CENTRO FEDERAL DE EDUCAÇÃO TECNOLÓGICA CELSO SUCKOW DA FONSECA
UNIVERSIDADE FEDERAL FLUMINENSE DIRETORIA DE PESQUISA E PÓS-GRADUAÇÃO DEPARTAMENTO DE PÓS-GRADUAÇÃO
COORDENADORIA DO PROGRAMA DE PÓS-GRADUAÇÃO EM INSTRUMENTAÇÃO E ÓPTICA APLICADA

A Coordenadoria do Programa de Pós-Graduação em Instrumentação e Óptica Aplicada tem a satisfação de convidá-lo para assistir à

DEFESA DE TESE DE DOUTORADO

TÍTULO:

Architecture for Heterogeneous Multi-Robots for Covered Path Planning in Partially Known Dynamic Environments

Gabriel Gerlard Reis de Castro

This doctoral research presents a cooperation strategy for heterogeneous teams of robots composed of multiple Unmanned Aerial Vehicles (UAVs) and Unmanned Ground Vehicles (UGVs) operating in environments with dynamic obstacles. Two scenarios were evaluated: an electrical substation and a precision agriculture environment. To address challenges such as partially known terrains and moving obstacles, the architecture assigns specific roles to UAVs and UGVs. UAVs are responsible for aerial inspection and mapping, while UGVs handle ground-level inspection and can also transport UAVs. An offline Coverage Path Planning (CPP) algorithm, developed by integrating Wavefront and Bidirectional A* methods, is employed to generate initial obstacle-free paths for both UAVs and UGVs, using a precomputed occupancy grid map as a reference. While this step provides a baseline coverage strategy, the system's main innovation lies in its online decision-making layer, which is designed to adapt in real-time to dynamic environmental changes. This layer integrates advanced techniques such as Neural Networks and Deep Reinforcement Learning (DRL) for reactive path planning. At its core, the system implements an adaptive 3D trajectory planning strategy that combines Rapidly-Exploring Random Trees (RRT) with DRL, enabling the robots to respond to unforeseen obstacles and changes in the environment dynamically. The architecture also includes contingency subroutines for UAVs and UGVs to handle critical issues such as battery depletion, communication loss, and localization failures. Extensive simulations using the Robot Operating System (ROS) and the Gazebo simulator were conducted to validate the proposed hybrid approach, demonstrating its effectiveness in addressing the challenges of autonomous multi-robot cooperation in partially known and dynamic scenarios.

Banca Examinadora composta pelos Doutores:

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Local e data: 13 de Janeiro de 2026 às 13h00 – Terça-Feira, no auditório V da DIPPG (Bloco E – 5 Andar) e na Plataforma Teams.

Link do Teams