



# SENIOR DESIGN PROJECT IN ELECTRICAL ENGINEERING



# NMEA 2000 SMART BUOY

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## PROJECT BACKGROUND

The Smart Buoy project can be compared to a NOAA weather buoy which records environmental readings on site and sends those readings to a land-based location. The data is subsequently displayed on the internet for public access. NMEA 2000 is a data communication standard that is used to connect marine sensors, developed by the National Marine Electronics Association. It is an update of the NMEA 0183 standard, which is being phased out due to its slow communication speed, limited message size, and its bulky physical requirements. Using NMEA 0183 every sensor must have its own set of wires to connect to each sensor. A NMEA 2000 network uses the updated data standard to connect multiple sensors and displays, using only one connection wire for the entire network. On board the buoy are two COTS (commercial off the shelf) sensors that are NMEA 2000 compatible. The first sensor is an AIRMAR 200WX weather sensor, and the second is a Lowrance EP-80R water temperature sensor. Both sensors are connected to a laptop via a NMEA 2000 to USB converter. The laptop is then connected to a CaptiFi antenna which converts raw NMEA 200 data to text, and sends the readings to a computer in McAllister Hall which displays the data on a Google website.

## RAW NMEA DATA

ID	Name	Description	Src	Dest	Prio	Time
127200	Vessel Heading		1	AM	2	4/21/02
127251	Track of Turn		1	AM	2	4/21/02
128025	Position Report U		1	AM	2	4/21/02
128026	COG & SOG, Ra		1	AM	2	4/21/02
130006	Wind Data		1	AM	2	4/21/02
120082	System Time		1	AM	3	4/21/02
127257	Latitude		1	AM	3	4/21/02
128028	GNSS Position D		1	AM	3	4/21/02
128033	True S. Date		1	AM	3	4/21/02
130230	Lowrance Tempo		2	AM	5	4/21/02
130232	Metecological St		1	AM	5	4/21/02
130800	Amarr Additional		1	AM	5	4/21/02
128039	GNSS DOPs		1	AM	6	4/21/02
127258	Magnetic Variation		1	AM	7	4/21/02

## WEBSITE



## COMPLETED PRODUCT



## RESULTS

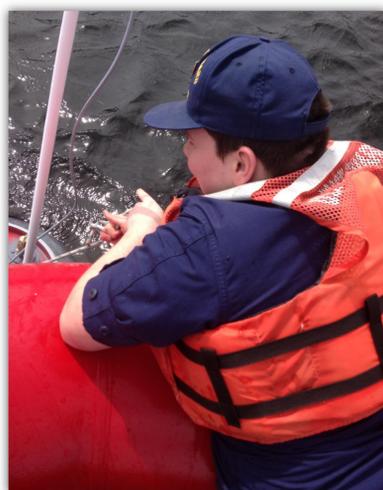
N2K SMART BUOY WAS A SUCCESS, BEING ABLE TO RECORD ENVIRONMENTAL CONDITIONS ON THE THAMES RIVER AND SEND THE DATA IN A TEXT FILE FORMAT TO A COMPUTER IN McALLISTER HALL. THIS COMPUTER THEN PARSED THIS DATA AND USED IT TO POPULATE A GOOGLE WEBSITE AND A MICROSOFT ACCESS DATABASE. ANY USER IS ABLE TO ACCESS THE GOOGLE WEBSITE TO VIEW THE CURRENT CONDITIONS ON THE THAMES RIVER, WHILE THE MICROSOFT ACCESS DATABASE SERVES AS A RECORD OF PAST CONDITIONS ON THE RIVER.

## PHYSICAL NETWORK

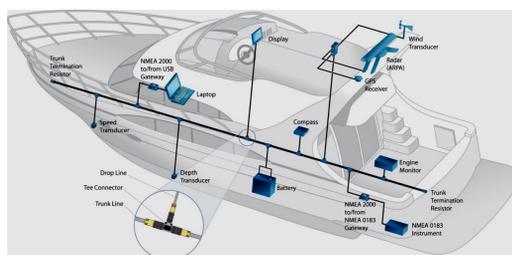


## PROJECT DELIVERABLES

- OPERATIONAL NMEA 2000 COMPATIBLE BUOY
- WEBSITE TO DELIVER INFORMATION TO CUSTOMERS
- SOFTWARE TO CONVERT PHYSICAL BITS OF NMEA 2000 DATA TO TEXT
- CONSOLE APPLICATION TO SAVE NMEA 2000 DATA TO MICROSOFT ACCESS DATABASE AND GOOGLE SPREADSHEET



## SAMPLE NMEA 2000 NETWORK



## PROJECT PURPOSE

IN ORDER TO KEEP COAST GUARD SMALL BOATS UP TO DATE AND MISSION CAPABLE, THE COAST GUARD MUST LEARN HOW TO OUTFIT ITS ASSETS WITH THE NMEA 2000 DATA STANDARD. IN ORDER TO GAIN A BETTER UNDERSTANDING OF THE STANDARD, OUR GROUP WAS TASKED TO INVESTIGATE THE NMEA 2000 STANDARD. BY MERGING COAST GUARD NEEDS WITH ACADEMY NEEDS, WE DEVELOPED THE IDEA OF A WEATHER BUOY THAT RUNS ON THE NMEA 2000 STANDARD WHICH CAN DELIVER LIVE WEATHER DATA TO THE ACADEMY, IN ORDER TO INFORM THE ACADEMY COMMUNITY OF CURRENT THAMES RIVER CONDITIONS.



## FUNCTIONAL DESIGN

