**Analysis: Automated Pet Feeder**

Step 1: Understand and Define the Problem (Analyse)

1. What features must the feeder include?

**Scheduled Dispensing:** The ability to dispense a measured amount of pet food at specific times of day (e.g. each morning and evening needs to provide food once).

**Consumption Monitoring:** A way (usually use a sensor) to detect whether the dispensed food has been eaten. This could involve measuring the bowl’s weight or using a sensor to detect food remaining.

**Alert Mechanism:** If something goes wrong (for example, if no food was dispensed when it should have been, or if the food was dispensed but not eaten within the setting time), the system must alert shelter staff (like through an indicator, sound, or message).

1. What inputs and outputs are needed (e.g., feeding times, sensors)?

**Inputs:**

Feeding schedule times (from a real-time clock or internal timer): It can trigger dispensing at 8:00 AM, 6:00 PM (as above said, twice a day).

Food level sensor (in the food container): It can detect if the food remain level can still be enough for the next feeding.

Bowl (The food supply place) weight sensor: It can measure whether the amount of food dispensed is correct and how much food has been eaten (weight change over time).

**Outputs:**

Dispensing mechanism controller: It can send a signal to a servo motor to dispense a portion of food at feed times.

Alert or Notification: It can be a LED indicator, or network message to notify staff of issues (such as “Food not dispensed” or “Food not dispensed as the right amount” or “Pet did not eat all the food”).

1. What are possible assumptions or limitations (e.g., limited memory, one type of pet food)?

1. The feeder handles one type of dry pet food for all intended animals (portion sizes are consistent).

2. Feeding times are predetermined and relatively few (e.g. two times daily). The schedule can be stored in the system’s limited memory.

3. The environment is indoor and controlled (e.g. normal temperature, shelter conditions), so sensors and electronics operate reliably.

4. The system is powered and running continuously (power backup or always plugged in, so it can keep track of time).

5. Portion size is fixed (for example, 50 grams per feeding) for consistency. Assume this is appropriate for the pets (the shelter can reset this as required).

6. The bowl weight sensor is calibrated such that it can detect the presence of food and measure changes when the pet eats.

**A simple block diagram of the system:**

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| Component | Role in System |
| Controller (Control Unit) | It can coordinate all operations of the feeder. It reads inputs from the clock and sensors, makes decisions based on programmed logic, and controls the outputs (motor and alerts). |
| Real-Time Clock module | Keeps track of current time and signals the microcontroller when scheduled feeding times occur. The RTC module runs on an electrical clock, so it remains accurate. At each preset feeding time, it prompts the controller to start a feeding sequence. |
| Food Container Level Sensor | Monitors the amount of food remaining in the storage. If this sensor detects that the food level is lower than normal one-time feeding amount, the controller can prevent a failed feeding and raise an alert. It can be an ultrasonic level sensor or infrared sensor. |
| Bowl Weight Sensor | Measures the weight of food in the pet’s bowl. This allows the system to detect if food has been dispensed and if the pet has eaten it. After a feeding, the controller checks in bowl weight over time. It can detect whether the amount of food is the same as measured and, If the weight remains unchanged after a set period (meaning the pet did not eat), the system flags an issue. If before next feeding time, the weight is not 0, the system will alert to the operator. |
| Servo Motor (Food Dispenser) | It is an electric motor that dispenses food by rotating a mechanism (such as a flap, or turntable) when activated. At feeding time, the controller signals the servo to operate and release a portion of food into the bowl. The amount dispensed might be controlled by timing or by feedback from the weight sensor. |
| Alert System (LED/Buzzer/Network Module) | Notifies operators of important statuses. A simple LED or buzzer can provide alerts (e.g., blinking or sounding if an error is detected). In more advanced setups, a network module can send notifications to a smartphone app. The alert is triggered if the food container is empty at a feed time, the dispenser motor jammed and no food dispensed, or the pet hasn’t eaten the food after a set time. |