

# Autonomous SailBoat

Estudo preliminar e proposta

# Email colaboradores

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(favor preencherem aqui os seus emails)

Módulo de energia (liga e desliga barco pelo controle remoto)

Quem desenvolveu o módulo de energia na PUCRS:

- Guilherme heck
- heckgui@gmail.com

# Projeto Atual NBoat-UFRN

# Links importantes do projeto

Projeto Atual NBoat - UFRN

Site Docs: <https://nboat-documentation.readthedocs.io/en/master/index.html>

Trello:

<https://trello.com/invite/b/QkVBSZVx/77e12984a26b566ea53c6bccba184d20/nboat-constru%C3%A7%C3%A3o>

<https://trello.com/invite/b/l0wS5HER/f9e4bd0ce091755a3661ba295378b9c5/trabalhos-uff>

Google Drive:

[https://drive.google.com/drive/folders/1q38gfsI9PdQJXJiWq1MY8W6JsQIL--\\_2?usp=sharing](https://drive.google.com/drive/folders/1q38gfsI9PdQJXJiWq1MY8W6JsQIL--_2?usp=sharing)

# Partes de um veleiro

opções de comunicação (pensar)

**Mastro:** Suporte central que serve para dar sustentação vertical à vela.

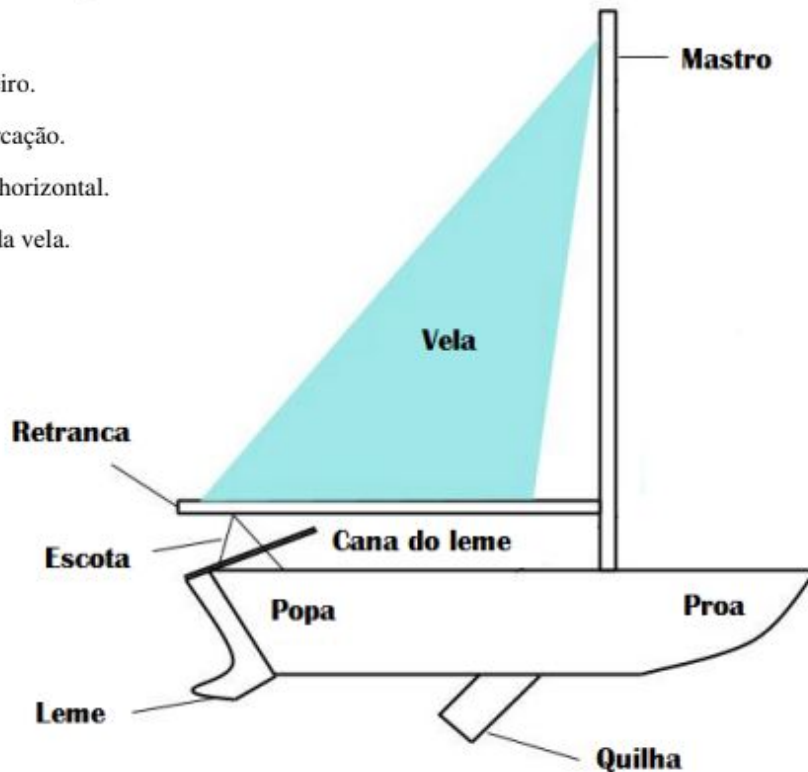
**Vela:** Superfície responsável por captar o vento e dar velocidade ao veleiro.

**Leme:** Lâmina submersa que permite mudanças na orientação da embarcação.

**Retranca:** Haste situada no inferior da vela, que serve para seu suporte horizontal.

**Escota:** Cabo conectado a retranca e utilizado para alterar a angulação da vela.

**Cana do leme:** Auxilia na mudança de orientação do leme.



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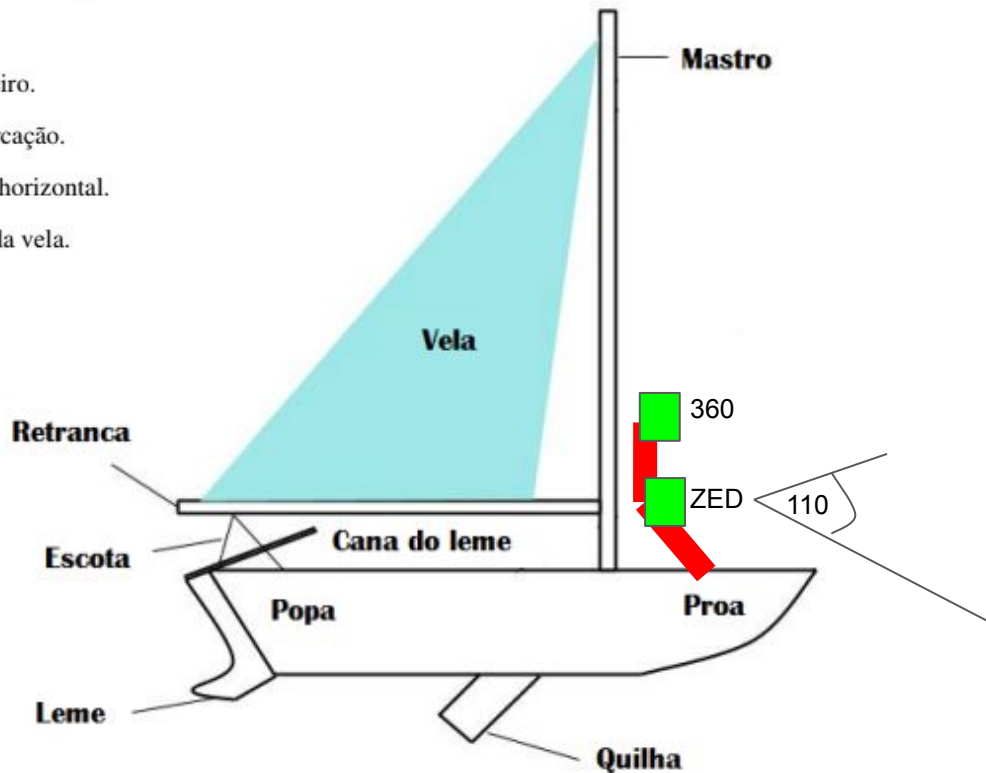
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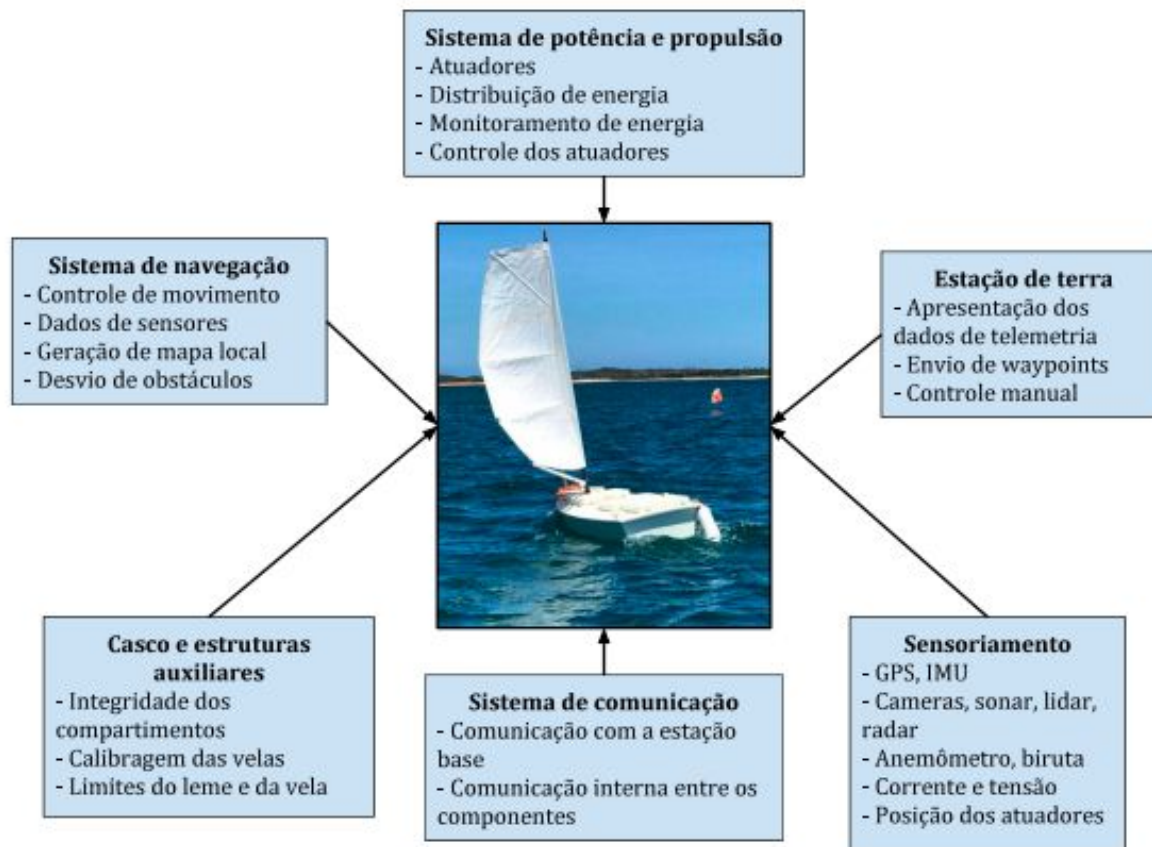


# Arquitetura de hardware do veleiro Nboat



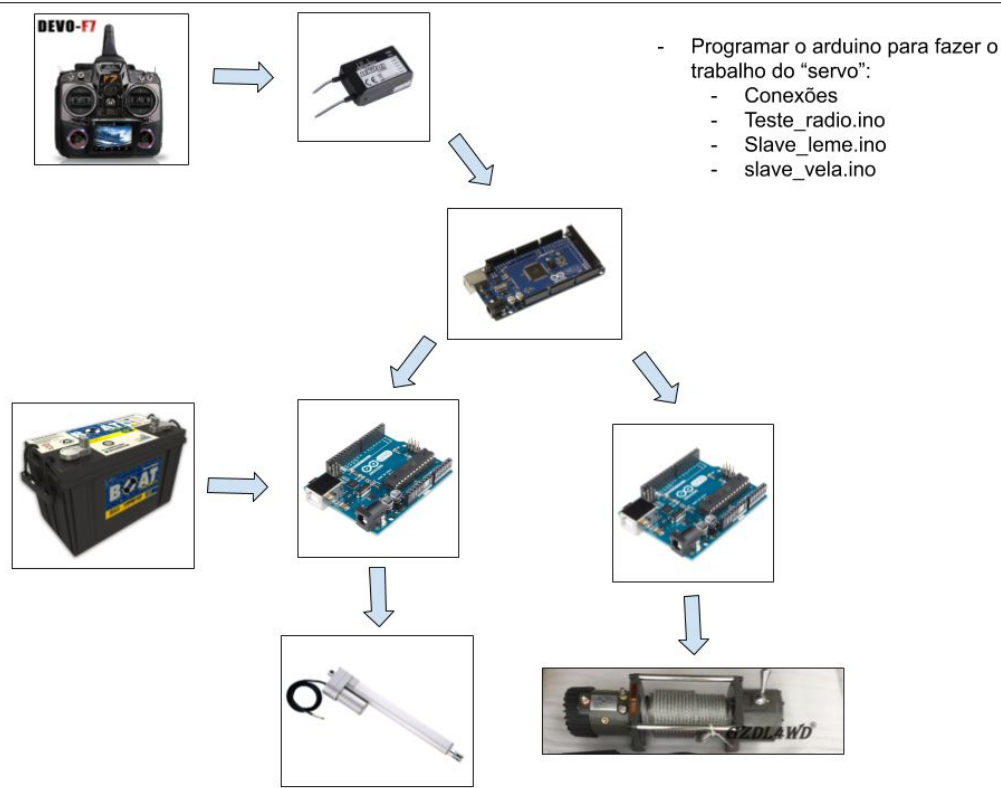
1. Pixhawk 2.4.6;
2. Arduino Mega;
3. Driver vnh5019 para os atuadores;
4. Atuador linear do leme;
5. Potenciômetro do leme;
6. Mini-guincho para atuar a vela;
7. Potenciômetro da vela;
8. Bateria náutica;
9. Sensores do vento;
10. GPS, IMU;
11. Telemetria 433 MHz;
12. Transmissor e receptor Rádio R7;

# General diagram of the autonomous system for NBoat





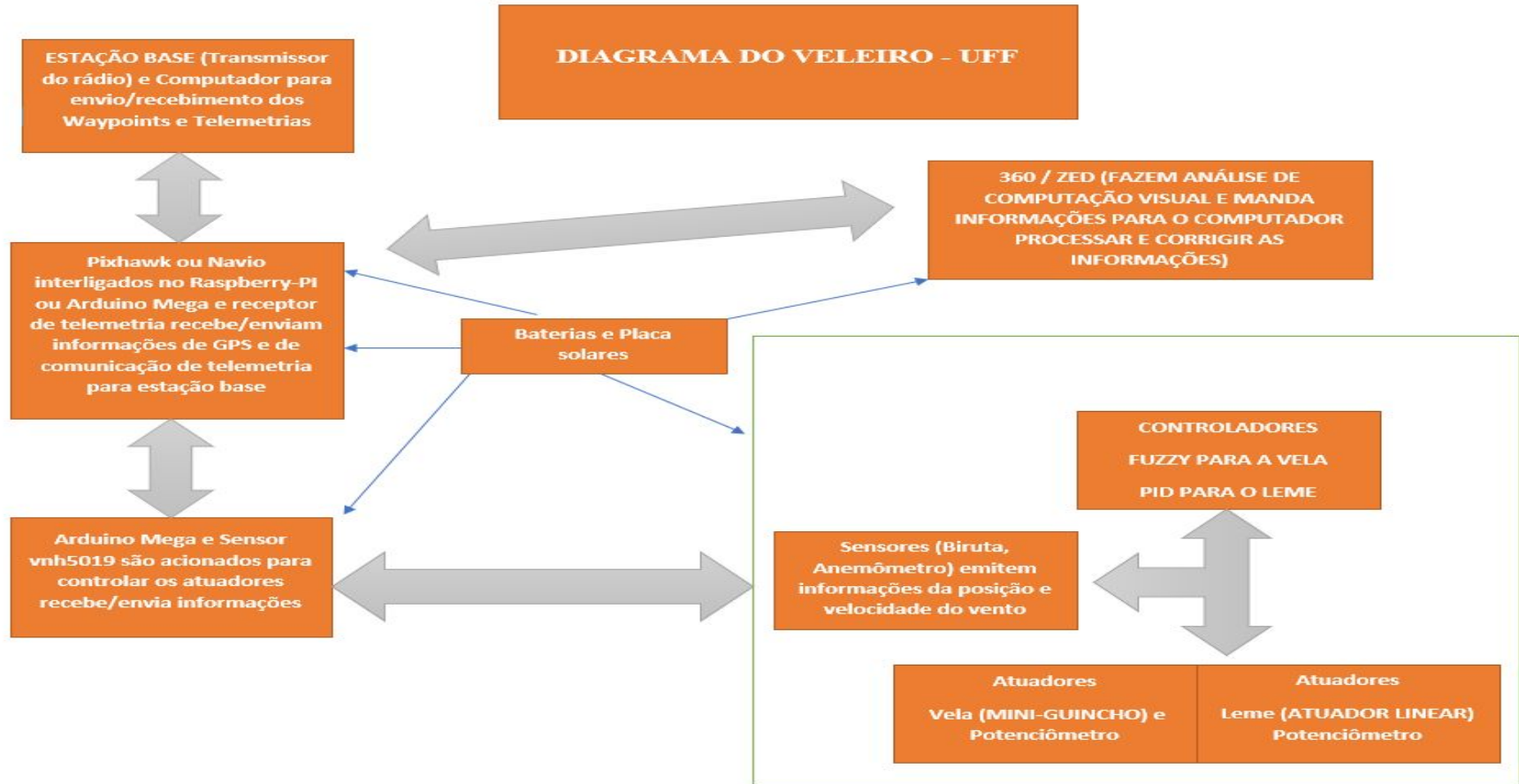
# Arduino programming for servo work



Primeira versão da eletrônica do Nboat (controle RC)

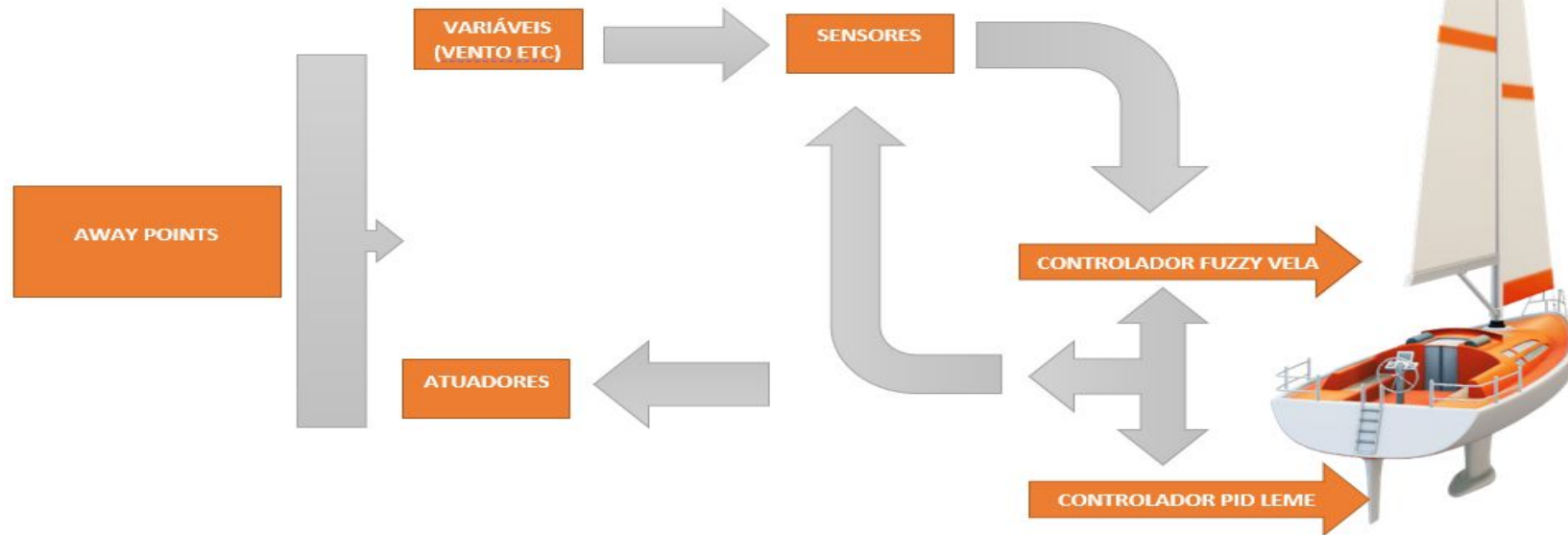
fonte: Trello NBoat

# Electronic System: Components and Communication



# Control System State Machine

CONTROLADORES DO VELEIRO - UFF



# Projeto Proposto (NOME\_VELEIRO) - UFF

## Fase 1

# Links importantes do projeto

Projeto Proposto UFF

Site Docs (wiki): a definir

Trello: a definir

Artigo referência de diagramas:

<https://www.frontiersin.org/articles/10.3389/frobt.2021.630081/full>

A seguir, os diagramas do artigo de referência  
para nos orientarmos e criarmos os nossos  
próprios

Slide dessa cor, figura  
retirada do artigo

# Components layout diagram



Diagrama referência do artigo:

[https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image\\_m/frobt-08-630081-g003.jpg](https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image_m/frobt-08-630081-g003.jpg)

# Components layout diagram



# Bills of Material

Component	Description	Cost per unit currency	Sources of Materials
Arduino mega 2,560	Microcontroller (16 MHz clock, 8 KB SRAM)	¥200RMB	Semiconductor
Pixhawk V2.4.8	State observer (STM32F427 and STM32F103)	¥400RMB	Semiconductor
GPS u-blox M8N	Gnss receiver	¥200RMB	Semiconductor
Battery	Lipo pack 2200 mAh 3S25C	¥80RMB	Battery
Wireless module	E62-433T30D (433 MHz)	¥200RMB	Semiconductor
Winch servo	Futaba S3010	¥200RMB	Motor
Rudder servo	Futaba S3102	¥200RMB	Motor
Wind vane sensor	Magnetic rotary encoder AS5040	¥200RMB	Other
Sailboat	Hull, keel, rudder, sail and rigging	¥8000RMB	Other
	Total	¥9680RMB	

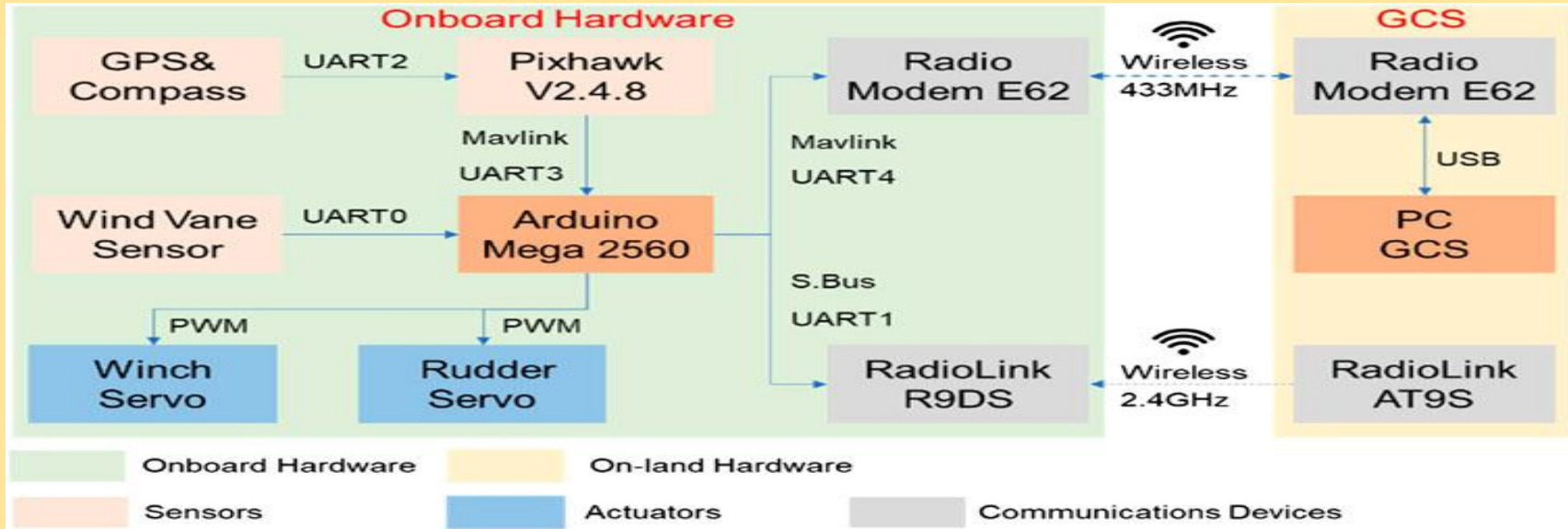
referência:

[https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image\\_m/frobt-08-630081-t003.jpg](https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image_m/frobt-08-630081-t003.jpg)

# Bills of Material

# Definição do Motor elétrico e diagrama elétrico

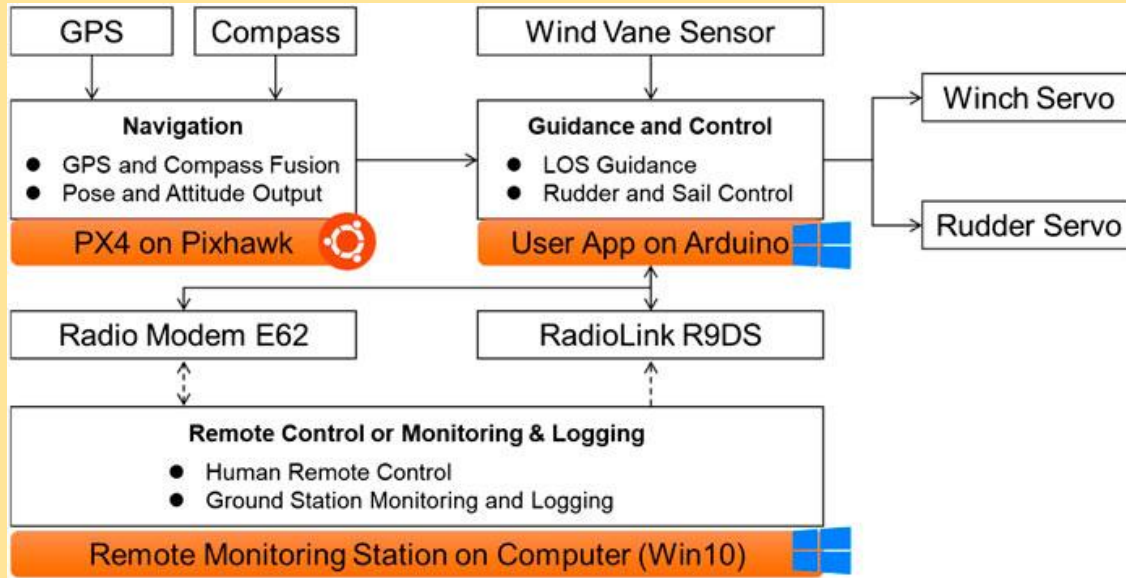
# Hardware connection diagram



ref: [https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image\\_m/frobt-08-630081-g004.jpg](https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image_m/frobt-08-630081-g004.jpg)

# Hardware connection diagram

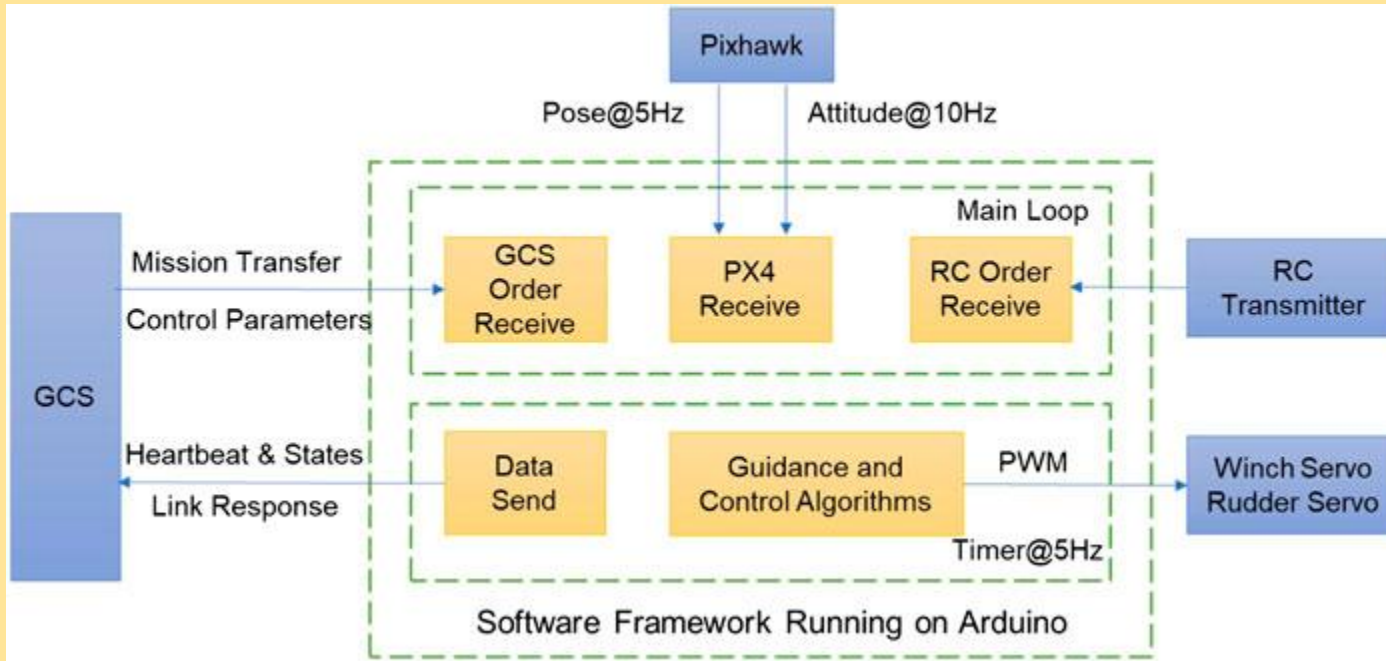
# Illustration of functionality of microcontrollers and remote computer



ref: [https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image\\_m/frobt-08-630081-g005.jpg](https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image_m/frobt-08-630081-g005.jpg)

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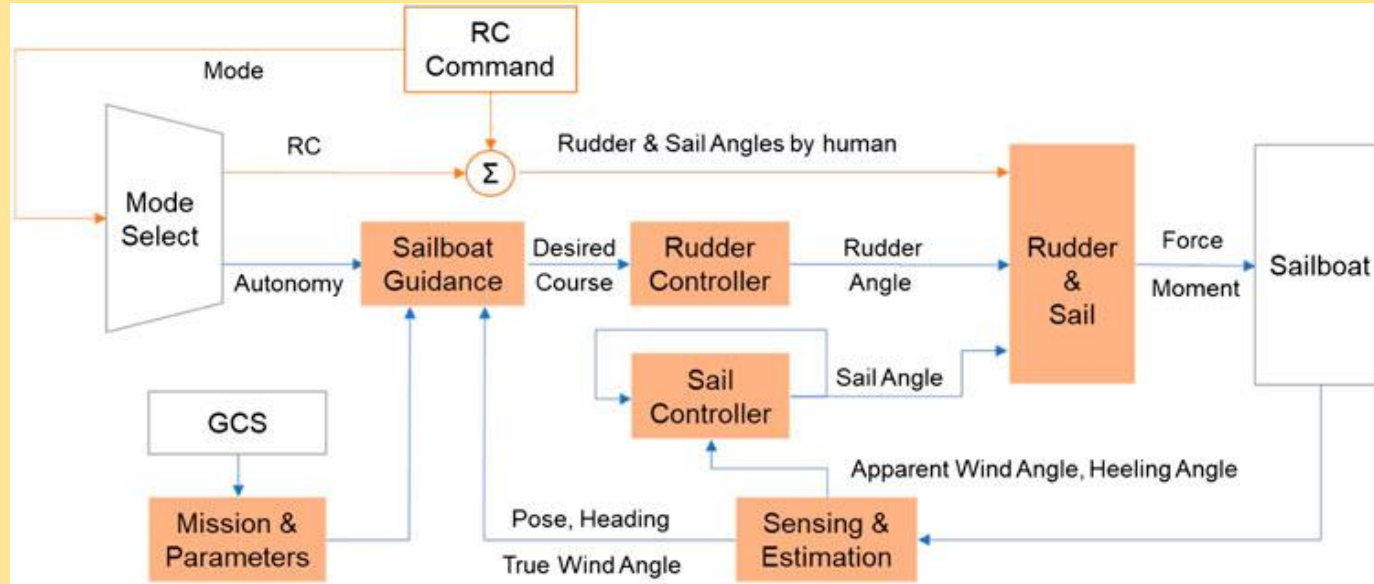
# Software framework running on Arduino Mega 2,560 microcontroller





Software framework running on Arduino Mega 2,560  
microcontroller

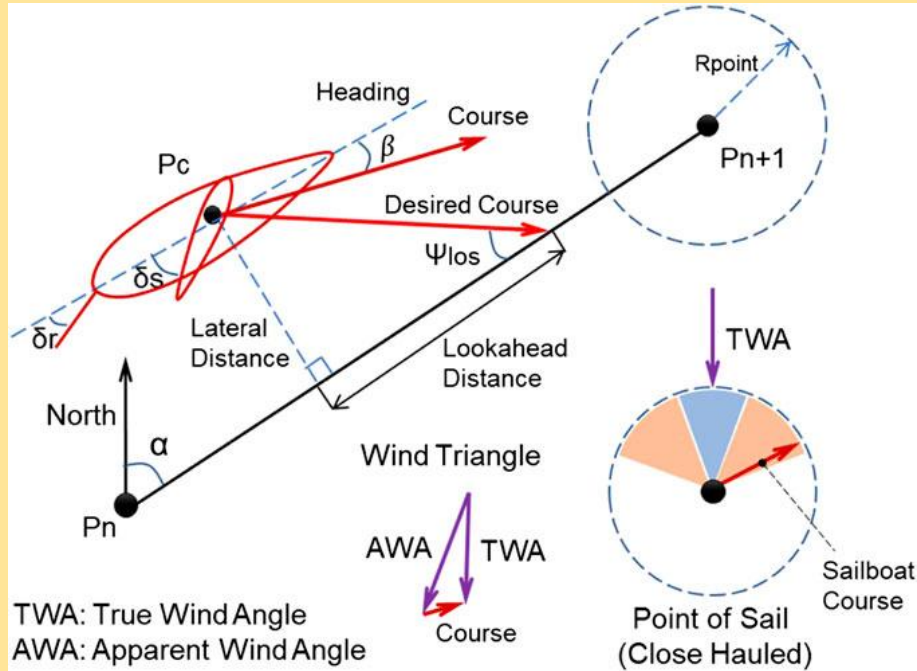
# Guidance and control structure of sailboat



ref:[https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image\\_m/frobt-08-630081-g008.jpg](https://www.frontiersin.org/files/Articles/630081/frobt-08-630081-HTML/image_m/frobt-08-630081-g008.jpg)

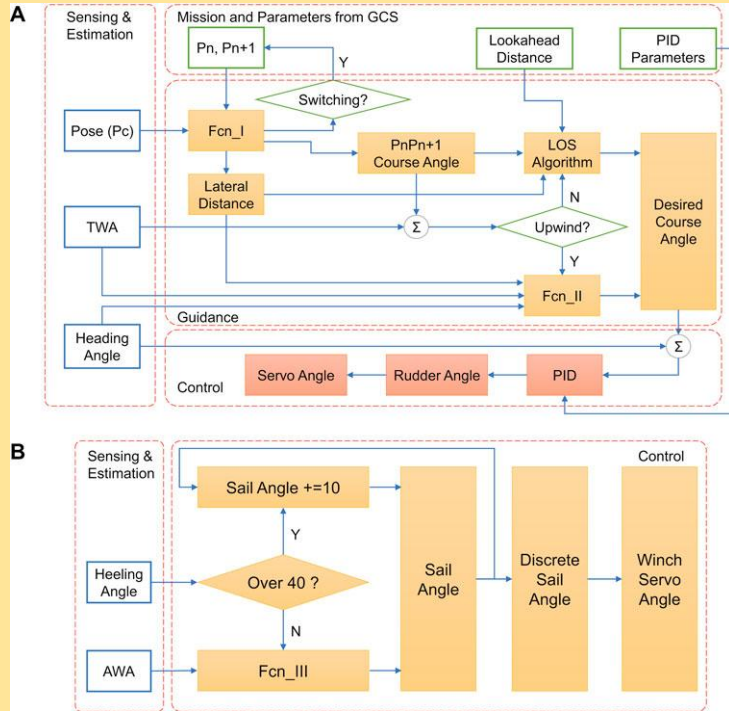
# Guidance and control structure of sailboat

# Autonomous sailboat sailing and guidance principle (analysis at horizontal plane)



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# Detailed block diagram of control architecture, (A) Sailboat guidance and rudder controller, (B) Sail controller.



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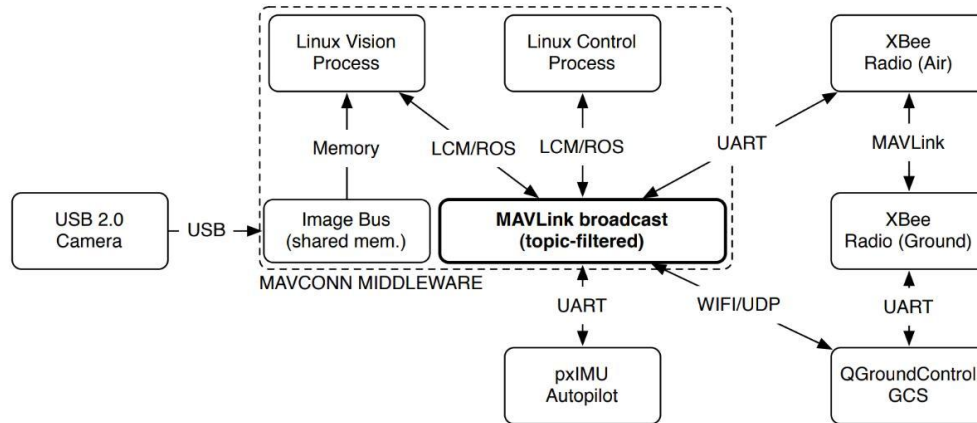
# Proposta de evolução de arquitetura

## Fase 2



# Visão Computacional e ROS - Responsável atual Alex

“Acho que colocando o ROS (sobre a Navio 2 ou a **Jetson/Xavier**) e os arduinos fazendo o baixo nivel, seria uma contribuicao legal... o pessoal de software iria agradecer muito. Facilitaria a vida. Tem que replanejar tambem a comunicacao entre cada modulo/tanque e a comunicacao (e telemetria) com a estacao de terra.” (**Prof LM**)



- OpenPilot project
- Software: OpenPilot(Empresas Automobilisticas Usando)
- ROS
- Tecnologia: PIXHAWK
- Uso: Drone
- Ground robotics toolkits offer a very wide range of sensor drivers and computer vision and simultaneous localization and mapping (SLAM) packages.
- Their communication infrastructure does however require all components to support either TCP/IP or UDP connections

# Proposta de Inclusão da Jetson com ROS para permitir...

- Reinforcement Learning for Navigation
- Horizon line Detection
- SLAM
- Mapping
- Uso de LIDAR, Cameras
- Incluir Telemetria
- Estação Terra

**ZED camera:**  
\$449.00



lidar: \$349,00



# Desenho da arquitetura proposta com Jetson e ROS

- Criar simulação no Gazebo
  - USV\_SIM  
([https://github.com/disaster-robotics-proalertas/usv\\_sim\\_isa](https://github.com/disaster-robotics-proalertas/usv_sim_isa))
- Arquitetura em andamento



Roll over image to zoom in

## NVIDIA Jetson AGX Xavier Developer Kit (32GB)

Visit the [NVIDIA Store](#)

★★★★★ 53 ratings

Amazon's Choice for "nvidia xavier"

Price: **\$699.00** & **FREE Returns**

**Pay \$58.25/month for 12 months** (plus S&H, tax) with 0% interest equal monthly payments when you're approved for an Amazon Store Card.

Series	Jetson AGX Xavier
Brand	NVIDIA
Graphics Coprocessor	NVIDIA Volta - 512 CUDA and 64 Tensor cores
Chipset Brand	NVIDIA
Graphics RAM Type	72-Pin EDO SIMM Memory

### About this item

- Newly updated version with an additional 16GB of memory for a total of 32GB of 256-bit wide LPDDR4X memory.
- NVIDIA Jetson Xavier is an AI computer for Autonomous Machines with the performance of a GPU workstation in under 30W
- The Jetson Xavier Developer Kit with Jetson Xavier module and reference carrier

**\$699.00**

& **FREE Returns**

**FREE delivery: Monday, March 29** [Details](#)

**Fastest delivery: Today**  
Order within 3 hrs and 30 mins  
[Details](#)

📍 Deliver to Marcos - San Francisco 94109

**In Stock.**

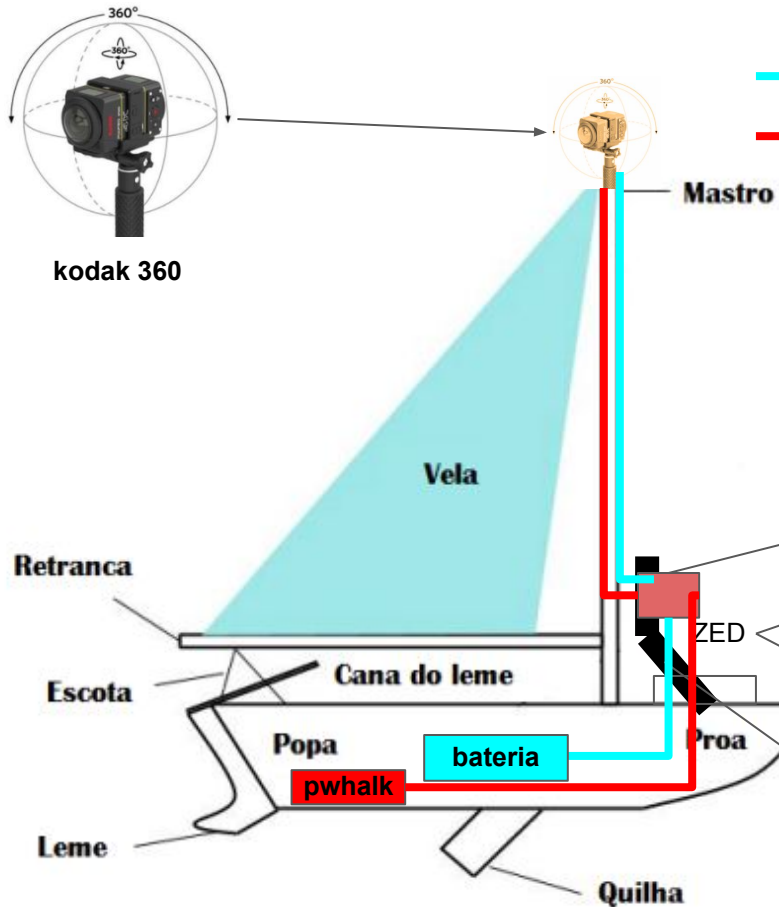
Qty: 1

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**Buy Now**

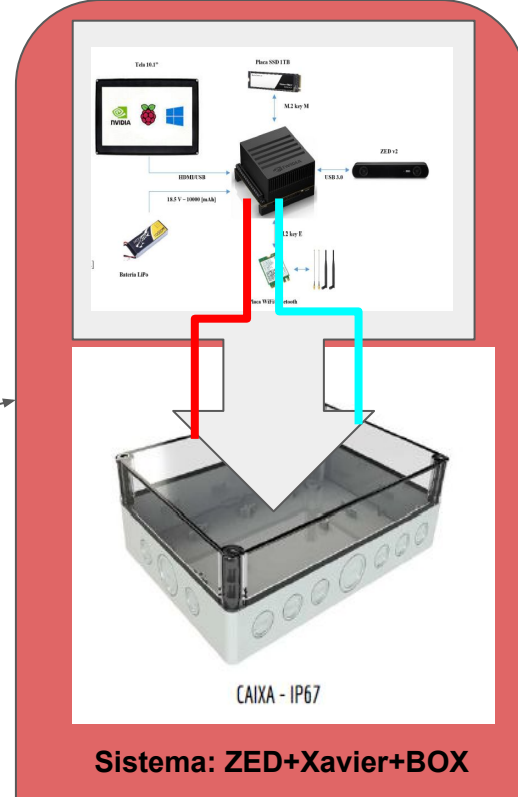
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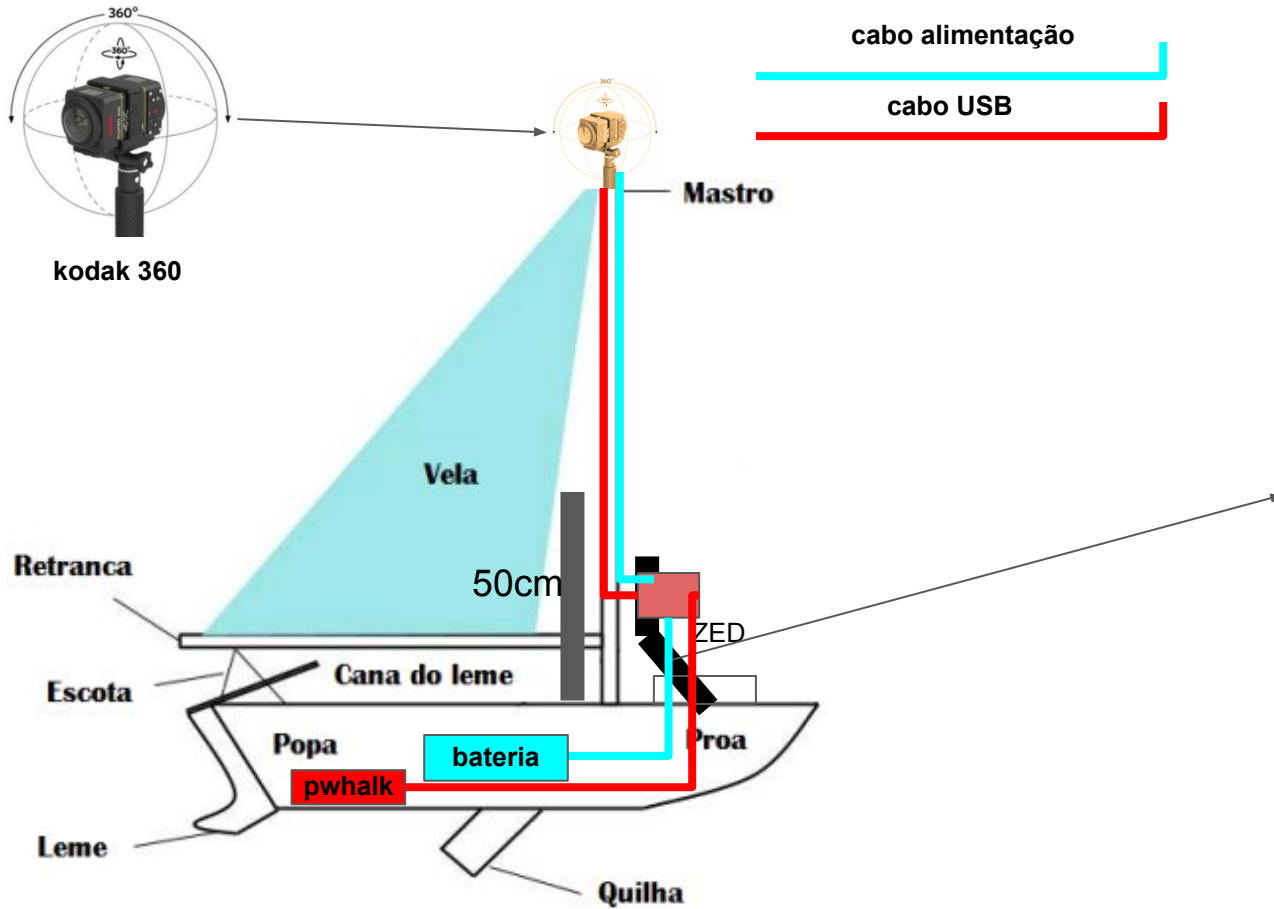


## Sistema: ZED+Xavier+BOX

# Estrutura e cabos visão



**suporte na lateral das escotilhas**



Estrutura e cabos visão

suporte na lateral das escotilhas