current	500µA (maximum)
Supply Voltage Range	4.5V to 5.5V
I2C Interface	Supports I2C bus communication
Time Format	24-hour or 12-hour with AM/PM indication
Calendar Accuracy	+/- 2ppm from 0°C to +40°C
	+/- 3.5ppm from -40°C to +85°C
RTC Output Frequency	32.768 kHz
Trickle Charger Input	Used for backup power source
Battery Backup	Supports battery backup for timekeeping
Operating Temperature	-40°C to +85°C
Dimensions	Varies depending on package
Package Options	SOIC (Small Outline Integrated Circuit), DIP (Dual In-line Package), or SOP (Small Outline Package)
Additional Features	- Programmable square-wave output
	- Automatic power-fail detection
	- Programmable alarm output
	- 56-byte, battery-backed, non-volatile RAM
	- Oscillator stop flag status
	- Simple interface to most microcontrollers

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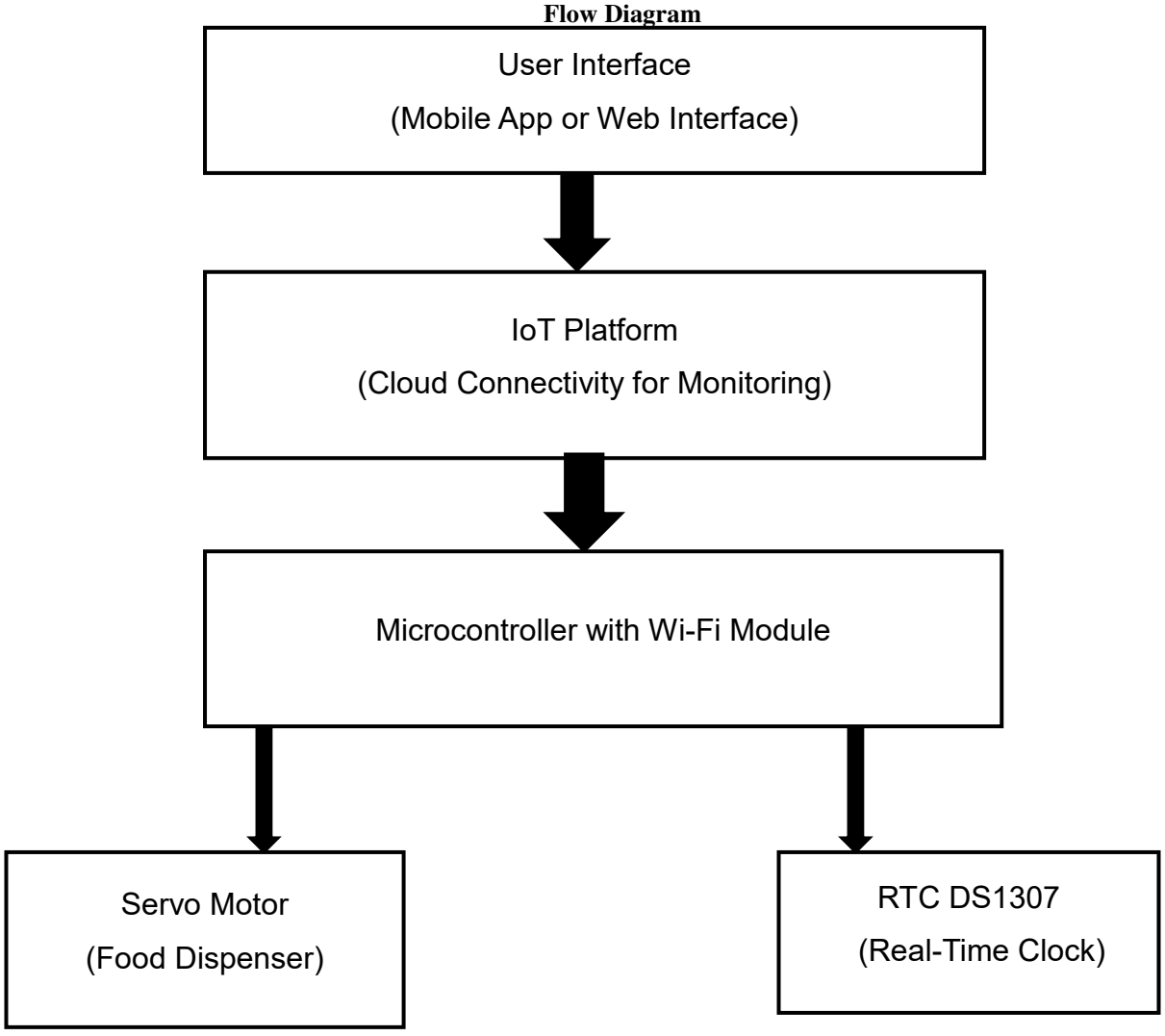
SOFTWARE SPECIFICATION

Blink App

The Blink Home Monitor app is a smart home security app that allows users to monitor their homes, vacation homes, or businesses from anywhere at any time. It connects your home to your phone in HD video, enabling you to see and protect what matters most. The app supports multiple camera systems within one single app, making it easy to manage multiple camera systems. It also offers features such as HD day and night video, two-way audio, motion detection, and person detection with a Blink Subscription Plan. The app is available for download on Google Play.

3.3 Flow Diagram

Flow Diagram



V. ADVANTAGES

1. The integration of a servo motor in the system enables precise control over the portion sizes dispensed to pets.
2. Automatic pet feeding systems offer convenience by allowing pet owners to schedule and automate feeding times.
3. The use of IoT technologies, such as the ESP8266 and cloud connectivity, allows pet owners to monitor and control the feeding system remotely.
4. The inclusion of an RTC DS1307 ensures accurate timekeeping and scheduling. Pets thrive on routine, and scheduled feeding contributes to their overall well-being by providing a consistent and predictable feeding routine.
5. This helps in preventing food spoilage, ensuring that pets receive high-quality and nutritious meals.

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VI. APPLICATIONS

1. Remote Feeding: IoT-enabled APFS allows pet owners to remotely dispense food to their pets from anywhere with an internet connection. This feature is particularly useful for pet owners who travel frequently or work long hours, ensuring that their pets receive timely meals even in their absence.

2. Customized Feeding Schedules: APFS can be programmed to accommodate customized feeding schedules tailored to the specific needs of individual pets. Whether the pet requires multiple small meals throughout the day or a single large meal, the system can adjust feeding times and portion sizes accordingly.

3. Portion Control: IoT technology enables precise portion control, ensuring that pets receive the appropriate amount of food based on their size, age, and dietary requirements. This helps prevent overfeeding or underfeeding, promoting better weight management and overall health for the pet.

4. Monitoring and Data Analysis: APFS equipped with sensors can monitor food consumption patterns, feeding activity, and food levels in real-time. This data can be analyzed to track the pet's eating habits, detect any changes in appetite or behavior, and identify potential health issues early on.
5. Smart Alerts and Notifications: IoT-enabled APFS can send notifications and alerts to pet owners' smartphones or devices, informing them of feeding events, low food levels, or any abnormalities detected by the system. This ensures that pet owners stay informed and can take prompt action when necessary.
6. Integration with Health Monitoring Systems: APFS can be integrated with other IoT devices and health monitoring systems to provide comprehensive pet care solutions. For example, data collected by the feeding system can be synced with wearable devices or health trackers to monitor the pet's activity levels, calorie intake, and overall well-being.

VII. CONCLUSION

An Automatic Pet Feeding System using IoT involves creating a system that can automatically dispense a predetermined amount of food and water to pet bowls. This project aims to address the need for automation in pet feeding, reducing human intervention in the process. The system typically includes sensors to automate the feeding process efficiently. The objective is to design an automatic feeding machine for pets, catering to various settings like dairy farms, poultry farms, and homes where pets need consistent and healthy feeding. By leveraging IoT technology, pet owners can remotely manage their pet's diet and feeding schedule through a mobile application or web interface. The system ensures that pets receive the right amount of food at the right time, even when owners are away from home. Future enhancements may include additional features like cameras for monitoring pet eating habits and improving overall pet care

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