PDE3413 Systems Engineering for Robotics

Individual Project Draft Proposal Report

Automated Multi Pet Feeder (MPF)

2021 Oct Intake

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Date of Submission: 14/10/2022

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Abstract

The use of robots is currently widespread throughout the world. In the area of automated industries, they have signalled a tremendous technical advancement for humanity. The future of robotics, however, lies with social robots. They successfully execute difficult repetitive jobs. The proposed concept aims to make pet feeding better while still providing them with nutrition and hydration while we are away from home.

Since many families currently have pets but also frequently travel, they must find someone to take care of their animals while they are gone, which could be expensive. This Multi Pet Feeder (MPF) will be constructed using a variety of sensors, cameras, and motors to serve food effectively and reduce food waste.

There are pet feeders available on the market, but they are insufficient if you have a variety of animals, thus this MPF will serve as a solution. Therefore, the major goal of this project is to feed various pets autonomously from a single robot and to limit food waste since extras shall be pull back into the container and shall provide proper weight management by giving your pet the portioned feedings they need.

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1. Introduction

A social robot is a physical-mechanical machine that works by using different robotic technics to interact with its surrounding environment.

They are built with the objective of having fundamentally human-like behaviours, such as hearing, seeing, and recognizing objects by using sensors and cameras. Based on information they gather, such as hand gestures or vocal soundwaves, they can adjust their movements.

One of the newest innovations of a social robot is an automatic pet feeder. The latter is designed to assist pet owners in caring for their pets while they are away from home.

Users should be aware that, like people who adore pets, these animals require correct food management. User may feel confident that the cherished pet will be looked after and fed on time whether user is unexpectedly away from home or would just like one less duty to worry about.

Many animal feed systems can be designed to function as an automatic device that allow the user to feed whenever he wishes remotely. The purpose of having sensors in a system like this is to automate the feed process completely with less/no human interference. (Jayaram, automatic pet feeder using internet of things,2019, pp.1)

1.1 Aims & Main Objectives of the Multi Pet Feeder (MPF)

1.1.1 Multiple animal detection (maximum 2)

The MPF shall be capable of using computer vision which pet is approaching the robot and shall dispense the food accordingly. This shall be a smart feature since some people do have multiple pets at home.

The MPF can be programmed to identify 2 different pets (e.g., dog & cats) and if someone has only one pet same can be run on only 1 pet

1.1.2 Pre-sets in terms of quantity

Approximately 55% of cats and dogs are overweight, which poses major health hazards such diabetes, kidney illness, heart, and lung disease. (McDowell, n.d)

By giving your pet the portioned feedings, they require, automatic feeder's aid in correct weight maintenance. Same will ensure that the pets are properly fed.

1.1.3 No earlier wake-up for Users

Several pet Owners have this issue of having their pet waking up them early morning or late at night. MPF will feed the pet when same is required.

1.1.4 Food Available even in absence of Owners

All of us lead busy lives, and our schedules occasionally prohibit us from maintaining a regular feeding plan for our animals. The assurance that your pet will be fed while you are gone or at work comes from MPF. If you are confident that your pet will eat the same meals as always, it will be simple to fit a late meeting into your schedule.

2. Target Audience

The MPF is targeted mainly 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.

3. Background Research

3.1 Review and short analysis-Existing Projects

The Microchip Pet Feeder (MPT) was made to recognize either the Sure Petcare RFID Collar Tag (one is included - one not) or the microchip that has previously been put in your pet allowing your cat to access their food while maintaining out other creatures.

Surepetcare has created a pet feeder as below diagram.

Figure 1. Microchip Pet Feeder (Surepetcare, n.d)

3.2 Features and Structural of system

3.2.1 Feature Analysis

3.2.1 Stock Levels

This system does not have a stock level control to notify user when low in stock and refill is required

3.2.1 Tags/Collars

Collar has a specific id which is permanently stored in memory of the MPT
It has both pros and cons that is it can identify if it's the pet which is on the pad of the pet feeder.
But as cons it's both ethical and in practice issue.
For instant several animal right activists are against wearing of collars which play an important role and in practice since we are dealing with animal the collar tag can get easily lost or damage thus a higher cost for user. User will have to buy one directly form the company since it has a unique way of identifying the collars which is costly

3.2.1 Retrieving remaining food by pet for later use

Unfortunately, this pet feeder has no way to put remaining food back to the bowl which might lead to food wastage.

3.2.1 Identification of pet

The MPF does not include a way to identify the animal since some household may have more than 1 cat of pet for instance 1 household can have dogs and cats therefore will have to buy 2 separate device and will create a confusion for the pet.

3.2.1 Food holder in metal

With the way the product is designed the bowl can hold both wet and dry food. Bowl capacity 400 ml or two pouches of wet food which is a good side

3.2.1 Battery powered

This product features 6 months battery life which is Definity good if users is away for a long period of time and there is no power in the home

3.2.2 Structural Analysis

3.2.2 Button Placement and function control

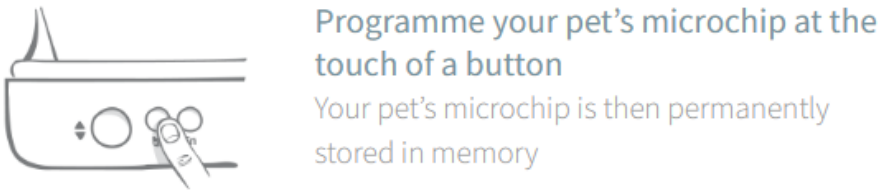

Figure 2 Button Placement and interaction board (Surepetcare, n.d)

Pros:

1. Minimalist approach and in a way that pet won't tamper with it.
2. Easily accessible on side

Cons

1. Not too many options and not a user-friendly interface.
2. Pet id is permanently stored and need to be sent to factory for hard reset. -No Flexibility
3. There is no variety of option available and same is not targeted to people who are less acquainted to technology

3.2.2 Lid opening

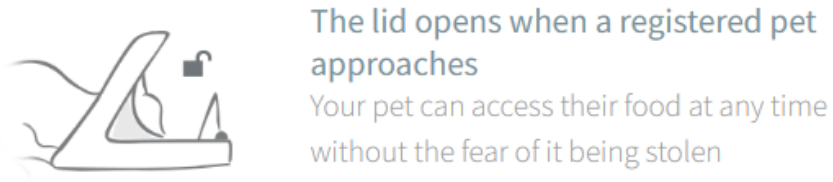

Figure 3 Lid Mechanism (Surepetcare, n.d)

Pros:

1. Sanitary wise it's a better option so as food does not scatter everywhere.
2. Proper control of food if you have multiple pets. Lid shall response only to pet with tag.

Cons

1. The mechanical lid shall take to open thus the pet may go away
2. The Lid opening is dependent on the tags If two tags are close together this shall create conflict and machine require restart

3.2.2 Movement of lid details

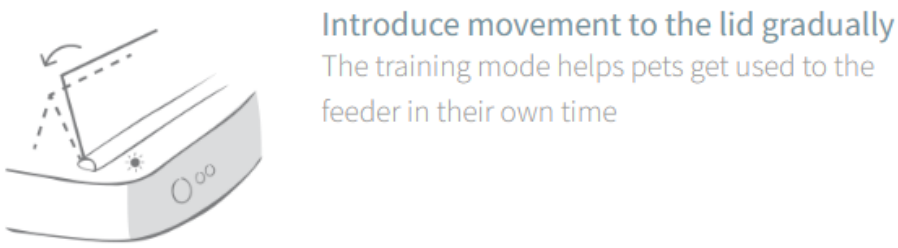

Figure 4 Lid Adaptation (Surepetcare, n.d)

Pros:

1. The way that the lid will use data from previous opening and closing to adapt to the pet which is an adequate of learning the animal to optimise ideal use

Cons

1. For the initial adaptation same will be difficult and uncomfortable for the pet.

4. Proposal

4.1 Description and concept behaviour.

An Automated Multi Pet Feeder to distribute and monitor food. Same will be able to store food and to identify which pet is coming to its base and shall give appropriate food. After a while if food is left over same shall be put back in the storage of the Food. Also, this MPF shall have a water dispenser.

4.2 Review and short analysis-Proposed projects

4.2.1 System Architecture

In Figure 4 you shall find a Block Diagram of internal structure.
Same will explain on how the sensors and driver react with Arduino and raspberry pi to do actions

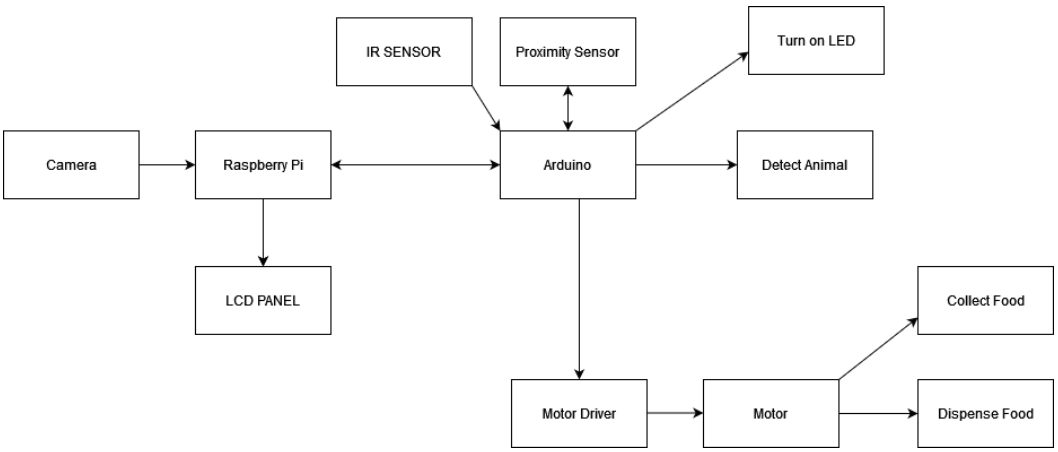

Figure 5 Block Diagram

4.2.2 Data Collection

Data shall be collected using sensors.
Below will be the list of sensors

1. **Proximity Sensors (Sharp GP2Y0A41SK0F):** detect an object without touching it, and they therefore do not cause abrasion or damage to the object. Same will be used to detect if the animal is coming close to the MPF thus starting the robot Same will be capable of detecting up to 40 cm

Figure 6 Analog Distance Sensor (Pololu, 2022)

2. **Camera:** Camera will be connected to raspberry pi and same will be capture photo of pet and shall send for processing

Figure 7 Pi Camera Module (Raspberry Pi Foundation, 2022)

3. Float Switch: float switch is used to detect the level of liquid within a tank. Same will be used to detect the amount of level remaining in the tank

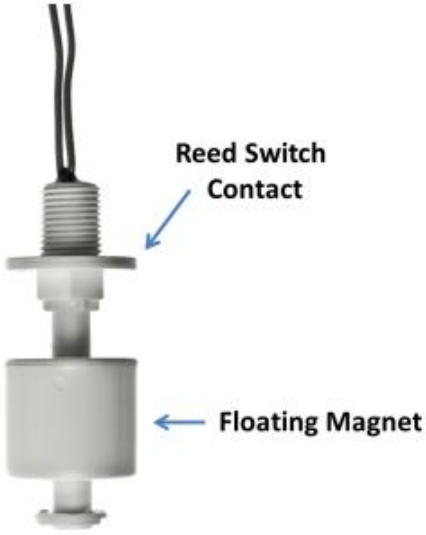

Figure 8 Float Switch (Pijaeducation, Soud)

4.2.3 Feature Analysis

4.2.3 Detection & Identification of Pet

As soon as pet come close to the sensor the Robot will detect the animal thus starting the identification process. Computer vision will be implemented to Identify which pet shall be used using camera

The Project use camera vision linked to capture the face& body of the pet and shall compared that to a database. Base on the outcome the respected food shall be delivered

4.2.3 Selection of Food

After pet has been identified a plate shall be move on the x plane to collect proper food. (More details in Structural Analysis)

After selection of food, the plate shall move on the Y plane down next to the out-source to the bowl. (More details in Structural Analysis)

When the plate come to the outside it shall be tiled by a motor to empty the plate into the food bowl.

After that same shall be reset to initial position.

4.2.3 Level of Food in Stock

Stock shall be monitored like a being in low stock same shall light a red bulb next to the slot for the corresponding food. (An on-board interface shall be implemented depending on the time frame).

4.2.3 Food storage

Food will be stored internally to avoid contamination of food and risk of heal issue of the pet

4.2.4 Structural Analysis

4.2.4.2 Outside structure

The MPF Shall be a box like structure having several outlets as seen In Figure 5

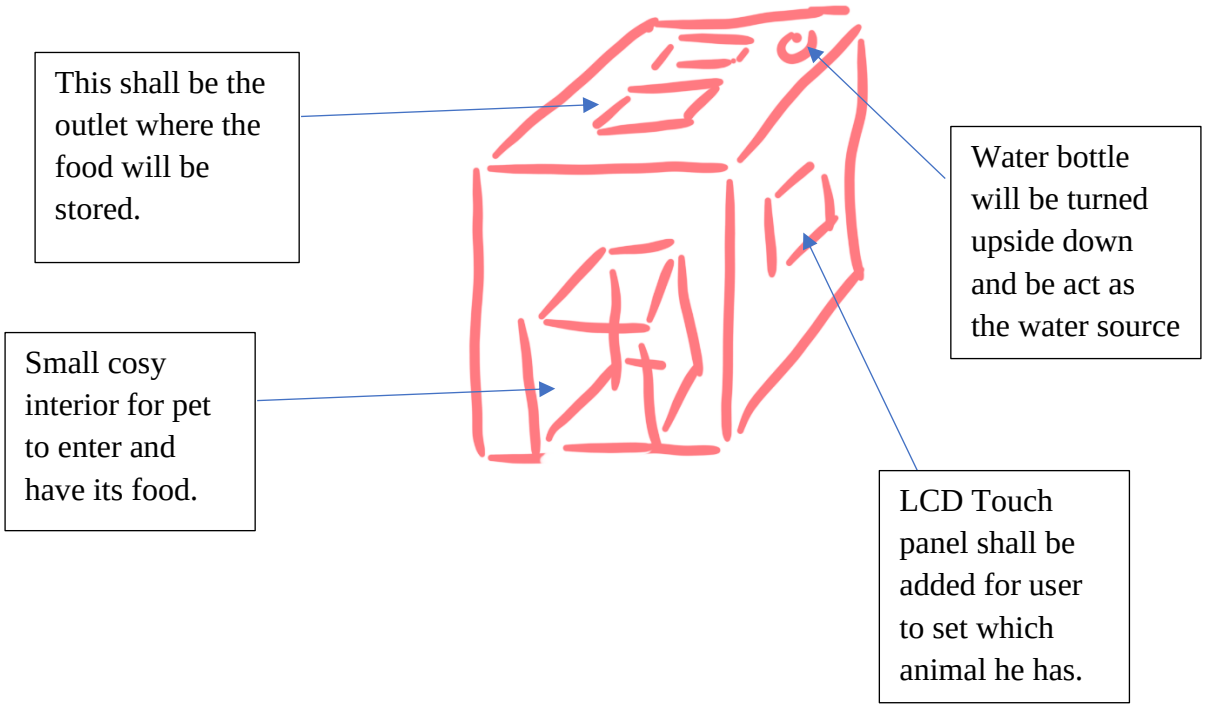

Figure 9 Sketch of outside pet feeder

4.2.4.2 Movement of plate for food dispense

The plate shall be place on wheels. Same structure will be put on 2 rods and a chain shall be attached to both end of structure.

For the movement of the plate same shall act as a pulley system to move right and left (x-axis) refer to Figure 6

For the Movement up and down system shall be same as x-axis put just on y-axis

The pulley will work with a motor. Refer to Figure 6

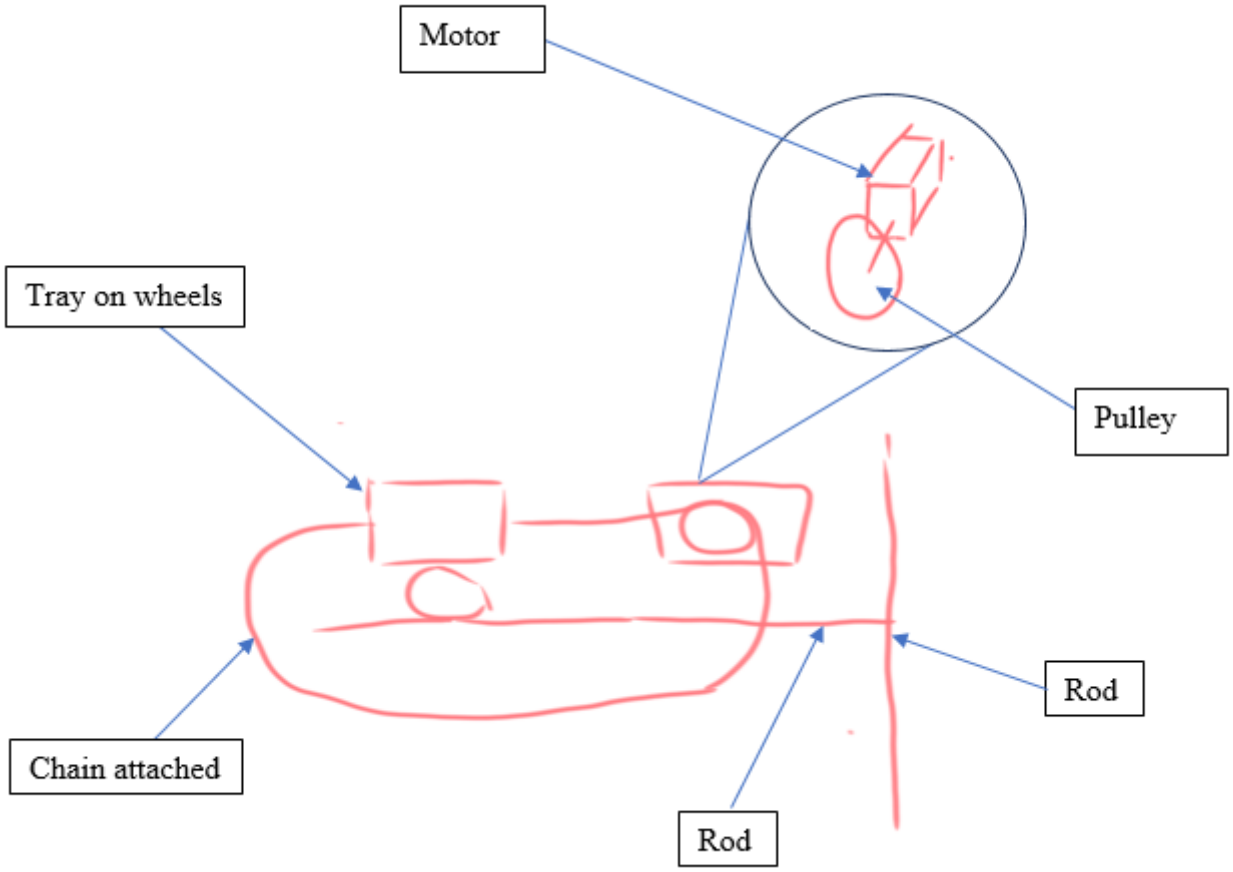

Figure 10 Side View of movement system

5. Testing the System

- The robot must be able to use the proximity sensor to detect the pet and start the machine
- The robot must be able to capture the photo and process it to give the correct food
- The robot shall be able to resist small bumps and crashes since we are dealing with a pet and some pet can be aggressive
- The multiple should have multiple places to dispense

6. What are the potential pitfalls of your system?

- Power Supply- The Robot should have enough power to supply to the 2 motors.
- The size of the entrance for the dog should be enough
- If knocked down, internal part may move
- Since we are dealing with water, circuits may get damage.

7. Conclusion

To conclude this social robot is a small prototype that has a great utility in our live. Robots are taking the spotlight in almost every industry. The outcomes not only demonstrate a significant advancement in the social robot technology's pet monitoring system, but also satisfy pet owners' needs.

8. Reference List

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