

Electronic buoy

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Introduction

- Team 3:
 - Bennet Möller, International Purchases and Sales Engineering
 - Emil Konrad Wlazlo, Mechanical Engineering and Applied Computer Science
 - Mateusz Tarkowski, Mechanical Engineering and Applied Computer Science
 - Toon Van den Bleeken, Building and Civil Engineering

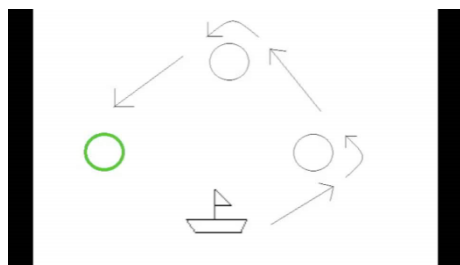
Introduction

- Table of contents:
 - Introduction of the project
 - State of the art
 - Project development
 - Marketing Plan
 - Energy and sustainability
 - Ethics and deontology
 - Conclusions

Introduction

- Project description
 - 2 functions

Regatta mode



- reconfigurable

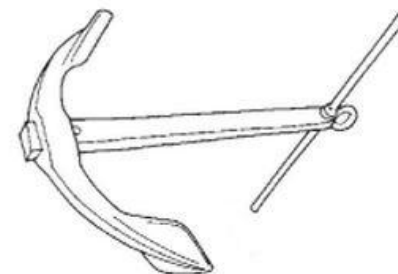
- Motivation

Environmental mode



State of the Art

Anchors



Batteries



	Lead-acid	Nickel-cadmium (NiCd)	Nickel-metal-hydride (NiMH)	Lithium-ion (Li-ion)	Li-polymer
Specific energy density (Wh/kg)	30-50	45-80	60-120	150-190	130-200
Cycle life	200-300	1000	300-500	1200	>1000
Fast-charge time (h)	8-16	1	2-4	1 or less	1 or less
Nominal cell voltage (V)	2	1,2	1,2	3,6	3,6
Self-discharge/month (%)	5	20	30	5	5
Toxicity	Very high	Very high	Low	Low	Low
Price	Moderate	Low	High	High	Very high

State of the Art

Camera



Product name	<i>Superyacht Underwater Colour Surveillance System</i>	<i>GoPro Hero 3 - black edition-</i>	<i>Logitech HD Webcam C270</i>
Price [€]	250	449	19,99
Dimensions (l x w x h) [mm]	188 x 40 x 95.5	59 x 41 x 21,2	/
Weight [g]	363	73	/
Power supply voltage [V/mAh]	12 / 500	/	/
Energy consumption [W]	24	/	/
Waterproof [yes/no]	Yes	Yes	No
UV-proof [yes/no]	Yes	No	No
Working temp. [°C]	-5 to 70	/	/
Others:			
- Interface	- 420p	- USB/SD	- USB
- Resolution	- 20m	- 1080p	
- Waterproof (depth)		- 60m	
- Battery type		- 1050mAh lithium-ion	
Special features	9 LEDs	- Ultra wide angle - Ultra sharp - Internal memory - Waterproof housing	
Advantages	- Small - Integrated datalogger	- HD - Housing	- Price
Disadvantages	- Price - Energy consumption - Dimension	- Power consumption - Price - Charging option	

State of the Art

Communication



	GSM	UMTS	Wi-Fi	Bluetooth
Max range [m]	35 000	?? (a little less than GSM)	150	100
Max data capacity [Mb/s]	0,23 (EDGE)	21,6	1024	40
Power consumption	high	high	moderate	low
Need of in-between device	yes	yes	No (Wi-Fi Direct)	No
Cost of module (€)	50 - 150	100 - 550	10 - 50	5 - 90

State of the Art

Control unit



Product name	STM32VL Discovery	STM32F3 Discovery	STM32F4 Discovery	Raspberry Pi B	Arduino Uno
Price [€]	8	13,5	12	28	17
Voltage needed [V]	5 or 3.3	5 or 3	5 or 3	5	3,3 or 5
Working temp. [°C]	-40 to +85	-40 to +85	-40 to +85	0 to +70	-40 to +85
Microcontroller:	STM32F100RBT6B	STM32F303VCT6	STM32F407VGT6	ARM1176JZF-S	ATmega328
- Flash memory [kB]	128	256	1024	?	32
- RAM [kB]	8	48	192	512*1024	2
- core frequency [MHz]	24	72	168	700	16
- number of pins [-]	64	100	100	26	
- max current consumption [mA]	15,4	66,2	93	??	0,2
-supported interfaces (number):	- I2C (2) - USART (3) - SPI (2) - CEC (1)	- I2C (2) - USART (3) UART (2) - SPI (3) - CEC (1) - I2S (2) - CAN (1) - USB (1)	- I2C (3) - USART (4) - UART (2) - SPI (3) - CEC (1) - I2S (2) - CAN (2) - USB (1) - SDIO (1) - ethernet (1)	- I2C (1) No info - UART (1) - SPI (1) No info No info - USB (2) - SDIO (1) - ethernet (1)	-I2C (2) - USART (1) - SPI (1)
Number of I/O	51 GPIOs	45 normal GPIOs, 42 5V tolerant GPIOs	82 GPIOs	8 GPIOs	14 digital I/O, 6 analog inputs
Fixed interfaces				- HDMI - LAN - RCA video	
Special features		- accelerometer - gyroscope - e-compass	- accelerometer - 2 motion sensors - microphone	- SD card socket	

State of the Art

Data storage



	Hard disk <i>WD MY PASSPORT</i>	Optical disk		Flash drive <i>Toshiba USB 3.0 Flash Drive</i>	Flash memory card <i>Sandisk SDHC Extreme</i>
		CD	DVD		
Maximum capacity	500 GB	700 MB	4,7	32 GB	32 GB
Data transfer speed (MB/s)	30-40	7,8	1,3	100	30
Dimensions (mm)	83 x 110 x 15 (w x d x h)	120 x 1,2 (diameter x h)	120 x 1,2 (diameter x h)	21 x 69 x 10 (w x d x h)	24 x 32 x 2.1 (w x d x h)
Weight (g)	140	15	15	15	2,5
Power consumption for transferring data	High	High	High	Low	Low
Price	€90	< €1	1€	€30	€25

State of the Art

Sensors

- Wind speed and direction sensor
- Buoy orientation sensor
- Air temperature sensor
- Air pressure sensor
- Current speed and direction



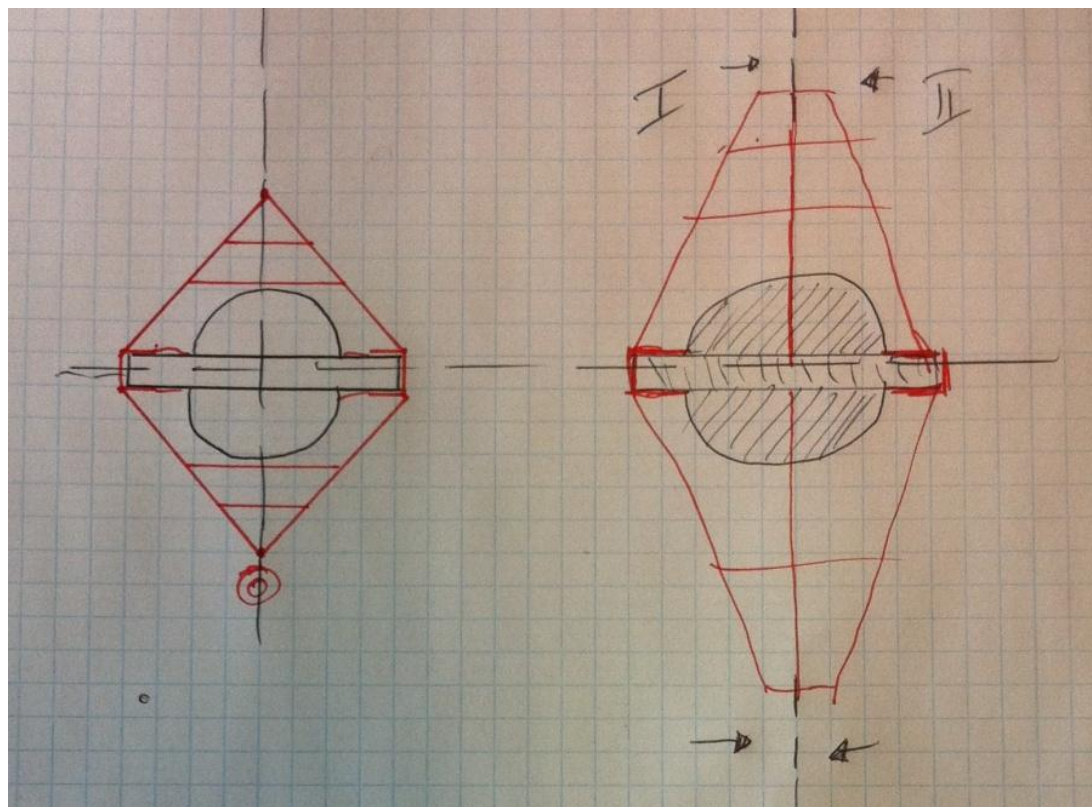
Project Development

Materials

Part	Product	Price	Quantity	Source
Fiberglass hull	Fiberglass hull	€0	1	LSA
Microcontroller	STM32F3 Discovery kit	€13,5	1	LSA
Battery	Lithium-polymer battery	€0	?	LSA
Wind speed and direction sensor	Mechanical wind speed and direction sensor	€0	1	LSA
CTD sensor	Developed by a professor at ISEP	€0	1	LSA
Steel structure	Stainless steel	+/- €600	1	ISEP
Anchor for sand bottom	Danforth standard galvanized anchor	€19	1	www.defender.com
Anchor for rock bottom	Lewmar Horizon Claw Anchor	€32	1	www.defender.com
Data storage	Flash memory card	€25	1	www.sandisk.com

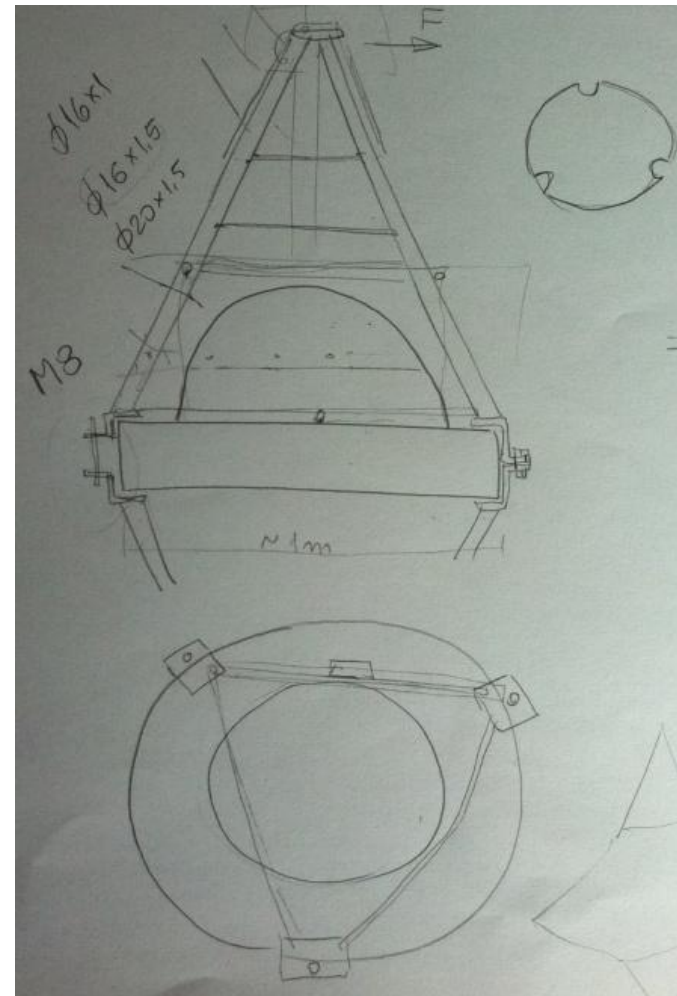
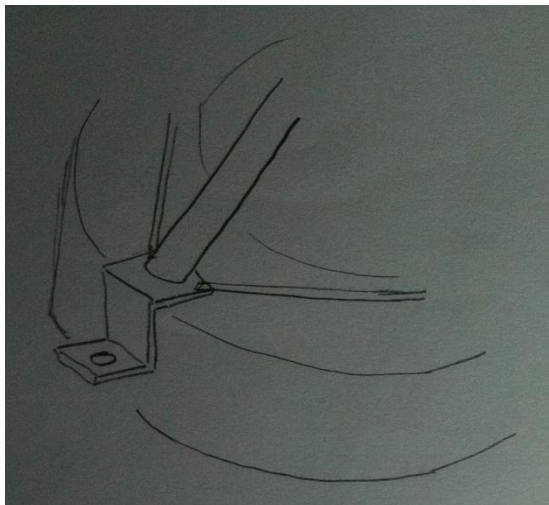
Project Development

Architecture Steel structure



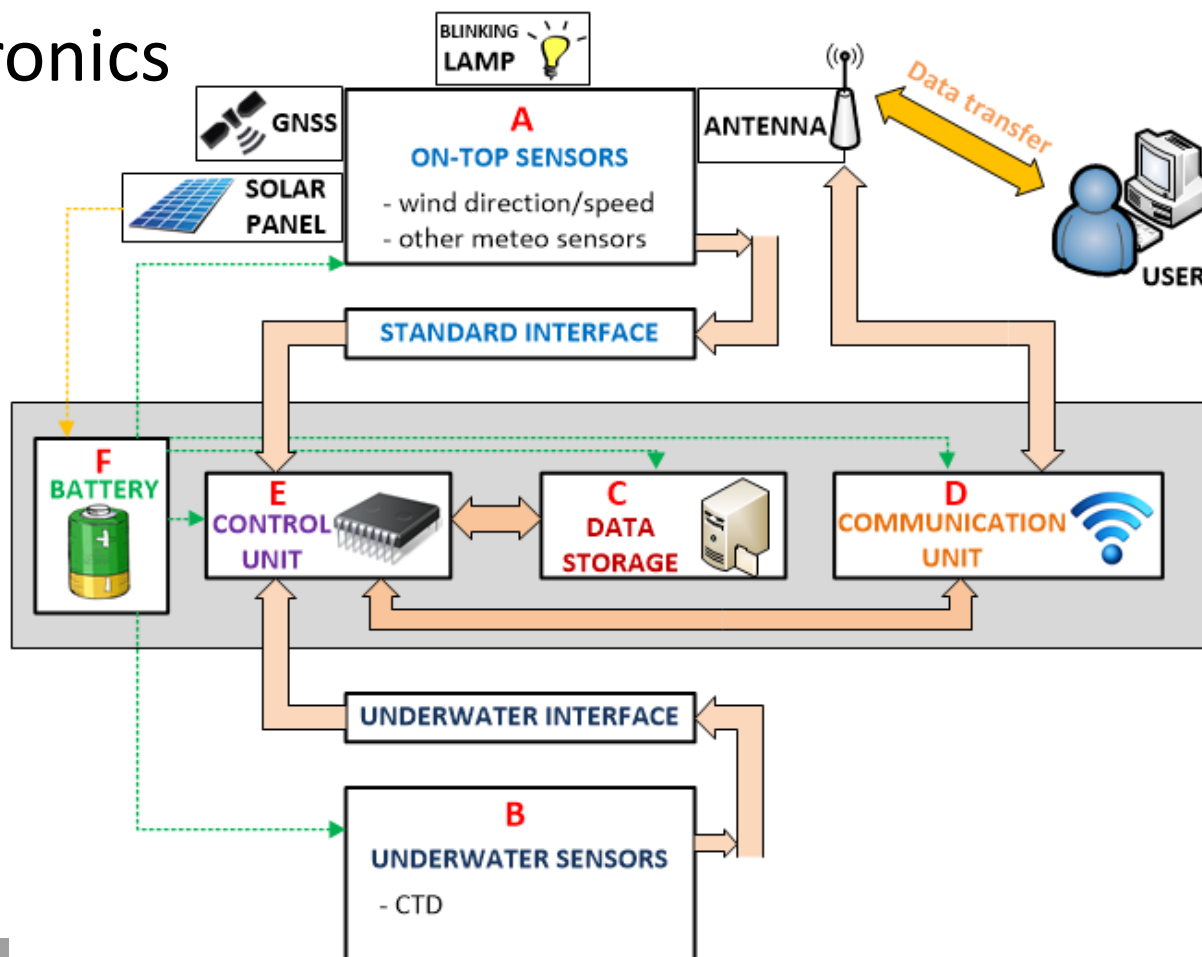
Project Development

Architecture Steel structure

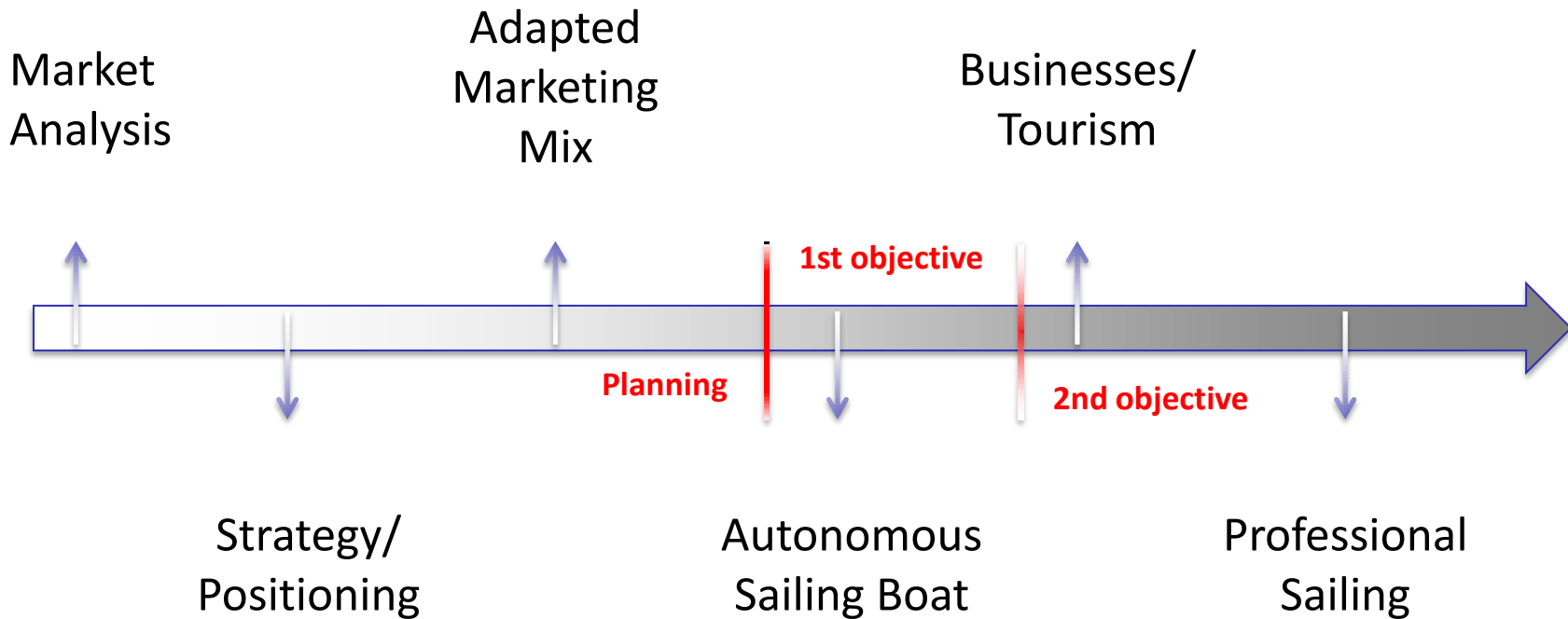


Project Development

Architecture Electronics



Marketing Plan



Energy and Sustainability

- The three E's [1]



- General concerns before and during development:
 - the reuse of materials and reduction of raw material
 - reduction of power consumption
 - use of eco-friendly materials

Energy and Sustainability

- Materials for the prototype
 - batteries
 - electronic components
 - fibreglass hull
 - stainless steel structure
- LCA of the final product [2]
- Future improvements
 - solar panels [3]
 - servomotor
 - certificates and labels



Ethics and Deontology

- General concerns:
 - Code of ethics
- Four main ethical aspects
 - engineering ethics
 - sales and marketing ethics
 - academic ethics
 - environmental ethics



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Conclusions

- **Achievements:**
 - solid background knowledge about issues related to buoys
 - profound research on required State of the Art
 - decent concept of steel structure
 - general architecture of buoy's electronics
 - first choices concerning some components
 - solid market analysis
 - decisions how to apply sustainability in our project
- **Future Recommendations/Developments:**
 - choose and buy all components
 - create precise drawings: steel structure, electrical schematics, signals
 - figure out how to combine all components and build the prototype
 - do all necessary tests

Thank you for your attention!

References & Bibliography

- For the references of 'State of the Art' and 'Project Development' you can consult the interim report
- [1] California Student Sustainability Coalition, „The Three E's of Sustainability,” [Online]. Available: http://www.sustainabilitycoalition.org/_excerpt/the-three-es-of-sustainability. [Accessed 6 April 2013].
- [2] SolidWorks, „Life Cycle Assessment,” 2009. [Online]. Available: http://www.solidworks.com/sustainability/design/2722_ENU_HTML.htm. [Accessed 8 April 2013].
- [3] Solar Power Resources, “Most Efficient Solar Panels In The Market,” [Online]. Available: <http://www.ontario-sea.com/most-efficient-solar-panels-in-the-market/>. [Accessed 10 April 2013].