IOT BASED PET FEEDING SYSTEM USING IR SENSOR

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Abstract:

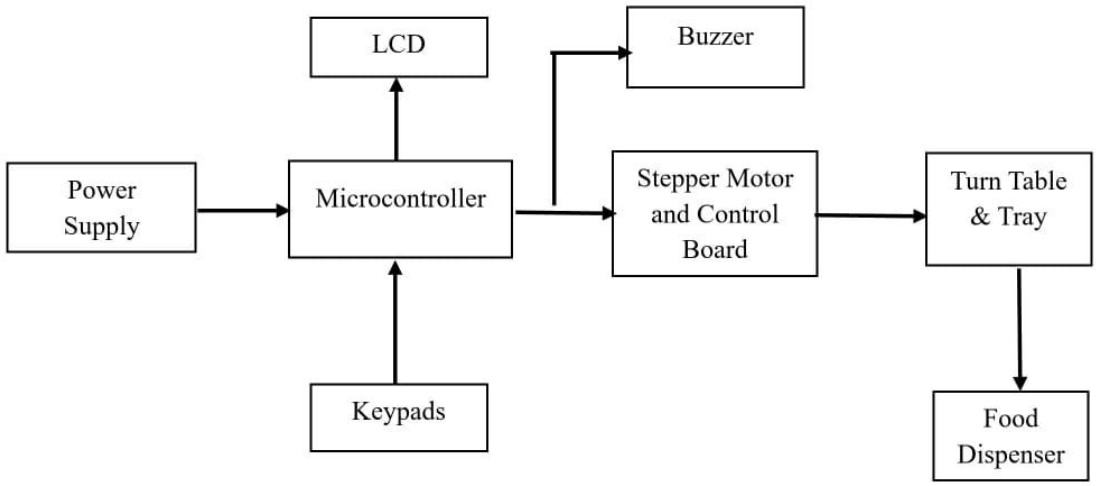
The "**Smart Pet Feeding System**" is an IoT-based system that automates and improves pet feeding, assuring efficiency and convenience for pet owners. The project's goal is to create a system that detects a pet's presence at a feeding station using an infrared (IR) sensor, transmits real-time notifications to a designated user via Telegram, and permits manual food distribution via an on/off button. The goals include developing an intelligent feeding system, integrating real-time communication for pet monitoring, enabling remote feeding control, and enhancing automation to avoid overfeeding or underfeeding. The device works by sensing pet movements, sending a Telegram notice, and allowing the user to remotely administer food. The approach includes integrating an infrared sensor for motion detection, employing Telegram for quick warnings, and providing a human control mechanism for food distribution. The findings demonstrate that the system successfully detects pet movement, maintains continuous communication, and allows for precision feeding management, decreasing food waste and providing timely pet nourishment. The Smart Pet Feeding System improves pet care automation by merging IoT technology with real-time monitoring, delivering a dependable, user-friendly, and efficient feeding solution to pet owners, generating a Telegram notice and enabling the user to distribute meals remotely.

Literature Survey:

A study on smart pet feeders with IoT and deep learning integrates weight sensors, ultrasonic sensors, and a YOLOv5-based deep learning model to ensure accurate pet recognition and customized feeding. The system dispenses food based on pet identification and feeding schedules, with real-time monitoring through a mobile app for remote control, enhancing personalized pet care and portion optimization [1]. Another research proposes an IoT-based automatic pet feeding and monitoring system that uses Raspberry Pi, a Pi camera for real-time streaming, and a servo motor for controlled food dispensing. The system sends feeding alerts, has a relay-based water dispensing unit, and ensures pets receive timely, measured portions [2]. A study on the design and implementation of an IoT-integrated pet feeder highlights scheduled feeding times, a weight sensor for measuring food quantity, and a web-based remote monitoring system. It prevents overfeeding while allowing owners to track pet

feeding habits over time [3]. A smart pet feeder with health monitoring is designed to track pet feeding habits and health conditions using temperature and heart rate sensors. Feeding patterns are analysed, and alerts are sent to owners if irregular feeding is detected, helping to improve pet wellness through data-driven insights [4]. Research on an IoT-based pet feeder with real-time monitoring introduces an embedded camera to capture images during feeding, cloud integration for tracking feeding history, and a mobile app for remote control. Owners can modify feeding settings, ensuring proper nutrition for pets even when they are away [5]. Another study focuses on an automated pet feeding system using IoT and machine learning, where an AI model learns from past feeding behaviour, predicts optimal food portions, and dynamically adjusts schedules based on pet activity. Alerts notify owners if a pet misses a meal, improving feeding accuracy and efficiency [6]. An IoT-enabled smart pet feeder with voice recognition supports voice commands through Google Assistant and Alexa, allowing hands-free control of food dispensing. IoT connectivity enables real-time food level monitoring, and owners receive alerts when food stock is low, enhancing accessibility for pet care [7]. A study on the design of an RFID-based smart pet feeder ensures only authorized pets access food, preventing food theft in multi-pet households. The system dispenses customized meal portions per pet and records feeding history for better nutritional tracking [8]. Research on remote monitoring and control of pet feeding using IoT introduces a smartphone application for managing feeding times and portions. IoT sensors detect when the pet approaches the feeder, and alerts notify owners if food or water runs low, helping to maintain a proper feeding schedule [9]. Finally, a smart pet feeding system with nutritional management tracks pet dietary intake over time, with AI suggesting meal adjustments based on nutritional needs. IoT sensors monitor food consumption, and cloud data storage provides owners with insights to optimize pet health [10].

Existing system:



Components:

1. **Power Supply** → Provides electricity to the system, ensuring all components function.
2. **Microcontroller** → Acts as the brain of the system, controlling all operations.
3. **Keypads** → Allows users to manually input commands or settings.
4. **LCD Display** → Shows information such as feeding schedules or system status.
5. **Buzzer** → Alerts users when food is dispensed or if any issue occurs.
6. **Stepper Motor and Control Board** → Controls the movement of mechanical parts to dispense food.
7. **Turntable & Tray** → Rotates or moves food portions into the dispenser.
8. **Food Dispenser** → Releases food for the pet after receiving a signal from the microcontroller.

Working of the system

1. **Powering the System**
    - The power supply ensures all components, including the ESP32 microcontroller, sensors, motor, and display, receive adequate electricity to function efficiently.
2. **Detecting the Pet**
    - The IR sensor continuously monitors for pet movement near the feeder. Once a pet is detected, it sends a signal to the microcontroller, which then triggers a notification via the Telegram API.
3. **User Control via Blynk App**
    - The user receives the pet detection notification and can manually activate the feeding system through the Blynk app, which sends a command to the microcontroller.
4. **Food Dispensing Mechanism**
    - Upon receiving the feed command, the microcontroller activates the stepper motor and control board, rotating the turntable or tray to dispense food into the feeding bowl.
5. **Status Updates & Alerts**
    - The LCD display shows feeding status and schedules, while the buzzer alerts when food is dispensed. After feeding, if the button is turned off in the Blynk app, a "Feeding Completed" message is sent via Telegram. The system then resets and waits for the next pet detection cycle after 5 minutes.

Limitations of the system:

1. **Limited Detection Accuracy**
    - The IR sensor may not accurately detect smaller pets or may be triggered by other objects, leading to false alerts.
2. **Single Pet Feeding**
    - The system is designed for one pet at a time, and it cannot differentiate between multiple pets, which may lead to food being consumed by the wrong pet.

3. **Dependency on Internet Connectivity**
    - Since the system relies on the Blynk app and Telegram API, a poor or lost internet connection may disrupt remote control and notifications.
4. **Power Dependency**
    - The system requires a continuous power supply. In case of a power outage, the feeding process may be interrupted unless a backup power source is available.
5. **Fixed Feeding Portions**
    - The feeder dispenses a fixed amount of food per cycle, which may not be suitable for pets with different dietary requirements. A more advanced system with portion control would be needed for customization.
6. **No Real-Time Monitoring**
    - While notifications are sent via Telegram, the system lacks a live camera feed, making it impossible to visually confirm whether the pet has eaten the food.
7. **Motor Wear & Tear**
    - Continuous use of the stepper motor over time may lead to mechanical wear, requiring periodic maintenance and possible replacement of parts.
8. **No Emergency Override**
    - If the system malfunctions or the food gets stuck, there is no emergency override mechanism for manual feeding unless the user is physically present.

Design Methodology:

1. Purpose & Requirements Specification

Purpose:

The goal is to develop an **automated pet feeder system** that:

- Detects a pet using an IR sensor.
- Sends notifications to Telegram when a pet is detected.
- Allows users to control the feeder via the **Blynk app**.
- Activates a servo motor to dispense food.
- Sends a notification when feeding is completed.
- Limits redundant detections by restricting the IR sensor for **5 minutes** after each detection.

Requirements:

Hardware:

- **ESP32** (WiFi-enabled microcontroller)
- **IR sensor** (to detect pet presence)
- **Servo motor** (to dispense food)
- **Power supply**

Software:

- **Blynk App** (for remote control)
- **Telegram API** (for notifications)
- **Arduino IDE** (for programming)

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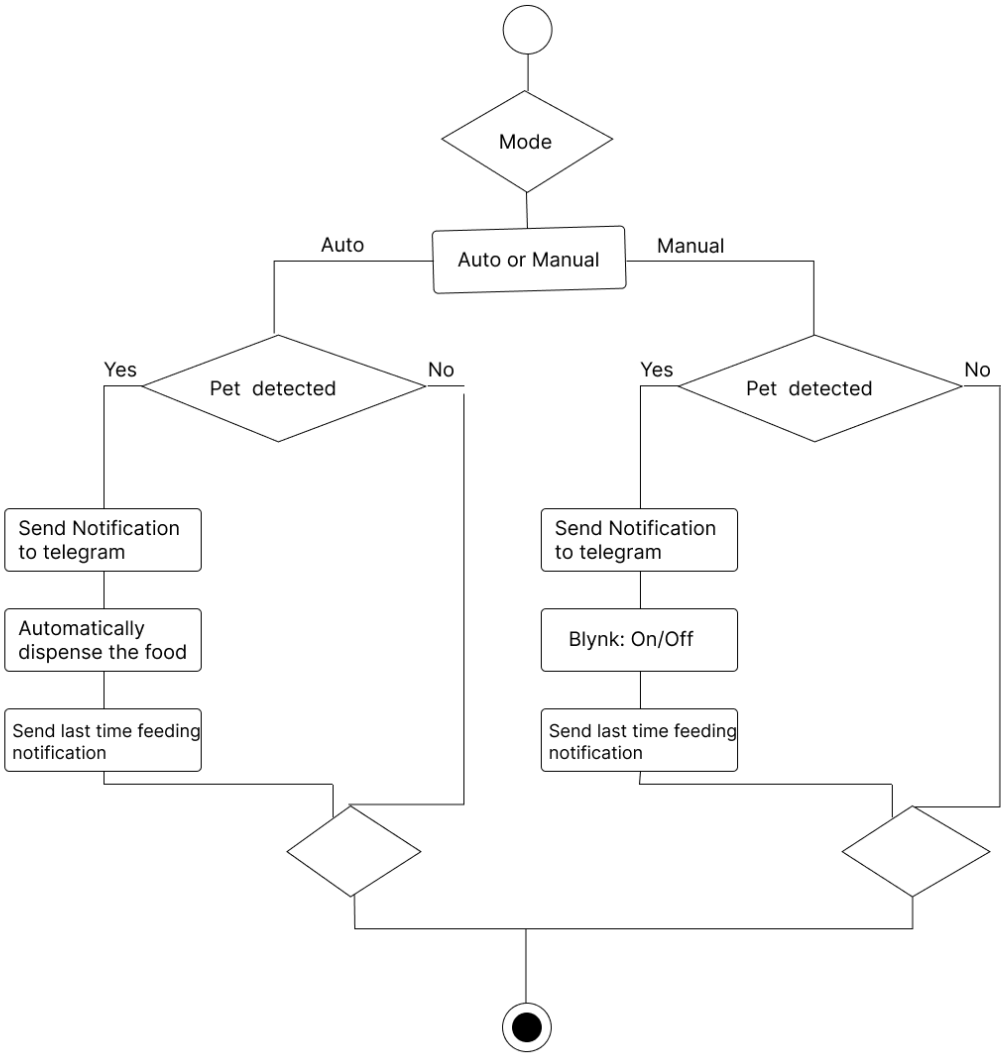
2. Process Specification

- **Step 1:** IR sensor detects pet presence.
- **Step 2:** Telegram notification sent: *"Pet detected near the feeder!"*
- **Step 3:** User presses the **Blynk button** to start feeding.
- **Step 4:** Servo motor rotates, dispensing food.
- **Step 5:** User turns off the **Blynk button** → Telegram message: *"Feeding completed!"*
- **Step 6:** IR sensor disabled for **5 minutes**, then re-enabled.



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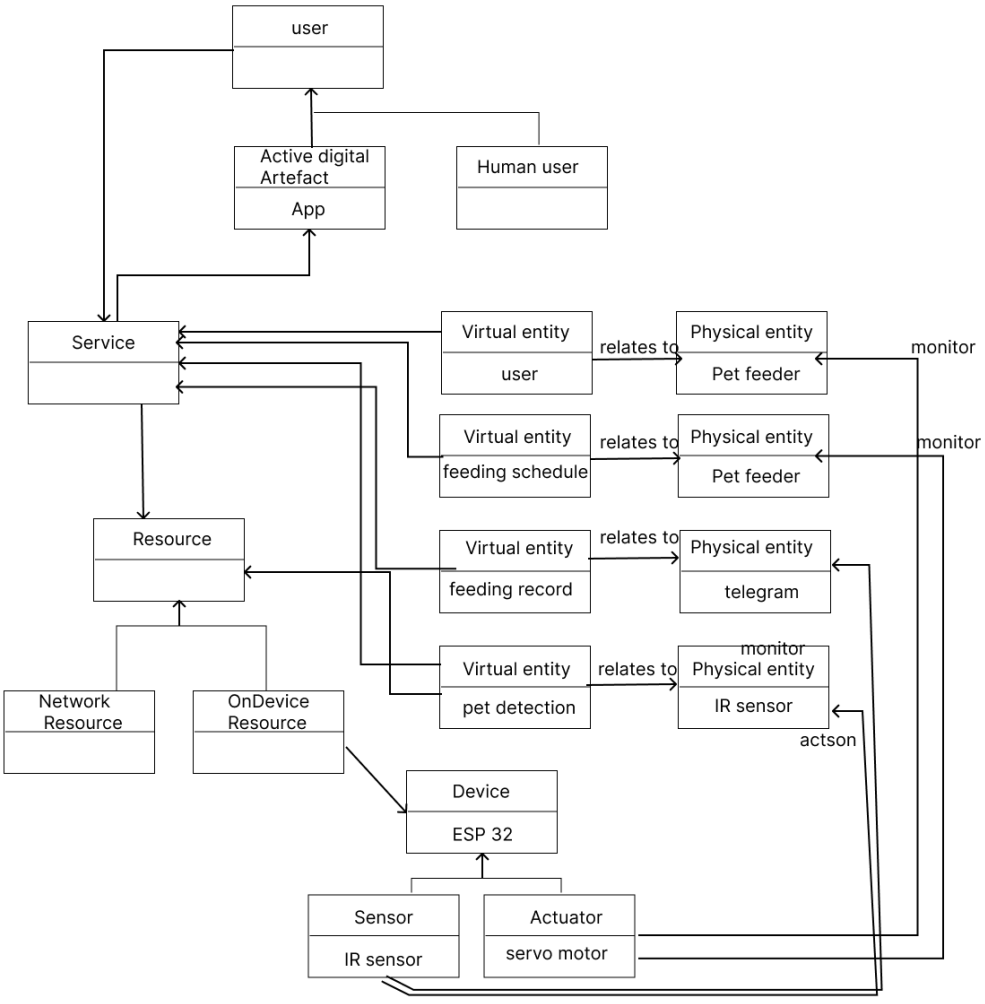
3. Domain Model Specification

The **domain model** defines interactions between system components:

- **ESP32** → Controls IR sensor, servo motor, and communication.
- **IR Sensor** → Detects pet motion.
- **Blynk App** → Allows user interaction.
- **Servo Motor** → Dispenses food.
- **Telegram API** → Sends alerts.



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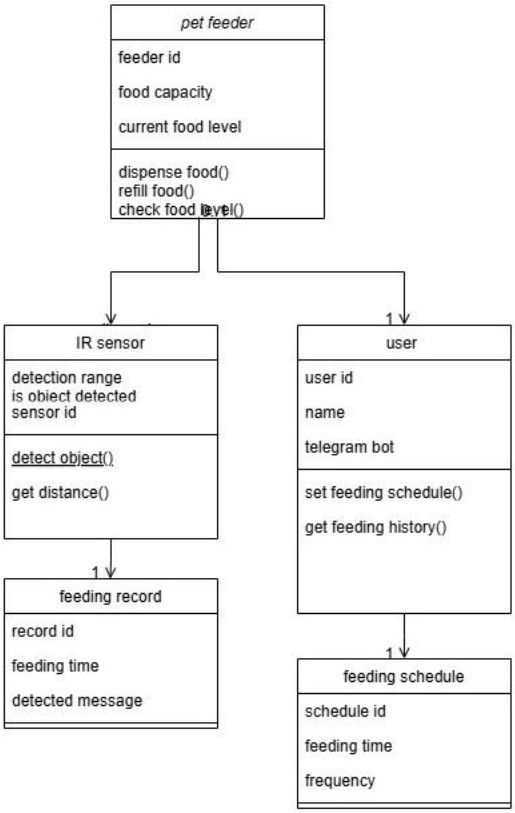
4. Information Model Specification

Defines the **data flow**:

- **Sensor Data:** IR sensor detects pet.
- **Control Data:** User inputs from Blynk.

- **Action Data:** Servo motor rotation.
- **Notification Data:** Messages sent via Telegram.



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5. Service Specifications

Defines **functionalities provided by the system**:

1. **Pet Detection Service:** Uses IR sensor.
2. **Notification Service:** Sends messages via Telegram.
3. **Feeding Control Service:** User interacts with Blynk to dispense food.
4. **Delay Service:** Disables IR sensor for 5 minutes after detection.

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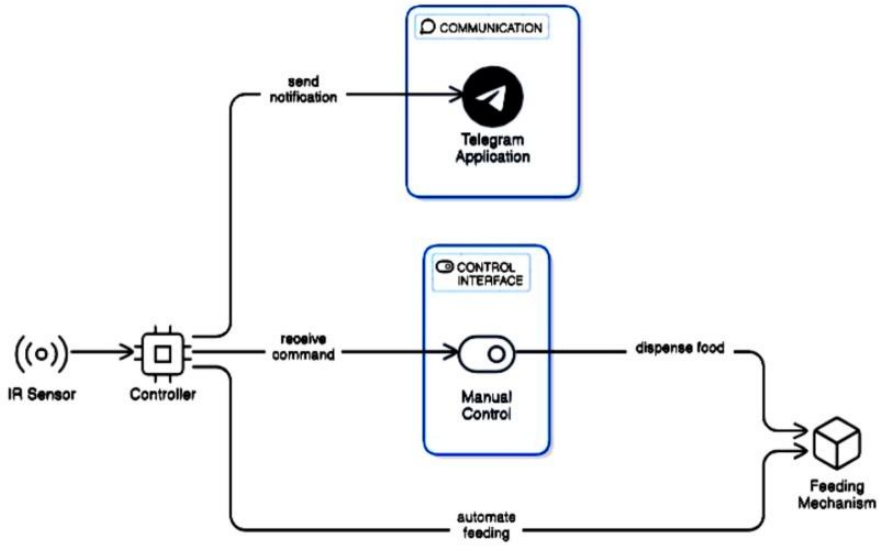
6. IoT Level Specification

- **IoT Level: Level 2** (Devices connect to cloud via WiFi for monitoring & control).
- **Components:**
  - **Perception Layer:** IR sensor, Servo motor.
  - **Network Layer:** WiFi module in ESP32.
  - **Application Layer:** Blynk App, Telegram API.



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7. Functional View Specification

- **Input:**
  - IR sensor detects motion.
  - Blynk button press.
- **Processing:**
  - ESP32 processes inputs, controls motor, and sends notifications.
- **Output:**
  - Servo motor rotates.
  - Telegram notifications.

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8. Operational View Specification

- **Modes of operation:**
  - **Idle Mode:** No pet detected.
  - **Active Mode:** Pet detected → Notification sent → Blynk app controls feeding.
  - **Cooldown Mode:** IR sensor disabled for 5 minutes after detection.

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9. Device & Component Integration

- **ESP32 is integrated with:**
  - IR Sensor → Digital input pin.
  - Servo Motor → PWM output pin.
  - WiFi module → For Blynk & Telegram API.

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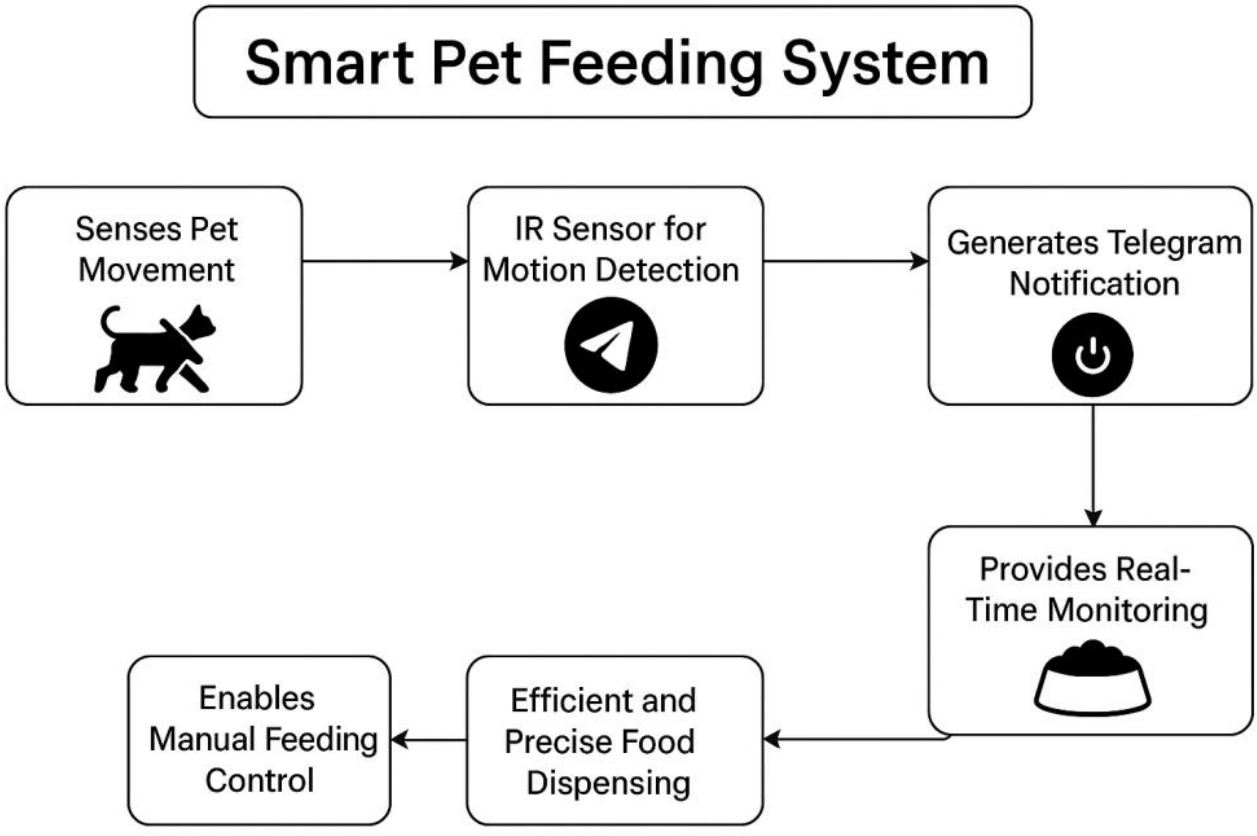
10. Application Development

- **Programming Languages:** Arduino C++
- **Development Tools:**
  - **Arduino IDE** (for coding & uploading firmware).
  - **Blynk App** (for remote control UI).
  - **Telegram API** (for sending alerts).

Proposed System



Explanation On System Components:

1. ESP32(MicrocontrollerUnit):

 Features:

1. Supports WiFi and Bluetooth for remote control and data logging.
2. Has multiple GPIO pins to connect various sensors and modules.

 Working Principle:

1. Receives data from the IR sensor and processes it.
2. Sends an alert to the owner's mobile via the Blynk app when motion is detected

2. Servo Motor :

 Features:

1. Can rotate to specific angles based on input signals.
2. Low power consumption and precise movement.

 Working Principle:

1. Rotates when the Blynk app button is pressed.
2. Controls the food dispensing mechanism by moving a flap or lever.

3.IR Sensor :

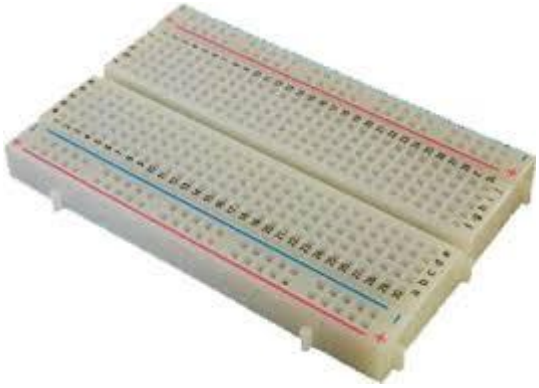
 Features:

1. Detects motion by sensing infrared radiation changes.
2. Works in low-light conditions.

 Working Principle:

1. Detects pet movement and sends a signal to ESP32.
2. Triggers an alarm notification to the owner's mobile.

4.Bread Board :



 Features:

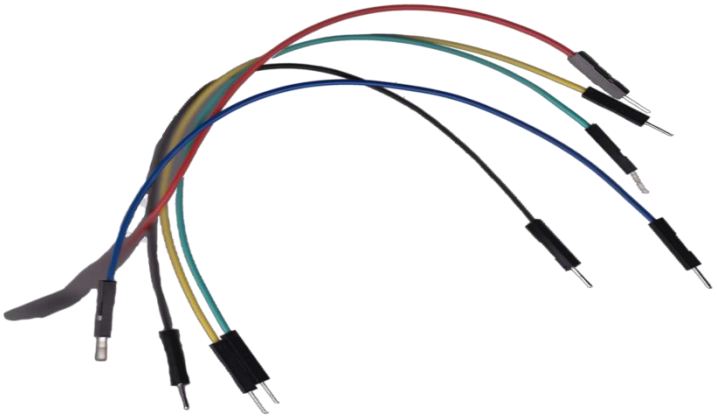
1. Allows easy circuit connections without soldering.
2. Reusable for multiple projects.

 Working Principle:

1. Connects ESP32, IR sensor, and servo motor using jumper wires.

2. Helps in testing and debugging the circuit before final assembly.

5. Jumper Wires (Male-to-Male, Male-to Female):



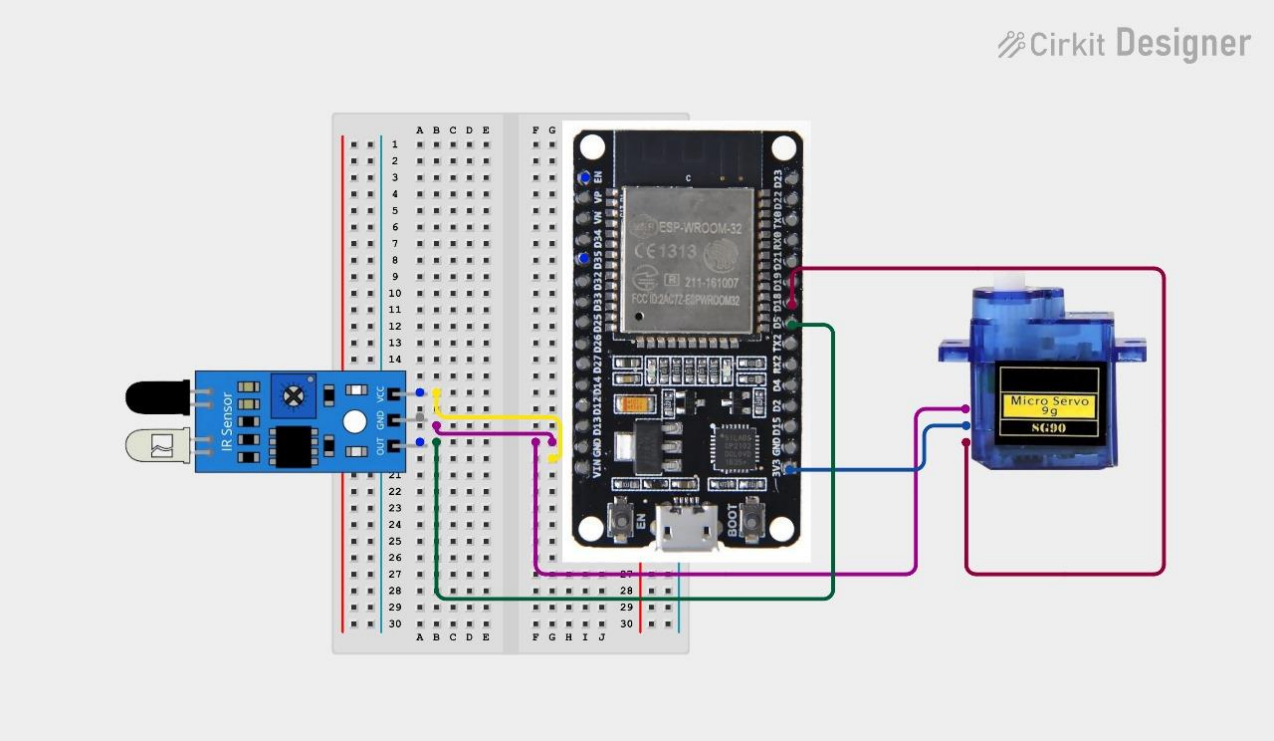
 Features:

1. Used to connect electronic components without soldering.
2. Available in different types for flexible connections.

 Working Principle:

1. Transfers signals between ESP32, IR sensor, and servo motor.
2. Provides power supply connections for different modules.

System architecture:



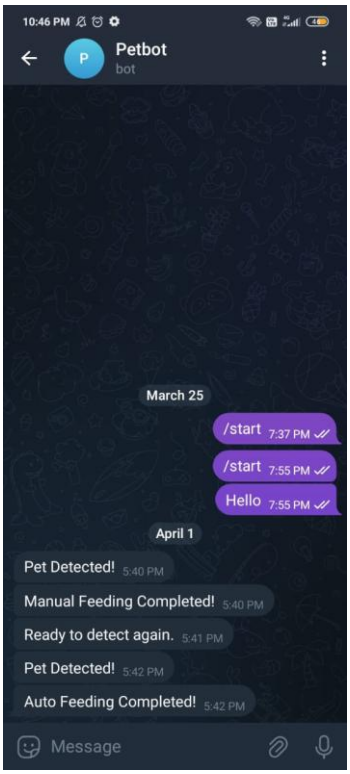
This circuit represents a smart pet feeding system using an ESP32 microcontroller. The IR LED emits **infrared light** continuously. Infrared light is **invisible** to the human eye but can be detected by the sensor.

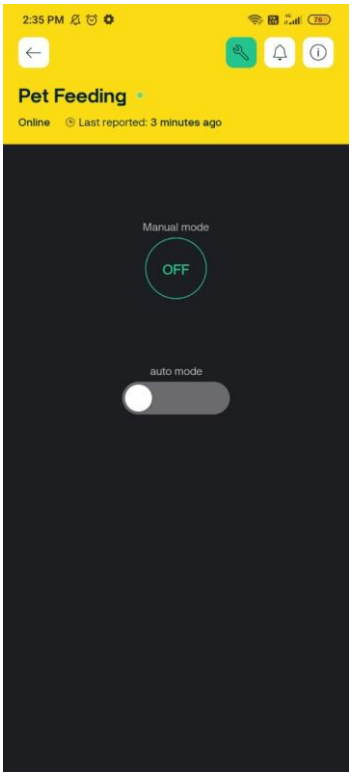
When a pet comes near the feeding bowl, the **infrared light is reflected** off the pet's body (fur, face, etc.). The photodiode (receiver) detects the **reflected infrared light** and converts it into an electrical signal. The comparator circuit analyzes the received signal. If the received signal crosses a certain threshold, the IR sensor **confirms the presence of the pet**.

The IR sensor sends a **HIGH signal** (logic 1) to the ESP32 when it detects a pet. The ESP32 then **activates the servo motor**, opening the food dispenser. If no pet is detected, the IR sensor sends a **LOW signal** (logic 0), keeping the dispenser closed

The **ESP32 sends a PWM (Pulse Width Modulation) signal** to the servo motor. The PWM signal determines the **rotation angle** of the servo. When the IR sensor detects a pet (or a manual command is given via the Blynk app), the ESP32 sends a signal to **rotate the servo motor**. The servo motor **turns a flap, lid, or rotating dispenser mechanism** to release food into the pet bowl. After food is dispensed, the ESP32 sends another signal to the servo motor to return it to its **original closed position**, preventing further food from coming out. The system keeps monitoring for further signals from the IR sensor or the app to repeat the process when required.

Output and Result:






```
Connecting to WiFi.
Motion Detected: Pet Near Feeder!
 Sending Telegram Message
Sending feeding data to ThingSpeak
Data Sent Successfully
IR Sensor Re-enabled. Ready to detect again.
Auto Mode: Enabled
Motion Detected: Pet Near Feeder!
 Sending Telegram Message
Sending feeding data to ThingSpeak
Data Sent Successfully
Auto Feeding Started.
Auto Feeding Complete!
 Sending Telegram Message
Sending feeding data to ThingSpeak
Data Sent Successfully
IR Sensor Re-enabled. Ready to detect again.
Auto Mode: Disabled
```

This project successfully implements a smart pet feeding system using the ESP32 microcontroller, IR sensor, servo motor, and Blynk IoT integration. The primary objective is for timely feeding of the pet based on IR sensor signal, ensuring optimal food feeding while reducing food wastage. The system sends notification in telegram if any pet is detected. The **Smart Pet Feeding System** ensures **automated and controlled food dispensing** based on **pet presence** or **remote commands.** The system also connected with Blynk IoT in order to turn on or off the servo motor.

Conclusion:

The **Smart Pet Feeding System** successfully automates pet feeding using **ESP32, an IR sensor, a servo motor, and IoT-based control through Telegram and Blynk**. The system ensures that food is dispensed **only when necessary**, based on **pet detection notifications** and **manual activation via the Blynk app**.

By integrating a **Telegram bot**, the system notifies the owner whenever a pet is near the feeder, allowing them to **remotely monitor their pet's activity**. The **Blynk app** enables the owner to **manually turn the feeder ON or OFF**, ensuring **controlled and scheduled feeding**.

This system helps in **preventing overfeeding, reducing food wastage, and providing convenience for pet owners**. The use of **IoT technology** enhances **remote accessibility**, making it easier for owners to manage pet feeding even when they are not at home.

Future enhancements could include **automated feeding schedules, real-time camera monitoring, and a feeding history log** to improve efficiency further. Overall, this project demonstrates the practical application of **IoT and automation** in pet care, making feeding more **efficient, smart, and user-friendly**.

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