

Capstone Proposal: Underwater Glider Audio Recorder

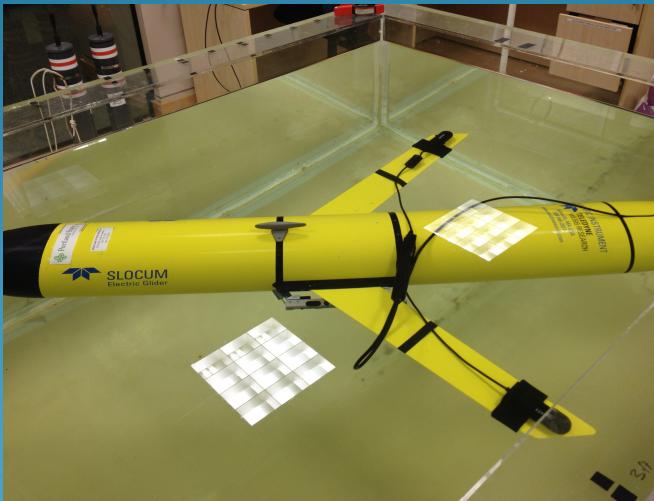
Sponsor: Metron, Dr. John Gebbie

Team Members: Chelsea Throop

Trevor Conant

Phu Nguyen

Saida Akhter





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

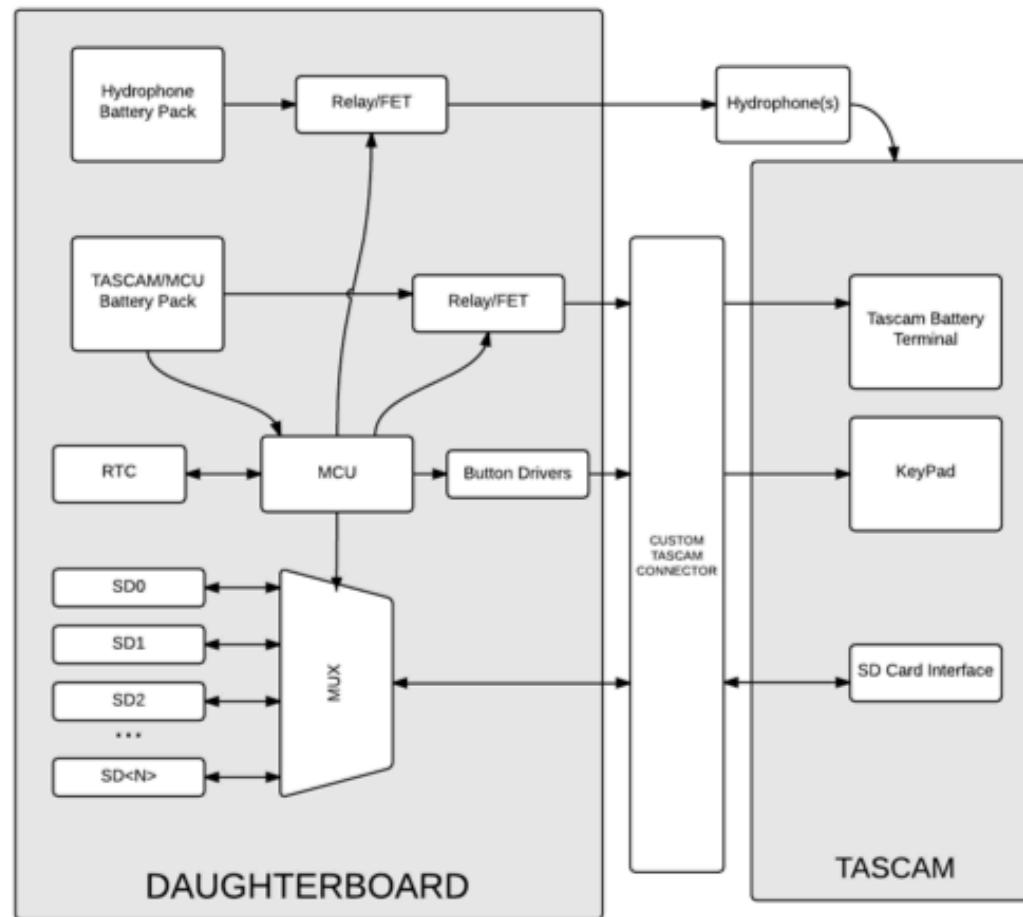
- To improve current commercial audio recording device
 - Inexpensive device that includes a user interface
 - Records broadband signals over 30 days with up to 4 days of acoustic data
 - Includes hardware and software updates

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- Block Diagram



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

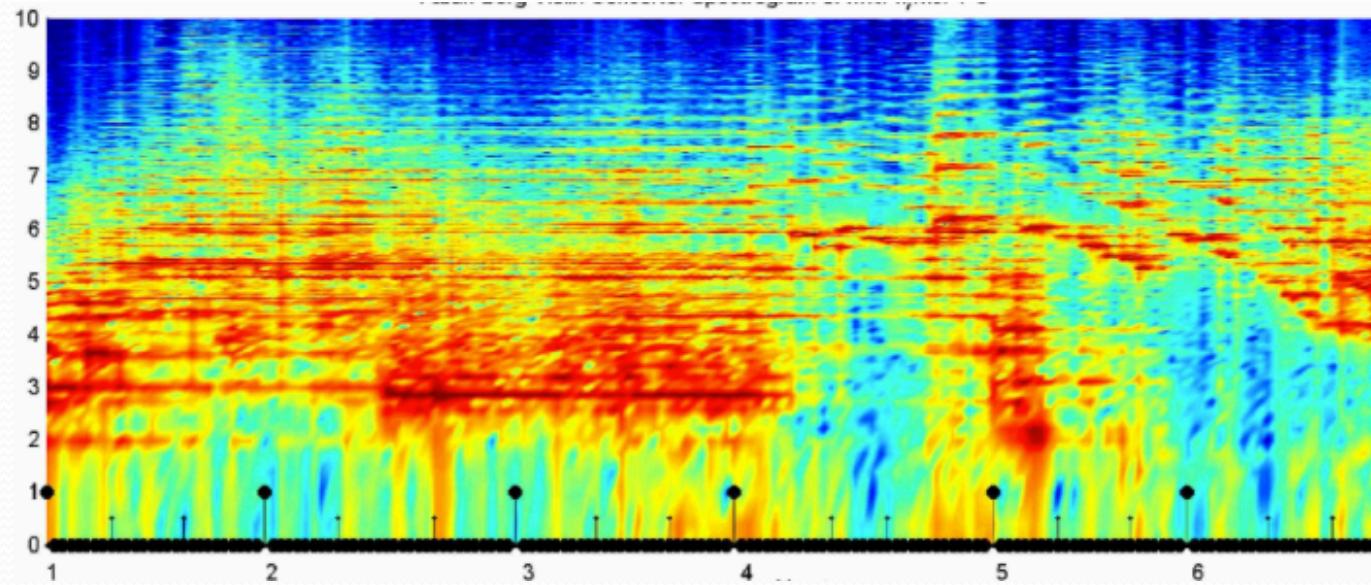
- User interface : command line or GUI
 - Allow user to program the schedule by inputting:
 - recording and stand-by interval
 - sample rate
 - delay for start
 - Confirm the schedule if the inputs are “good”
 - Estimate maximum operation time of the system
 - Set the operation parameters for the system

Software- In-Mission

- Control the operation as per programmed 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