Pondus Tech Presents: Automatic Product Tracker

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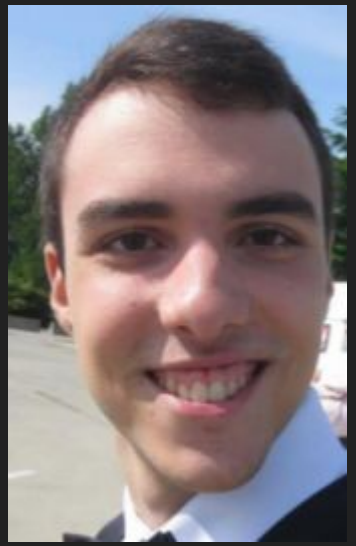

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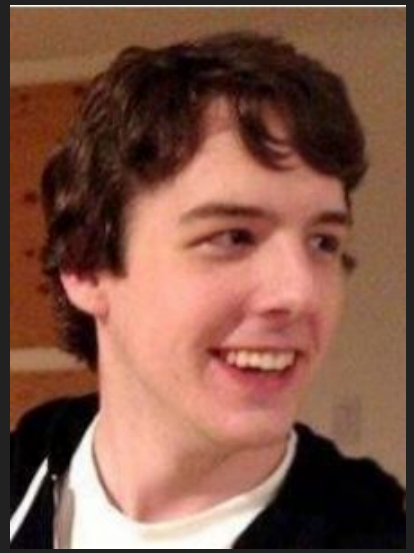

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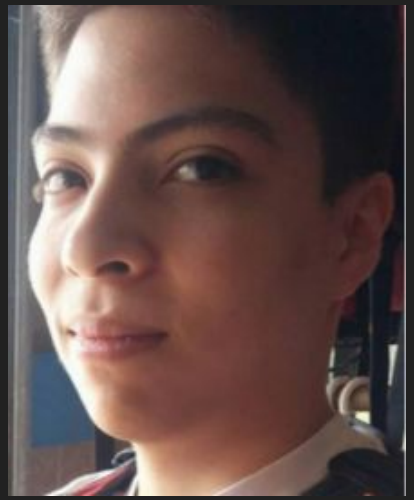

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Introduction

Problem:

- Over 50% of our food produced in Canada is either lost or wasted

Our Solution:

- Automatic smart scale
- Tracks products over time
- Uploads it to the cloud

Background and Motivation

- First hand experience working in kitchens and restaurants
- Large amounts of food wasted due to over-ordering
- Improve product usage statistics to create optimal ordering schemes
- We wanted a project that could be completed in the time frame with our skills and experience
- Include aspects from each of our engineering disciplines

Business Case: Market

- Target market: Grab N’ Go kitchen
  - Ex. Buffets, restaurants where ingredients are not tracked every time they are used
  - Easier tracking of these ingredients
- Specifically designed for this market
  - Household smart kitchen appliances would not work as well
  - Does not require large infrastructure
- Attract businesses with easy-to-use, low cost, low maintenance device

Business Case: Price and Financing (1)

Type of Cost	Component	Price
Hardware Cost	Arduino Uno Wi-Fi Rev2	$83.48
	LCD Screen	$13.99
	Uxcell Alluminum Alloy Load Cell (x2)	$31.60
	HX711 Load Cell Amplifier	$13.95
MSC Hardware	Tact Switches	$7.00
	Wood Enclosure	$5.00
	Aluminum Pressure Plate	$22.93
	Mounting Hardware	$10.00
	Wires	$1.00
Server	Server Maintenance	$1.00
Total		$189.95

Table 1: Proof of Concept Cost Breakdown

Type of Cost	Component	Price
Hardware Cost	Atmel Atmega328P	$5.00
	LCD Screen	$13.99
	Uxcell Alluminum Alloy Load Cell (x2)	$31.60
	HX711 Load Cell Amplifier	$13.95
	Printed PCB	$40.00
MSC Hardware	Tact Switches	$7.00
	Wood Enclosure	$5.00
	Aluminum Pressure Plate	$22.93
	Mounting Hardware	$10.00
	Wires	$1.00
Server	Server Maintenance	$1.00
Total		$151.47

Table 2: Prototype Cost Breakdown (Est.)

Business Case: Price and Financing (2)

- Many component's unit prices could be reduced by buying in bulk
  - Ex. PCBs are expensive in small quantities
- PoC reflects actual costs
- Prototype costs are estimates, subject to change

Funding options

- ESSS Student Endowment Fund: Category B - Entrepreneurial
- Wighton Fund
- Self funding

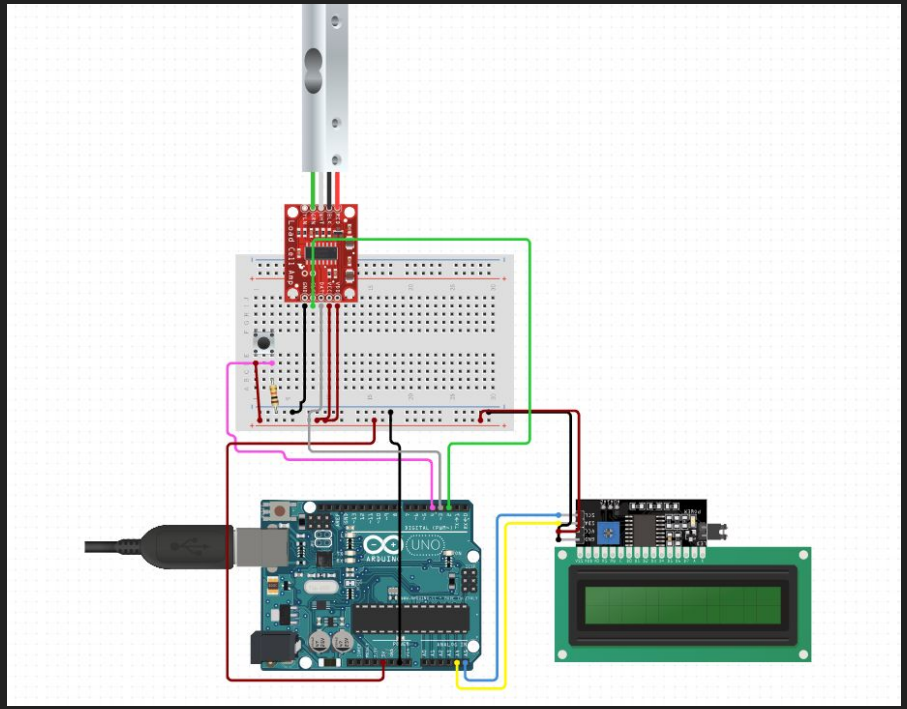
Business Case: Competition

- Amazon Go [1]
  - Uses machine learning, computer vision, AI
  - Take item from shelf, no checkout step
- LeanPath 360 [2]
  - Food waste tracking
  - Display through analytics algorithms
- SKE Labs Neo Smart Jar [3]
  - Household Tracking
  - Barcode Scanning

LeanPath 360

Technical Case (Hardware)

- Load Cell acts as Wheatstone Bridge, change in resistance causes change in voltage
- Load Cell feeds through Load Cell Amplifier into Arduino
- Weight information displayed on LCD



Technical Case (Arduino)

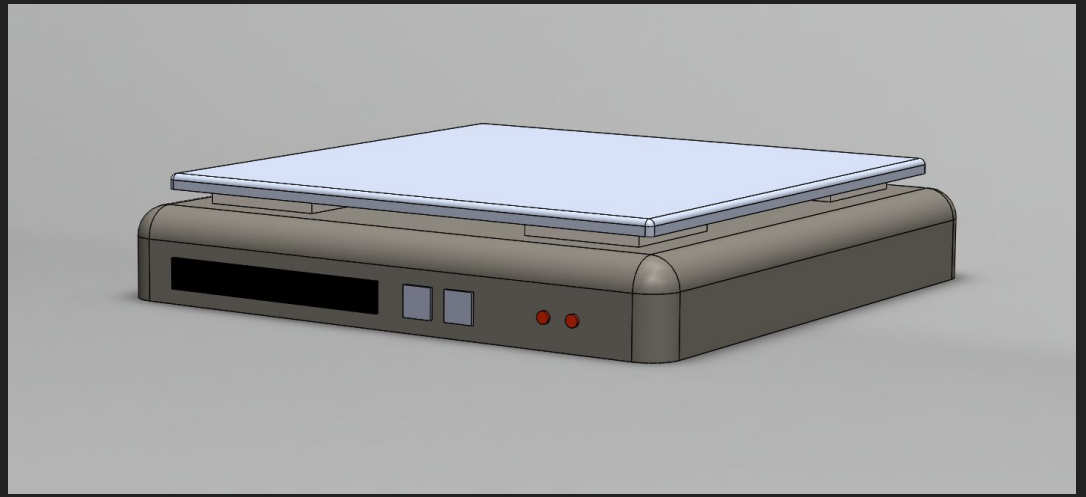
- Arduino takes in the information from the Load Cell, converts digital signal into a mass
- Arduino prints weight information to the LCD display
- Arduino connects to internet upon initialization, can send weight data upon button push

Technical Case (Website and Server)

- Push button to send POST request to server containing:
  - Time (UNIX epoch time)
  - Mass reading in grams to nearest integer
  - 6 bytes containing MAC address
- All information goes into database
- Database/website processes raw data
- Currently using Google server
  - Working prototype will have its own server likely using a LAMP stack

Materials and Design

- PoC
  - Made of ½ inch recycled wood
  - Tare and send buttons
  - Digital display



- Prototype
  - Made of 3D printed body and metal trays
  - Modular system
  - Less buttons/ information on local display

Risk Analysis/Management: Product Safety

- Working with electricity
  - Minimize risk of electrocution for user
    - Plastic/non-conductive enclosure
    - Low voltage, reduce severity
- Sharp edges
  - APT handled with bare hands
- Drops and falls
  - Durable material
- FOODSAFE
  - Kitchen use, materials must conform to FOODSAFE BC guidelines

Risk Analysis/Management: Business Risks

- Making a cost efficient product
  - Digital scales already exist with low cost and high accuracy
  - Unable to test multiple different designs
- Similar products
  - Need to separate our product from others fitting a similar niche
  - Amazon Go store: weighted shelves and sensors
  - LeanPath 360: food waste tracking system

Adherence to Standards

- Hardware standards
  - CAN/CSA-C22.2 NO. 0-10 – General Requirements - Canadian Electrical Code, Part II
  - CAN/CSA-C22.2 NO. 61508-1:17 – Functional Safety of Electrical/Electronic/Programmable Electronic Safety Related Systems
  - CSA C22.1-15 PACKAGE - 2015 – Canadian Electrical Code, Part I
- Software standards
  - IEEE 1016 – Standard for Software Design Description
  - IEEE 29148 – Standard for Systems and Software Engineering Requirements
  - IEEE 802.6 – Standards for Information Exchange between Systems
  - IEEE 830 – IEEE Recommended Practice for Software Requirements Specifications

Self Reflection

What have we learned?

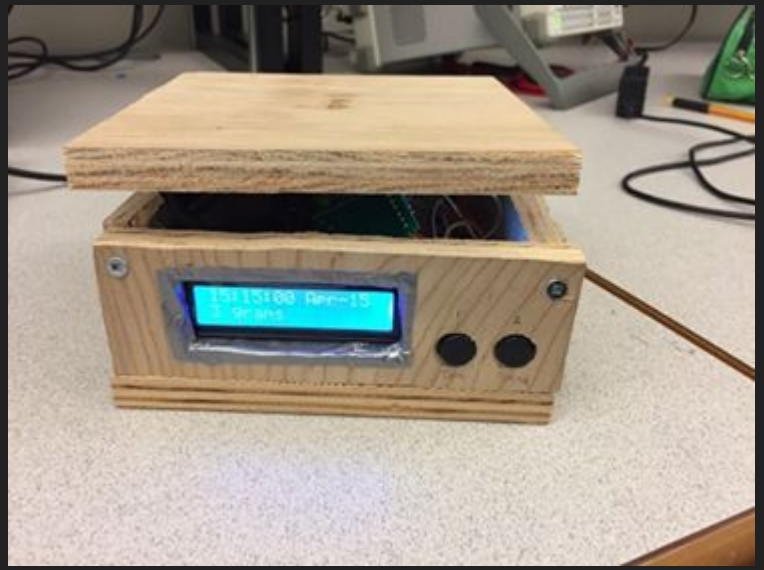
- Include more backup sources for parts
  - Issues with arrival of load cell amplifiers
  - Include more backup plans in general
- Plan around heavy workloads
  - Midterms piled up
- Moving forward:
  - Organize git repository better

Plan for 440

- Begin Beta-Phase Planning Document for ENSC 440
- Make system compatible with multiple scales
- Design and implement a 3D printed enclosure
- Design website with visual/graphical representation of data
- Work on how we want to report the data
- Set internal deadlines once 440 schedule is available
- Begin constructing Working Prototype

Conclusion

- Proof of Concept done
  - Some research for prototype stage still needed
- Be more prepared for ENSC 440
  - Heavier focus on software side



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[2] Prevent Food Waste with Leanpath Technology. (2019). Solutions » Prevent Food Waste with

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References

[3] Indiegogo. (2019). Neo - Smart Jar. [online] Available at: https://www.indiegogo.com/projects/neosmart-jar#/updates/all [Accessed 20 Mar. 2019].

Acknowledgements

- Michael Steele - Former Kitchen Manager at White Spot
  - Discussed details of the project at a high level
- Dr. Craig Scratchley
- Dr. Andrew Rawicz

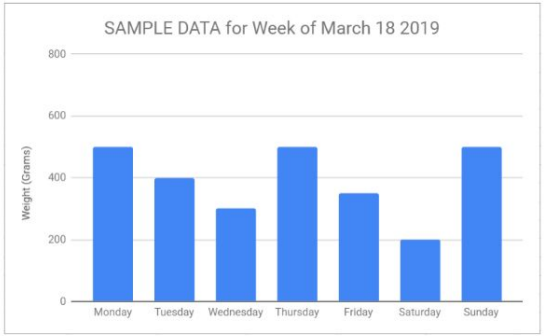
Questions?

Demonstration

Test Scenario	Expected Result
Load cell can accurately determine the weight of objects on the scale.	Microcontroller can accurately (±5% of weight) determine the weight of predefined objects under 1kg
Microcontroller output pins provide consistent voltage to digital output pins.	Digital multimeter provides consistent (< 5% variation) voltage readings from output pins.
Microcontroller analog inputs should display the correct value.	Digital multimeter value and microcontroller values are consistent (< 5% variation).
Microcontroller can determine when it receives improper data from input sensors.	Removing an object and then putting the same object back on the scale within a three second period should not result in excessive data variation (< 5% variation) being received by the server.

Test Scenario	Expected Result
Microcontroller sends timestamped data to the server when send button is pressed.	Data values received by the server shows proper timestamp, with a data point every time the send button is pressed.
Microcontroller needs to be able to tare an empty scale, or a container	Data values received by the server should change from the previous weight being read, to around zero (with < 5% variation)
Server can properly receive data from the controller via the wi-fi chip	A .csv File on the server can be viewed to check that it is receiving updated values from the wi-fi chip.
Website and .csv file should be available on Firefox, Chrome and Edge.	Open the website in Firefox, Chrome and Edge, and be able to open the .csv file in all three scenarios.

Date Range Dropdown



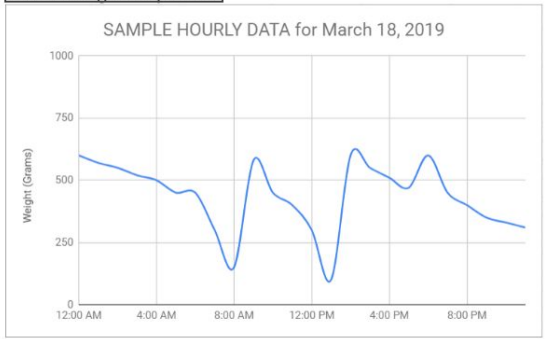
Download .csv

Sign Out

List of generated reports

Delete Graph

Date Range Dropdown



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