TECHNOMART Malaysia -Navigating The Future Through Drone-Related Technologies

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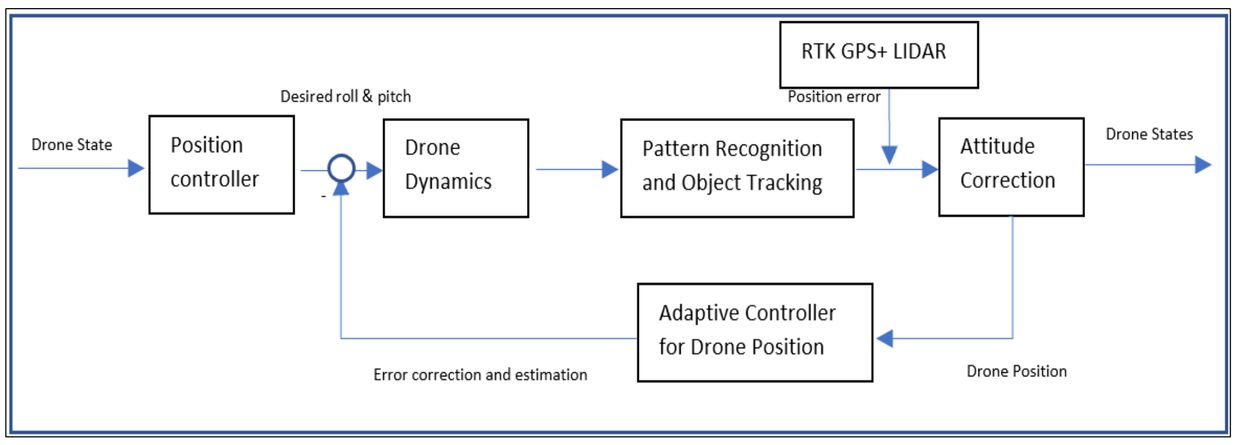
Autonomous Unmanned Aerial Vehicle Precision Landing on a Moving Platform Using Light Detection and Ranging (LIDAR) and Real Time Kinematics Global Positioning System (RTK GPS) For Marine Applications

Abstract

An unmanned aerial vehicles (UAV) are flying vehicles with no pilot inside the vehicle. UAVs are commonly used in aerial surveillance. It can be controlled either manually or autonomously. In the current method, the take-off coordinates are being saved and to be used as landing points for the UAV flight controller (FC). However, this method is only applicable to a non-moving point and unsuitable for moving platforms such as ships or moving vehicles. Thus, an Autonomous UAV Landing On a Moving Platform is invented to overcome the issue. Using an adaptive controller with RTK GPS and LIDAR coupled with a Vision System implemented on a customised VTOL UAV, the required system was successfully developed. The VTOL UAV performed autonomous landing with accuracy of 3m within the landing target using onboard CPU that can be embedded onto any commercial FC. This invention is beneficial to companies that require aerial surveillances in a large area while moving from one point to another point.

Objective

1. To develop an appropriate design concept for autonomous precision landing using sensor fusion of RTK GPS and LIDAR.
2. To design a custom UAV optimized to perform autonomous precision landing on a moving platform.



Frame of Work

The adaptive controller model implementation is shown in Figure 1. The core of the precision landing system is in the position error correction that uses sensor fusion of RTK-GPS with LIDAR and the image processing technique. The RTK-GPS installed in the moving platform updates its location to the onboard CPU on the UAV which then sends the attitude correction commands to the FC. Additionally, a camera is installed on the UAV to capture unique pattern images placed at the centre of the landing platform to refine the position correction further by adjusting the UAV movement to be at the centre of the images while the UAV slowly descends until it lands.

Implementation

1. This project uses an actual image recognition system using Companion PC(Raspi 4).
2. Algorithm tested on actual VTOL UAV (Figure 2) [patented]
3. Completed full algorithm using RTK GPS and Vision System and LiDAR [patented]
4. Add-on fail safe feature: retry landing if target moves suddenly out of the target radius

Commercialization Potential

1. Suitable for companies that require aerial surveillance
2. Suitable for companies that provide delivery services by using drones

Project Partners:

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