Capstone Proposal: Underwater Glider Audio Recorder

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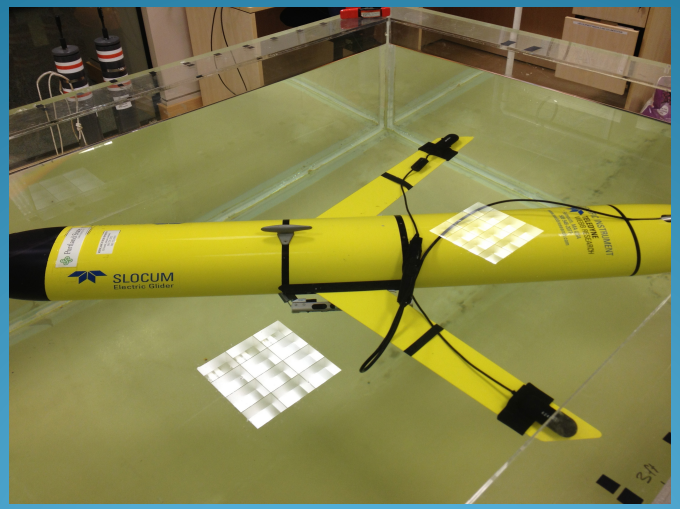


Concept

- There is increased interest in using underwater gliders for marine mammal research and monitoring
- NEAR-Lab Webb Slocum Glider has currently implemented an off the shelf recording device with two hydrophones
- Our goal is to design additional software and hardware to improve the usability of the device

Project Goals

- To improve current commercial audio recording device
  - Inexpensive device that includes a user interface
  - Records broadband signals over 30 days with up to 4 days of acoustic data
  - Includes hardware and software updates

Hardware

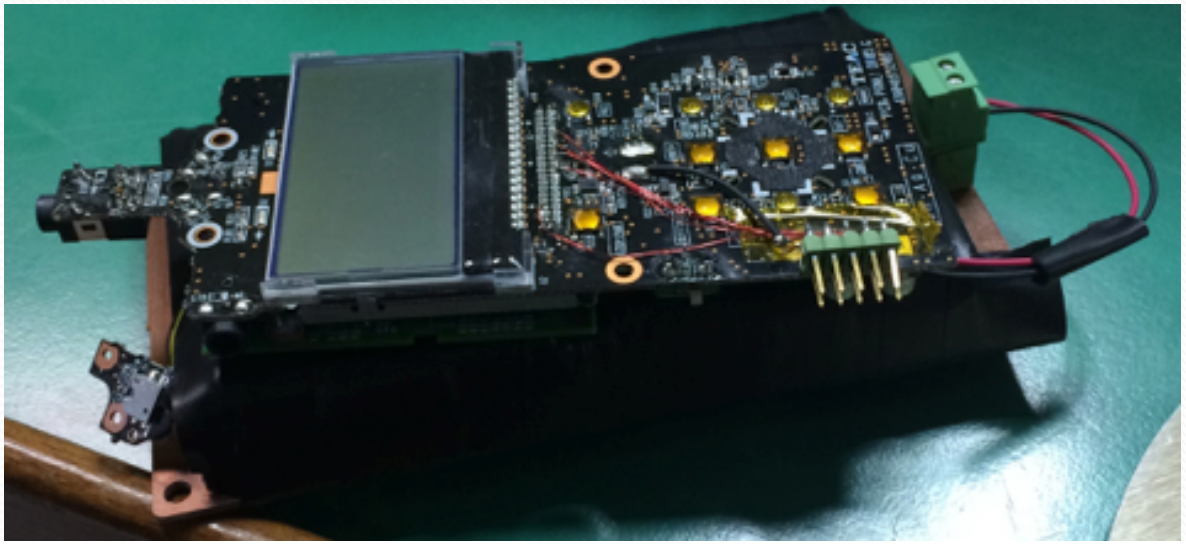
- Three major updates to hardware
  - Addition of a multiplexor to interchange up to 4 SD cards
  - Separate Microcontroller unit and Real Time Clock for complex scheduled recordings
  - Button interface for hands-free schedule programming

Hardware- Data Storage

- DSP on TASCAM (current off the shelf device) supports SDHC carts with FAT32 file format
  - 32GB max on pre-formatted SDHC cards.
- Multiple SD cards needed to meet storage requirements.
  - Requires multiplexing data bus to multiple devices
- 2x Fairchild FSSD06 multiplexer
- Each MUX interfaces 2x micro SD cards each
- 4 micro SD cards total, 128GB combined total storage
- Maximum power consumption for entire MUX system is <0.01 mW

Hardware- Button interface

- Must be able turn on and record with out manually pressing buttons
- Requires connection to send electrical signals as if button sequence is being pressed



Hardware- RTC

- A number of RTC (ISL12082, DS1307, PCF2127, M41T82/83, DS1337) was looked at before selecting one.
- Any of these could be used but we picked PCF2127
- Feasibility of communicating with the MCU
- Power consumption
- Temperature compensated
- Operating range
- I2C bus interface
- Programmable watchdog timer with interrupt

Hardware- MCU

- Several MPU were studied - 8-bit PIC MCUs, ATmega328p, PIC24F16KA101. All these are extreme low power Microcontrollers.
- Among them 8-bit PIC MCU looked most suitable.
- 128KB Flash, 4KB RAM, Onboard EEPROM,
- I2C, SPI, UART, USB, Ethernet
- Operation down to 1.8V, sleep current as low as 20nA
- Special low power BOR, WDT, RTC
- Programmable Switch Mode Controller
- Industry's most robust offering

Software

- Three major components of software
  - Pre-Mission user interface
  - In-Mission recording schedule control
  - Post-Mission data analysis

Software- Pre-Mission

- User interface : command line or GUI
  - Allow user to program the schedule by inputting:
    - recording and stand-by interval
    - sample rate
    - delay for start
  - Confirm the schedule if the inputs are “good”
  - Estimate maximum operation time of the system
  - Set the operation parameters for the system

Software- In-Mission

- Control the operation as per programed schedule
- Manage the data storage
  - Store data to SD card
  - Switch to the next available SD card when existing card “full”
  - Reset power of “mainboard” to direct the data to targeted SD card

Software- Post- Mission

- Display list of audio files
- Allow user to playback the records
- Display the spectrogram and plots for analysis

Schedule