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Advances in Drone Technology Applications and Control

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Related Works

Drones or Unmanned Aerial Vehicles (UAVs) are pilotless aircraft operated with advanced components comprising ground control stations (GCS), sensor technology, and modern communication tools to facilitate remote navigation and control. Previously, drone technologies were popular only in military operations, such as search, rescue, and mapping missions (Ul Hassan et al., 2017). However, with recent advances in computer technology and the Internet of Things, the application spectrum and control technology for drone systems has exploded to include other unimagined deployments, such as emergency evacuations during disasters, for example, fires and floods (Song & Scaramuzza, 2022). Figure 1 shows the drone technology application array.

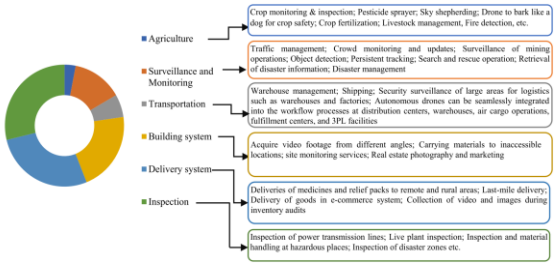

***Figure 1**: Application Array of drone technology. **Source**: (Ahmed et al., 2022)*

This research focuses on drone applications and control. It explores current and past applications of drone technology and examines the advancement trajectory of drone technology to reveal potential areas of research and alternative usage. This research forms a crucial inquiry as it may facilitate a more expanded use of drones and attract broader research, investments, and improved policy for their application to protect human wellbeing. The specific research objectives of the study are:

1. To identify the various drone applications.
2. To explain the major technologies used in the development of drones
3. To identify some of the opportunities and challenges associated with the drone technology
4. To develop a more efficient drone navigation system based on Global Navigation Satellite System to facilitate item deliveries to customers

Current Outcomes

Drone Application Areas

1. ***Application in agriculture***.
2. ***Application in remote sensing***
3. ***Long-range environmental monitoring***
4. ***Aero Robotics in agricultural applications***
5. ***Application in defense***
6. ***Application in power line inspection***
7. ***Application in road traffic monitoring*****A GNSS-Based Drone Navigation System for Item Deliveries**

The system architecture of the proposed drone navigation system will implement Erle-Brain 3 hardware, which comprises a Linux-based embedded computer, an ROS system and a preinstalled Autopilot software. The system sparingly depends on a GPS to collect information about the current location of the Drone in the navigation path. Precise positional data is required to facilitate autonomous navigation. For this purpose, the proposed system implements GNSS to supplement the positional data from GPS system. Based on this data, the system schedules a navigation trajectory between the selling store and the customer using bearing. Course-over-ground data is used to enhance the navigation data. It is obtained using the bearing calculated between two geodetic coordinates as the drone proceeds along the trajectory. The algorithm for the proposed navigation system is shown in Figure 2.

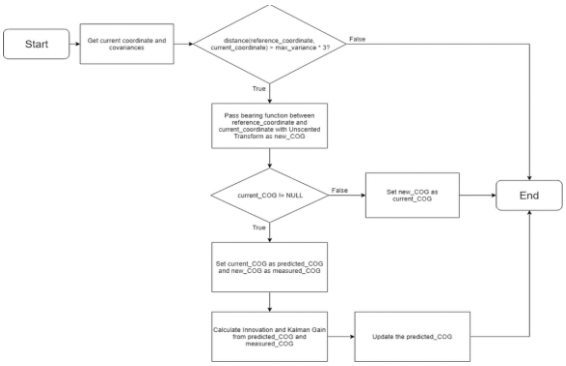

Figure 2: Algorithm for GNSS-based drone navigation system for item deliveries

Research Contribution

It is expected that the proposed system will outperform the existing state-of-the-art drone navigation system to make autonomous item delivery to customers realizable. The study realizes the benefits of deep learning, especially in object localization and detection. The research will contribute to the growing drone technology literature, and facilitate further commercialization of UAVs.