MEng Design Project Announcement – 2018-19 AY

**Project title:** Digital Turnstile Tag (DTT) Development

**Brief Description of Design Project Goals:**

**Overview:** The conservation of migratory bird populations requires detailed knowledge of individual migration routes and timing. For birds too small to carry tags containing GPS receivers, tags that perform solar geolocation logging are being used instead. Solar geolocation involves recording light level and time data throughout the migration period so that times of sunrise and sunset can be reconstructed. By analyzing data on the rate of change of light level at twilight, the individual’s location can be estimated on a daily basis.

This project will continue the development of a geolocation tag capable of transmitting its logged data to a ground station long after it is deployed, dramatically increasing the scope of studies using geolocation by eliminating the need to recapture the tagged birds. Ground stations located at concentration points in migratory routes (“digital turnstiles”) will be able to collect logged data from a large number of tagged birds as they pass by on their regular migration.

**Specific MEng Contribution:** This project will update an earlier design incorporating wireless microcontroller technology (the TI CC1310 chip) and a solar-rechargeable battery. The following work items are included:

- Collect light levels at one-minute intervals during the 90-minute period surrounding each sunrise and sunset.
- The data are to be compressed and stored in the microcontroller’s on-board flash memory in a way that minimizes memory and power consumption. Flash memory “wearout” must be minimized as well.
- Program the on-board clock/calendar function to wake up the receiver when the tag is likely to be near a ground station to listen for an interrogation signal.

These tasks must be closely coordinated with the Digital Turnstile Ground Station project:

- Once contact is established perform data transfer with error recovery: the ground station will manage timing.
- Utilize the power management capabilities of the CC1310 and SimpleLink real-time operating system (RTOS) to minimize power consumption throughout the tag’s operating cycle (light sensing, sleeping, and ground station data transfer.) This must include intelligent restart from loss of power, which will occur if the battery runs low. The real-time clock/calendar and data logging process must be capable of running for several days if there is insufficient light to fully recharge the battery.

This work will be concurrent with small improvements to the prototype hardware design. Prototype code for sensor and clock/calendar interface code and communication protocol based on the SimpleLink RTOS is also available.

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**Project Web Site:**  TABER: Technology for Animal Biology and Environmental Research
http://www.eeb.cornell.edu/winkler/wordpress/?page_id=335

**Number of MEng Students Needed:**  2

**Required Skills:**  C-language microcontroller programming, algorithm development, Microcontroller interface experience, reliable low-power RF communication, data compression, solar energy harvesting, microcontroller power management

**Estimated Project Time Frame:**

2018-19 Academic Year, Two (2) Semesters