B.O.A.T.

A Software Exposé

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Summary

What is B.O.A.T.?

- Drone-sized aquatic autonomous GPS waypoint tracker
- Determines position, orientation, and heading using GPS, accelerometer, and magnetometer
- Stores waypoints and position logs on 8MB on-board flash
- Waypoint and log transfers over Bluetooth

Tools

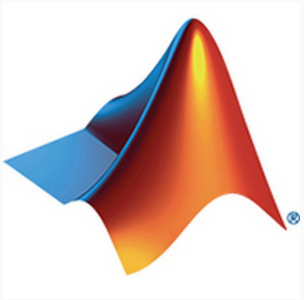
Coding: Code Composer Studio, MATLAB

Debugging: Code Composer Studio

Flash Programming: TI XDS110 JTAG debugger

Revision Control: Git

Testing: Tektronix MDO3024 oscilloscope,
Fluke DMMs, field tests



MCU Resources

Required RAM: 26KB

Required ROM:

- *Internal*: 110KB
- *External*: 2MB

- **UART**
  GPS: 56000 baud
  Bluetooth: 115200 baud
- **SPI**: 16Mbps
- **GPIO**
- **PWM**
- **I^2C**
  100KHz SCL
- **ADC**
  20KHz battery level sampler
- **RTC**

Kernel

- µC/OS III Real Time Operating System
- Expandable
- Reliable
- Familiar

µC/OS by Micriµm

Navigation Task

- Handles all calculations and communications related to navigation
- Reads Accelerometer, GPS, and Magnetometer data to calculate heading and control motors
- Handles fault ISRs and safe shutdown procedure

- Execution Period: 1s
- Execution Time: 100ms
- CPU Load : 10%

Data Logger Task

- Controls the periodic storage of GPS data to ROM

- Execution Period (minimum): 5000ms
- Execution Time: 20ms
- CPU Load: 0.4%

Bluetooth Task

- Controls wireless transfer of data to and from user
- Exclusive execution while in Sync mode

Idle Task

µC/OS system task to be used to enter low power modes.

- Execution Period: N/A
- Execution Time: N/A
- CPU Load: 0

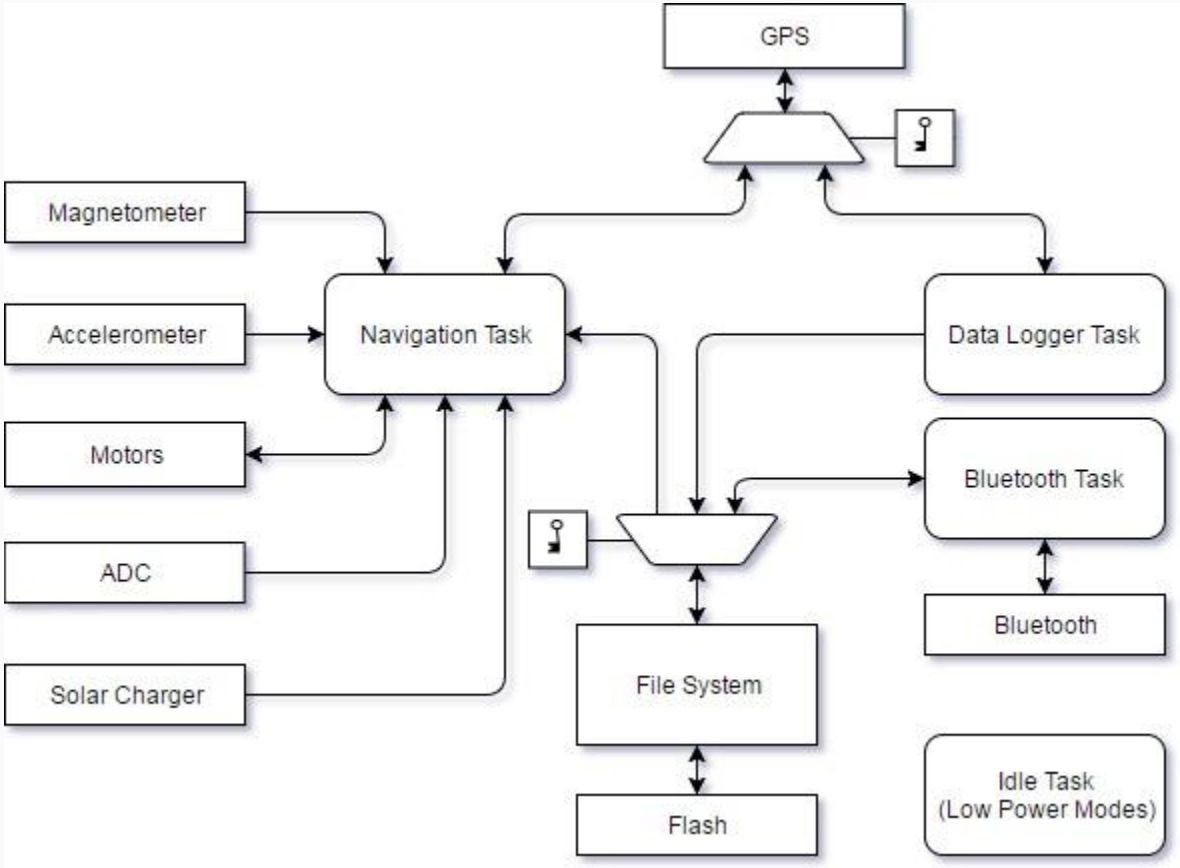
Total CPU Load

10% + 0.4% = 10.4%

Module/Library Description

Module	Tasks	Functions	Data	Licenses
BOATmain.c	Navigation Task Data Logger Task Bluetooth Task		GPS waypoints Battery voltage	Micrium µC/OS III
GPS.c		GPSInit() GPSRead() GPSOff()	GPS text data	ti Driverlib (BSD)
Mag.c		MagInit() MagRead() MagOff()	Direction data	ti Driverlib (BSD)
Motor.c		MotorInit() MotorStart() MotorChangeDuty() MotorStop() MotorISR()		ti Driverlib (BSD)
Flash.c		FlashInit() FlashTransmit()	GPS waypoints	ti Driverlib (BSD)
Accel.c		AccelInit() AccelISR()		ti Driverlib (BSD)
ADC.c		ADCInit() BatteryISR()	Battery Voltage	ti Driverlib (BSD)

Inter-Task Communications



Test Plan

3 phases of testing:

1. Bench testing
2. Controlled environment testing
    a. Will it float?
    b. Basic operation
3. Maiden voyage: Lake Whatcom
    a. Full scale tracking test circumnavigating Reveille Island in Lake Whatcom
    b. Monitor B.O.A.T.'s behavior

Verification Plan

Based on 3 phases of testing:

1. Do all peripherals work properly
2. Make sure B.O.A.T. is buoyant and can perform basic movements
3. Can B.O.A.T. handle more treacherous waters and successfully navigate

Questions