Cat Health Monitor – 9 Lives

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Our Team

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Outline

1. Motivation

2. Background

3. Business case

4. Technical case

5. Risk

6. Standards

7. Conclusion

8. Questions?

INTRODUCTION

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Motivation

- Health of cats

- Assist veterinarians

- Affordability and simplicity in smart litter box

- Rapidly growing market (CAGR of 9%)

Background

- ~ 8% die suddenly and unexpectedly [3]

- Health of an animal can be measured by bathroom habits

- Examine data for early indicators of illness

  - Eg. pH levels, frequency and duration of use of litter box

BUSINESS

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Business

- Canadian residential market ~ $7.7B CAD

- 16 million veterinarian visits in Canada annually ~ $800M CAD

- Huge blue ocean market

- Growth of ~7-9% due to smart litter boxes and self-cleaning litter boxes

Market	Number of Residential Cats	Residential Market Size [12]	Residential Cat Litter Box Market	Veterinary Clinics
Canada	7.9 million [6]	$7.7 billion CAD	N/A (Extrapolated to $390 million CAD)	3,224 [9]
North America	82 million [7]	$80 billion USD	$3.9 billion USD [13]	29,000 [10]
Internationally	600 million* [8]	$195 billion USD**	N/A (Extrapolated to $10 billion USD)	1.8 million*** [11]

Business – Pricing

- Material cost ~ $45 CAD

- Selling price of $90 CAD (100% profit margin ignoring R&D costs)

- Competitive to the competitors asking for between $ 750-1000 USD

Item	Quantity	Price Per Unit	Source
HX711 Opamp/ADC	1	$12.00 CAD	Amazon
2x 50kg Half-Bridge Weight Sensor	2	$8.86 CAD	Amazon
3x Arduino Nano V3	1	$18.65 CAD	Amazon
Cat Litter Box	1	~$9.00 CAD	Pet Store
		Total = $48.51 CAD	

Business – Financing

- Low costs/ mainly self funded

- ESSEF

- Wighton Engineering Development Fund

- $50 parts budge from SFU Engineering Science
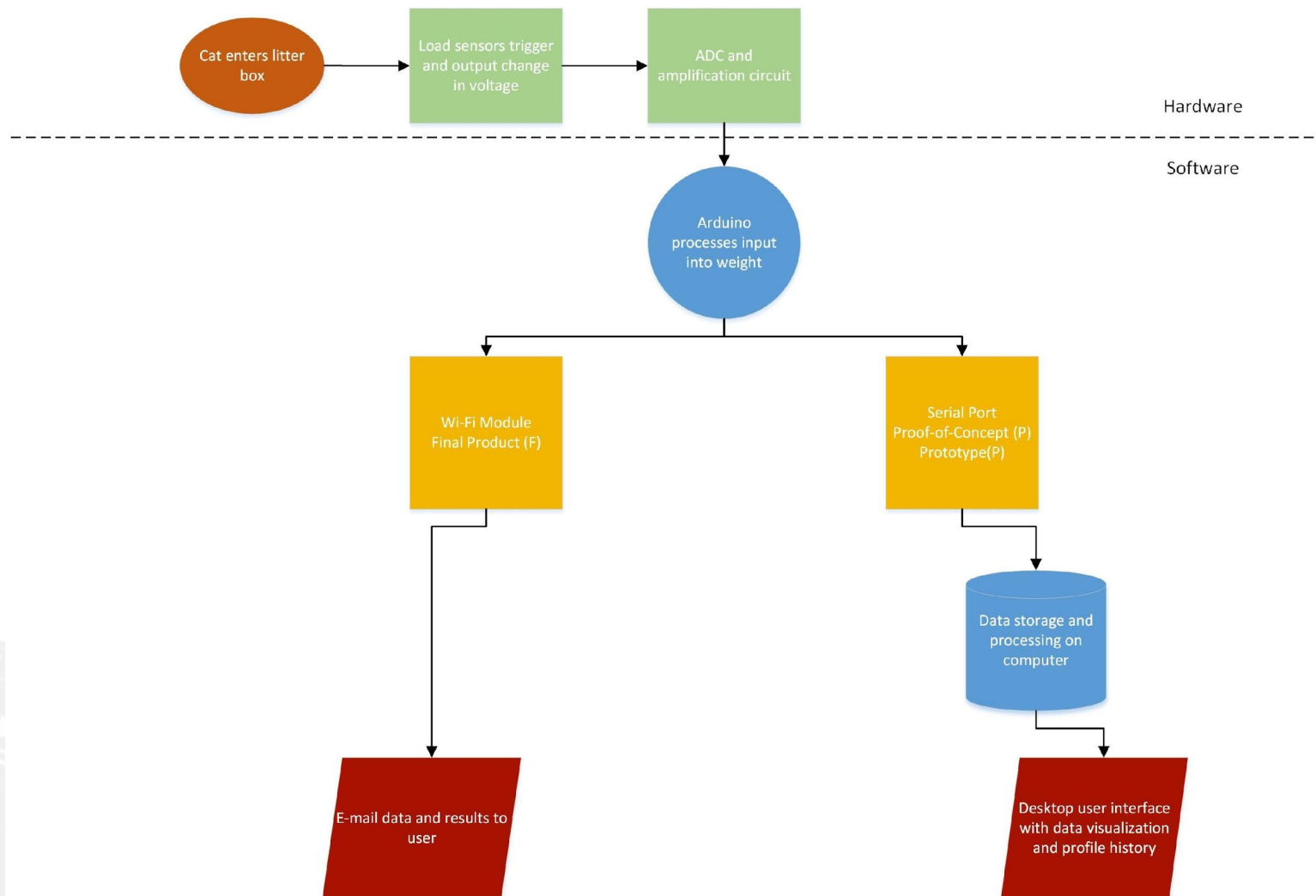
Business – Competition

Footloose

Litter Robot

All competition target the residential market and many focus on the automatic cleaning.

Technical
High Level Overview

Technical
Software

- There is an existing Arduino library for the HX711 from Sparkfun.

- There is a lot of background code that is specific to the architecture.

- Read function involves bit-banging.

- The received data is parsed in the Arduino IDE and written to the serial port.

- Now that we are able to capture raw data, and timing, the majority of future effort will be put towards writing code to carry out our purpose.

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Technical
Hardware

- Load sensors circuit will be in a Wheatstone bridge like layout (schematic shown in next slide)

  - Four load sensors, labelled 1 to 4, contains a strain gauge and a resistor

- HX711 circuit consists of a 24-bit ADC and 128 Gain non-inverting amplifier

- Arduino will be connected to the HX711

  - Supply 5V and Ground to entire circuit

  - Input clock for HX711 ADC

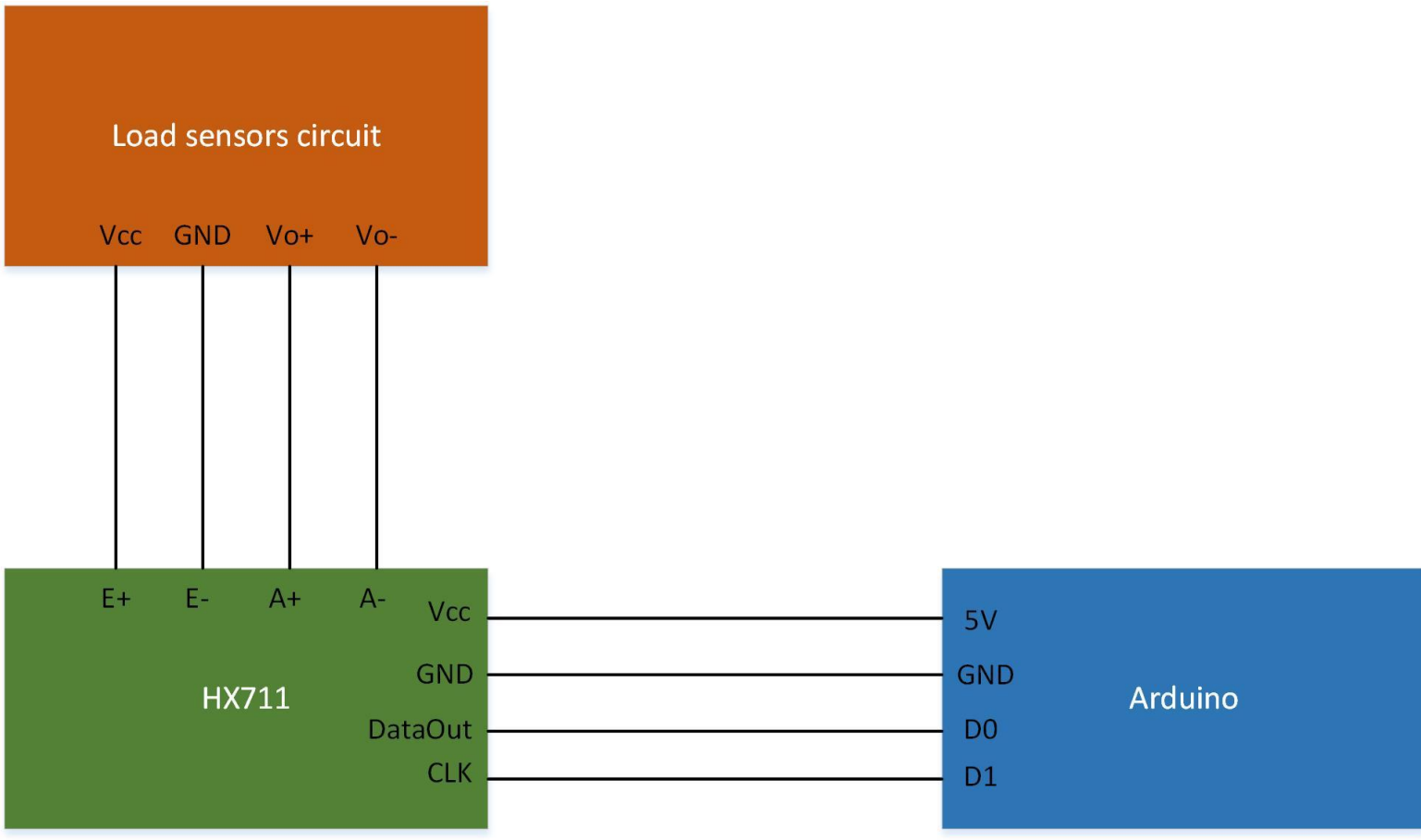 - Read in voltage data produced by circuit

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Technical
Hardware – Load Sensors Circuit
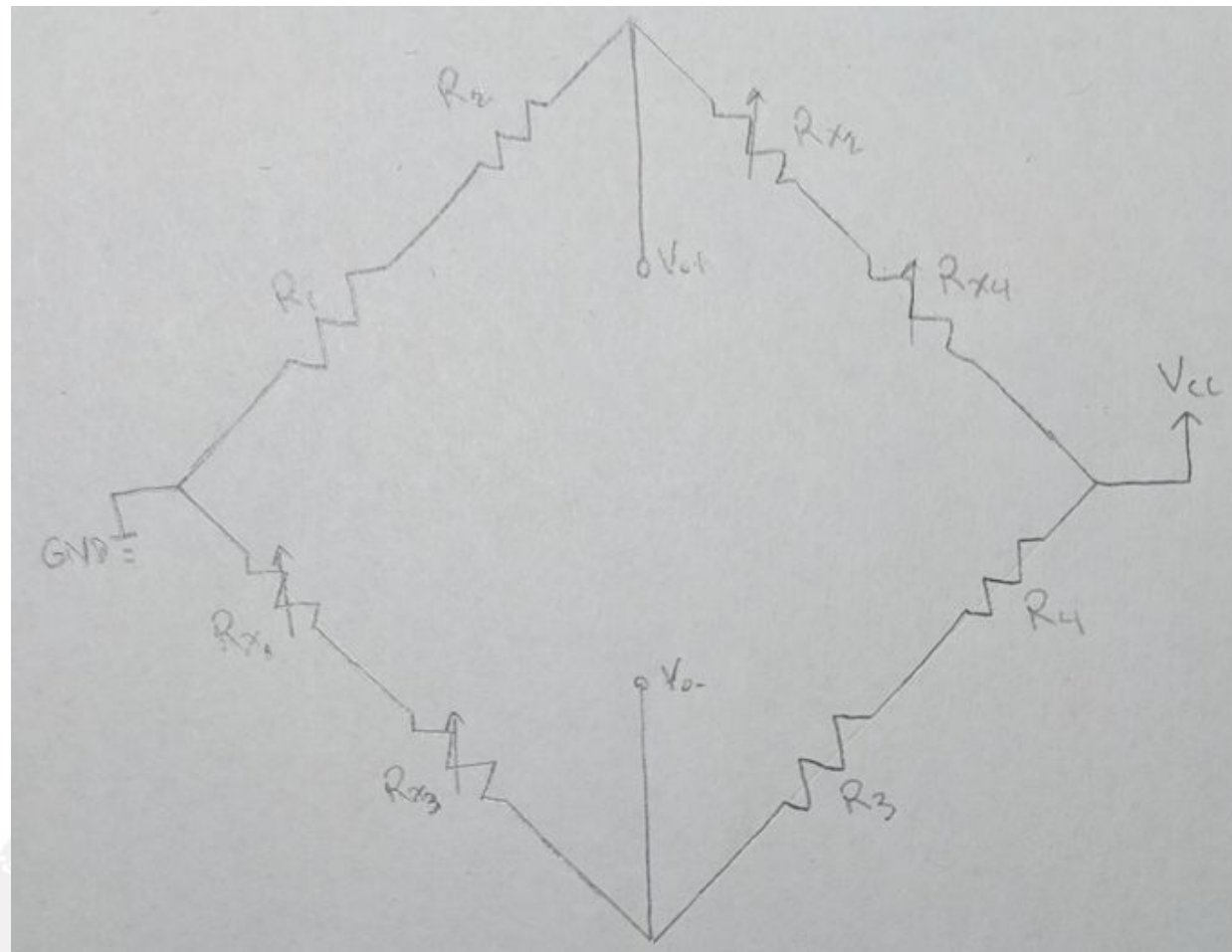
Technical
Hardware – Circuit High Level Overview

RISKS

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Risk Analysis

- Destabilization Due To Excessive Force

- Electrical shortage

- Error in data

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Risk Management

- ## Destabilization Due To Excessive Force
  - Use non slip feet
  - Ensure that surface is flat and weight is evenly distributed

- ## Electrical shortage
  - Use adequately strong material for electrical housing
  - Use waterproof material for electrical housing

- ## Error in data
  - Adjust weight sensing threshold of software
  - Error control in software

Adherence to Standards

- The AC power adapter and electrical connections to Cat Health Monitor will comply with the CSA Safety Standards for Electrical Installations CSA 22.1-18 [2]

- The electronic components and system will follow the Safety Guidelines for Consumers and Users under ISO 10377:2013 [3]

- The cat health monitor will have an environmentally sensitive product life cycle as outlined in ISO 14040:2006 [4]

- The cat health monitor's safety and responsibility for animals will reference FDA regulations on Animal Medical Devices [5]

CONCLUSION
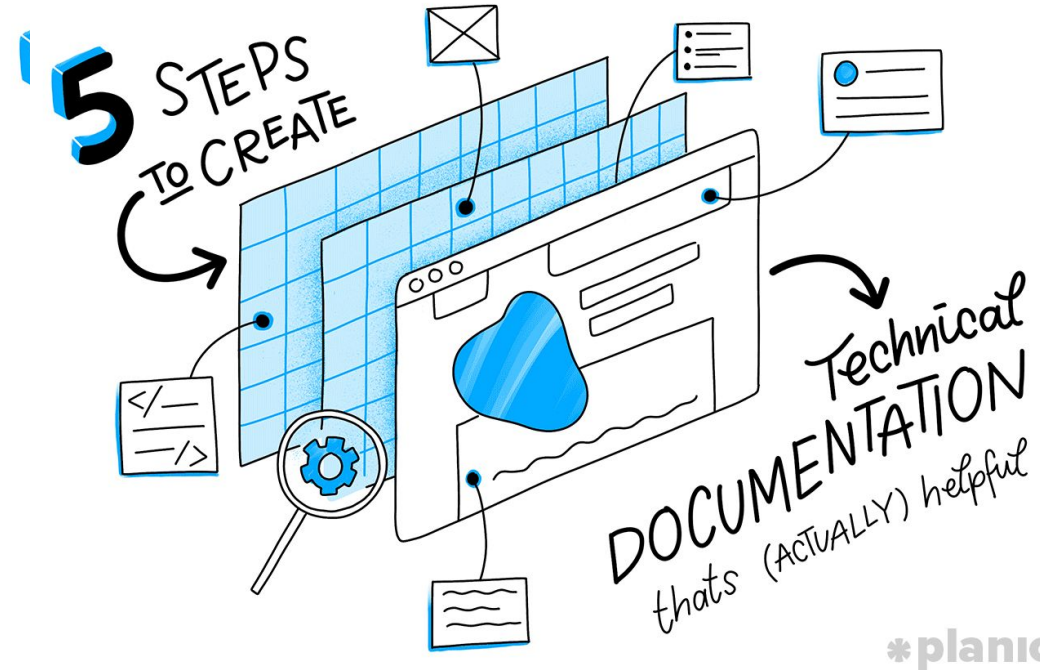
9 lives

What have we learned?

- Teamwork

- Presentation

- User Interface

- Documentation

5 STEPS TO CREATE

Technical DOCUMENTATION thats (ACTUALLY) helpful

*planio

Future Works

Hardware

- Selecting appropriate surface
    - Dimensions
    - Material

- Integrate sensors into surface

- Investigate pH sensor feasibility

- UI Implementation

Software

- Convert voltage reading to weight

- Convert data transmission to email sent over wifi

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- M Bakhtiar Azim

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References

[1] T.F. Olsen and A.L. Allen, "Causes of sudden and unexpected death in cats: a 10-year retrospective study," The Canadian veterinary journal = La revue vétérinaire Canadienne, vol. 42, no. 1, pp. 61-2, 2001.

[2] CSA Group, "Canadian Electrical Code, Part I (24th edition), Safety Standard for Electrical Installations," 2018. [Online]. Available: https://store.csagroup.org/ccrz__ProductDetails?viewState=DetailView&cartID=&sku=C22.1-18&cclcl=en_US. [Accessed Feb. 7, 2019].

[3] ISO, "ISO 10377:2013 Consumer product safety -- Guidelines for suppliers," 2018. [Online]. Available: https://www.iso.org/standard/45967.html. [Accessed Feb. 7, 2019].

[4] ISO, "ISO 14044:2006 Environmental management -- Life cycle assessment -- Requirements and guidelines," 2016. [Online]. Available: https://www.iso.org/standard/38498.html. [Accessed Feb. 7, 2019].

[5] U.S. Food & Drug, "Animal Products FDA Regulates," *U.S. Food & Drug*, Oct. 26, 2018. [Online]. Available: https://www.fda.gov/AnimalVeterinary/ResourcesforYou/ucm268125.htm. [Accessed Feb. 7, 2019].

UI
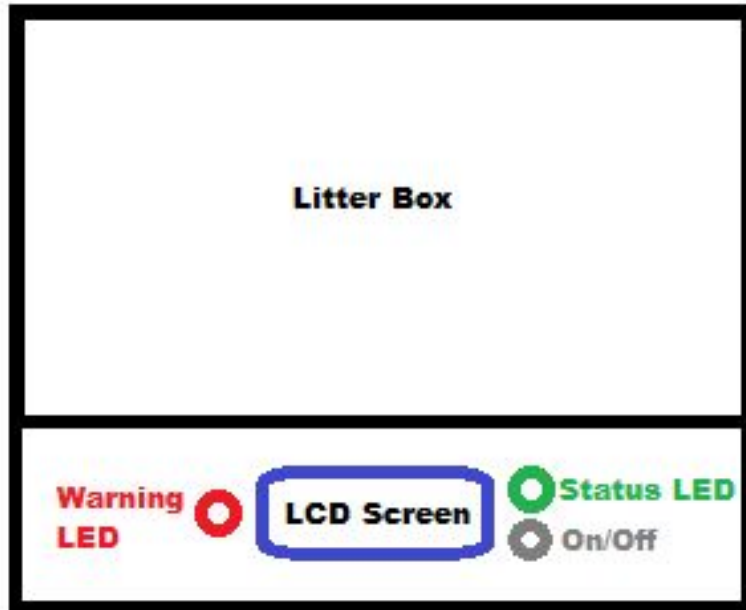
Dear John Doe,

We at 9 Lives have been notified that it has been requested that information regarding cats/a cat under your care be sent to you! Please see our health index calculated from weight and urinary parameters along with figures briefly identifying the health of the cat with regards to each parameter. Our HI is only for reference and may not accurately depict the health of the cat. Please find the text file storing the cats' raw data attached to this email.

Regarding: Oliver, 5 y/o (Male Maine Coon)
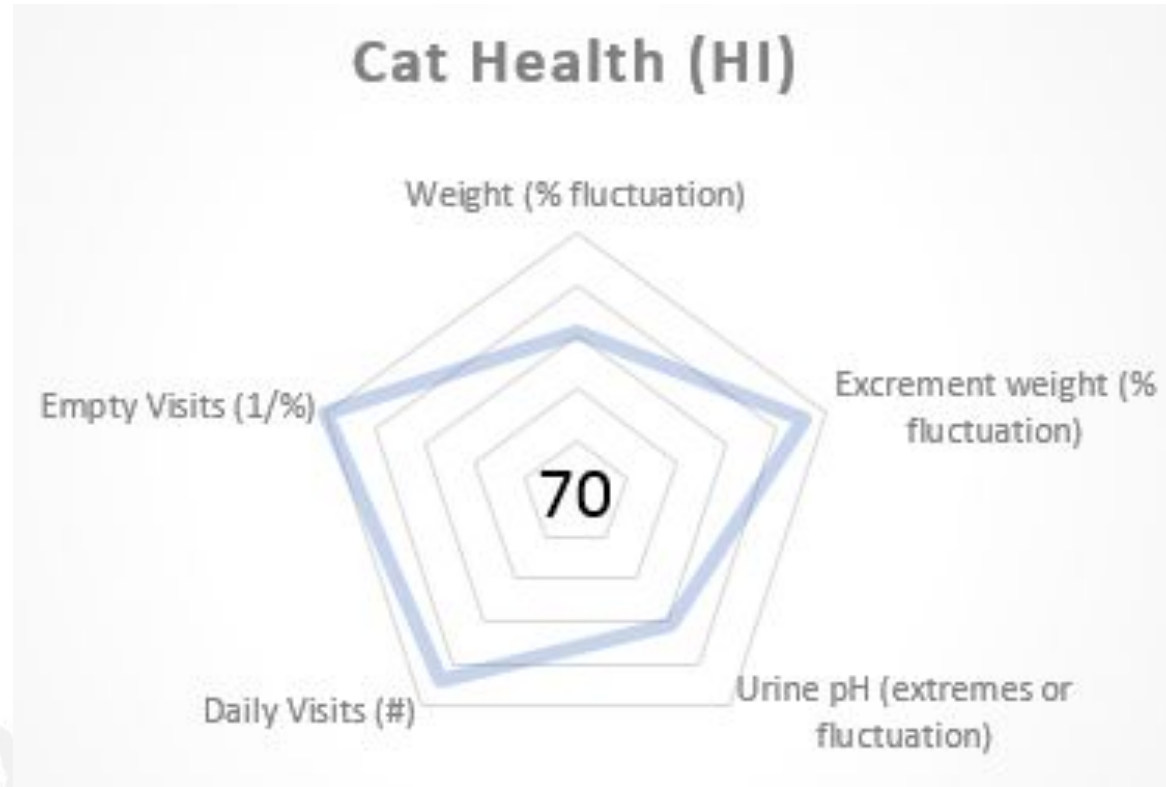
Health Index (HI):
70

Last five HI:
60   65   62   72   70

Best Regards,

UI

UI

Regarding: Oliver, 5 y/o (Male Maine Coon)
Data requested: 14:12:59 (13/03/2019)

TIME	DATE	WEIGHT (KG)	EXCREMENT WEIGHT (KG)	URINE PH	DAILY FREQUENCY	DAILY OCCURANCES OF NO EXCEMENT	RED FLAGS
05:06:15	01/03/2019	2.1022	0.0083	6.21			
10:06:12	01/03/2019	2.1050	0.0025	6.82			
18:06:15	01/03/2019	2.1355	0.0050	N/A			
23:06:15	01/03/2019	2.2120	0.0042	6.21			
					4	0	
02:06:15	02/03/2019	2.1983	0.0098	6.41			
08:06:15	02/03/2019	2.1125	0.0066	6.00			
13:06:15	02/03/2019	2.1675	0.0071	6.01			
19:06:15	02/03/2019	2.1031	0.0073	6.67			High pH
22:06:15	02/03/2019	2.1120	0.0001	6.90			High pH & no excrement
					5	1	
01:06:15	03/03/2019	2.1125	0.0012	6.89			High pH
06:06:15	03/03/2019	2.1308	0.0020	7.3			High pH

UI - Survey

1. What was your role in testing the Cat Health Monitor device?

- [ ] Cat owner
- [ ] Veterinarian
- [ ] 9 Lives developer
- [ ] None of the above

2. Did a cat use the litter box in your test?

- [ ] Yes
- [ ] No

3. For how long have you been taking care of cats?

- [ ] Never
- [ ] 0 to 1 year
- [ ] 1 to 3 years
- [ ] 3 to 5 years

13. The pH parameters are important to our diagnosis.

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

14. Clinics could benefit from having this device

○ 1 ○ 2 ○ 3 ○ 4 ○ 5

15. Additional Comments:

Characters Remaining: 100

Clear answers on page   Submit