

## Read Me First! P11252

**Initial Mission Statement:** Outdoor cats are more prone to fighting. Since the owners are not always near the cat to prevent fights, a device must be made which will have the same effect. Primary object of this project is to design two short range alert collars. Each device must fit a specific dimension and only converse at a certain range. The collars must also be low power and low weight. The end goal of the design must deter the cats from getting to close to one another.

**Proof of Concept Mission:** The main purpose of this part of the project is to prove feasibility of the use of RF technology versus distance. A previous study was documented, titled Radio Cat Collar System, which can be found on Team P11252 EDGE website. This study researched Texas Instrument's CC430 microcontroller, which became the chosen technology.

**Customer Needs:** After meeting with Mr. David Perlman, customer needs were created. Table 1 shows the Customer needs that were created for this project. Since the project became a proof of concept, the customer needs highlighted in blue were no longer a priority for the original team.

Revision #6:

5/15/2011

Customer Need #	Importance	Description	Comments/Status
1.a	1	A safe stimulus	Nothing should harm any cats in the making of this device
1.b		A safe stimulus that will slowly increase in annoyance as the cat moves closer to another cat.	In Fall (2010) research was done for investigating possible cat stimuli. References can be mad to this document to further design.
2	2	Device can be switched on and off	Possibly remote on and off
3	1	The range must be wide enough to annoy the cats before they are close enough to hurt one another	This is a loose signal range. Possible changes to this range can be made per discussion with Dr. Perlman.
4	2	This device must be able to fit on a cat collar	
5	2	A cat must be able to move comfortably with this device around its neck.	
8	2	Weather-resistant	John Bonzo, Brinkman Lab
9	1	Device must have acceptable maintenance practices (i.e. battery life cycle, inoperative notice, power on/off, power save).	
10	2	Stimulus defined. Audible range, pitch, tone for the device.	SPL meter in necessary
11	1	Notify cat owner of needed maintenance (i.e. low battery, inoperative).	Sound of collar may be enough. Home testing station? LED?
12	2	If one device goes off, the other goes off as well (handshake model)	Keeps both cats equal with level of annoyance
13	1	Device must keep from misfiring	
14	1	After a period of time, the device resets.	
15	2	Alert for if the cats start fighting	Alert the owners?

Table 1: Customer Needs

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**Engineering Specifications:** Once the Customer Needs were created, the Engineering Specifications were decided. Similarly to the customer needs, the engineering specifications highlighted in blue, are not required for a proof of concept.

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5/15/2011

Engr. Spec. #	Importance	Source	Specification (description)	Unit of Measure	Marginal Value	Ideal Value	Comments/Status
1	1	4	Size of device for Cat Collar	Inches		0.8"x1"x0.5"	Generic Collar at any pet store
2	1	3	Range of device	Feet		5'-25'	
3	1	9	Battery Life Cycle (power/hour)	w/hour		TBD	
4	1	10	Audible range of device	Hz		45 - 64000	Need SPL Meter, this range includes human range
5	1	1.a	Safe Stimulus	Binary		Sound	
6	2	5	Weight of Cat Collar with device	oz		1.0 - 2.0	
7	2	1.b	Sound Pattern (.wav file or recording)	Binary			Possibly multiple sounds (at different frequency) at once
8	1	1.b	Volume Range upper	dB		TBD	
9	1	1.b	Volume Range lower	dB		TBD	
10	1	2	Turning device on/off	Binary			Can be switch (hardware) or built into algorithm
11	2	8	Making the device weather-resistant (dealing with humidity, moisture, dir, etc...)	Binary			Device housing
12	1	11	Indicator for needed maintenance			Light -> Working battery	LED and Test Sound
13	1	10	Annoyance level for cats			TBD	This can be determined through testing, use of Audacity
<b>Algorithms</b>							
14	1	1.b	Stimulus will increase in speed	Binary			
15	1	9	Battery Life cycle can be determined	Binary			
16	1	14	Device resets after a period of time, prevents misfires	Binary			
17	1	15	Alert for if the cats start fighting	Binary			

Table 2: Engineering Specifications

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**Programs to have:** Code Composer is necessary to run this device. All files are uploaded as .txt files on EDGE, but can be easily changed to .c files and imported into code composer. A folder containing the code as well as all archived files can be found on EDGE as well. Code Composer can be found on Texas Instruments website along with some very helpful sample code. RFStudio (TI's website) was used for testing, but is no longer necessary for this project.

**Testing:** A testing summary can be found on EDGE with result explanations.

**Coding:** The code that was created for the proof of concept can be downloaded from EDGE along with necessary archive files. This can be then uploaded to the boards using Code Composer and run.

**Future Work:** In future senior design projects, the primary goal should be to design and build two, short-range communication devices that will be placed on cat collars; to safely deter the cats from fighting. Since this project was successful in proving the feasibility of using RF to accurately determine small incremental distances; the next team will focus on the design and construction of the communication devices and the collars. In continuing this project, the primary concerns for the following team will be the design of the antenna and the PCB board to communicate between each device, a collar design that is durable enough to withstand the daily life of a cat, the stimulus that will be used to deter the cats, and finally alternations to the RSSI algorithm that can effectively output a stimulus at a specific thresholds.

In determining the appropriate antenna and board design sufficient testing of different antennas at different frequencies and sizes will need to be done. Those and other potential factors will have to be thoroughly tested because communication between the devices needs to remain accurate and consistent. The precision of the receive signal allows for the short range communication devices to accurately determine distance. It is also recommended that further research is done with the CC430 microprocessor. Its size, weight, and power saving capabilities allows for it to be ideal in being a CPU for the communication devices.

The collar design has to be durable as it will be attached to an outdoor cat. This entails that it has be able to withstand the natural elements including and not limited to sunlight, moisture, wind, debris, etc. In addition the electrical elements within the device must be securely placed and tested to work in a quick and abrupt moving environment.

For solutions to stimuli, this will need to be identified with further discussed with customer and tested with the individual cats. One possible solution could be using an ultrasonic frequency that is only audible to the cats. A very successful consumer product "*Cat Stop*" by Contech uses a specific ultrasonic frequency to keep cats away from specific areas. Other potential stimuli could be recorded as .wav files that the cats are conditioned to hear that could be outputted.

Lastly there will be test needed to see what adjustments need to be made to the provided software algorithm. This may include adjustments to the battery saving methods, delay time between transmits and receives, the different threshold etc. The final product must be capable of appropriately approximating the distance of the two cats, at the speeds in which they move in their daily lives. It is necessary to find resolutions to all the above concerns because the customer wants his cat to remain outdoors but not get into anymore altercations

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