



CANEAT

School of Engineering Science
Burnaby, BC, V5A 1S6
kailunl@sfu.ca

June 21, 2018

Steve Whitmore
School of Engineering Science
Simon Fraser University
Burnaby, BC V5A 1S6

Re: ENSC 405W Requirement Specification for Caneat Inc.

Dear Mr. Whitmore:

The attached document provides a high-level perspective requirement for implementing our product, automated kitty litter box. This product, CANEAT, aims to provide a convenient and clean life for pets and hosts.

The requirement specification document aim to outline all the component requirement throughout different design stage, which include C, P and F, and each of stage stand for proof of Concept, Prototype and Final product, respectively. Firstly, we will introduce the system overview and detail the system and user interface requirement. Then, we will list the engineering standard, user document and the system test plan.

CANEAT consists of 3 brilliant and compassionate senior engineering students: Kailun Liang, Wenjie Li, Zewen Wu. If you have any questions or concerns regarding proposal, please contact kailunl@sfu.ca.

Regards,

Kailun Liang

Enclose: Project Proposal for Caneat



CANEAT

Requirement Specification

Automated Kitty Litter Box

“Make your life convenient and neat”

Project Members: Kailun Liang

Wenjie Li

Zewen Wu

Contact Person: Kailun Liang

kailunl@sfu.ca

778-999-8115

Submitted to: Steve Whitmore

Dr. Andrew Rawicz

School of Engineering Science

Simon Fraser University

Issue Date: June 21, 2018

Abstract

This requirement specification document will outline the requirements for Caneat Inc. After introducing the scope, potential customers, and system overview, we will go into the details for the system requirements such as physical, electrical, mechanical, etc. Especially, it will provide some safety requirements to ensure it is safe to use. Next, we will explain the engineering standard specifications, and the user interface unit. Finally, we will discuss the sustainability and test plan we are going to work with. Through this document, the reader will acquire a high-level explanation of the product to get into it.

Caneat is a product that allows cat owners and breeders to get rid of the cat waste automatically. Using Caneat will allow the users to have a more convenient and cleaner life environment.

Overall, there are four main sections in this document:

- Introduction
- System and user interface requirements
- Engineering standards
- System Test Plan

Table of Contents

Abstract	i
Table of Contents	ii
List of Figures	iii
List of Tables	iii
Glossary	iv
1. Introduction	1
1.1 Scope.....	1
1.2 Intended Audience.....	1
1.3 System Overview.....	1
2. System Requirements	2
2.1 Classification.....	2
2.2 General Requirements.....	3
2.3 Physical Requirements.....	4
2.4 Electrical Requirements.....	4
2.5 Mechanical Requirements.....	5
2.6 Environmental Requirements.....	5
2.7 Safety Requirements.....	6
2.8 Sustainability Requirements.....	6
2.9 Luxury Functions.....	6
3. User Interface Unit	7
3.1 Classification.....	7
3.2 General Requirements.....	7
3.3 Usability Requirements.....	8
3.4 Physical Requirements.....	8
4. Engineering Standards	8
4.1 Application Guide Requirements.....	9
4.2 Safety Requirements.....	9
4.3 Performance Requirements.....	9
4.4 Automation Requirements.....	9
4.5 Software Requirements.....	9
5. System Test Plan	10
6. Conclusion	11
7. Reference	12
8. Appendix A: Proof - of Concept	14

List of Figures

Figure 1.3 High-Level Functional Block Diagram

Figure 2.1.1: Reference Convention of System Requirements

Figure 3.1.1: Reference Convention of User Interface Unit

List of Tables

Table 2.1.1: Design Stage of Requirement

Glossary

- IP** International Protection Marking [1]
- ISO** International Organization for Standardization [9]
- CSA** Canadian Standards Association [9]
- DC** Direct Current [11]
- ADC** Analog-to-Digital Converter [12]

1. Introduction

Caneat Inc. is denoted to developing the most reliable automatic litter box in the current market. The automatic kitty litter box we are designing can scoop the waste intelligently 10 minutes after a cat has used the litter box. The waste will be stored in the receptacle with a weight sensor monitoring if it has to be replaced simultaneously. Our product is intended to be promoted among all cat breeders, which is 61% of Canadians, especially for the disabled, the elder and people who need to travel for business or leisure frequently. Meanwhile, people who are interested in automated products and willing to invest on their luxurious lives have higher possibility to be attracted by our design.

1.1 Scope

The document describes the functional objectives that must be realized in order to make the automated litter box reliable and popular. Overall, expected systems requirements can be classified into nine categories, which are general, physical, electrical, mechanical, environmental, safety, sustainability, engineering standard and luxury functions requirements. In addition to systems requirements, there are sets of requirements regarding user interface.

1.2 Intended Audience

The functional specification is intended for use by all members of Caneat. The project manager shall refer to functional requirements as a concrete evaluation of progress throughout the development process. Design engineers shall refer to the requirements as overall design goals before they finalize their prototype. Test and Quality engineers shall follow the test plan to generate a test report.

1.3 System Overview

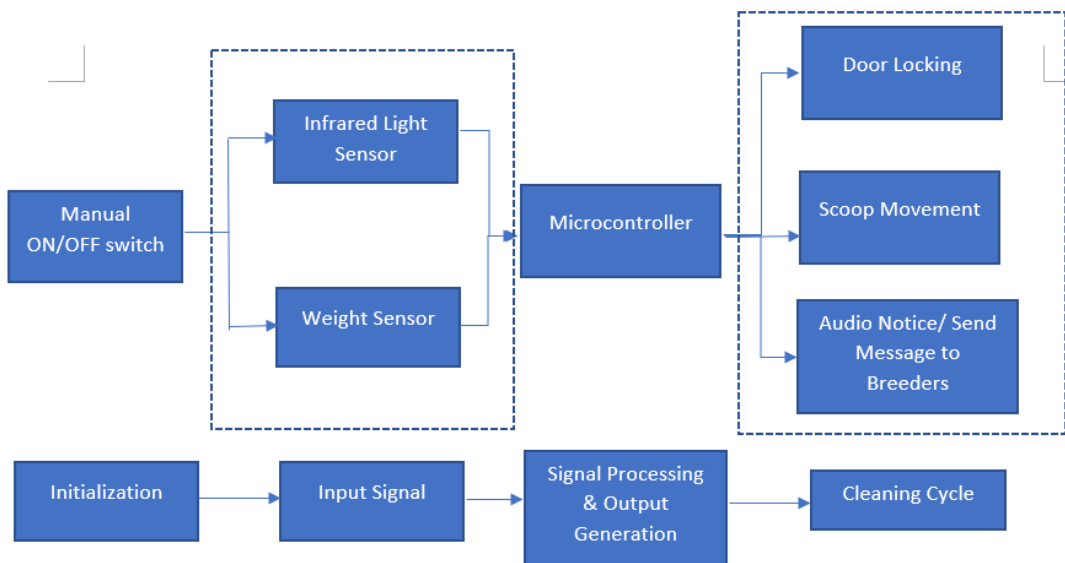


Figure 1.3 High-Level Functional Block Diagram

Overall, the system can be classified into four steps. Once it is initialized, the input signal will be continuously generated, which is going to be processed in real time. Based on the processed signal, the system will compute the output signal controlling the cleaning cycle. To be specific, the manual ON/OFF switch is designed to activate the entire system. Once the system is initialized, both infrared light sensor, which is used to detect whether the cat is currently in the litter box, and weight sensor, which is intended to decide if the receptacle is full, are going to generate signals concurrently and simultaneously. Immediately after, the microcontroller is going to process the signal, make decisions and generate voltage analog signals. Assisted with electric circuit, if necessary, door locker and scoop movement mechanisms will be performed. Meanwhile, if the receptacle is full, the system will be terminated, and the audio notice can remind breeders to replace the receptacle. If time permits, we will implement program so that, in this case, a text message will be sent to breeders. Once the receptacle is detected to be replaced, the system will be reactivated.

2. System Requirements

2.1 Classification

In Caneat system, the requirement of Caneat system can be described by the section following, which are designed by Caneat Inc. The requirements are combined with 9 different sections, which shows in the following list.

- **General Requirements**
- **Physical Requirements**
- **Electrical Requirements**
- **Mechanical Requirements**
- **Environmental Requirements**
- **Safety Requirements**
- **Sustainability Requirements**
- **Luxury Functions Requirements**

To indicate the reference requirement section, the convention will be adopted in the figure 2.1.

[**Req. SE.# - X**]

SE represents the section of the requirement, and the list of section is shown in the above list. **#** indicates the requirement number of each section. **X** refers to the design stage. The design stage can be separated into 3 sections, which shows in Table 2.1.

Coding Scheme	Design Stage
C	Proof of Concept
P	Prototype
F	Final Product

Table 2.1.1: Design Stage of Requirement

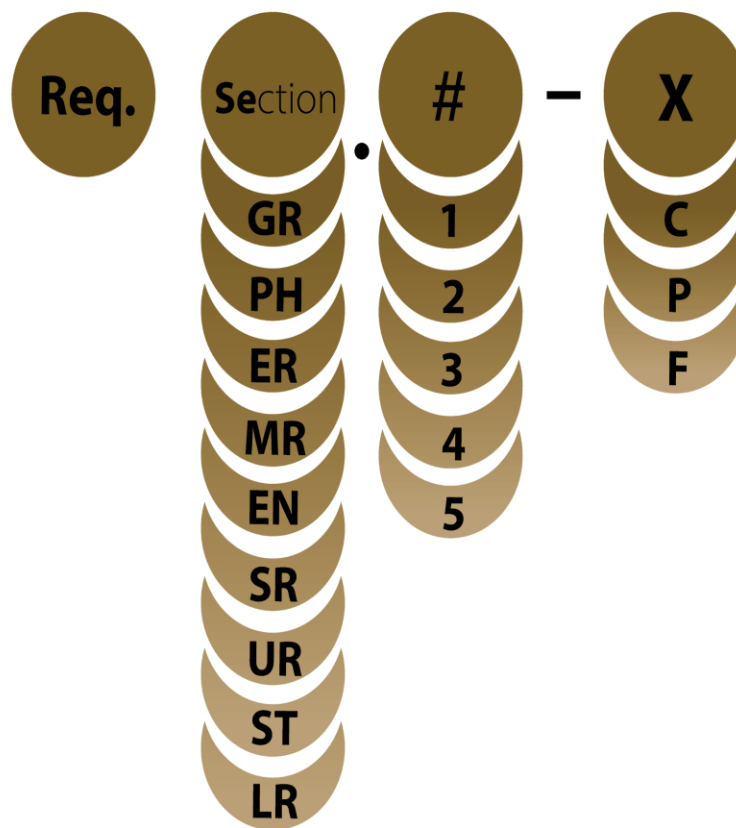


Figure 2.1.1: Reference Convention of System Requirements

The example of the reference requirement section for this section will be **[Req. SO.1-C]**. The reference requirement section means that this is in section “System Overview”, so it displays “SO” in section area. It is the first requirement of this section, because **1** shows in the number of requirement section. In addition, it is to be complete in proof of concept, since **C** is defined in design stage.

2.2 General Requirements

The general requirement section describes the general condition of Caneat, which include the expectation of prototype and final product.

[Req. GR.1-C]	The device shall fit the normal size of cat.
[Req. GR.2-F]	The device shall be affordable.
[Req. GR.3-P]	The device shall be complete by the instructional material.
[Req. GR.4-P]	The physical user manual must be provided with the product.
[Req. GR.5-P]	The manual will be done for major languages.
[Req. GR.6-F]	The small size garbage must be applied on the device.
[Req. GR.7-F]	The device shall be able to ship by vehicles.
[Req. GR.8-F]	The device shall be used by any height of customer.
[Req. GR.9-F]	The total lifetime should be at least 3 years.
[Req. GR.10-F]	The final product price shall not exceed \$250.
[Req. GR.11-F]	Real time 1-800 Technical support line provided to customer.
[Req. GR.12-F]	Professional Website with instruction video will be provided to general public.

2.3 Physical Requirements

In physical requirement part includes the characteristic of the device, such as weight, overall dimension and the protection system of each component. The purpose of physical requirement is building a lightweight and strong device for customer.

[Req. PH.1-P]	The device shall be ergonomically designed.
[Req. PH.2-P]	The weight shall no greater than 5 kilograms.
[Req. PH.3-P]	The height of device shall no higher than 90 centimeters.
[Req. PH.4-P]	The width of device shall no longer than 80 centimeters.
[Req. PH.5-P]	The litter box shall be waterproof.
[Req. PH.6-P]	The device shall have at least an IP53 specification [1].
[Req. PH.7-F]	The device shall afford the lightly impact [2].
[Req. PH.8-F]	The device shall afford the weight of cat [3].
[Req. PH.9-F]	The device shall be capable of supporting weight up to 5 kilograms [8].
[Req. PH.10-F]	The door of product shall afford the impact of cat [2].
[Req. PH.11-P]	The door of product shall greater than the size of cat.
[Req. PH.12-F]	The device shall be 80 centimeters in diameter.
[Req. PH.13-F]	The device shall be easy to open or clean, and any required maintenance.
[Req. PH.14-F]	The size of filter shall be the radius of the device, which is 40 centimeters.
[Req. PH.15-F]	The length of linkage, which connected the motor to the filter, shall be 65 centimeters.

2.4 Electrical Requirements

The electrical requirement section outlines the characteristic of the electrical component that been applied on the device. For our design, we are going to use Arduino Uno for our prototype, because it is easy to implement and test for all the functions. However, for our final product, we plan to design our own chip to minimize the size of board and maximize the performance of the function.

[Req. ER.1-F]	The internal circuit shall have short circuit protection for unexpected excessive voltage or frequency run in the circuit
[Req. ER.2-F]	The voltage of motor, that operate to clean the excrement of cats, shall not exceed 5.5 Volt [7].
[Req. ER.3-P]	The microcontroller will draw no more than 500 mA of current [11].
[Req. ER.4-P]	The microcontroller will operate at the voltage between 3 Volt - 5.5 Volt [11].
[Req. ER.5-P]	The sample rate of the ADC will be 9600 Hz [12].
[Req. ER.6-P]	The multi-voltage regulated DC power supply shall be 4.5 volt to operate the system [11].

2.5 Mechanical Requirements

The mechanical requirement part specifies mechanical components, especially, the motor and linkage. We are going to apply the high torque motor in our device, since the normal motor can't generate enough torque to move the cat litter and excrement of cat.

[Req. MR.1-F]	The torque of motor shall be able to move the excrement of cat with the linkage weight.
[Req. MR.2-F]	The torque of motor shall around 1 kg [7].
[Req. MR.3-F]	The resistance of lock of door shall counteract the impact of cat.
[Req. MR.4-P]	The linkage in the device shall afford the beat of cat.
[Req. MR.5-P]	Angular displacement of the rotor for all motors must be easily and accurately calculable.

2.6 Environmental Requirements

The environmental requirement part indicates the components' environmental condition. In addition, we considered about the environment kind product for our final product, so most of the component will be green material, which has less harm to our planet.

[Req. EN.1-P]	The device shall operate between $0^{\circ}C - 50^{\circ}C$ [4].
[Req. EN.2-P]	The operating altitude of the device should be at most 8300 feet [5].
[Req. EN.3-P]	The minimum air pressure of operating the device is 0.47 atm [6].
[Req. EN.4-P]	The development process of device shall agree with CAN/CSA-ISO/TR14062-03 regarding consideration of environmental aspect while implementation [9].

2.7 Safety Requirements

Safety is definitely our top priority when finishing up prototype for user testing or final product. The safety requirement specifies all the situation that may occur while user use it in the right way. However, the requirements did not contain the situation that device is misused by user.

-
- | | |
|----------------------|---|
| [Req. SR.1-F] | Door of device got break by accident, and all the system shall be shut down immediately. |
| [Req. SR.2-F] | The power button of device will be located at the place that won't be trigger accidentally. |
| [Req. SR.3-F] | The system shall shut down immediately while the cover of device got open. |
| [Req. SR.4-F] | The motor will stop rotating while the motor is blocked by obstacle. |
| [Req. SR.5-F] | All the wiring and circuitry components shall be perfectly hidden from the cat and user so as to prevent contact accidentally. |
| [Req. SR.6-F] | The system shall short the circuit right away while the liquid penetrates into any wiring or circuitry components in order to prevent the further damage of device. |
| [Req. SR.7-F] | The device shall not overheat under specified working condition. |
| [Req. SR.8-P] | The device shall short the circuit while the excessive voltage going into the device. |
-

2.8 Sustainability Requirements

In sustainability requirements section, it is important that our team have to consider about not only the attracting product that we are going to create but also the afterlife of component. We have to keep in mind that where we got the material from and where the material goes after disassembling, which should not cause damage to our planet.

-
- | | |
|----------------------|---|
| [Req. ST.1-F] | The material is applied to the device shall be green material when it if affordable. |
| [Req. ST.2-F] | The power consumption of device shall be minimized with transferring between different modes. |
| [Req. ST.3-F] | The component shall not cause damage to other components while replacing component process. |
-

2.9 Luxury Functions

The luxury function contains the further functions that we considered to apply to our product. Those functions may or may not appear on our final product, and it depends on how we accomplished our final product.

- [Req. LF.1-C] The case of the device can be customized by customer with listed materials and colors.
- [Req. LF.2-F] The device shall automate refill the kitty litter while the sensor detects that kitty litter is lower than normal level.

3. User Interface Unit

3.1 Classification

In Caneat system, the user interface requirements are combined with 9 different sections, which are listed below.

- **G**eneral Requirements
- **U**sability Requirements
- **P**hysical Requirements

To indicate the reference requirement section, the convention will be adopted in the figure 2.1, which is same as the system requirement format. Figure 3.1.1 shows the reference naming convention of this section, user interface unit. The only different thing between user interface requirements and system requirements is the section part. There are three sections under user interface unit, so all the sections start from letter **U** and is followed by the first letter of sub-section requirement. Taking general requirement as an example, the section code for general requirement will be **UG**. The rest of parts are exactly same as system requirement. We reused the table 2.1.1 for the design stage code.

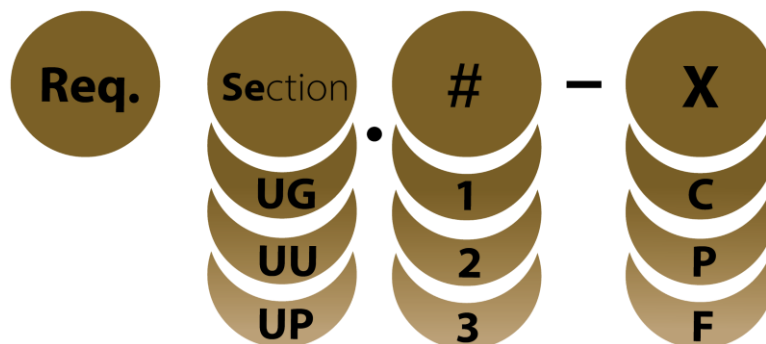


Figure 3.1.1: Reference Convention of User Interface Unit

3.2 General Requirements

- [Req. UG.1-F] The primary user input will be through push buttons and switches.
- [Req. UG.2-F] The user interface unit shall have a power switch and some buttons for user input.
- [Req. UG.3-F] The user interface will have a reset button to restart system.

-
- [Req. UG.4-F] The user interface will have buttons to switch signal lights.
[Req. UG.5-F] The signal lights will indicate system status.
[Req. UG.6-F] The user interface will have switches to allow user to change the operating mode.
-

3.3 Usability Requirements

- [Req. UU.1-F] The user shall indicate through the control panel unit when they are ready to use the device.
[Req. UU.2-F] The model-chosen buttons shall be intuitive and easy to use.
-

3.4 Physical Requirements

- [Req. UP.1-F] The control panel shall be easy accessed by users.
[Req. UP.2-F] The control panel shall be isolated from cats.
[Req. UP.3-F] The mechanism shall be isolated from cats' active area to prevent from hurting cats.
[Req. UP.4-F] The mechanism will be isolated from litter to avoid stuck.
[Req. UP.5-F] The cover shall be isolated litter box from outside access to block smell and leakage of litter.

4. Engineering Standards

As the automated kitty litter box intended to be promoted among cat breeders, it has to satisfy related engineering standards. In order to guarantee that our product can manage to be distributed globally, we have done research especially on International Organization of Standardization (ISO) and International Electrotechnical Commission (IEC). As the product will initially be promoted in Canada, we are also going to ensure that our product will not conflict with Canadian Standards Authority (CSA) and Canadian General Standards Board (CGSB). In the future, as long as our product enter the market of the US, it has to be regulated by American National Standards Institute (ANSI). Related to the characteristics of our product, overall, developers should pay attention to its safety, performance, automation and software requirements. In this case, throughout these documents, regulations regarding automation and robotics should be highlighted,

4.1 Application Guide Requirements

ISO/ DTR 23482-2 Robotics -- Application of ISO 13482 -- Part 2: Application Guide [13]

4.2 Safety Requirements

IEC 61508-2 Requirements for electrical/electronic/programmable electronic safety-related systems [14]

ISO 13482:2014 Robots and robotic devices -- safety requirement for personal care robots [15]

CAN/CSA-C22.2 Functional safety of electrical/ electronic/ programmable electronic safety related systems [16]

IEEE C2-2017 2017 National Electrical Safety Code ® (NESC(R)) [17]

4.3 Performance Requirements

ISO/ DIC 18646-2 Robotics -- Performance criteria and related test methods for service robots [18]

IEEE Std 1872-2015 IEEE Standard Ontologies for Robotics and Automation[19]

ISO 10218-1:2006(E) 3.1 Actuating control -- a) Mechanical mechanism within a control device [20]

ISO 10218-1:2006(E) 3.9 End effector -- Device specifically designed for attachment to the mechanical interface to enable the robot to perform its task [20]

4.4 Automation Requirements

ISO 10218-1:2006(E) 3.2 Automatic mode -- Operating mode in which the robot control system operates in accordance with task program [20]

4.5 Software Requirements

ISO/IEC 26551:2016 Software and systems engineering -- Tools and methods for product line requirements engineering [21]

IEEE 2050-2018 IEEE Approved Draft Standard for Real-time Operating System for Small - scale Embedded System [22]

5. System Test Plan

The general approach to system testing consists of firmware test, separately mechanism test, combined modules test, and the complete unit test. Once the proof-of-concept has been reached, and the device generates an expected functionality, we will seek some volunteers to experience the product, and ask for some detailed feedback. The trials shall provide some further considerations and suggestions. Testing procedure will be discussed through various aspects, and the primary function will be focused on as a major task. If necessary, more specific aspects and methods for problem solving will be discovered and introduced during the development.

There are many requirements on the physical dimensions of the litter box, and its operation of the mechanism. The dimension will be designed in a reasonable way, and then sketched in an appropriate ratio using software in order to have an more intuitive view for further modification and discussion. After producing the prototype, the requirements will be finalized, or improved if necessary.

First of all, all the components of the mechanism will be assigned calculated data such as angle, length, and moving speed. After designing, and calculating these data, we will simulate this on the mechanism system manually before connecting to the microcontroller so that there are chances for modifying and improving on the structure. When connecting all the bar components, some nodes will apply just in case that the mechanism is adjustable, and it will be easy to modify and record data during the tests.

Secondly, we will make tests on the microcontroller in order to control the mechanism properly. One of the most primary thing is to test the code that related to switches and buttons since the signal lights are going to give information back to us about the status of the operation. Then it is the time to check whether the servo motors can rotate in the correct direction and speed at the exactly period that we wish.

Thirdly, we will have a combined modules test which will be the most necessary part before finalization because of the gravity, friction between each mechanism components, and resistance between the cat litter and the scoop will be introduced. So, we need to find a ratio that can make the ideal measurements to the actual data trial-by-trial. The calculated data will always be a reference only.

Ultimately, as a complete unit, the prototype will be assembled, and test its whole functionality during daily use. This is the opportunity to discover some unforeseen issues which may improve on algorithm and mechanism of our project.

6. Conclusion

Caneat Inc.'s aim is to create convenient device to assist the cat breeders or owners who are disabled, elderly, busy, and lazy to clean up after cats using the litter box. By making this product, there are two kinds of requirements which are necessary to determine the devices are properly functioned. The main sections of requirements consist of system requirement such as physical, mechanical, and electrical, and user requirements.

Finally, the design specification and requirements are the goals which aid us in ensuring the proof of concept of device is developed properly and up to standard.

7. Reference

- [1]"IP Rating Chart | DSMT.com", *DSMT.com*, 2018. [Online]. Available: <http://www.dsmt.com/resources/ip-rating-chart/>. [Accessed: 17- Jun- 2018].
- [2]*Isjos.org*, 2018. [Online]. Available: <http://isjos.org/JoS/vol8iss1/Papers/JoSV8p3-CatLanding.pdf>. [Accessed: 17- Jun- 2018].
- [3]"Size Guidelines for Cats", *Softpaws.com*, 2018. [Online]. Available: <https://www.softpaws.com/size-guidelines-for-cats/>. [Accessed: 17- Jun- 2018].
- [4]"The Hot Issue of Motor Temperature Ratings", *Electrical Construction & Maintenance (EC&M) Magazine*, 2018. [Online]. Available: <http://www.ecmweb.com/content/hot-issue-motor-temperature-ratings>. [Accessed: 18- Jun- 2018].
- [5]*Industrialelectricalco.com*, 2018. [Online]. Available: <http://industrialelectricalco.com/wp-content/uploads/2014/01/Elevation-Derating-factor.pdf>. [Accessed: 18- Jun- 2018].
- [6]W. issue?, "What is the minimum air pressure the human body can tolerate if oxygen supply is not an issue?", *Biology Stack Exchange*, 2018. [Online]. Available: <https://biology.stackexchange.com/questions/16741/what-is-the-minimum-air-pressure-the-human-body-can-tolerate-if-oxygen-supply-is>. [Accessed: 18- Jun- 2018].
- [7]"25mm High Torque 6v 12v 24v Dc Rc Toy Using Gear Motor - Buy Rc Toy Using Gear Motor,12v Dc Gear Motor For Rc Toy,25mm High Torque 12v Dc Gear Motor Product on Alibaba.com", *www.alibaba.com*, 2018. [Online]. Available: https://www.alibaba.com/product-detail/25mm-high-torque-6V-12v-24v_60047345236.html?spm=a2700.7724838.2017115.13.1a51127a9qJOkI. [Accessed: 18- Jun- 2018].
- [8] Cats, "What's a Healthy Weight for Cats?", *WebMD*, 2018. [Online]. Available: <https://pets.webmd.com/cats/guide/healthy-weight-for-your-cat#1>. [Accessed: 18- Jun- 2018].
- [9]"CSA Store - Standards | Training | Subscriptions | .", *Store.csagroup.org*, 2018. [Online]. Available: https://store.csagroup.org/ccrz__Products?categoryId=a0K1I000002IWGrUAO&isCSRF_low=true&portalUser=&store=&cclcl=en_US. [Accessed: 18- Jun- 2018].
- [11]"Analog Input Pins - Max voltage", *Forum.arduino.cc*, 2018. [Online]. Available: <http://forum.arduino.cc/index.php?topic=13395.0>. [Accessed: 18- Jun- 2018].
- [12]"Sampling rate of arduino?", *Community*, 2018. [Online]. Available: <https://community.openenergymonitor.org/t/sampling-rate-of-arduino/1130>. [Accessed: 18- Jun- 2018].
- [13] ISO/ DTR 23482-2 [Online]. Available: <https://www.iso.org/standard/71627.html>. [Accessed: 20- June- 2018].

- [14] IEC 61508-2 [Online]. Available: <http://www.iec.ch/functionalsafety/standards/page2.htm>. [Accessed: 20- Jun- 2018].
- [15] ISO 13482:2014 [Online]. Available: <https://www.iso.org/standard/53820.html>. [Accessed: 20- June- 2018].
- [16] CSA Group, "AN/CSA-C22.2 NO. 61508-1:17 - Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements (Adopted IEC 61508-1:2010, second edition, 2010-04, with Canadian deviations)," CSA, Mississauga, 2017.
- [17] IEEE C2-2017 [Online]. Available: <https://standards.ieee.org/findstds/standard/C2-2017.html>. [Accessed: 20- Jun- 2018].
- [18] ISO/ DIC 18646-2 [Online]. Available: <https://www.iso.org/standard/69057.html>. [Accessed: 20- June- 2018].
- [19] IEEE Std 1872-2015 [Online]. Available: <https://standards.ieee.org/findstds/standard/1872-2015.html>. [Accessed: 20- June- 2018].
- [20] ISO 10218-1:2006(E) [Online]. Available: <https://www.sis.se/api/document/preview/907442/>. [Accessed: 20- June- 2018].
- [21] ISO/IEC 26551:2016 [Online]. Available: <https://www.iso.org/standard/69530.html>. [Accessed: 20- Jun- 2018].
- [22] IEEE 2050-2018 [Online]. Available: <https://standards.ieee.org/findstds/standard/2050-2018.html>. [Accessed: 20- June- 2018].

7. Appendix A: Proof-of-Concept

In order to demonstrate the feasibility of our product, and to attract potential investors. We will provide a proof-of-concept after finalizing the prototype. Our proof-of-concept will show the main concepts with its functionality. The following are some details for proof-of-concept for Caneat:

1. Initializing the system by users through functional switches, and it will then provide information and instruction which is indicated by signal lights
2. Detecting the period that cats enter the litter box by using infrared ray sender and receiver.
3. Scooping the waste, then put it into the garbage bin.
4. The scooping mechanism will avoid touching cats and cat litter in order to not hurt or scare cats, or get stuck by cat litter.
5. The power of the operation is adjustable in order to fit in all kinds of cat litter.
6. The external garbage bin will inform users when it gets full.
7. The usage of cat litter will be recorded automatically so that the cat litter can be refill or replace on time.