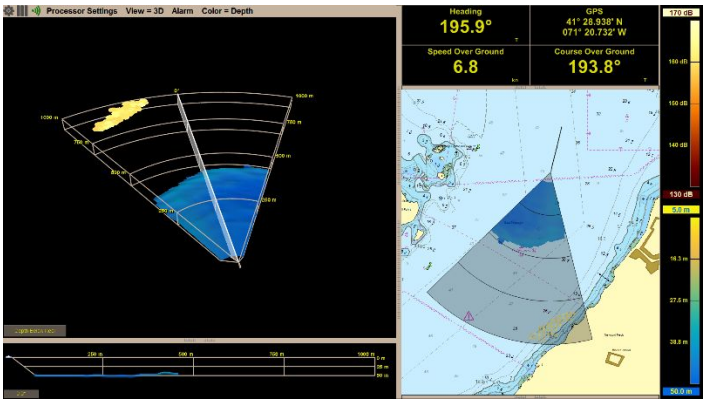
Roll/Pitch Sensor

Roll Pitch Measurement for Sonar Geo Reference

ELECOMP Capstone Design Project 2018-2019



Sponsoring Company:

FarSounder, Inc.
151 Lavan St
Warwick, RI 02888
http://www.farsounder.com

Company Overview:

FarSounder, Inc. is a U.S. based marine electronics manufacturer specializing in underwater acoustics. With unique patented technology, the company has a global customer base of commercial, government, and private sector users. FarSounder is the recognized leader in real time 3D sonar systems and has been selling its flagship navigation and obstacle avoidance systems since 2004.

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Project Motivation:

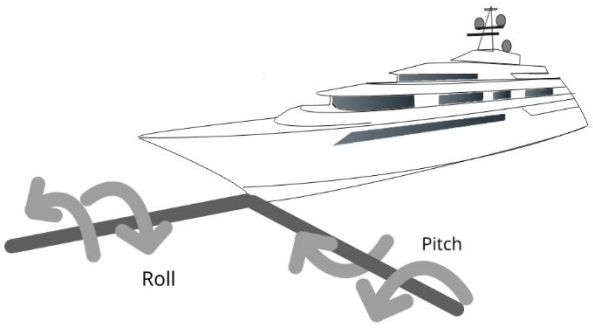
FarSounder 3D forward looking sonar products feature a Transducer Module that both transmits acoustic energy and “listens” for returning echoes over an array of acoustic sensors. The received acoustic signals are digitized and processed to produce a three dimensional representation of navigation hazards in front of the vessel.

Because the receiving elements are within a package affixed to a floating vessel that is constantly in motion, the position of the Transducer Module, in particular its roll and pitch, needs to be measured so that the processed data can be displayed with appropriate geo reference.

The sensor that is currently used to measure roll and pitch is large enough to require a mounting bracket with associated hardware and cabling, and also requires manual configuration. New technologies for multi-axis motion sensing have been coming to the market as single chip devices that run on a few milliamps and take up negligible circuit board real-estate. FarSounder would like to take advantage of these new, less expensive, and physically-smaller devices by having them soldered directly to the data acquisition circuit board.

Anticipated Best Outcome:

The goal of this project is to design and test a solid state device that can be included on the data acquisition circuit board within the existing Transducer Module hardware package. This device will be capable of measuring roll and pitch with sufficient accuracy, precision, and speed to reflect the conditions during which the received sonar signals are sampled.



FAR SOUNDER A WHOLE NEW VISION UNDERWATER

Project Details:

System Engineering tasks include:

- Use FarSounder's existing roll/pitch measurement solution to develop component requirements in collaboration with FarSounder
    - Identify update rate of existing sensor
    - Identify accuracy of existing sensor
    - Identify precision of existing sensor
- Identify if preliminary components identified by FarSounder meet these requirements
- Identify alternate components that meet these requirements
- Identify tests to verify performance metrics
- Identify ways to maximize system performance

Hardware tasks include:

- Obtain evaluation modules of proposed components
- Coordinate a means of reading the output of the evaluation modules
- Identify requirements to interface components with FarSounder data acquisition system
- Interface evaluation module with FarSounder specified DSP
- Design and fabricate a PCB with the proposed components that will interface with the FarSounder data acquisition system

Firmware tasks include:

- Familiarize with SPI and I2C protocols
- Establish communication between device and DSP
- Establish method of configuring and retrieving data from device
- Develop method of verifying performance and acceptability of component

Composition of Team:

- All team members share in developing product requirements, architecture, and test development
- FarSounder Engineering team
- 1 ELE and 1 CPE seniors will split these tasks:
    - Identify and obtain possible sensors and evaluation modules
    - Communicate with and configure sensors via evaluation modules
    - Interface DSP with sensors
    - Measure performance of sensors
    - Compare performance of new sensor with existing solution
    - Design and fabricate PCB to interface one or more solutions with existing hardware

Skills Required:

- Strong desire to learn along with professional drive
- Excellent verbal and written communication skills
- C Programming experience for working with DSP
- Prior experience with DSP beneficial
- Python or MATLAB programming experience for calculations, simulations, and verifications
- PCB design and layout experience beneficial (preference will be given to seniors taking the PCB Design Course (ELE391) with Mike Smith, simultaneously, in the Fall)

Anticipated Best Outcome's Impact on Company's Business, and Economic Impact

By removing a legacy device and hardware assembly, FarSounder's core product will be easier to assemble and service while saving approximately $1,000 in materials cost per system. Additionally, by using a newer sensor product, the risk of component obsolescence will be reduced. This new solution is the first step in making it possible to design new products that demand smaller physical sizes, ultimately leading to new market opportunities. By lowering cost and reducing hardware size, FarSounder envisions a wider line of products with price/performance points suitable for all vessels utilizing a radar.

Broader Implications of the Best Outcome on the Company's Industry:

FarSounder sonar products improve safety and provide new exploration opportunities for ocean going vessels. With existing products detecting navigation hazards as far as 1,000 meters away, it is critical that the sensors used have an accurate reference on which to base the data. By improving upon these sensors, new products may be able to better detect and represent hazards to navigation and possibly help avoid catastrophe at sea.