Feline Acoustic and Visual Orienting Arena
Product Design Specifications
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Function: Dr. Tom Yin has requested a feline acoustic and visual orienting arena that will send auditory signals to a cat in the middle of the arena from four speakers located around the arena. The cat will walk toward the speaker that it heart the sound from and activate the switch by that speaker to receive a food reward. The cat will then have to move back to the middle of the arena and look at an LED light before the device resets and the process begins again. The system is meant to serve as a control experiment for Dr. Yin's research.

Client Requirements:

1. Design must be fully automated during the length of each individual replicate.
2. The speaker that is turned on for each replicate must be randomly generated.
3. After each replicate the system must be quickly reset itself for a second replicate without the need for human assistance.
4. Each speaker must be adjustable in its location around the arena and the arena should accommodate the use of more than four speakers, if necessary.
5. Speaker heights must be adjustable to account for different cat heights.
6. The entire system must allow manual cleaning at the end of an experiment.
7. System must be constructed of materials that do not interfere with a magnetic field to be used in the experiment.

Design Requirements:

1. **Physical and Operational Characteristics**
    a. *Performance Requirements*: The system must be fully automated for the length of each replicate and must reset after automatically after each replicate. The speakers need to sound on the same frequency. The system must be able to handle between 100 to 200 replicates in one test session.
    b. *Safety*: The cat cannot sustain any injury from the use of the system. The switches the cat must trigger to receive a food reward cannot exceed the amount of force a human can exert without difficulty with the pointer finger. The food being dispensed to the cat must be free of contamination and safe for consumption. The speaker noise level shouldn't exceed 100 db.
    c. *Accuracy and Reliability*: The system should have a high level of accuracy and consistency. Each speaker should fire for the same time length, between 0.1 and 0.2 seconds, the time delay between switch activation and food reward dispersal should be approximately 0.1 second and be delivered for 2 seconds for each speaker. The system should not disperse a food reward to the wrong speaker or when the wrong switch is activated.
    d. *Life in Service*: The system must accommodate 100-200 replicates in a trial session and should function for the estimated life of the experiment, approximately 2 years. The parts used should be easily replaceable in case of breakage.
    e. *Shelf Life*: The only concern for shelf life is the slurry cat food. The food must be able to be replaced and the food lines flushed daily

f. *Operating Environment:* The arena will function on an approximately 3 ft platform inside of a roughly 6 ft by 6 ft by 6 ft room sound proof room. The speakers are to be oriented 33 in from the center of the platform which is encompassed by a 5 ft cube creating the magnetic field.
g. *Ergonomic*s: The system must be programmed to run on its own and need minimal human intervention. The speaker setup needs to be easily interchangeable to create variances in speaker frequency for each speaker.
h. *Size*: All speakers must sit on a radius 33 in from the center of the platform. The speaker should be between 10 in to 12 in in height with the switch located directly in front of it.
i. *Weight*: The system should be easily interchangeable and each speaker system should weigh no more than 5 lbs.
j. *Materials*: The tubing feeding the food reward must be pliable and safe for food transmission. All materials used should be non-ferromagnetic so as not to disrupt the magnetic field being used and must be able to be manually cleaned.
k. *Aesthetics, Appearance, and Finish*: The system should be well-organized. The design should be easy to follow from the food pumps to the reward distribution. The arena in which the cat is should be clean and all parts used should be consistent.

2. Production Characteristics:

a. *Quantity*: One device is needed with four separate speaker setups constructed.
b. *Target Product Cost*: Current budget is $4000.00 for all materials including specific client requested peristaltic pump

3. Miscellaneous:

a. *Standard and Specification*: The system must fit within the constrained space and be able to deliver the reared upon the cat activating the correct switch
b. *Customer*: The device must meet all client requirements and be operable by someone who did not design it.
c. *Patient-Related Concerns*: The food being provided to the cat must be fit for consumption, activating the switch should be within a reasonable level for a cat using its nose, and the arena must give the cat ample room for maneuver.
d. *Competition*: Stephen Lomber of the University of Western Ontario created a similar device in 1999 that required extensive human input. We are not working to improve the device and make it more automated to reduce human impact on the experiment. Dr. Lomber is working in conjunction with Dr. Yin.