INTRODUCTORY DESIGN PROJECT: AUTOMATED TREAT DISPENSER

Project Summary: In this project, you will explore the design of an automated treat/food dispenser for pets. This conceptual design project will focus on understanding the customer needs associated with this type of system, development of engineering requirements, generation of concept alternatives, and selection to address the problem. The deliverables are described below.

Project Description: The size of the domestic pet industry exceeded $103.6B in 2020 and has steadily increased nearly 10% year over year for the past decade. This growing market represents a significant business opportunity for entrepreneurs and large corporations to develop new, high-tech and innovative products to meet the needs of pets and pet owners. Among products that are available, automated food/treat dispensers are relatively new products that have become increasingly popular amongst pet owners. These products have been promoted as tools to help relieve separation anxiety, provide capability for pet and pet owner to interact remotely and even support reward-based pet training. An example of an automated treat dispenser offered by Petzi is shown in Figure 1, and many other products are available from commercial vendors (e.g., PetSafe, Furbo, PetSpy). Common features of these products are an ability to dispense food/treats remotely by the pet owner or though physical actions taken by the pet. Multiple factors must be considered when designing these products, ranging from control and features of the dispensing action (e.g., dispensing speed, launch distance, launch angle, number dispensed), capacity of the unit, user interface, aesthetics, and others deemed critical to product functionality.

The objective of this project is to design an automated treat/food dispenser that can support: (1) remote interaction by pet and pet owner and (2) reward-based pet training. Factors that may be important to products in this category must consider a number of objectives including safety, cost, stability, adjustability, dispensing control, size/weight, aesthetics, ease of installation, ease of use, compatibility with the existing environment and legal requirements. Your design should address these customer needs and other qualities that you feel may be important to potential customers. From a device compatibility perspective, these devices must accommodate common treat/food products on the market in terms of dimensions and weight. Your team should consider the range of functions that would be needed for the design solution.

You must follow the structured design process we discuss in the lecture in addressing this need using the design tools you have been learning in class. You should strive to thoroughly understand the customer needs and establish engineering requirements/specifications that can be useful metrics for the system to achieve these needs (e.g., house of quality, specification sheet). You should also evaluate at least 2-3 existing products with regard to the customer needs and engineering requirements. You must determine functions that the system must achieve (e.g., function tree) and generate solution approaches for accomplishing these functions (e.g.,

Figure 1. Automated treat dispenser.
morphological chart). A set of solution approaches will determine feasible alternatives. You must generate 3-4 alternatives according to your group size and select one of these as a preferred alternative using quantitative concept selection (e.g., evaluation matrix). Visual communication of your designs will require sketching and/or CAD. For non-selected alternatives, visual communication (e.g., figures) should have enough detail to accommodate design assessment and evaluation. This can involve good sketches or very simple CAD for communicating the ideation. For the preferred alternative, you should have a more complete design with detail and CAD. In working through the design process as a team, consider facilitating the discussion with the following questions:

(1) **Customers:** What are the needs of a customer seeking this type of product and what is their relative priority?

(2) **Specifications/Requirements:** What are quantitative performance metrics/specifications that this type of product should consider? Search the web for quantitative data to support target values for these metrics/specifications. Associate each of these metrics with a particular customer need in terms of low (1), medium (3), and high (9) relationship. What do you think the most important and least important metrics are from those that you brainstormed? Are there any examples of two metrics that when optimized are in direct conflict with each other?

(3) **Users/Functions:** Who are the users of this device? For this type of product, how do these users interface with the device? You should brainstorm specific actions of the user across the entire life cycle of the product and the sequencing of these actions.

(4) **Users/Functions:** What are some ideas of functions that this product should accomplish to meet the intended use cases? Functions generally have verb-noun pairs (e.g., load object, measure light, display message, adjust volume, etc.).

(5) **Risks/Safety:** What are the risks associated with using this type of product and how might these be addressed by the original equipment manufacturer (OEM)?

(6) **Mechanisms:** What are different methods/mechanisms/approaches that could be used to accomplish each function? Think of 3-5 ways of accomplishing each function. Point out some major advantages and disadvantages of key ones you identify.

**Deliverables:** Your team will be responsible for the following deliverables to be completed outside of class.

1. **Peer Evaluation.** You will be evaluating the performance of your peers and yourself on the project team. A sample peer evaluation form is provided on the ME2110 Canvas website. The peer evaluation should be submitted in PDF form to Canvas before the deadline.

   *Deadline: This presentation is due in Week 4.

2. **Presentation (15 points).** This presentation should cover the complete design problem and solution. It should include a restatement of the problem at hand, customer needs, engineering specifications, functions, concept generation, concept selection, and explanation of the final design. The presentation should be submitted in PDF form to Canvas before the deadline. One person on your team will give this presentation, it is limited to 10 minutes.

   *Deadline: This presentation is due in Week 4.
3. **Report (85 points).** This report should cover the complete design problem and solution. All reports should be uploaded to Canvas before the start of studio. The report should include a maximum of 3 pages of text. The cover page, abstract and appendix do not contribute to this 3-page limit. The report should use 12-point font, 1-inch margins and 1.5 line spacing (unless otherwise specified). Use page numbers at the bottom of each page. This report should contain the following:

- **Cover Page:** See below for example cover page. This should indicate the title of the assignment, the section information (e.g., name/number), instructor name, TA name, team member names. It should be on its own separate page. Does not count toward page limit.

- **Abstract:** This is a one-paragraph summary of the report including any key findings and/or results. It should be on its own separate page. Does not count toward page limit.

- **Report Body:** Consider dividing your report into sections below for clarity. Limited to 3 pages.
  - **Introduction:** Restatement of the problem, goal of the study and inherent design challenges associated with achieving this goal.
  - **Problem Understanding:** Review important customer needs and design tradeoffs/synergies, (house of quality), engineering specifications to address these needs (specification sheet) critical functions (function tree) and use case workflow, concept generation (morphological chart).
  - **Design Overview:** Presentation of the preferred alternative, detailed description of the design including quality figures that shows its parts and how it operates.
  - **Alternative Designs:** Presentation of the non-selected alternatives and brief description of how they operate. Discussion of the quantitative concept selection results (evaluation matrix).
  - **Conclusions:** Summary with key results and potential next steps and final thoughts.
  - **Appendix:** Any figures/tables should NOT be included in the report body, they should be placed here in an Appendix. This is a separate page or pages. These displays should be put into an appendix such that it is straightforward to determine the total number of pages. Each figure/table should be presented to match the sequential order of citation in the report body. Figure captions should be provided for all figures and go below the figure. Table captions for any tables are to be placed above the table. Figures and tables must be cleanly formatted for a professional environment. All font in figures and tables must be easily visible (e.g., at least sized equivalent to 10 pt Times New Roman). Figures and tables must be cited in sequential order in the text and all figures/tables must be cited in the report body. Does not count toward page limit.

*Deadline: This report is due in Week 4.*
**EXAMPLE COVER PAGE**

ME2110 – Section A1

Introductory Project Report

Team 1:

Team Member 1
Team Member 2
Team Member 3
Team Member 4

Submitted to: Instructor Name

TA: TA Name

Date: ####