FAU

COLLEGE OF ENGINEERING & COMPUTER SCIENCE
Florida Atlantic University

CEN 5035 Software Engineering, Fall 2019

Project 1 Project Proposal: Couch Guardian

"An evolutionary pet behavior correction solution"

Team Name: thePefect10

Team Number: 10

Prepared By: David Baston (dbaston2017@fau.edu)

Francis Iniobong John Ifon

Alyssa Johnson

Tsz Shing Tsoi

Course Instructor: Dr. Shihong Huang

Date: September 27, 2019

Version History:

Date	Version	Description	Approved By
09/27/2019	1.0	Initial proposal	David Baston

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Couch Guardian is a smart home pet behavior correction device. Upon detection of bad pet behaviors, its built-in compressed air and/or pre-recorded audio messages are activated to immediately cease those behaviors. In addition to stopping cats from clawing furniture, Couch Guardian can also stop dogs from barking, cats from laying on a kitchen counter, pets from chewing indoor plants, and various other behaviors specified by the pet owners. Couch Guardian operates autonomously, giving new and veteran pet owners a peace of mind in protecting furniture and other properties at home while continuously correcting pet behaviors in their absence. Couch Guardian also tracks pets' behaviors through a dashboard summarizing the history of device activations and pet activities.

According to the *American Pet Products Association* in [1], 67% of U.S. households or 84.9 million households own a pet. In 2018, the total U.S. pet industry expenditures were at $72.56 billion, which is equivalent to an annual pet expense of $855 per pet-owning household. Pet expenditures had grown three-fold in the past two decades and the trend is expected to continue in the future. Additional studies further indicate that, due in part to the increase in value of smaller, portable electronic devices, pet related property damage has surpassed $3 billion per year for pet owners [2].

Pet products have a sizable market. Some existing pet behavior correction devices require manual activation while autonomous, motion sensor-activated pet deterrent devices are unable to differentiate pets from humans or other moving objects, nor are they capable of targeting only bad pet behaviors. No existing products currently provide a history or log of pet behavior improvements. Couch Guardian is a complete home pet behavior correction solution, providing pet owners all the tools needed to correct pet behaviors and protect their homes from damage caused by untrained pets.

COMPETITIVE ANALYSIS

The proposed functionality of Couch Guardian can be distilled into three key purposes: detecting motion, identifying pets and cataloguing their behaviors, and activating a prescribed deterrent if necessary. The Couch Guardian system aims to surpass services currently provided by similar market competition with interactive user notifications and data tracking, communicating charted improvement in pet behavior.

Products with similar feature sets have been reviewed from notable platforms such as Amazon.com in [3], [4], [5] and [6]. Similar to primary attributes featured by these competitors, Couch Guardian will consist of motion detectors to identify the movement of a valid entity within the detection area. However, unlike these competitors, what sets Couch Guardian apart is the built-in machine learning algorithm trained to distinguish between pets and their human counterparts. Advancements to this algorithm will further classify pets by species and individual behaviors. Couch Guardian also rivals competitors with its utilization of a dashboard to monitor a pet's behavioral history. This dashboard will maintain a timeline of device activations and pet activities, making device performance and evidence of product effectiveness available for pet owners' review.

The competitive products examined in this competitive analysis are summarized below. Table 1 compares Couch Guardian's proposed features with features of these competitive products.

- **PetSafe SSSCat Cat Training Aid**: This product ensures cats are deterred from going near valuable furniture, counters and plants. It consists of an adjustable electronic motion sensor that detects

a cat approaching the restricted area, before releasing a harmless scentless spray to surprise the intruder cat.

- **PetSafe Pawz Away Pet Barriers**: This product is designed to keep dogs away from problem areas around the home. It is a cordless and wireless deterrent. It is a waterproof and battery-operated barrier that consists of a transmitter and an adjustable receiver collar worn by the pets.
- **PredatorGuard PestAway Ultrasonic Repeller**: This product consists of motion sensors that detects pets and pests from entering a specified range of protection by emitting an ultrasonic noise, which is only audible to the pets and pests, and flashes ultra-bright strobe lights to effectively scare and keep pests far away. This product is designed for outdoor use.
- **Doggie Don't Device**: This is a handheld dog repellent and bark control device that uses a loud sound, over 100 decibels, to deter bad behavior.

Table 1:   Comparison of Top Competitive Products from Amazon.com

Price / Features	Couch Guardian	PetSafe SSSCat Cat Training Aid	PetSafe Pawz Away Pet Barriers	PREDATOR-GUARD PestAway Ultrasonic Repeller	Doggie Don't Device
Retail Price	TBD	$35.94	$59.95	$44.97	$49.95
Deter pets	✓	✓	✓	✓	✓
Detect motion	✓	✓	✓	✓	*
Identify pets and non-pets	✓	✗	✗	✗	*
Identify pet behaviors	✓	✗	✗	✗	*
Activate deterrent(s) adaptively	✓	✗	✗	✗	✗
Record pet behaviors	✓	✗	✗	✗	✗

* Manually activated by user

DATA DEFINITION

Glossary of key terms to be used throughout this project is included below:

Bad pet behavior. Bad pet behavior is any pet behavior defined by user regarding a valid entity which results in the activation of deterrent(s).

Dashboard. Dashboard is a software interface which is used to generate plots for summarizing and displaying data.

Data storage system. Data storage system is the system which stores error logs, captured images, video recordings and device activation history. The data storage system may reside on the device or external to the device.

Detection area. Detection area refers to the entire effective area of the sensor if not specified by user, or a subset of it if specified by user.

Deterrent. Deterrent refers to any substance, physical stimulus and mechanism to repel pets. Its current capability refers to a directed burst of pressurized air and pre-recorded audio messages when used in the context of Couch Guardian version 1.0.

Device. Device refers to the physical integrated system of Couch Guardian, specifically components responsible for visual detection, data collection, and deterrent delivery.

Entity. Entity refers to any living organism and non-living object capable of being recognized by the learning algorithm, and their behaviors.

Entity type. Entity type refers to a label or classification of an entity by the learning algorithm.

Invalid entity. Invalid entity is an entity type with no associated user-defined action or with an associated action of "do nothing".

Learning algorithm. The software model responsible for classifying visual data from the device and prescribing a response from the system.

Pet. Pet refers to only cats and dogs when used in the context of Couch Guardian version 1.0.

Pet behavior correction. Pet behavior correction refers to the use of deterrent(s) to stop and cease any bad pet behavior.

System. The software architecture that manages the user interface responsible for maintaining user access to saved device data and the statistical dashboard.

Valid entity. Valid entity is an entity type defined by a user with an associated action of activating deterrent(s).

OVERVIEW, SCENARIOS AND USE CASES

This section discusses the project and usage scenarios of Couch Guardian through several main use cases. The actors are first summarized in Table 2, followed by the main use cases in Table 3a, Table 3b, Table 3c and Table 3d.

Table 2:   **Actors**

Name	Type	Description
Pet Owner	Primary	The owner of the pet and person placing the device in a designated area
System Support Engineer	Supporting	The engineer or system which accesses the device remotely to perform software update without pet owner intervention
Data Storage **System**	Supporting	The storage system that is sent error logs, video recordings, and device activations for reporting and error handling

Table 3a: **Use Case - Set-up Device**

Items	Description
Use Case Name	Set-up device
Use Case ID	UC-001
Brief Description	The Pet Owner sets up the device to monitor a specific area
Actors	Pet Owner, Data Storage System
Type	[**X**] External [ ] Temporal
Preconditions	1. The Device is off
Basic Flow	1. The Pet Owner places the device front of the area it wishes to protect 2. The Pet Owner turns the device on 3. The device analyzes the sensor area and initializes the pet detection area 3.1. Optionally, the Pet Owner specifies a custom detection area 4. Optionally, the Pet Owner sets up custom entity types 4.1. The Pet Owner records individual pets with the device sensor 4.2. The Pet Owner records bad pet behaviors with the device sensor 5. Optionally, the Pet Owner configures audio deterrent 5.1. The Pet Owner select custom pre-recorded audio message files from the Data Storage System to be used as audio deterrent 6. Optionally, the Pet Owner sets up Data Storage System location 7. The device creates a notification for the Pet Owner to say the detection area is set 7.1. This is the end of the use-case
Alternative Flow	1. The device is unable to determine the area

Items	Description
	1.1. An error should be logged in the Data Storage System and sent to the Pet Owner for review
Post Conditions	1. An area for pet detection is set

Table 3b: **Use Case - Deter Pet from Area**

Items	Description
Use Case Name	Deter pet from area
Use Case ID	UC-002
Brief Description	Deters a pet from being in the detection area
Actors	Pet Owner, Data Storage System
Type	[**X**] External [ ] Temporal
Preconditions	1. The Pet Owner has placed the device in the area to be monitored 2. Monitoring is currently turned on for the device 3. The Device is on and functioning 4. The deterrent is functional

Basic Flow	1. An object enters the area
	    1.1. The use case begins when the device senses an object in the defined area
	2. Determine if pet in area
	    2.1. The device determines if the object is a pet
	3. Log pet entry
	    3.1. The device logs the pet encounter to later be handled by the system
	4. Record Pet Behavior
	    4.1. The camera on the device should activate to begin recording the pet's behavior
	    4.2. This recording is sent to the Data Storage System to be viewed later by the Pet Owner
	    4.3. The recording should continue until it is confirmed the pet has left the area, and then an additional 2 seconds
	5. Activate deterrent
	    5.1. The deterrent is activated to scare the pet away from the area
	6. Confirm the pet has left the area
	    6.1. The device records the time the object leaves the area
	    6.2. This ends the use case

Alternative Flow	1. Handle the object is not a pet
	    1.1. Then the device should not report non-pet objects in the area. The device should stop processing at this point if the object is not a pet
	2. Handle errors with the sensors not working properly
	    2.1. When the sensors stop functioning during the process, an event should be logged to the system that notifies the Pet Owner to inspect the device and ensure it is operational

	2.2. The device should then shut-down until reactivated by the Pet Owner
	3. Handle errors with pet entry log
	3.1. If the device is failing to send log entries for the pet being in the area, this should be noted in the event log. Processing should continue as normal otherwise
	4. Handle errors with the video recording
	4.1. If the device is failing to send files to the external system, an error should be recorded in the event log and the Pet Owner notified
	4.2. If the camera is not functioning, an error should be recorded, the Pet Owner notified, and the device shut down
	5. Handle errors with deterrent running out of air
	6. Handle errors with error logging
	6.1. In the event that error logs are failing to be recorded, the device should shut down
	7. Handle pet not leaving the area
	7.1. If after activating the deterrent, the pet fails to leave the area, it should attempt to active the deterrent again
	7.2. If after a second attempt to deter the pet fails, this should be reported to the report system to notify the Pet Owner
	7.3. The camera should cease recording 2 seconds after the second failed attempt
Post Conditions	1. The pet leaves the areas and the Pet Owner is notified; a log entry exists for the pet entering the area; a log entry exists for the pet leaving the area; a video exists for capturing the deterrent activation and pet leaving the area
	2. The pet does not leave the area and the Pet Owner is notified; a log entry exists for the pet entering the area; a log entry exists for the pet failing to leave the area; a video exists capturing the deterrent activation and the pet not leaving the area

Table 3c: **Use Case - Review Notifications**

Items	Description
Use Case Name	Review notifications
Use Case ID	UC-003
Brief Description	The user reviews notifications generated by the device regarding the pet
Actors	Pet Owner
Type	[**X**] External [ ] Temporal
Preconditions	1. There are unread notifications 2. The pet owner has an account for the System 3. The System is operational

Items	Description
Basic Flow	1. Pet Owner signs into System 2. The System presents the list of unread notifications 3. The Pet Owner selects the notification they wish to view 4. The system retrieves that notification and any supporting video and error logs if applicable and presents them to the Pet Owner 5. The Pet Owner views the notification and marks it as read 5.1. This ends the use case
Alternative Flow	1. The Pet Owner is unable to sign in 1.1. Account management will be necessary for the user to reset their password if they have forgotten it
Post Conditions	1. The notifications are no longer considered unread

Table 3d: **Use Case - View Dashboard**

Items	Description
Use Case Name	View Dashboard
Use Case ID	UC-004
Brief Description	The user reviews the dashboard for device activation and pet activity history
Actors	Pet Owner
Type	[**X**] External [ ] Temporal
Preconditions	1. The Pet Owner has an account for the system 2. The system is operational
Basic Flow	1. Pet Owner signs into System 2. Pet Owner navigates to dashboard portion of the system 3. The system retrieves the dashboard and any supporting video and error logs if applicable and presents them to the Pet Owner 4. The Pet Owner is presented the dashboard 4.1. This ends the use case
Alternative Flow	1. The Pet Owner is unable to sign in 1.1. Account management will be necessary for the user to reset their password if they have forgotten it
Post Conditions	1. The notifications are no longer considered unread

INITIAL LIST OF HIGH-LEVEL FUNCTIONAL REQUIREMENTS

An initial list of high-level functional requirements is provided below.

F-1.   Entity Detection

    1.1. Motion Detection

        1.1.1.   *(Required) Detect motion*. The device shall monitor for any detectable change in the environment or movement of any entity within the detection area. Upon detection of such change or movement, the device shall signal that a motion is detected.

    1.2. Object Detection

        1.2.1.   *(Required) Identify pets and non-pets*. When a motion is detected within the detection area, the device shall differentiate pets from all other moving entities and signal in accordance with the detected entity type of pets and non-pets.

        1.2.2.   *(Desirable) Identify pet species*. When a motion is detected and pets are identified as the entity type, the device should further differentiate pet species and signal in accordance with the detected pet species as the additional entity type.

        1.2.3.   *(Optional) Identify individual pets*. When a motion is detected and pets or pet species are identified as the entity type, the device may further differentiate individual pets and signal in accordance with the detected individual pets as the additional entity type. The individual pets may be pre-defined by the user.

    1.3. Behavior Detection

        1.3.1.   *(Desirable) Identify bad behaviors*. When a motion is detected and pets, pet species or individual pets are identified as the entity type, the device should further differentiate the current pet behaviors and signal in accordance with the detected pet behaviors as the additional entity type. The pet behaviors should be pre-defined by the user.

F-2.   Deterrent Activation

    2.1. Deterrent Activation Mode

        2.1.1.   *(Required) Activate deterrent on valid entity*. When a signal is received from motion detection, the device shall analyze if the signal entity type matches user-defined valid entity. If a match is found, the device shall activate the deterrent(s) once.

        2.1.2.   (*Desirable) Activate deterrent based on entity types*. When a signal is received from motion detection, the device shall analyze if the signal entity type matches any valid entity from a list of user-defined entity types. If a match is found, the device shall activate the deterrent(s) once corresponding to the valid entity type. The list of entity types and the corresponding deterrent(s) should be pre-defined by the user.

F-3.   Device Set-up

    3.1. General System Configuration

        3.1.1.   *(Optional) Define data storage location*. The user may define on-device storage (default), local area network storage, or cloud storage locations as the data storage system.

3.2. Detection Area Configuration

    3.2.1.   *(Optional) Define detection area*. The user may define a subset of the entire sensor effective area as the detection area for motion detection.

3.3. Entity Configuration

    3.3.1.   *(Optional) Define individual pets*. The user may define individual pets to be used for pet detection. The user may direct the device sensor towards the individual pet from multiple angles and store this individual pet in the device.

    3.3.2.   *(Optional) Define custom pet behaviors*. The user may define custom pet behavior to be used for pet behavior detection. The user may direct the device sensor towards observed pet behavior from multiple angles and store this pet behavior in the device.

3.4. Deterrent Configuration

    3.4.1.   *(Desirable) Define pre-recorded audio messages*. The device should allow users to select human-audible audio up to a duration of 30 seconds to be stored in the device and used as deterrent.

F-4.   Data Storage

4.1. Activity Logs

    4.1.1.   *(Desirable) Log activities in dashboard*. The device should log device activities in a database stored in the device. The logged data should include date and time of motion detection, entity type, whether the entity is a valid entity, date and time of deterrent activation, activated deterrent type(s), and errors. The database should be retrievable from a third-party system connected to the same local area network, and the content of the database should be summarized and visually displayed in a dashboard format.

    4.1.2.   *(Desirable) Log activation effectiveness in dashboard*. The device should log the effectiveness of deterrent activation in a database stored in the device. The logged data should include date and time of deterrent activation, date and time of the valid entity becoming invalid entity or date and time of no motion detected since the last deterrent activation, whichever is earlier. The database should be retrievable from a third-party system connected to the same local area network, and the content of the database should be summarized and visually displayed in a dashboard format.

4.2. Sensor Data

    4.2.1.   *(Optional) Upload pet statistics and videos to the cloud*. The user may upload statistics of pet activities stored in the database and images and videos captured during device activations to a cloud storage location specified by the user. The device may allow users to specify the pet statistics type to be uploaded, the image quantity and resolution to be captured and uploaded, and the video duration and resolution to be captured and uploaded.

4.3. Error Notifications

    4.3.1.   (*Optional) Notify user on errors*. The device shall notify the user if the compressed air-based deterrent is no longer functional with an LED warning light.

F-5.   User Interface

    5.1. *(Optional) Help screen*. The user interface may include a help screen for accessing recorded information from the data storage system.

LIST OF NON-FUNCTIONAL REQUIREMENTS

An initial list of high-level non-functional requirements is provided below.

NF-1.   Usability

    1.1. Humanitarian factors
        1.1.1.   The system shall conform to all standards in regards to the ethical treatment of animals. The system should serve as an uncomfortable but non-harmful deterrent to pets while protecting pet-based damage to property.

    1.2. Aesthetics
        1.2.1.   The device shall inhabit an unobtrusive space, easily portable within a common living space. The system should not be a distracting feature in the room or become a possible tripping hazard to human occupants.

    1.3. Area of Effect
        1.3.1.   The device shall be capable of monitoring an area within 5 feet of the device with a field of view encompassing 62.2 x 48.8 degrees.
        1.3.2.   The device shall be capable of dispersing an air-based deterrent within its field of operation.

NF-2.   Reliability

    2.1. Frequency and severity of failure
        2.1.1.   The device shall fail to respond no more than once per week.
        2.1.2.   The system shall fail to provide access to saved data resources no more than once per week.

    2.2. Accuracy
        2.2.1.   The system shall correctly distinguish between human and pet with 95% accuracy under normal lighting conditions.
        2.2.2.   The system shall detect bad pet behavior and initiate an appropriate response with 90% accuracy when a pet is detected by the device.
        2.2.3.   The device shall not initiate a deterrent action without the presence of an animate entity.

    2.3. Durability
        2.3.1.   The device should be able to withstand an attack from an average sized housecat under 20 lbs.
        2.3.2.   The device shall allow repeated uses of compressed air with easy refilling by the user without damaging functionality.
        2.3.3.   The device shall not be damaged if it is overturned in the course of operation.

NF-3. Performance

3.1. Response Time
- 3.1.1. The device shall detect an animate entity within 5 seconds of entering its field of operation.
- 3.1.2. The device shall detect bad behavior within 3 seconds of from the start of such an occurrence.
- 3.1.3. The device shall initiate a deterrent response within 2 seconds of detection of bad behavior.
- 3.1.4. The device shall store relevant data and up to 20 seconds of video of performance upon activation and upload to a user-accessible repository within 5 minutes of activation.

3.2. Efficiency
- 3.2.1. The device shall not sustain a deterrent alarm, recording, or compressed air dispersion for longer than 3 seconds per activation.
- 3.2.2. The system shall not record additional data when storage capacity for device exceeds 80%.

3.3. Throughput
- 3.3.1. The device shall be able to identify the presence of one pet at a time and judge the appropriateness of its behavior.
- 3.3.2. The data repository shall be accessible by at least 5 simultaneous users.

NF-4. Supportability

4.1. Maintainability
- 4.1.1. There is a preference for systems that will include the use of source code version control as provided in systems like Git.

4.2. Compatibility
- 4.2.1. There is a preference for Linux based systems using Python and Python language libraries and tools designed for use with the Raspberry Pi 3B+ Microcontroller.

4.3. Configurability
- 4.3.1. No further requirements anticipated at this time.

4.4. Installability
- 4.4.1. The device should be recognizable to an established network for internet connectivity when powered on. The system should allow manual registration of a device to pair with a user-specific data repository account.
- 4.4.2. The data repository system should be accessible from a standard web browser such as Google Chrome or Firefox.
- 4.4.3. At this time, the device should be functional at the time of plug-in without further customization on the part of the user.

4.5. Localizability (Internationalization)
- 4.5.1. At this time, only support for U.S. English is anticipated.
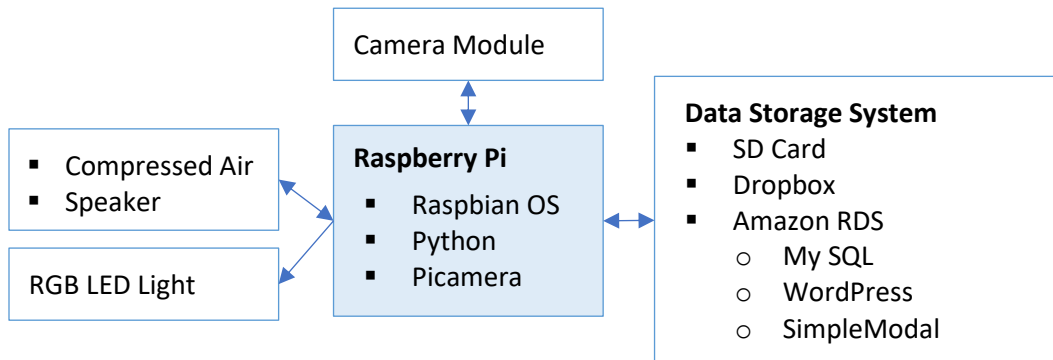
NF-5. Security

5.1. Access Control

      5.1.1.   The system shall limit access to data storage from the device to registered users of the device.

HIGH-LEVEL SYSTEM ARCHITECTURE

The high-level system architecture and the relationship between the core components for Couch Guardian is shown in Figure 1.

Figure 1:   **Couch Guardian High-level System Architecture**

Each component, including the software products, tools, languages and systems, is briefly discussed below.

- **Raspberry Pi 3B+**: The microcontroller that will be used for the device.
- **Raspbian OS**: The operating system for the Raspberry Pi, which comes pre-installed with several programming languages including Python.
- **Python**: The main language to be used, which comes pre-installed with Raspbian OS.
- **Picamera**: Python library module to interact with the camera module.
- **Raspberry Pi Camera Module**: Connected to the Raspberry Pi for capturing video of the detection area.
- **Compressed Air**: The primary pet deterrent.
- **Speaker**: Used to play pre-recorded audio messages to serve as the secondary pet deterrent.
- **RGB LED Light**: Connected to the Raspberry Pi to alert the user when the compressed air is empty/running low.
- **SD Card**: Local storage solution for image and video files captured from the device.
- **DropBox**: A cloud solution that could be used to store the image and video files captured from the device.
- **Amazon Relational Database Service (RDS)**: An Amazon Web Service (AWS) cloud solution to store a MySQL database of entries, including logs, for the dashboard to access pet activity statistics and captured image and video files.
- **WordPress and SimpleModal Login**: Add-ons to the AWS solution for dashboard web-hosting (WordPress) with sign-in capability (SimpleModal).
- **MySQL**: MySQL database to store log files created as flat flies in the Amazon RDS solution to be displayed in a WordPress solution, emailed to users, or other actions configured by the users.

TEAM

The team information including product owner, Scrum master and development team and their initial roles are summarized in Table 4. The initial roles were developed with reference to [7].

Table 4:   **Team Information**

Product Name: Couch Guardian	
Scrum Team Name	thePerfect10
Product Owner	David Baston
Initial Roles	- Create, own and manage product backlog on Trello - Participate in sprint planning meetings and determine sprint goals - Participate in sprint review and retrospective meetings - Prioritize features - Decide on release date and content - Communicate with stakeholders (Dr. Shihong Huang) to adjust features and priorities as needed - Accept or reject project results
Scrum Master	Tsz Shing Tsoi
Initial Roles	- Participate in sprint planning meetings and create sprint backlog - Participate in daily Scrum and guide sprint execution - Help the team understand and embrace Scrum values, principles and practices - Ensure the team is fully functional and productive - Help the team resolve issues and make improvements on the use of Scrum - Shield the team from external interferences and remove impediments which inhibit team productivity
Development Team	Francis Iniobong John Ifon Alyssa Johnson
Initial Roles	- Participate in sprint planning meetings and create sprint backlog - Participate in daily Scrum and execute sprints - Design system architecture and integrate all system components - Design user interface - Program all features - Test all implemented features - Create potentially shippable product increments when the features are "done"

CHECKLIST

Table 5 summarizes the status of each required checklist item.

Table 5:   Checklist Item Status

Status	Checklist Items
DONE	Team decided on basic means of communications
ON TRACK	Team found a time slot to meet outside of the class
DONE	Skills of each team member defined and known to all
DONE	Team lead ensured that all team members read the final Project 1 and agree/understand it before submission

REFERENCES

[1] "Pet Industry Market Size & Ownership Statistics", *American Pet Products Association*, 2019. [Online]. Available: https://americanpetproducts.org/press_industrytrends.asp. [Accessed: 21- Sep- 2019].

[2] M. Roppolo, "Pet-damage pricetag reaches $3 billion per year, study claims.", *Fox News*, 2019. [online]. Available: https://www.foxnews.com/tech/pet-damage-pricetag-reaches-3-billion-per-year-study-claims. [Accessed 27- Sep- 2019].

[3] "PetSafe SSSCat Cat Training Aid", *Amazon.com*, 2019. [Online]. Available: https://www.amazon.com/PetSafe-PDT00-13914-SSSCAT-Spray-Deterrent/dp/B000RIA95G. [Accessed: 26- Sep- 2019].

[4] "PetSafe Pawz Away Pet Barriers", *Amazon.com*, 2019. [Online]. Available: https://www.amazon.com/PetSafe-Barriers-Adjustable-Proofing-Stimulation/dp/B000A76ZYS. [Accessed: 26- Sep- 2019].

[5] "PREDATORGUARD PestAway Ultrasonic Outdoor Animal & Cat Repeller", *Amazon.com*, 2019. [Online]. Available: https://www.amazon.com/PREDATORGUARD-PestAway-Ultrasonic-Repeller-Destroying/dp/B00WXIJHHO. [Accessed: 26- Sep- 2019].

[6] "Doggie Don't Device", *Amazon.com*, 2019. [Online]. Available: https://www.amazon.com/Doggie-Dont-Device-Repellent-Behaviors/dp/B01FE2FYTA. [Accessed: 26- Sep- 2019].

[7] S. Huang, "An Introduction to Scrum", Florida Atlantic University, Boca Raton, FL, 2019.