Turtlebot 3

Mini curso SAPCT

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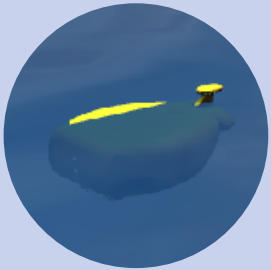
Introduction

The main objective of this research is to propose an AUV model with small dimensions, capable of carrying missions on sea coastal and shallow waters with 50 meters deep. For this project, is expected:

1. A navigation system able to navigate in indoor and outdoor environments
2. Identify and avoid objects
3. Perform all activities with minimal intervention

Specific goals

The specific goals is divided into:



1. Conduct SOTA on topics related to the AUV concept;
2. Design the vehicle's external structure and perform CFD simulation;
3. Real time simulation using Gazebo and UUV Simulator [Manhães et al. 2016];
4. Write papers related to the project.

Main requirements

Customer

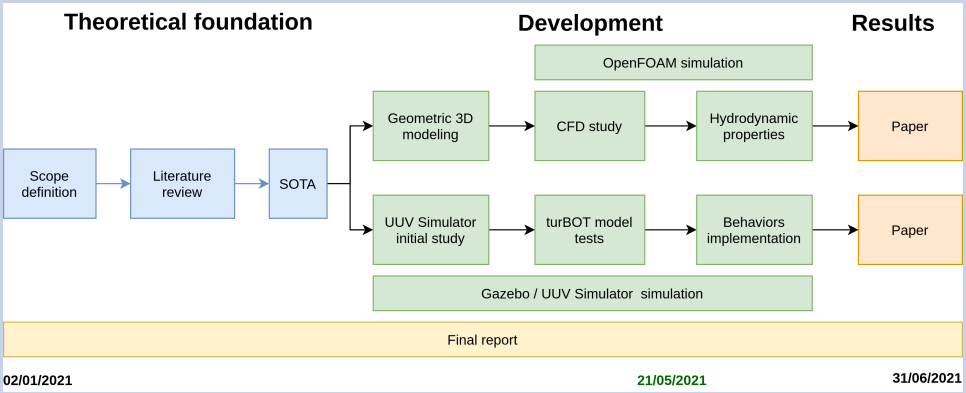
- Indoor/outdoor navigation
- Obstacle avoidance
- Autonomous navigation
- Small dimensions
- Energetic efficiency
- Emergency system
- Lighting system

System

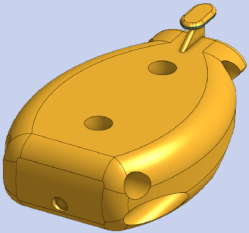
- 5 DOF and 6 thrusters composition
- Perceive dynamic environments
- 50 depth operation
- 1.5 m/s max velocity
- Max 20 kg weight
- 2 h of battery autonomy
- Positive buoyancy

Methodology

The methods adopted for the development of this project were divided into three parts: theoretical foundation, development, and results.



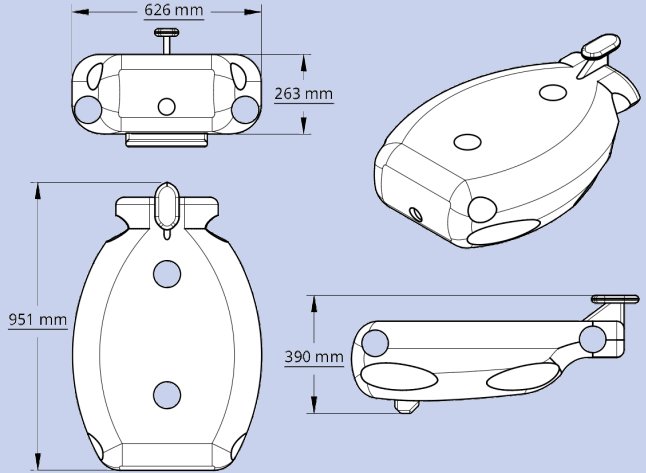
Vehicle's design



The first vehicle's design was made using OnShape software,based on real-life Turbot Fish.

After CFD analysis, an optimized design a will be developed by the team.

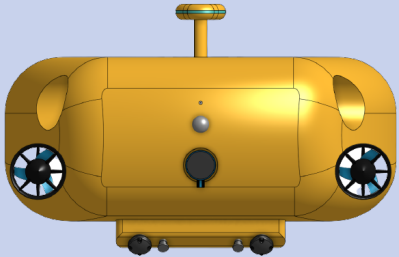
Vehicle's dimensions



Sensors and peripherals

Currently the turBOT project relies on these sensors, actuators and peripherals to perform the simulation:

1. Low-light HD USB camera
2. Minteye standard stereo camera
3. Ping sonar altimeter and echosounder
4. Red laser diode module
5. MPU6050 IMU
6. Venus638Flpx GPS
7. Lumen Subsea Light
8. Thruster Bluerobotics T200



Gazebo simulation

References (1)

[Manhães et al. 2016] Manhães, M. M. M. et al. Uuv simulator: A gazebo-based package for underwater intervention and multi-robot simulation. In: **OCEANS 2016 MTS/IEEE Monterey**. [S.l.: s.n.], 2016. p. 1–8.

ROS - Robot Operating System

O ROS é um conjunto de bibliotecas e ferramentas de software que nos ajudam a desenvolver aplicações robóticas. Possui desde ferramentas de visualização até drivers e algoritmos de Estado-da-Arte, de forma que não precisamos criar tudo do zero.
E tudo isso é **Open Source**!

Distribuições ROS

ROS Noetic Ninjemys (**Recommended**)	May 23rd, 2020			May, 2025 (Focal EOL)
ROS Melodic Morenia	May 23rd, 2018			May, 2023 (Bionic EOL)
ROS Lunar Loggerhead	May 23rd, 2017			May, 2019
ROS Kinetic Kame	May 23rd, 2016			April, 2021 (Xenial EOL)
ROS Jade Turtle	May 23rd, 2015			May, 2017
ROS Indigo Igloo	July 22nd, 2014			April, 2019 (Trusty EOL)
ROS Hydro Medusa	September 4th, 2013			May, 2015

ROS Groovy Galapagos	December 31, 2012			July, 2014
ROS Fuerte Turtle	April 23, 2012			--
ROS Electric Emys	August 30, 2011			--
ROS Diamondback	March 2, 2011			--
ROS C Turtle	August 2, 2010			--
ROS Box Turtle	March 2, 2010			--

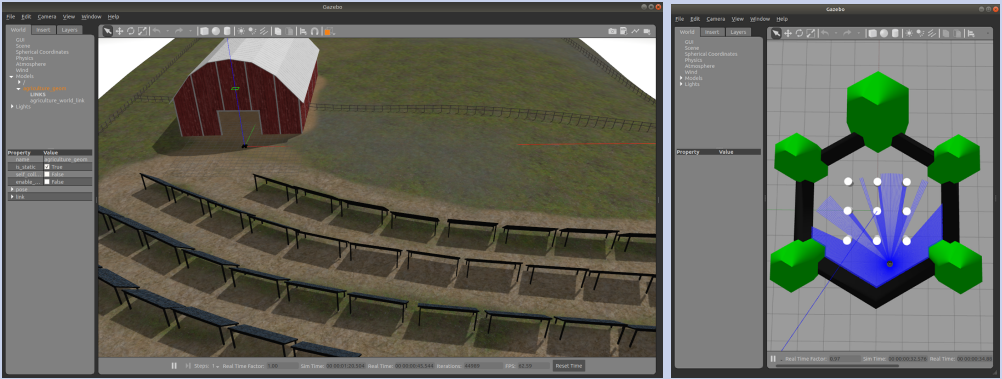
Robôs que utilizam ROS

https://robots.ros.org/

Por que utilizar o ROS?

- ROS é de uso geral, você pode utilizá-lo na aplicação que desejar;
- Possui uma gama de ferramentas úteis para simulação e visualização;
- Possui pacotes para tudo do que se possa imaginar;
- Podemos controlar diversos robôs, fazendo com que eles se comuniquem

Gazebo



Gazebo é um simulador 3D robusto e de código aberto, muito utilizado para simulação de robôs, tornando possível o teste de seus controles e algoritmos em ambientes próximos do real.

Como funciona o ROS?

- **Nodes:** Nós são executáveis que utilizam o ROS para se comunicar com outros Nós
- **Messages:** Mensagens são os tipos de estrutura de dados utilizados pelo ROS
- **Topics:** Os nós podem publicar e ler mensagens em Tópicos
- **Master:** Mestre, controla a comunicação entre todos os nós
- **Rosout:** Equivalente do ROS ao stdout
- **Roscore:** Master + rosout + parameter server

Questions?

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