Automatic Pet Food Dispenser

Group 25

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Project Description

We are all familiar with feeding our pets or, at least, have a friend that does. We have noticed that, sometimes, pet owners are out of their house and need to go home whenever they have to, or forgot to, feed their pet. This can be an inconvenience at times when we do not want to leave where we currently are (ex: date, out with friends, etc). Our solution to this problem is an automatic food dispenser, with many helpful features, that makes life, for the average pet owner, easier.

The goal of this project is to provide the end user with automatic/manual control of when, and how much, food is dispensed for their pet. This can be achieved through various methods and features that are built into the design. The design will be easy to use and can be used remotely, or physically, at the dispenser through buttons and/or a menu.

Although there might be few similar designs out there, our design will be unique in many ways. Our design will provide the pet owner with peace of mind wherever they may be. With a few clicks from a mobile phone, they should be able to feed their pet and not worry about rushing to get home from work or a trip in order to feed their pet. Our design will also allow the pet owner to control the amount of food dispensed to the pet. The owner will be able to provide a specific portion of food to the pet; the owner can decide if the pet should get a certain amount of portions for a meal or just one portion for a snack.

Furthermore, our design comes with a schedule that can be programmed by the owner to dispense at certain times. Through this option, the owner can decide when their pet should be fed while they can also control the pet's diet.

Project Requirements

In order to build such a project we will need multiple hardware parts that will be controlled by a software program. The first requirement for this project would be the availability of internet and a mobile phone. Both will establish a connection between the pet feeder and the owner's mobile device through the web. We will also design a software interface through which the owner can control the feeder. We will also need to establish a wireless connection between the feeder and the owner's router such as a bluetooth that will enable wireless communication between the feeder and the mobile device. These devices will be connected to a programmable controller that will receive commands from the owner's mobile device and send signals to the hardware in order to execute these commands. This controller will most likely be embedded in the pet feeder and connected to a PCB that will control the hardware.

When it comes to hardware, we will design a PCB that connects all the pet feeder hardware elements. This will include a power supply that will power all the elements of the feeder; this will be accomplished with a step down transformer. Once the owner plugs the feeder into an outlet, the step down transformer will convert the supplied power into a lower voltage that will provide adequate power to all the components inside the feeder. We are unable to provide power specifications at this time such as the voltage rating or whether we are using AC or DC voltage since we are at an early stage of the project. These specifications will be determined later on when other critical parts of the feeder are specified.

Another hardware component that would be very critical to the functionality of the feeder is a mechanical motor. The motor will receive a voltage signal from the PCB to open and close a gate through which the food portions will be dispensed. The PCB will in turn be controlled by the programmable controller. The motor should be able to rotate back and forth in order to accomplish its purpose, which is to swing the gate back and forth. It should also have a quick response capability in order to dispense the right amount of food and not exceed what the amount that the owner specified.

Table 1, **Specifications**

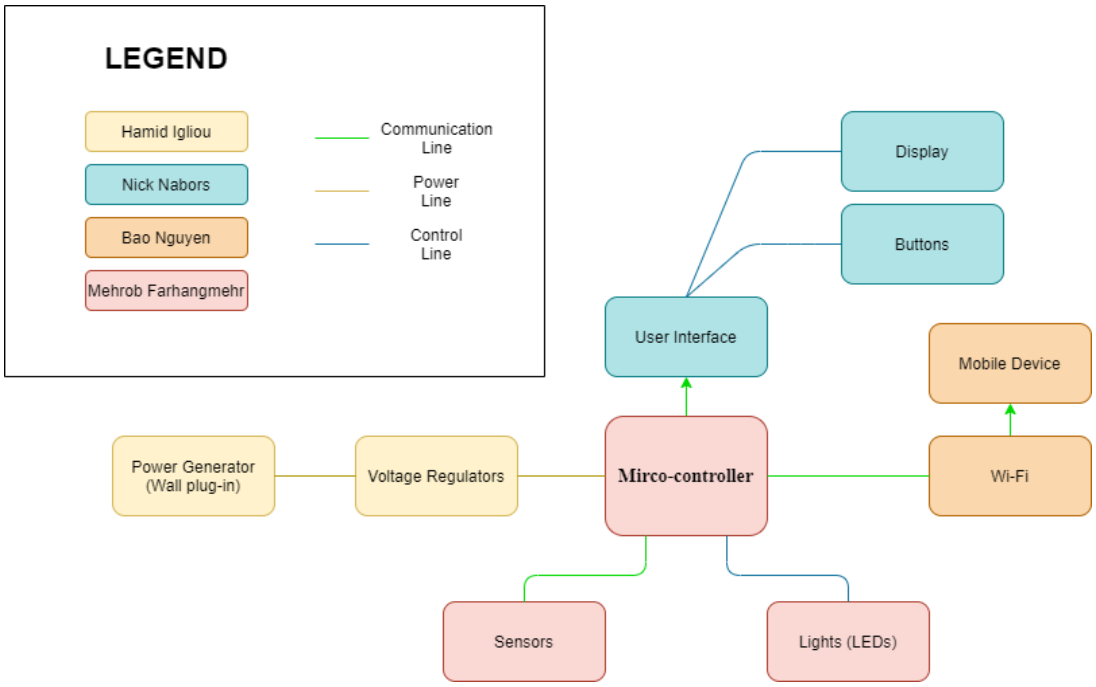
Portion Control	**ADULT DOG SIZE DRY FOOD FEEDING AMOUNT (CUPS)** 3-12 lbs. — 1/3 to 1 cup 13-20 lbs. — 1 to 1 1/3 cups 21-35 lbs. — 1 1/3 to 2 cups 26-50 lbs. — 2 to 2 2/3 cups 51-75 lbs. — 2 2/3 to 3 1/3 cups 76-100 lbs. — 3 1/3 to 4 ¼ cups Over 100 lbs. — 4 ¼ cups plus ¼ cup for each 10 lbs. of body weight over 100 lbs.
Wireless control	Wireless connection up to 30 feet to internet
Dimensions	2 feet in height x 2 feet in width x 2 feet in length
Power consumption	5V - 12V (estimated), 1W-3W (estimated)
Low food reminder	When the food is ¼ full send reminder
Manual dispensing	Drops food within 1 minute of command
Scale	5% error
Setting Timer	Dispenses with 30 seconds of set time
LEDs	LED Indicator Level: (1: Green, Full) ⇒ (2: Yellow,(¼) Low) ⇒ (3: Red, Empty)
Weight	2-3 lbs without food
Container size	Should hold 4 lbs of food

Here in *Table 1*, we have the specifications that we expect our auto pet feeder to be able to do.

Ideally, we would like to have wireless control from a remote location with the design having up to 30 feet of wireless connection to WiFi. For portability, we want the design to be compact and lightweight for the average user. The container size fits in with this as it decides the overall loading capacity thus affecting the design of the weight and dimensions. For food reminders, this will be tied in with the scale and will notify the user by LED, display or by the app. Most of the power consumption will be based on a per use basis. This is because the device will only need to draw power when it is being used, otherwise, it is in a low power mode that waits for use. The setting timer and manual dispenser will be able to be set from the app or directly on the design itself.

Block Diagram

Figure 1, **Block Diagram**



Here in *Figure 1,* We can see that there are many major parts needed for our prototype of the automatic pet feeder. At the center of the Block diagram there is a micro-controller that will be the mastermind and control between all of the parts. Right below the micro-controller there are the Sensors and Lights(LEDs) we can see based on the color of the lines connecting them the sensors will be communicating to the microcontroller and the LEDs will be controlled by MCU. To the left of the MCU there is the power aspect of the project, we can tell by the dark yellow lines that are connecting the “Power Generator” block and the “Voltage Regulator” block to the MCU. Above the MCU we can see there is an User Interface which will communicate to the MCU, and control the Display and Button. Finally on the right side we can see that there is going to be a Wifi module that allows us to connect to a mobile device. This will allow the user to remotely control the Auto pet feeder.

From the color scheme blocks that we have we can see who oversees which part of the project. Hamid is in charge of the yellow blocks, Mehrob is the red block, Nick is the blue, and Bao the orange. As we see in *Figure 1*, there are many moving parts to this product, but we have divided up the parts so we can cover more ground quickly since there are time constraints for our project.

Project Budget and Financing

Table 2, **Estimated Budget**

Component	Price (Estimated)
Power Supply / Regulation	$15-$20
MCU	$10
Sensors (scale, level, etc)	$10
WiFi (on device)	$10-$20
LCD	$10-$50
Buttons / Control	<$1
PCB	$5-$10
Mobile App (Android, Apple, Web Interface)	Free
Motors	$15
Housing (plastics, rubber feet)	$10
Pet Food	$50

The prices for the components are based on the prices on seller sites such as Amazon and Digikey. For MCU, a simple microcontroller is Arduino Uno. It goes as high as $20 on Amazon and as low as $10 on Walmart.

A pressure sensor will need to be purchased for the food weight. When using an Arduino Uno MCU the weight signal is low, so it will need to be amplified. Hx711 module sensors are used as load cell conversion to assist with measurements. They are around $6. The portable scale itself is $4.

The pet feeder will also need a way to send messages to the user. Wifi will be used to connect the Arduino to the internet so it can connect an application and send notifications. The esp8266 wifi module allows the Arduino to be used with Wifi, and it is priced high $20, low $5 sold mostly at $10.

The LCD price can vary depending on the features wanted such as size or color. However, for this project a simple LCD that is compatible with Arduino Uno will suffice. A 16x2 LCD costs around $10.

A button will be added for manual food dispensing. This button can be very simple, but of course it needs to work with the Arduino board. On Digikey and TE connectivity, push buttons are very cheap, they can go for $0.10.

A motor is needed to allow the food to drop. Servo motors are the most common motor to work with Arduino boards and will suffice for this project. They are mid priced at $10, but can go up to $20.

Project Milestones (Initial)

Table 3, **Senior Design 1 Milestones (Tentative)**

Week number (Date range of Week)	Milestones
Week 1 (1/11/21 – 1/17/21)	Create Group
Week 2 (1/18/21 – 1/24/21)	Think of Design Idea/Problem
Week 3 (1/25/21 – 1/31/21)	Plan Idea/ Finish Divide and Conquer 1.0
Week 4 (2/1/21 – 2/7/21)	Research
Week 5 (2/8/21 – 2/14/21)	Research, Finish Divide and Conquer 2.0
Week 6 (2/15/21 – 2/21/21)	R&D
Week 7 (2/22/21 – 2/28/21)	R&D
Week 8 (3/1/21 – 3/7/21)	R&D
Week 9 (3/8/21 – 3/14/21)	R&D
Week 10 (3/15/21 – 3/21/21)	R&D
Week 11 (3/22/21 – 3/28/21)	R&D
Week 12 (3/29/21 – 4/4/21)	60 page Draft Senior Design I Documentation
Week 13 (4/5/21 – 4/11/21)	R&D
Week 14 (4/12/21 – 4/18/21)	100 page report submission_updated
Week 15 (4/19/21 – 4/25/21)	R&D
Week 16 (4/26/21 – 5/2/21)	Final Document Due

Table 3 shows the tentative schedule for the semester of Senior Design 1. The main focus of this semester is preparation and research for Senior Design 2 the following semester. The administrative work in this semester will set us up for success in the following semester when we implement our research and planned budget the way we planned in Senior Design 1. This is subject to change on a weekly basis, after we have had our weekly meeting. Even more so if we meet more than once per week to discuss any changes or adjustments that need to be made to help us achieve our goal of success.

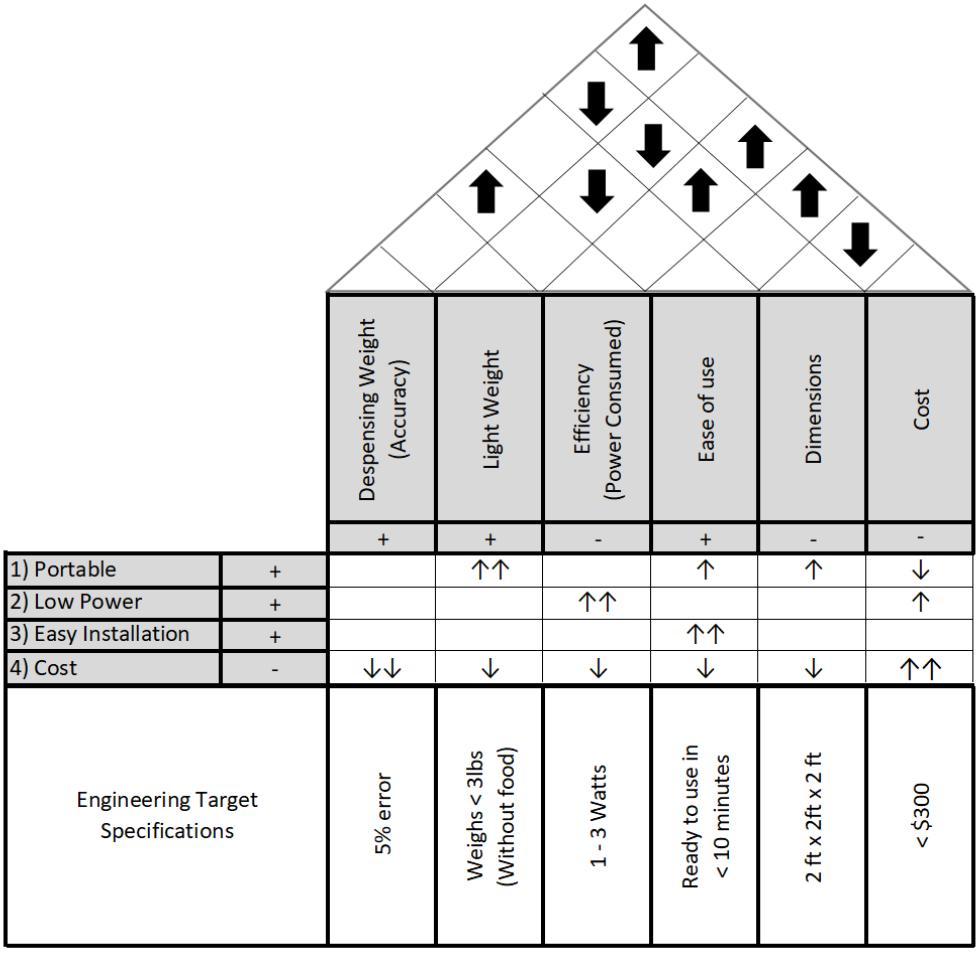
Table 4, **Senior Design 2 Milestones (Tentative)**

Week number (Date range of Week)	Milestones
Week 1 (5/17/21 – 5/23/21)	Acquiring Materials
Week 2 (5/24/21 – 5/30/21)	Acquiring Materials
Week 3 (5/31/21 – 6/6/21)	Build Prototype
Week 4 (6/7/21 – 6/13/21)	Build Prototype
Week 5 (6/14/21 – 6/20/21)	Test
Week 6 (6/21/21 – 6/27/21)	Build Prototype
Week 7 (6/28/21 – 7/4/21)	Build Prototype
Week 8 (7/5/21 – 7/11/21)	Test
Week 9 (7/12/21 – 7/18/21)	Build Prototype
Week 10 (7/19/21 – 7/25/21)	Build Prototype
Week 11 (7/26/21 – 8/1/21)	Test
Week 12 (8/2/21 – 8/8/21)	Finalize Prototype
Week 13 (8/9/21 – 8/15/21)	Prepare Final Reports
Week 14 (8/16/21 – 8/22/21)	Prepare Final Reports

Table 4 demonstrates the same schedule type of layout that *table 3* presents. The difference this semester, for Senior Design 2, is that we begin building from our research and budget. The administrative work laid out in *table 3* will help us reach our end goal of having a successful and completed project.

During this semester, as stated in *table 4*, we will begin with acquiring the materials we have specified. From there, we will begin testing and building of a prototype over the course of Senior Design 2. We aim to finish towards the tail end of the semester so we can finalize reports and anything else we need.

Figure 2, House of Quality



We built a house of quality in order to clarify some of the distinct features of our project as compared to similar products. Although we are not exactly sure how much the pet feeder will cost, we are certain it will not exceed $300 which will make it affordable for every pet owner. Other qualities include efficiency; our product will be very efficient when it comes to power consumption as we will use low power components, thus our product will not be a financial burden on the owner. Our pet feeder will also be efficient when it comes to the amount of food dispensed, the use of the scale will give the pet owner the ability to to provide the exact amount of food to their pet. Ur feeder will also be easy to use for any owner and the installation also be very simple and wouldn't require any expertise. All these qualities will make our pet feeder very competitive in the market.