Top Cat (P11252)

Team Members:
Alexandra Peruzzini
Duncan Topley
Obinna Ukuchukwu

Project Information

Goal:

To create a device which will deter two cats from fighting.

Project Readiness Package

1-Page Project Summary

Customer Needs

Customer Need #	Importance	Description	Comments/Status
1.a	1	A safe stimilus	Nothing should harm any cats in the making of this device
1.b		A safe stimilus that will slowly increase in annoyance as the cat moves closer to another cat	In Fall (20101) research was done for investigating possible cat stimuli. References can be mad to this document to further design
2	1	Device can be switched 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	1	This device must be able to fit on a cat collar	
5	1	A cat must be able to move comfortably with this device around its neck	
8	1	Weatherproof	
9	1	Device must have acceptable maintenance practices (i.e. battery life cycle, inoperative notice, power on/off, power save).	
10	1	Stimulus defined. Audible range, pitch, tone for the device.	
11	1	Notify cat owner of needed maintenance (i.e. low battery, inoperative).	

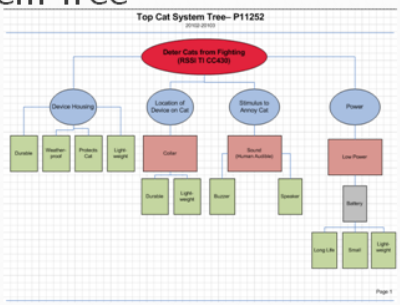
Customer Needs

Engineering Specifications

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	N/A	0.8"x1"x0.5"	Generic Collar at any pet store
2	1	3	Range of device	Feet	N/A	5'-25'	
3	1	9	Battery Life Cycle (power/hour)	w/hour	N/A		Currently Researching
4	1	10	Audible range of device	dB	N/A	45Hz - 64KHz	Need SPL Meter, this
5	1	1.a	Safe Stimulus	N/A	N/A	Sound	Completed
6	1	5	Weight of Cat Collar	oz	N/A	1.0 - 2.0	
7	1	1.b	Sound Pattern (wav file or recording)	N/A	N/A	N/A	
8	1	1.b	Volume Range upper	dB			Researching
9	1	1.b	Volume Range lower	dB			Researching
10	1	2	Turning device on/off	N/A	N/A	N/A	
11	1	8	Making the device weatherproof (dealing with humidity, moisture, dir, etc...)	N/A	N/A	N/A	Device housing
12	1	11	indicator for needed maintenance	N/A	N/A	N/A	light? Test sound?

Engineering Specifications

System Tree



System Tree

Different Technologies

	RF	RFID	SONAR/Doppler	GPS
Description	Radio frequency can transmit and receive with limited issues of line of sight.	Radio frequency identification can pass data. Has three different modes of operation.	Uses reflected sound waves to see if objects are nearby.	Uses satellites to track where the receiver is and can track within a few feet.
Possible Problems	power	receiver size	random objects reflecting sound	implementation and getting ICs
benefits	Easiest to implement. Small IC. Lots of possible features.	Extremely small and low power for the transmitter.	Accurately calculate distance between cats.	Ability to track the cat anywhere.
Possible ICs	CC430	TRF7960	MAX2078	MAX2740
Cost	$11	$7	$66	Not Listed
Development Kit	Yes	Yes	Yes	Yes
Cost of Kit	150	200	Not Listed	Not Listed
Development Kit Part#	CC430F5137	TRF7960EVM	MAX2078EVKIT	MAX2740EVKIT
Datasheet	Adobe Acrobat Document	Adobe Acrobat Document	Adobe Acrobat Document	Adobe Acrobat Document

Technology Comparison

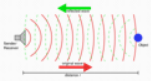
Concept Evaluation

We studied different types of devices such as GPS, Sonar, RF and RFID

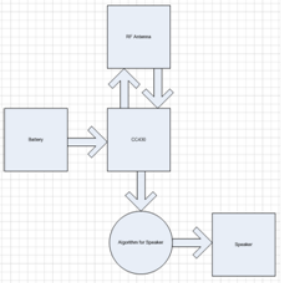
Concept Evaluation and Selection Documents can be found below:

Concept Screening Matrix

Concept Selection Matrix



Design Sketch



Design Sketch

Risk Analysis

ID	Risk Item	Effect	Cause	Likelihood	Severity	Importance	Action to Minimize Risk	Owner
1	RF Accuracy	May cause the device to trigger at the incorrect time	Limitations of RF, Poor algorithm	2	3	6	Test on development board to ensure a proper algorithm	Duncan
2	Weight	Product no longer useful. Not meeting customer needs	Battery, Strength of Collar, Speaker Size	2	2	4	Finding the limits to what a cat can handle. Properly purchasing parts	Alex
3	Battery Life	Product would need to be replaced often.	RF, Size limitations, speaker loudness	2	1	2	Developing the proper algorithm to reduce the amount of time the device is on	Obi
4	Indicator	Cats could fight which would defeat the purpose of the product	Dead battery, Bugs in the algorithm	1	2	2	Simple way to test functionality of the device at any time	Obi
5	Durability	Product would need to be replaced often.	Light materials, weather	1	2	2	Balance between strength of collar and weight	Alex
6	Loudness	Needs to be loud enough to deter the cat without causing hearing damage	Stimulus too loud when trying to deter cats from fighting	1	2	2	Properly design the output of the sound to be at a safe level for the cat	Duncan

Risk Analysis

Texas Instruments CC430

- Voltage Supply from 2.0V to 3.6V
- Different power consumption modes
  - CPU Active Mode (160 µA/MHz)
  - Standby Mode (2 µA)
  - Off Mode (2 µA)
  - Radio in RX (15 mA, 250 kbps, 915 MHz)
- Programmable output power (up to +12 dBm)
- High Sensitivity (-111 dBm)
- Digital RSSI Output

INTRODUCTION:

This document describes and serves as a template for preparation of a Project Readiness Package. The objective of the Project Readiness Package is to document customer needs and expectations, project deliverables (including time frame), budget, and personnel / organizations affiliated with the project. It will serve as the primary source of information for students necessary during the Planning phase to develop a SD I plan and schedule including specific deliverables and due dates. The Project Readiness Package will also support Faculty evaluation of project suitability in terms of depth, scope, and student / faculty resources by discipline.

In this document, italicized text provides explanatory information regarding the desired content of the sections indicated by non-italicized, bold, capitalized headings. If a particular aspect of a section is not applicable for a given project, it is only necessary to indicate that by entering N/A (not applicable).

ADMINISTRATIVE INFORMATION:

Information regarding contacts, budgets, facilities, resources, regulatory or legal considerations, proprietary or specialized components, technologies or intellectual property associated with the project.

- Project Name (tentative): Top Cat
- Project Number: P11252
- Project Track: Open Architecture Control Systems
- Project Family: n/a
- Start Term: 2010-2
- End Term: 2010-3
- Faculty Guide *(project mentor)*: George Slack
- Faculty Consultants *(disciplinary subject matter experts)*: Gill Tsouri, Jayanti Venkataraman
- Customer organization and primary contact (name, phone, e-mail):

  David Perlman [dnpeee@sprintmail.com]

- Principle sponsor or sponsoring organization: (*provider of financial support)*

  David Perlman

- Project Overview (*1-2 paragrapsh that provide a general description of the project: background, motivation(s), customer(s), and overall objective(s).*):
  From Dr. David Perlman; Customer.

  "My neighbor down the street has recently acquired a lady cat that she lets out. My cat, George, has been going out for years. He's discovered this interloper and he doesn't like her. In a word, they fight and neither my neighbor nor I like this situation. I want to keep the two animals apart. So...."

- Staffing Requirements: (*use WBS and associated resource estimates to summarize <u>anticipated</u> staffing needs)*

Discipline (*number*)	Skills required (*concise*)
EE 3	Wireless controls/ communications, compact power, stimulus device, integrate collar enclosure. Collar, weight, test fixture, test parameters.
ME 0	
CE 0	
ISE 0	
Other	

- Continuation, Platform, or Building Block project information (*Include prior project number and title and to what extent previous results are being incorporated*):
  na

DETAILED PROJECT DESCRIPTION:

- Customer needs:
  1. Review preliminary investigation work being completed this quarter by Andrew Bishop and Erwan Suteau. Andrew and Erwan are investigating stimulus that would "annoy" or discourage both cats from being near one another. As an example, a buzz or high pitched tone might work. Possibility: it gets louder as the cats get closer. Data and information will be made available.
  2. Two short range alert devices, one for each cat. Given typical cat's "conversation" range, a maximum range should be limited from 5' to 25'.
  3. Limit false alarms.
  4. Given the possibility that more than two cat alerts could be in the same proximity, some sort of a unique coded signal scheme is needed.
  5. Small. Roughly 0.8" x 1" x 0.5". The collar to which it is to be attached is 0.4" wide.
  6. The project solution should be driven by low power and light weight. The weight contribution may be due to power consumption needs. (As an example, a cat should be acceptable to the weight of 1 to 3 silver-oxide cells.)

The following were instructions given to Andrew Bishop and Erwan Sutea to perform preliminary feasibility from Dr. David Perlman.

> The biggest unknown in this project is determining how to safely annoy a cat sufficiently to make it stop. To determine this, a good first step would be a literature/internet search. A good thing to do in parallel would be to try and talk to vets or others who might have some useful knowledge about the topic. I think that is would be very good experience for you. Having been a practicing engineer for many years, I learned that searching prior art and talking to experienced people could save a significant amount of time and often point me in a useful direction that hadn't occurred to me before.

NOTE: Possibly, the stimulus would stay on only a second or two. If the cat moved toward the transmitter, the stimulus would get stronger; if the cat moved away, the stimulus would get weaker. If you succeed in identifying a likely stimulus approach, then a recommendation of how to generate the signal would be next.

- Customer deliverables (*Customer requested milestones, progress reports, and expected product*):
  Two devices; one for each cat. MSD deliverables.

- Customer and Sponsor Involvement (*Describe role of customer and sponsor in the project, planned participation in design and project reviews, etc.*):
  Review each phase of the project. Dr. David Perlman was faculty in electrical engineering, KGCOE. Events during Week 1 (Customer Needs), Week 5 (System Level Review) and Week 9 (Detailed Design Review) during MSD. Customer is available via email at any time.

- Regulatory requirements (*i.e. UL, IEEE, FDA, FCC, RIT*):
  Meets FCC and safety regulations.

- Project Budget and Special Procurement Processes (*Provide all budget details and processes associated with expenditures*):
  Cost of components (i.e. Bill of Materials and development kits), as needed. Bill of Materials and development kits will be reviewed with the customer prior to order components.

- Intellectual property (IP) considerations (*Describe any IP concerns or limitations associated with the project*):
  This will not be an open source project. Customer and students to consider IP considations.

- Other (*Describe potential benefits and liabilities, known project risks, etc.*):

DETAILED COURSE DELIVERABLES:

From the Course Deliverables document, extract general and discipline specific deliverables that are appropriate to the project. This should provide clear guidance to the students on what it expected.

As per MSD Grading Rubric.

PRELIMINARY WORK BREAKDOWN:

Describe the anticipated distribution of general tasks to be accomplished by project participants based on perceived skill set requirements. This should justify the requested skills and number of students from each discipline.

Review preliminary investigation work being completed this quarter by Andrew Bishop and Erwan Suteau. Consider multiple concepts and select the most feasible idea(s) for stimulus, weight and wireless solutions. As needed, gain knowledge via investigation of technologies and prototype feasibility models to verify performance needs.

GRADING AND ASSESSMENT SCHEME:

Describe how the grading rubric relates to expectations and deliverables. The impact of project enhancements and improvements from baseline should be clearly articulated.

As per MSD grading

THREE WEEK SDI SCHEDULE:

List expected activities in the first three weeks. Highlight any project specific activities that may not be part of the generic course syllabus (e.g. customer visits).

As per MSD recommended events. Investigate similar devices including USPO. See PRELIMINARY WORK BREAKDOWN above.

Project Description

Project Background:

The long-term goal of this project is to develop two short range alert devices. These devices will be used to stop cats from fighting. Initially the focus is to determine which type of alert would best suit the problem. The transmitter must be determined that will allow short range conversation while still being reliable. Eventually this design will be used for more than two cats but for now the design will be specific to only two cats.

Problem 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.

Objectives/Scope:

1. Determine alert method.
2. Determine transmitter with a 5 to 25 foot range.
3. Limit false alarms.
4. Signal scheme to differentiate between cats.
5. Collar dimensions to fit with design
6. Low power
7. Low weight

Deliverables:

- Two functioning collars that meet the customer's specifications.
- Schematics of the chip design/layout.
- Documentation

Expected Project Benefits:

- Less supervision for the cat owners
- Less cat fights
- Potential patent

Core Team Members:

- Alexandra Peruzzini – Project Manager -EE
- Duncan Topley - EE
- Obinna Ukachukwu – EE

Strategy & Approach

Assumptions & Constraints:

1. Cat deterrents
2. Budget:
3. Power
4. Happy Neighbors

Issues & Risks:

- Size
  - Must fit a cat collar (0.4 inches wide)
- Alert Method
  - Each cat may respond differently to a certain stimulus
- Transmitter
  - Specific range may be hard to pinpoint
- Power
  - Limited weight and silver-oxide cells

Revision #4: 1/9/2011

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11	1	8	Making the device weatherproof (dealing with humidity,moisture, dir, etc...)	N/A	N/A	N/A	Device housing
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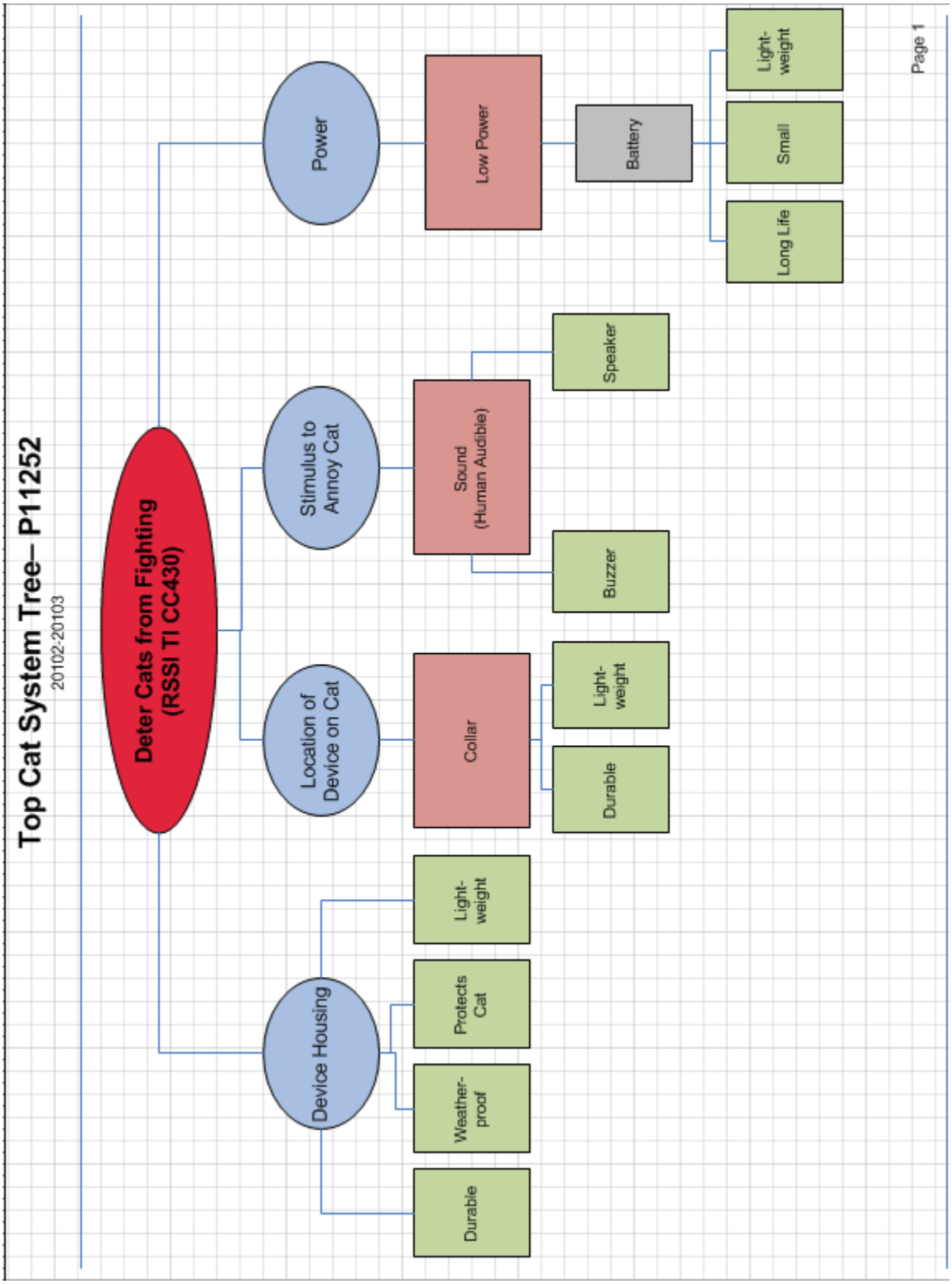
Top Cat System Tree– P11252
20102-20103
Page 1
Deter Cats from Fighting (RSSI TI CC430)
Power
Low Power
Battery
Light-weight
Small
Long Life
Stimulus to Annoy Cat
Sound (Human Audible)
Speaker
Buzzer
Location of Device on Cat
Collar
Light-weight
Durable
Device Housing
Light-weight
Protects Cat
Weather-proof
Durable

	RF	RFID	SONAR/Doppler	GPS
Description	Radio frequency can transmit and receive with limited issues of line of sight.	Radio frequency identification can pass data. Has three different modes of operation.	Uses reflected sound waves to see if objects are nearby.	Uses satellites to track where the receiver is and can track within a few feet.
Possible Problems	power	receiver size	random objects reflecting sound	implementation and getting ICs
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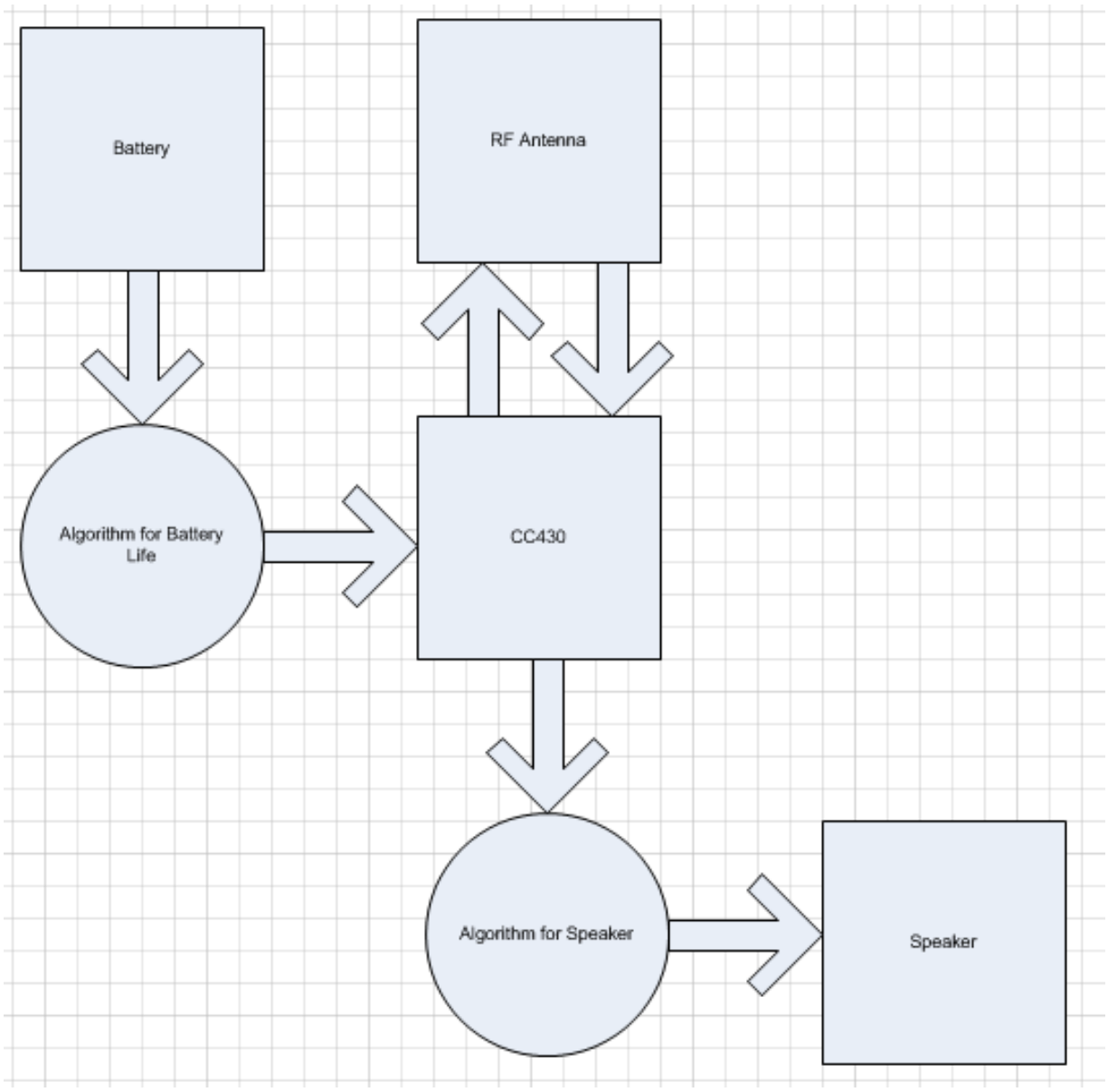
Possible ICs	CC430	TRF7960	MAX2078	MAX2740
Cost	$11	$7	$66	Not Listed
Development Kit	Yes	Yes	Yes	Yes
Cost of Kit	150	200	Not Listed	Not Listed
Development Kit Part#	CC430F5137	TRF7960EVM	MAX2078EVKIT	MAX2740EVKIT
Datasheet	Adobe Acrobat Document	Adobe Acrobat Document	Adobe Acrobat Document	Adobe Acrobat Document

Selection Criteria	A RF (Reference)	B Sonar	C GPS	D RF ID	E	G
Available development board	0	0	0	0		
Price of development board	0	x	-	-		
Price of chip	0	-	x	-		
Indoor/Outdoor practicallity	0	0	+	-		
Low power consumption	0	-	-	0		
Wieght	0	-	0	+		
Size	0	-	0	+		
Sum + 's	0	0	1	2		
Sum 0's	5	2	3	2		
Sum -'s	0	3	2	3		
Net Score	0	-3	-1	-1		
Rank	1st	4th	3rd	2nd		
Continue?	Yes	No	No	No		

			A			B			C			D	
			(reference)										
	Segment		RF			Sonar			GPS			RFID	
Selection Criteria	Weight	Rating	Notes	Wtd	Rating	Notes	Wtd	Rating	Notes	Wtd	Rating	Notes	Wtd
Available development board	20%	3		0.60	3		0.60	3		0.60	3		0.60
Price of development board	20%	4	TI Contest	0.80	0		0.00	3		0.60	2		0.40
Price of Chip	10%	3		0.30	0		0.00	1		0.10	4		0.40
Indoor/Outdoor practicallity	10%	3		0.30	0		0.00	1		0.10	2		0.20
Low power consumption	15%	3		0.45	1		0.15	2		0.30	3		0.45
Wieght	12.5%	3		0.38	1		0.13	3		0.38	4		0.50
Size	12.5%	3		0.38	1		0.13	3		0.38	4		0.50
				0.00			0.00			0.00			0.00
	Total Score		3.20			1.00			2.45			3.05	
	Rank												
	Continue?		Yes			No			No			No	


Battery
RF Antenna
Algorithm for Battery Life
CC430
Algorithm for Speaker
Speaker

ID	Risk Item	Effect	Cause	Likelihood	Severity	Importance	Action to Minimize Risk	Owner
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2	Weight	Product no longer useful. Not meeting customer needs	Battery, Strength of Collar, Speaker Size	2	2	4	Finding the limits to what a cat can handle. Properly purchasing parts	Alex
3	Battery Life	Product would need to be replaced often.	RF, Size limitations, speaker loudness	2	1	2	Developing the proper algorithm to reduce the amonut of time the device is on	Obi
4	Indicator	Cats could fight which would defeat the purpose of the product	Dead battery, Bugs in the algorithm	1	2	2	Simple way to test functionality of the device at any time	Obi
5	Durability	Product would need to be replaced often.	Light materials, weather	1	2	2	Balance between strength of collar and weight	Alex
6	Loudness	Needs to be loud enough to deter the cat without causing hearing damage	Stimulus too loud when trying to deter cats from fighting	1	2	2	Properly design the output of the sound to be at a safe level for the cat	Duncan