CENTRO FEDERAL DE EDUCAÇÃO TECNOLÓGICA CELSO SUCKOW DA FONSECA
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-la (o) para assistir à

DEFESA DE TESE

COM O TÍTULO:

"UNMANNED AERIAL VEHICLES SURVEILLANCE AND INSPECTION USING OPTICAL IMAGING SENSORS"

Por

CARLOS ALBERTO MORAES CORREIA

Resumo:

Unmanned Air Systems (UASs) have large and still increasing employment in many areas, such as military applications, industry, agriculture, entertainment etc. Inserted in this state of the art scope, this thesis presents two parts with solutions that will match many UASs autonomous missions.

Firstly, it is proposed an algorithm, using Model Predictive Control, for UAS applications in search and rescue autonomous missions. Search and Rescue (SAR) is one of the most prominent areas for the employment of UASs, in place of a manned mission. In this part, a real-time path-planning solution, using multiple cooperative UASs for SAR missions, is proposed. The technique of Particle Swarm Optimization is used to solve a Model Predictive Control (MPC) problem, that aims to perform search in a given area of interest, following the directive of international standards of SAR. A coordinated turn kinematic model for level flight, in the presence of wind, is included in the MPC. The solution is fully implemented to be embedded in the UAS on-board computer with DUNE, an on-board navigation software. The performance is evaluated using Ardupilot's Software-In-The-Loop, with JSBSim flight dynamics model simulations. Results show that, when employing three UASs, the group reaches 50% Probability of Success, 2.35 times faster than when a single UAS is employed.

The other part of this Thesis develops a method for direct georeferencing of images, gotten from optical sensors aboard the UAS. Optical image sensors are the most common remote sensing data acquisition devices present in Unmanned Aerial Systems (UASs). In this context, assigning a location in a geographic frame of reference to the acquired image is a necessary task in the majority of the applications. This process is denominated direct georeferencing when ground control points are not used. The complete direct georeferencing process involves much information, such as camera sensor characteristics, mounting measurements, attitude and position of the UAS, among others. In addition, there are many rotations and translations between the different reference frames, among many other details, which makes the whole process a considerable complex operation. Another problem is that manufacturers and software tools may use different reference frames, posing additional difficulty when implementing the direct georeferencing. In order to supply this demand, this research presents a comprehensive method for direct georeferencing of aerial images, acquired by cameras mounted on UAS, where all the required information, mathematical operations and implementation steps are explained in detail. Finally, in order to show the practical use of the method and to prove its accuracy, both simulated and real flights were performed, where objects of the acquired images are direct georeferenced.

Banca Examinadora composta pelos Doutores:

Diego Barreto Haddad, Orientador

Fábio Augusto de Alcântara Andrade, Coorientador, University of South-Eastern Norway (USN) – Noruega

Felipe da Rocha Henriques, CEFET-RJ

Mariane Rembold Petraglia, COPPE-UFRJ

Agnar Sivertsen, Norwegian Research Centre (NORCE) – Noruega

Anthony Reinier Hovenburg, TracSense AS - Noruega

Suplentes:

Ana Lúcia Ferreira Barros, CEFET-RJ

Alessandro Lopes Zachi, CEFET-RJ

Local e data:

- Plataforma Teams (https://teams.microsoft.com/l/meetup-join/19%3ameeting_MDNkZWYxZDItMGY5OS00ZjA1LWIwZTAtZDg1MWVhNzc5MjI2%40thread.v2/0?context=%7b%22Tid%22%3a%22bc758dd0-ab53-4372-9a7c-e98a9620862c%22%2c%22Oid%22%3a%2299c08d04-5564-4273-8e2c-de03598b049f%22%7d)
- 14 de setembro de 2022
- 08:00 às 10:00