

**CST3990 Undergraduate Individual Project**

**VisionHealth Multi-Pet Feeder**

**2021 Oct Intake**

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**Date of Submission: 02/04/2024**

Contents

[1.Background of Study 3](#_Toc148351705)

[1.1 Introduction 3](#_Toc148351706)

[1.2 The Role of Automated Pet Feeders 3](#_Toc148351707)

[1.3 Limitations of Existing Pet Feeders 3](#_Toc148351708)

[1.4 The Need for Advanced Pet Feeding Solutions 4](#_Toc148351709)

[1.5 Market Size 4](#_Toc148351710)

[1.6 Target Audience 4](#_Toc148351711)

[1.7 How project will fit the market? 4](#_Toc148351712)

[1.8 Health-Optimized Nutritional Dispensing 4](#_Toc148351713)

[1.9 The Significance of VisionHealth Multi-Pet Feeder 5](#_Toc148351714)

[2. Problem Statement 5](#_Toc148351715)

[3. Description of Project 5](#_Toc148351716)

[Project Overview 5](#_Toc148351717)

[Purpose of the Solution 6](#_Toc148351718)

[Scope of the Project 6](#_Toc148351719)

[Technology Stack 6](#_Toc148351720)

[Significance of the Project 7](#_Toc148351721)

[3.1. Aim and Objectives 7](#_Toc148351722)

[4. Key Activities of the Project 7](#_Toc148351723)

[5. Project Plan 8](#_Toc148351724)

[6. Project Resources 8](#_Toc148351725)

[7. Bibliography 8](#_Toc148351726)

[8. References 8](#_Toc148351727)

1.Background of Study

1.1 Introduction

The field of automated pet care has witnessed significant advancements in recent years, driven by the increasing demand for solutions that enhance the well-being of pets and offer convenience to pet owners. Pet owners often face challenges related to maintaining their pets' health, ensuring optimal nutrition, and addressing the diverse needs of different pet species within a household. As a response to these challenges, automated pet feeders have emerged as a critical innovation, offering a convenient way to manage pet nutrition and feeding schedules. However, there remains substantial room for improvement in the functionality and scope of these devices.

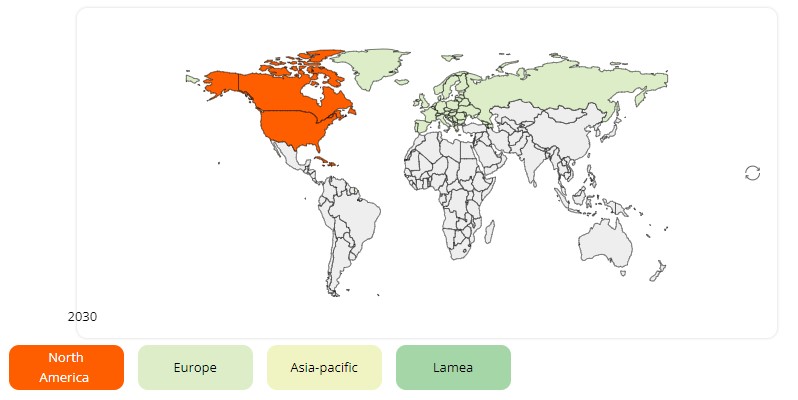
1.2 The Role of Automated Pet Feeders

Automated pet feeders have gained popularity for their ability to provide scheduled meals and portion control for pets. These devices are particularly beneficial for pet owners with busy schedules, frequent travelers, or those with multiple pets in one household. By automating the feeding process, pet owners can ensure their animals receive regular meals, addressing the issue of interrupted sleep due to early morning or late-night feeding.

# 1.4 The Need for Advanced Pet Feeding Solutions

With approximately 67% of U.S. households owning at least one pet, the need for more advanced pet feeding solutions is evident (American Pet Products Association, 2020-2021 National Pet Owners Survey). Many pet owners grapple with the challenge of maintaining the health and well-being of their pets. Obesity is a growing concern, with an estimated 56% of dogs and 60% of cats in the United States considered overweight or obese (Association for Pet Obesity Prevention, 2020 Pet Obesity Survey). These statistics underscore the importance of precise portion control and species-specific nutritional requirements in pet feeders.

# 1.5 Market Size

The Automatic feeder market size was valued at $344.6 million in 2020 and is projected reach $998.7million by 2030, registering a CAGR of 8.0% from 2021 to 2030s

From the above figures and diagram there is an existing market for Pet Feeders and same is expected to grow over the year.

**Figure 1. Market Sector (Alliedmarketresearch, Sept 2021)**

### 1.6 Target Audience

The Pet Feeder is targeted for:

* Pet Owners who travel a lot
* Pet with food disorder
* Pet Owners who have a rough time keeping up with the frequent food requirements of their pets.

### 1.7 How project will fit the market?

Seeing the increase in demand and that now several residences have multiple pet a new compact solution will be suited for the homes. The main selling point of this product is that it can be used for multiple pet.

### 1.8 Health-Optimized Nutritional Dispensing

Machine vision extends beyond species recognition. It enables the feeder to assess the condition and health of the pets. This real-time assessment is used to optimize the nutritional content of the dispensed food. For example, if a pet is overweight, the feeder can adjust the portion size accordingly to support weight management. This dynamic approach to pet feeding not only promotes overall health but also mitigates the risks associated with obesity and undernutrition.

1.9 The Significance of VisionHealth Multi-Pet Feeder

The "VisionHealth Multi-Pet Feeder" project stands as a testament to the potential of machine vision in pet care. By combining species recognition and health-optimized nutritional dispensing, this project takes a substantial step towards a future where pets receive precisely the care they need. In a world where pet ownership is on the rise, and the health of our animal companions is paramount, this research project represents an essential contribution to the evolution of automated pet feeding technology.

In summary, machine vision is at the heart of the "VisionHealth Multi-Pet Feeder" project, redefining the pet care landscape. This research project serves as a platform to explore, develop, and advance the potential of machine vision in ensuring the well-being of pets and addressing the limitations of traditional pet feeders.

2. Problem Statement

Automated pet feeders have become a valuable asset in modern pet care, offering convenience and scheduled feeding. However, existing pet feeders are plagued by limitations that compromise the well-being of pets. Traditional feeders provide uniform and unsuitable portions, do not differentiate between pet species in multi-pet households, and lack the ability to adapt to the health needs of individual animals. These limitations underscore the pressing need for an innovative and technologically advanced solution.

Furthermore, the high prevalence of pet obesity and the adverse health consequences it carries necessitate a more proactive approach to pet nutrition. Currently, most pet owners lack the tools to precisely manage their pets' dietary needs, leading to overfeeding, underfeeding, and ultimately risking their pets' health. The need for a holistic solution that addresses species recognition, health optimization, and real-time nutritional adaptation is evident.

The "VisionHealth Multi-Pet Feeder" project aims to bridge this gap by integrating machine vision technology to recognize different pet species, assess their health conditions, and adjust nutritional dispensing accordingly. By doing so, this research project seeks to offer a comprehensive and transformative solution that improves the health and well-being of pets while alleviating the concerns of pet owners in multi-species households. The overarching problem is to develop an automated pet feeding system that leverages machine vision to precisely meet the nutritional needs of pets, address pet obesity, and enhance the quality of pet care.

3. Description of Project

Project Overview

The "VisionHealth Multi-Pet Feeder" project represents a cutting-edge research and development effort aimed at addressing the limitations of existing automated pet feeders. This project capitalizes on the power of machine vision technology to create a smart and dynamic pet feeding system that recognizes different pet species, assesses their health conditions, and adjusts nutritional dispensing to cater to their unique dietary needs. By introducing species recognition and health-optimized nutritional delivery, this project sets out to revolutionize the landscape of automated pet care.

Purpose of the Solution

The core purpose of the "VisionHealth Multi-Pet Feeder" is to provide pet owners with an advanced and intelligent pet feeding system that goes beyond mere scheduling and portion control. This solution leverages machine vision technology to offer species-specific feeding and real-time nutritional adjustments, thereby addressing the challenges of pet obesity, dietary requirements, and multi-species households. The system aims to promote the health and well-being of pets by delivering tailored nutrition while offering convenience and peace of mind to pet owners.

Scope of the Project

The scope of this project encompasses the design, development, and implementation of a multi-functional pet feeding system with the following key features:

1. Species Recognition: Implementing machine vision to accurately recognize and differentiate between different pet species, such as dogs, cats, and other animals in multi-pet households.
2. Health Assessment: Employing real-time health assessment algorithms to monitor the condition of each pet and adjust feeding parameters accordingly.
3. Nutritional Optimization: Providing health-optimized nutritional dispensing based on the specific dietary needs of each pet, addressing concerns related to obesity, undernutrition, and dietary preferences.
4. User-Friendly Interface: Developing an intuitive and accessible user interface, including a mobile app, to allow pet owners to monitor and customize the feeding system.
5. Energy Efficiency: Ensuring the system operates with minimal power consumption and includes backup mechanisms to safeguard against power outages.

Technology Stack

The "VisionHealth Multi-Pet Feeder" leverages a range of cutting-edge technologies, including but not limited to:

1. Machine Vision: Utilizing machine vision algorithms for species recognition and health assessment through cameras and image processing.
2. Internet of Things (IoT): Employing IoT for real-time communication between the pet feeder, mobile app, and cloud-based databases.
3. User Interface: Developing a user-friendly interface accessible through a mobile application for convenient system control and monitoring.
4. Artificial Intelligence (AI): Incorporating AI for real-time health assessment and nutritional optimization.
5. Energy Efficiency Solutions: Implementing energy-efficient components and backup power options.

By integrating these technologies, the project aims to create a comprehensive and responsive system that caters to the unique needs of individual pets and transforms the way pet owners care for their animals.

Significance of the Project

The "VisionHealth Multi-Pet Feeder" project represents a significant advancement in the field of automated pet care. It addresses the pressing issues of pet obesity, dietary precision, and multi-species households by introducing innovative machine vision capabilities. The project offers a comprehensive and technologically sophisticated solution, enhancing pet health and the quality of life for pets and pet owners alike. As pet ownership continues to rise, this project is poised to contribute to a new era of pet care, where the well-being of our animal companions is prioritized and supported by cutting-edge technology.

3.1. Aims

The aim of the project is to design and develop an advanced automated pet feeding system, the "VisionHealth Multi-Pet Feeder," that leverages machine vision technology to recognize different pet species, assess their health conditions, and optimize nutritional dispensing. The project will utilize Arduino Cloud for real-time communication, remote access, and user control, offering pet owners a convenient and cloud-connected solution for pet care.

3.2 Objectives

1. Implement Species Recognition: Develop and integrate machine vision algorithms to accurately recognize and differentiate between various pet species, such as dogs, cats, and other animals, in multi-pet households.
2. Real-Time Health Assessment: Create algorithms for real-time health assessment of individual pets. This involves monitoring factors like weight, body condition, and specific health conditions, and adjusting feeding parameters accordingly.
3. Health-Optimized Nutritional Dispensing: Design a system capable of delivering health-optimized nutrition based on the dietary requirements of each pet. Ensure precision in portion control and nutritional content to address concerns related to obesity, undernutrition, and dietary preferences.
4. Arduino Cloud Integration: Integrate Arduino Cloud for real-time data communication, remote access, and user control. Ensure that pet owners can easily monitor and customize the feeding system through the cloud-based platform.
5. User-Friendly Interface: Develop an intuitive and user-friendly interface, including a mobile application, for pet owners to easily monitor and customize the feeding system. Enable remote access and control through the Arduino Cloud platform.
6. Energy Efficiency and Reliability: Ensure the system operates with minimal power consumption and implement backup mechanisms to safeguard against power outages. Prioritize system reliability to prevent disruptions in pet care.
7. Safety and Security: Implement safety measures to protect pets from accessing the feeder when not intended. Secure the system to prevent unauthorized access, especially in the context of cloud-based control.
8. Comprehensive Testing and Validation: Conduct thorough testing to validate the functionality and performance of the "VisionHealth Multi-Pet Feeder," including the Arduino Cloud integration. Ensure that real-time communication and control are reliable.
9. User Training and Support: Provide resources and support for pet owners to effectively use the system and Arduino Cloud platform, including instructions for setting up the feeder and utilizing the mobile app.
10. Evaluation and Feedback Collection: Evaluate the system's effectiveness in improving pet health, user satisfaction, and ease of use, including the experience of using Arduino Cloud. Collect feedback from pet owners to identify areas for improvement.
11. Documentation and Reporting: Document the development process, system specifications, and results of testing and evaluation, particularly focusing on the role of Arduino Cloud. Prepare comprehensive reports to communicate the project's outcomes and insights.

By achieving these objectives, the project aims to deliver a fully functional and transformative "VisionHealth Multi-Pet Feeder" with seamless integration with Arduino Cloud, which enhances the quality of pet care by leveraging machine vision and IoT technology.

4. Key Activities of the Project

–Introduce the methodology you plan to use and briefly describe

each key activity of the project.

4.1. Literature Review

- how will you conduct your literature review and what you will be.

researching into?

4.2. Systems Analysis and Design

- how will you design your proposed solution?

4.3. Implementation and Testing

- How will you implement your solution? How do you intend

to do testing?

4.4. Evaluation

- How you plan to evaluate the system?

5. Project Plan - A Gantt Chart providing a comprehensive timeline and sequence of project

activities. Should contains details about key milestones and interaction with supervisor.

6. Project Resources - Identifies what you need to complete the project - software, hardware, data.

7. Bibliography - Key reading list for the project (up to 6)

8. References - Cites sources actually