Top Dog Technologies
Territory Tracking and Restriction System

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Problem Background

- Track and control pet whereabouts when humans are absent
- Protecting indoor furniture and belongings
Needs Statement

There is a need to have a pet deterrent system that tracks pet movement throughout the house 24/7 by monitoring and documenting when a pet enters off-limit areas and deters the pet when needed.
Goal

Create a network of receivers and transmitters that can record the general location of a pet and deter it from the off-limit areas.
Requirements

- The prototype system must cost less than $500 to meet the project’s budget.
- The commercial system should cost $50 or less per receiver and $30 or less per transmitter to be competitively priced on the market.
- The system must use a power source accessible to the public, such as a battery, and the power source must last at least 1 month without being replaced.
- The system must not harm animals or people.
Requirements

- The system must function well in a typical indoor environment.
- The collars should be light, less than 1 pound, and comfortable for the pet.
- The system must be easy for the user to set up which is defined as the set up time taking less than 30 minutes.
- The system must be easy to use and adjust; any adult with basic computer knowledge should be efficient with the computer software after 1 week.
The system should have a variable range that covers an area with a 1 foot radius to an area with a 10 foot radius.

The system should document the zone and time when a pet violates a restricted location; should also record when a pet enters an allowable zone.

The recorded information should be displayed to the user in an organized and understandable fashion.
Design Alternatives

- **System Alternatives**
  - Triangulation based on RF, RFID, GPS, UWB and Ultrasonic technology

- **Transmitter and Receiver Chips**
  - TRF7960 from TI
  - ADF7020 from Analog Devices
  - CC1100 from TI
  - TXM-315-LR from Linx

- **Deterrent Settings**
  - Programmable through client software
  - Hardware Switches
Transmitter Design

Territory Tracking and Restriction System

Unit 12

Area Diameter

1 ft

20 ft

Deterrent Settings

1 2 3 4

Deter Track
Transmitter Design
## Transmitter Design

### Signal Transmitted

<table>
<thead>
<tr>
<th>Square Wave</th>
<th>Leading Zeros</th>
<th>Beginning Sequence</th>
<th>Transmitter ID</th>
<th>Deter Settings</th>
<th>Ending Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0 0 0</td>
<td>1 0 0 0 0 0 0 0</td>
<td></td>
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</tbody>
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### Example Signal Transmitted

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Receiver Design
Receiver System Design

Outside of Zone:
- Sleep
- Search
- USB Mode

In Zone:
- Deter & Store
- Stays in Zone
- Store Only

Still in Zone:
- Continue to Deter
- Stays in Zone
- Do Nothing

Return to Original State
Software Design
Team Management

- **Michael**
  - Team Leader, Head of Finances and Purchases
  - Working on receiver hardware

- **Chris**
  - Head of Software Design, Head of Technical Reports
  - Working on software suite

- **John**
  - Head of Systems Design, Head of Documentation
  - Working on PIC programming

- **Denise**
  - Head of Hardware Design, Head of Project Validation
  - Working on transmitter hardware
Teamwork

- Dividing the project equally
- Had open communication through meetings and email
- Overcame problems as a team
Environment, Health and Safety Concerns

- Verify that the transmitted signal conforms to FCC regulations
- Design the collar and deterrent method to not harm or hinder the pet
Social, Political and Ethical Concerns

- The Territory Tracking and Restriction System runs in the privacy of the user’s home.
- Situations where the collar is not used as intended (placed on children)
Manufacturability, Sustainability and Economics

- **Manufacturability:**
  - Can be created in mass quantities
  - Information programmed on PIC

- **Sustainability:**
  - Battery can be replaced
  - Information can be stored on the computer

- **Economics:**
  - Low material cost
Budget

- Prototype Cost: $298.32
- Transmitter Calculated Cost: $15.75
- Receiver Calculated Cost: $20.01
Final Product
Evaluation Results

- Range Testing
Evaluation Results

- **Power Testing**
  - Receiver will last 31.92 hours
  - Transmitter will last 44.15 hours

- **Ways to improve battery life**
  - Use batteries with higher mAhour rating
  - Sleep Receiver
  - Sleep PICs that control the transmitter and receiver
  - Use better voltage regulators
  - Create a recharging station for components
Evaluation Results

- **Deterrent Testing**
  - When the transmitter is in “Deter Mode” the receiver’s red LED lights up
  - When the transmitter is in “Track Mode” the receiver’s green LED lights up
  - Tests and demonstrations have shown reasonable consistency

- **Software Testing**
  - Data transferred from the receiver to the client software via USB is accurate
  - Client software responds correctly to user commands
Overview

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Any Questions?