Group A
EEL 4914
01/29/21

Initial Project Document - Divide and Conquer

Smart Pet Collar

University of Central Florida
Department of Electrical Engineering and Computer Science

Dr. Lei Wei
Dr. Samuel Richie
Senior Design I

Group A
Andres Graterol - Computer Engineering
Zac Kirksey - Computer Engineering
Hanh Le - Electrical Engineering
Hunter Miller - Electrical Engineering

Project Narrative

A pet is not just an animal, it is a good friend and a trust-worthy family member. Thus, the need of treating the best companion of humans is significant and has become a necessary part of our lives. However, people who own pets can completely understand the struggle of time consumption and high expenses, such as vaccinations, food, startup supplies, preventative medicine, … etc. For example, a dog owner is responsible for walking their dog three or four times a day to allow them to go to the bathroom and physical exercise. Our goal is using advanced technology to create a low-cost smart pet collar with features such as a GPS tracker, a heart rate monitor, and a calming monitor. These features will make owning a pet less challenging for people.

As we're all aware, dogs and cats are playful pets, there is always a possibility that they will go missing for several days, or worse, a few years while they have their potty breaks. For that reason, when people decide to adopt a pet, they are offered to insert a microchip in the pet. The basic microchip can give the information of the owner when it is scanned but it can't send the location of the missing pet to its owner. On the other hand, the thought of inserting a tiny electrical device under your pet's skin is terrifying to a lot of people. Therefore, our approach to this problem is to create a removable GPS collar which gives the pet owner full control of their pet's location. Of course, it will come with an application interface that is user-friendly and can be downloaded to any android device. In addition, there will be an alarm system to notify the pet owner if their pets' location is moderately far away from their device. This feature will allow people to let their pets go potty in their yard by themselves without worrying about the pets running away.

Beside the anxiety of losing pets, pets' health is also a significant concern of the pet owners. According to statistics, about 10% of dogs have heart disease [(1)] which gives them only 6 to 14 months left to enjoy their lives [(2)]. Hence, it is very important to spot the early symptoms so that the owners can help their pet to have appropriate treatments and to extend their lives. Nevertheless, the pet owners have to pay a high price to buy a pulse monitor for their pets or they have to detect their pets' heart rate using their hands, of course, this method takes time and requires medical knowledge. Our smart collar has a pulse sensor that can measure the pet's heart rate and send the data to the mobile device. It is possible for the collar to alert the pet owner if their pets have irregular heart rate. Moreover, the temperature sensor is also a part of our collar. Too high or too low temperature is extremely dangerous for the pets since it can damage the pets' internal organs or can be fatal [(3)]. The temperature sensor informs the owner of the pet's condition, as the result, the owner can fully take care of their pets and comfort them whenever they need it.

Another key point of our product is to calm the pets down. Both dog and cat are startled by sudden loud noises, such as thunder, or fireworks, which can lead to uncontrollable barking, shaking, or even biting. It is heartbreaking for animal lovers to realize that they can't really console their pets in those situations if they weren't at home with their pets. Although collars using pheromone technology help to calm the pet on the market, short lifetime is a huge weakness. Our smart collar will have a speaker that plays relaxing music when the pet has a high heart rate. This feature can be turned on/off using the application interface.

Last but not least, the smart collar can be charged using USB cable and solar energy is used as a backup power supply. By using both the USB charger and the solar energy, we are confident that the collar will get enough power as it needs. We want to cover the situation that the pet owners find their pets' location without worrying about the collar running out of its battery.

As mentioned above, our goal is bringing convenience to the people who own pets. We believe with our smart collar, people can spend time with their family while they are still able to fully look after their pets. The distance between the pet owners and their pets has been narrowed down using our low-cost smart collar.

Requirements Specifications

Req #	Requirement	Specification
1.1	The pet collar will be adjustable	16-26”
1.2	Speaker system to play alarm sounds and sounds to soothe the pet with connectivity to an Android application.	50 dB, 2 Watt
1.3	Power requirement	Maximum of 10 Watts
1.4	Battery powered (replaceable), or rechargeable	15 V maximum output
1.5	Heat	70 C max
1.6	PCB Voltage	15 V max
1.7	GPS sensor	Accurate to 2 feet
1.8	Heart rate monitor	3 V, 2 Watts
1.9	Temperature sensor	3 V, 2 Watts
1.10	Speaker	3 V, 2 Watts
1.11	There will be an application that will communicate with the collar.	Android
	Demonstrable	
1.12	The application will display heart rate and location data	
1.13	The application will play sounds from the collar’s speaker	
1.14	The application will have a database so that users can personalize data	

Stretch Requirements:

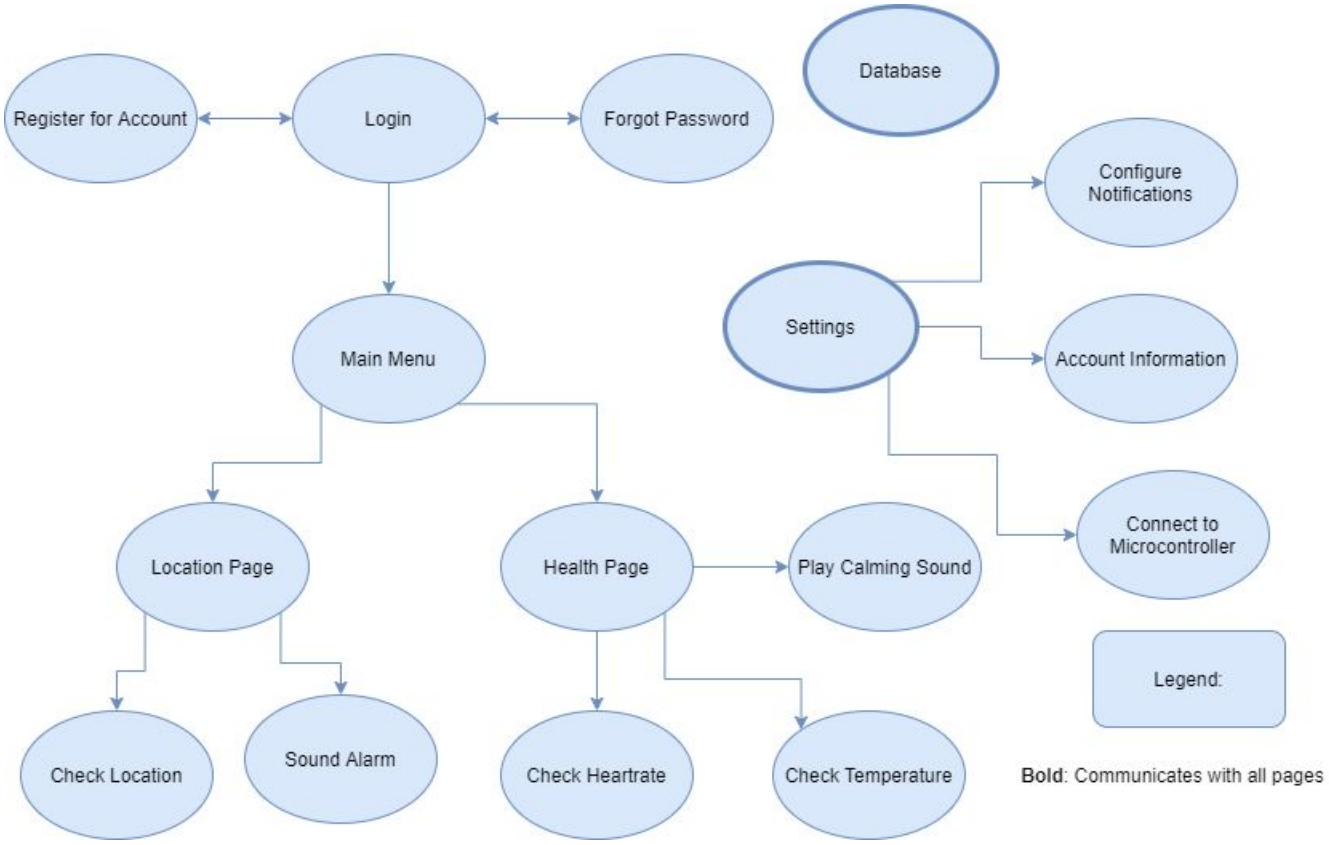
2.1	Solar cells	5V

Block Diagrams

- Disclaimer: At this point (1/29/2021) all blocks have yet to be acquired. Every block is currently being researched, therefore no blocks are being designed or prototyped.

Project Overview

Software Overview



Estimated Budget and Financing

Total Budget	$1000
Number of members	4
Project expenses per member	$250

Component	Quantity	Price	Total Cost
Arduino Mega 2560	1	$40	$40
PCB	1	$40	$40
Pulse Sensor	3	$25	$75
Temperature Sensor	3	$1.50	$4.50
GPS Module	3	$20	$60
Battery/Power source	3	$12	$36
Photoreceptive Cell	5	$2	$10
Speaker	4	$5	$20
Project Housing	1	$100	$100
TOTAL			$385.50

Project Milestones

Task #	Task	Week Timeline (Both Semesters)
	Senior Design 1	
1	D&C Version 2	5
2	Order initial components	6
3	Configure sensors (temperature & heart rate) to arduino microcontroller	7-8
4	Configure GPS module with arduino	7-9
5	Configure speaker system and code desired notifications	10-11
6	60 Page Report	12
7	Determine and implement power supply (possible solar cells?)	10-13
8	Connect components to wireless network (for app integration)	13
9	Design and order PCB	13-15
10	100 Page Report	14
11	Code android application along with data backend	12-SD2
12	120 Page Final Document	16
	Senior Design 2	
13	Redesign project with constructed PCB	TBA
14	Initial testing without app integration	TBA
15	Testing application with collar system	TBA
16	Build housing for components and attach to	TBA

	collar	
17	Final product testing	TBA

Works Cited

(1) Atkins C, Bonagura J, Ettinger S, et al. Guidelines for the diagnosis and treatment of canine chronic valvular heart disease. *J Vet Intern Med*. 2009; 23(6):1142-1150.

(2) Ineson, Deanna L., Lisa M. Freeman, and John E. Rush. "Clinical and laboratory findings and survival time associated with cardiac cachexia in dogs with congestive heart failure." *Journal of veterinary internal medicine* 33.5 (2019): 1902-1908.

(3) Staff, AKC. "Fever in Dogs: Causes, Symptoms & Treatment." *American Kennel Club*, American Kennel Club, 4 Mar. 2016, www.akc.org/expert-advice/health/dog-fever-and-temperature/.