

Step 1: Understand and Define the Problem

problem statement

The Client, a local animal shelter, requires the development of a low cost, programmable automated pet feeder system. The system's core functions are to reliably dispense dry kibble for both cats and dogs at user customizable, scheduled intervals. Notably, the system must incorporate robust monitoring capabilities to identify whether dispensed food has been consumed within the specified time frames. Furthermore, it is essential for the system to generate immediate and most importantly actionable alerts to staff. These alerts should specifically notify staff of critical issues, such as food not being dispensed due to mechanical failure or an empty food tank. And also, if dispensed food remains uneaten, triggering an alert to staff, this alert serves to prompt staff for further investigation into the animal's wellbeing. The design must consider future low-cost hardware implementation. Ultimately this system aims to enhance operational efficiency and ensure consistent reliable feeding practices within the animal shelter.

Assumptions

The system's design is based on the exclusive dispensing of commercially available dry kibble. This assumption is critical as it fundamentally simplifies the dispensing mechanism. And the overall food storage requirements of the unit. Opting for dry kibble naturally reduces potential complexities. Such as those associated with temperature control for wet food. Or the need for mechanisms to handle a diverse range of textures. Furthermore, it lessens the potential health hazards, like those from spoilage. Or the need for expiry date monitoring. This aligns directly with the client's low cost requirement. As simpler mechanics mean fewer components and reduced maintenance.

The system is explicitly designed to operate continuously through a consistent standard electrical wall outlet supply. This makes power management much simpler by removing the need for complex, costly, and potentially unreliable battery systems or solar integrations. Such complexities would not only increase initial hardware costs, but also introduce additional points where things could go wrong. Thus, a stable and readily available power source is assumed to keep the daily running costs low and ensure uninterrupted functionality for the animal shelter.

The system's monitoring capabilities will exclusively utilise off the shelf, low cost sensors. Specifically, this includes a weight sensor for the food bowl. And a simple infrared level sensor for food tank levels. This deliberate choice is crucial to adhering to the client's strict, low cost requirement. It ensures the system remains economically viable for widespread shelter implementation. And crucially, it ensures the system is easily maintainable. This is because custom made or specialised components lead to extended replacement times. Which could result in significant system downtime. And increased manual Labor for shelter staff. Ultimately compromising consistent speeding and operational efficiency.

A critical operational assumption is the timely response of animal shelter staff to the system generated alerts. This is vital because while the system identifies critical feeding issues. Such as unconsumed food or mechanical failures. It does not possess direct animal health diagnostic capabilities. Therefore, human intervention is indispensable.

inputs/outputs

The pet feeder needs various inputs to work and monitor effectively. These include exact feeding times from a real time clock. It also needs key information from sensors, like the food tank level, to check for enough food. And a sensor in the bowl to confirm food is dispensed and eaten. For outputs, the system will do important actions and send timely notifications. It will physically put out the dry food with a sound to go with it. It will also send quick and helpful alerts to shelter staff, these alerts will use both displayed messages and sounds. They'll tell staff about big problems, like if food isn't coming out or the tank is empty. a timer will also show how long food has been waiting. Important notifications will go off before feeding, after feeding, and if food isn't eaten. This helps staff check on the anime and manage feeding times well as well as alert the animals when its time for them to eat.