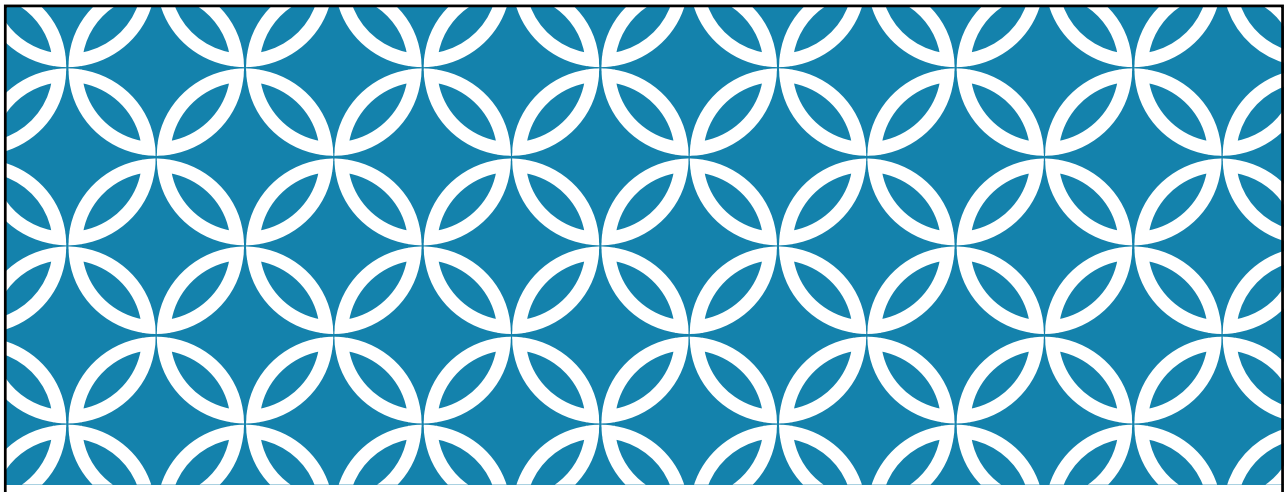


AUTOMATIC PET FEEDER

Michael Roth
Advisor: Gary Steffen
Instructor: Paul I-Hai Lin

WHAT'S TO COME?

- What and Why?
- Scope
- Design Process
  - Software
  - System Integration
- Problems
- Validation
- Demonstration

PROBLEM

Household pets and feeding schedules

- Balancing work and home
- Angry Pets

EXECUTIVE SUMMARY

- Provide a reliable feeding system for household pets
  - (Focus on felines)
- Utilize dry granule based pet foods
- Prototype produced meeting system requirements

PRIMARY PURPOSE

Confidence that pets are being taken care of

- Minimize necessity of user being present during feeding times
- Balancing work schedule with home

REQUIREMENTS

1. Dispensation of food at pre-determined times
2. User configuration for dispense times and amount
3. Manual activation of dispenser

Weight considerations, operating conditions, power supply

SCOPE

- Acquisition of existing microcontroller that will run project specific software
- Interfacing of stepper motor with microcontroller, and dispenser
- General adjustments to dispenser to better facilitate use as feeder

BACKGROUND

Cat Owner → Personal Usage of such a Device

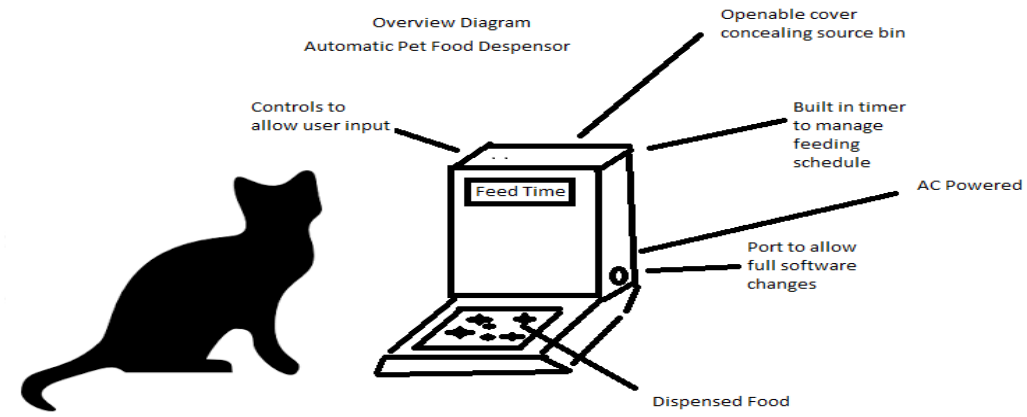
Experience in Programming Languages

Associate's in Electrical Engineering Tech.

FEASIBILITY

- Cost → One student
- General Experience → Programming / Electrical Background
- Time → Develop everything or buy some things

DESIGN PROCESS



FEATURES NEEDED

- Time Keeping
- Dispensation
- User Interface

TIME KEEPING

Initial Attempts

Millis() – Arduino

User Interface Revisions

DISPENSATION

Zevro Cereal Dispenser

- Existing dispenser
  - Removable Drive Shaft

MOTOR INTEGRATION

NEMA 17 Stepper Motor

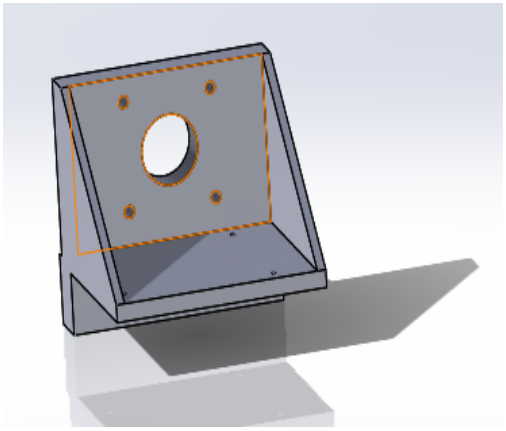
- How to interface with existing dispenser

3D Printed Drive Shaft

SECURING THE MOTOR

Motor can transfer power, but not very secure

- Lets design a mount



SYSTEM PHYSICAL ADJUSTMENTS

System was very short

Hard to access food in bowl

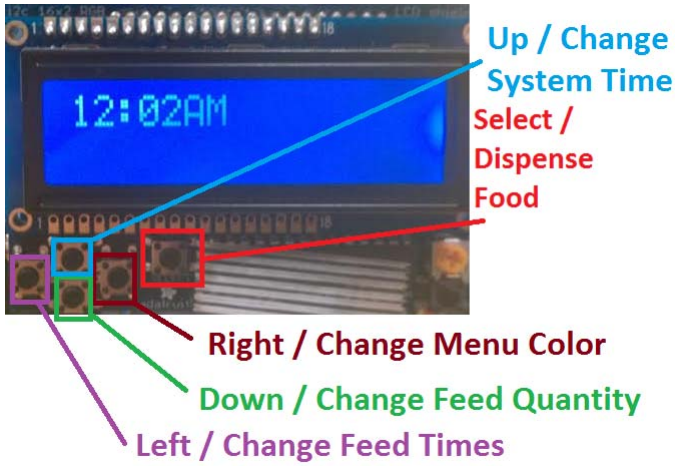
PHYSICAL ADJUSTMENTS CONT.

Added Height
- Physical Reinforcement

Feed Shute
- Bowl Access

USER INTERFACE

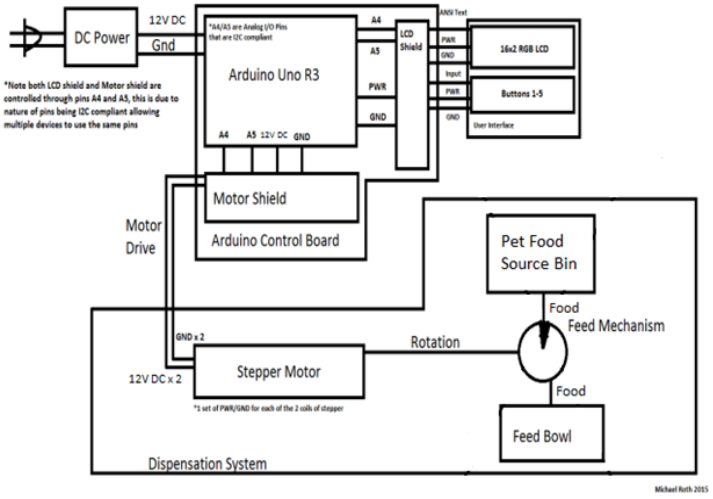
- 16x2 RGB LCD Screen
- Control Buttons



SOFTWARE

Software must control
- LCD/User Interface
- Motor Movement
- Maintain Schedule

Automatic Pet Feeder Physical Block Diagram



LANGUAGE AND IDE

Language
- C for Arduino
- Arduino Specific Commands

IDE – Integrated Development Environment
- Arduino 1.0.6
  - Syntax Highlighting
  - Brace Matching
  - Automatic Indentation

SOFTWARE FUNCTIONS

Setup

Main

Time

DisplayDispenseTimes

Dispense

FUNCTIONS CONT.

ChangeFeedTime

ChangeMenuColor

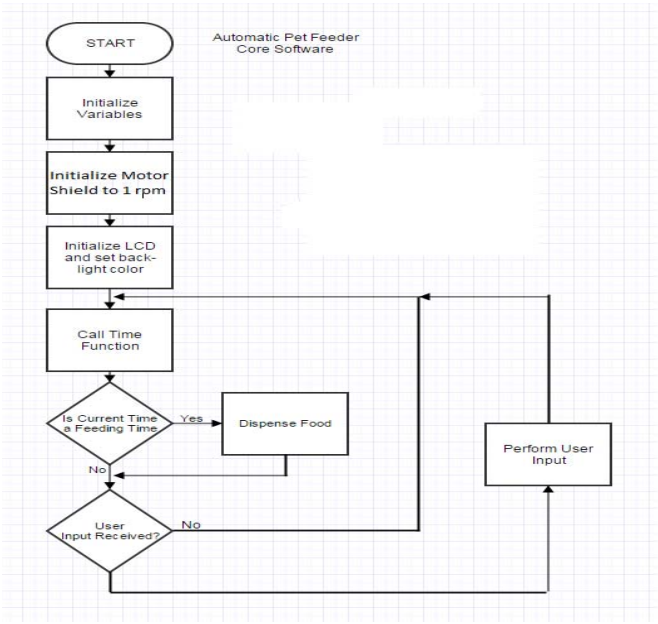
TimeChange

ChangeFeedQuantity

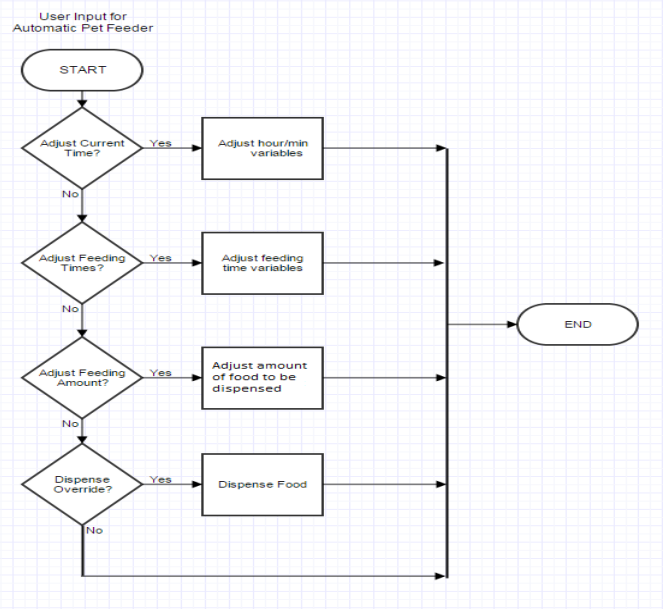
TimePrint

UML DIAGRAMS

Core Functions

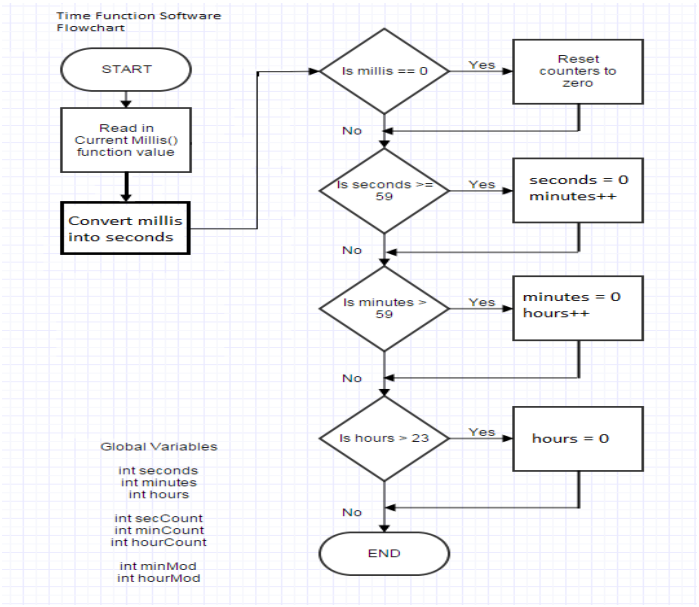


User Input



UML CONTINUED

Function Time



REQUIREMENT TESTING

ID	Requirement Type	Requirement (Shall or Should statements)	Verification Method	Date Verified
1	Operational	The system shall dispense dry pet food at predetermined times.	Demonstration	27-Mar-15
2	Operational	The system shall be user configurable for dispense quantity.	Demonstration	27-Mar-15
3	Operational	The system shall be user configurable for dispense times.	Demonstration	27-Mar-15
4	Operational	The system shall allow manual dispensing of dry food.	Demonstration	27-Mar-15
5	Operational	The system should monitor the level of food in the source bin.	Demonstration	
6	Functional	The system shall have a button that controls manual dispensing of food.	Demonstration	27-Mar-15
7	Functional	The system shall allow operation off standard U.S. Wall outlets.	Demonstration	27-Mar-15
8	Functional	The system shall use a microcontroller to track and manage feeding times.	Demonstration	27-Mar-15
9	Functional	The system shall have a user menu that accepts inputs from the user.	Demonstration	27-Mar-15
10	Functional	The system should operate off 9V battery.	Inspection	
11	Performance	The system should follow real time within 5 minute per day.	Test	19-Mar-15
12	Performance	The system shall follow real time within 30 seconds per day.	Test	19-Mar-15
13	Physical	The system shall weigh less than 30lbs without dry food.	Inspection	19-Mar-15
14	Physical	The system should weigh less than 10lbs without dry food.	Inspection	19-Mar-15
15	Environmental	The system shall operate at room temperature.	Test	19-Mar-15
16	Environmental	The system shall operate in dry conditions.	Test	19-Mar-15

PROJECT COSTS

Expected Cost ($)
- $167.75

Actual Cost ($)
- $172.15

Expected Labor
- 120 hours

Expected Labor
- 160 hours
  - 120 Group
  - 40 Non-Group

COSTS CONTINUED

Cost Reduction

- Prototyping costs eliminated in future runs
- Design of system specific boards

RISK ENCOUNTERED

Dispensation Jamming

- Dispenser Adjustments
- Alternative Motors
- Gearing System

LESSONS LEARNED

Mechanical Force

System Delays and Time

QUESTIONS?

DEMONSTRATION