Design of a GPS based Tracking Collar for Coyotes

Introduction

The Narragansett Bay Coyote Study (NBCS) has been tracking coyotes in Rhode Island since 2005 (www.theconservationagency.org/coyote.htm). In order to obtain a better record of the animals' territorial behavior, NBCS is trying to transition into wireless SMS tracking (texting coyotes) from standard GPS wildlife tracking collars or a satellite based 2-way communication system (e.g. *Iriduim*). Wildlife colors offering 2-way communication are commercially available (e.g. the *Lotek Iridium Collar*), but they come with a comparatively high price tag on the order of $ 3,000 or more.

During the past Capstone sequence, a URI team developed a system based on the *Adafruit GPS Logger Shield* and an *Arduino Mega* processor. Their system could acquire GPS coordinates and transmit them to a host. However, the power required by the electronics would have depleted the two Lithium Ion batteries within a few days.

Figure 1: NBCS logo.

Figure 2: Commercial Wildlife Collars

Project Description

This project addresses the design of a cost-effective wireless tracking collar for coyotes. To achieve an active lifetime of at least one-year, power management will be critically important. Another practical factor in this design will be packaging (robustness and weight), since the collar should be *easy to wear* so that the tacked animals are not unnecessarily hindered in their daily activities. Currently, no such device exists on the commercial market.

Apart from GPS logging, the electronic collar is expected to offer the possibility of adding more functions like count-down timing, on-demand activation and control features such as collar drop off, video drop off and real-time transmission of SMS information. The information transmitted should include animal ID, time, date, GPS location, precision and time since last positional fix.

Within the scope of this 2-semester project, students are expected to design and build a new tracking collar. They will also be encouraged to participate in coyote capture under the guidance of Dr. Mitchell from NBSC to deploy and test their prototype(s) in the field.

Tasks to be completed

- Evaluate **existing prototype** collar with regard to **functionality** and **power** dissipation.
- Evaluate **FPGA** or **micro-controller** based development platforms for potential system implementation with regard to **power**, **size**, **cost** and **flexibility**.
- Evaluate and develop reliable **collar release** mechanism.
- Develop preliminary **system specifications** and design **state machines** to execute the communication protocol and the data logging function.
- Build selected **hardware platform** and **develop** the necessary **code** to program the device and execute the specified tasks.
- Develop **procedures** for collar **testing** in the lab and in the field.
- **Perform tests** with prototype collar(s).
- **Adjust** hardware and software as necessary.
- Write **final report** including a complete system description and a listing of all relevant test results.

Minimum System Specifications

- Minimum active collar lifetime of 6 months
- GPS activation at regular intervals or upon request.
- Robust package that allows operation under extreme environmental conditions.
- Each collar must feature a functional release mechanism.

Engineering Skills required

- Electronic circuit design
- State machine design
- Familiarity with programming languages such as C, C++, VHDL, etc.
- Familiarity with embedded systems (desired)
- Familiarity with digital communication (desired)

Preferred Team Composition

1 **CPE** major, **2 ELE** majors

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