HUMAN DRONE INTERACTION

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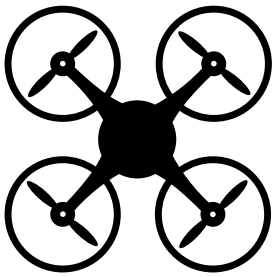
Introduction



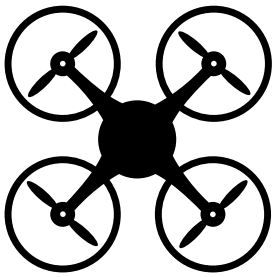
In today's rapidly evolving world, the surge of technological advancements is unmistakable. As innovation progresses, so does our ability to delve into new realms of possibility. Amidst this transformation, the fusion of human-drone interaction emerges as a beacon of promise.

Human-drone interaction transcends technical expertise; it's about leveraging technology to address real-world challenges. From assisting individuals with disabilities to transforming entire industries, seamless human-drone collaboration can effect tangible change.

Human-drone interaction can reshape education, fostering inclusivity through intuitive interfaces and personalized assistance, benefiting all students, including those with disabilities.

Embarking on this journey into human-drone interaction opens doors to endless possibilities. Together, we have the power to pioneer new inventions and usher in a future where technology serves as a force for societal good, fueled by collaboration and creativity.

Background Research

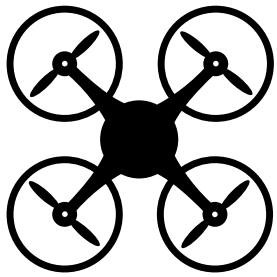


Human-drone interaction (HDI) stands at the forefront of technological innovation, blending human cognition with autonomous systems. Research in HDI spans various disciplines like human-computer interaction and robotics, aiming to optimize user experience and system efficiency.

In education, HDI fosters experiential learning, nurturing problem-solving skills and STEM literacy. In healthcare, drones offer promise for remote monitoring and emergency response. Industrial applications streamline tasks like inventory management and infrastructure inspection.

Challenges include user acceptance and regulatory compliance. By prioritizing a human-centered approach and interdisciplinary collaboration, we can unlock the transformative potential of HDI, shaping a future where drones seamlessly integrate into diverse aspects of society.

Literature Review

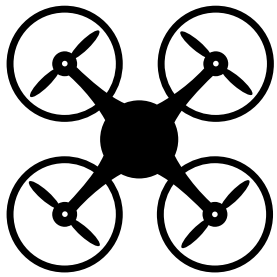


1. **Flyables: Exploring 3D Interaction Spaces for Levitating Tangibles by Pascal Knierim, Alexander Achberger, Thomas Kosch, and Markus Funk**

   The literature review of the paper can be summarized in the following points:

   - Tangible User Interfaces (TUIs) lack the ability to indicate digital changes and enable 3D interaction.
   - Actuated tangibles can move in 2D but are limited by gravity for 3D interaction.
   - Quadcopters have been proposed as levitating tangibles to enable 3D interaction through touch, drag, and throw gestures.
   - Previous research focused on theoretical concepts, technical implementations, and gestural input but lacked user-centered evaluations.
   - The paper aims to evaluate touch, drag, and draw interactions with levitating quadcopter tangibles through a user study.

Literature Review



2. **Collocated Human-Drone Interaction: Methodology and Approach Strategy by Anna Wojciechowska, Jeremy Frey, Sarit Sass, Roy Shafir, and Jessica R. Cauchard**

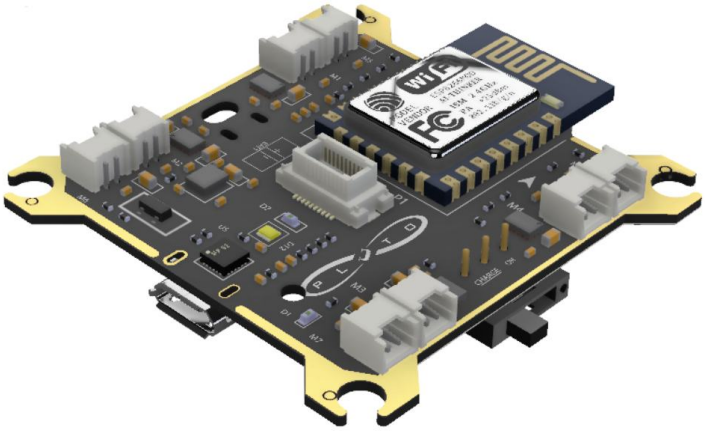
   The literature review of the paper can be summarized in the following points:

   - Research on proxemics and comfortable interaction distances between humans and robots has been conducted, mainly for ground robots.
   - Studies have investigated how robots should approach humans for tasks like fetching and carrying, considering factors like direction and speed.
   - Human-drone interaction research is relatively new, focusing on control mechanisms, interaction techniques, and UAV acknowledgment.
   - Limited work has explored comfortable approach parameters for drones, such as height and proximity.
   - Methodologies for human-drone interaction studies vary in realism, complexity, safety, reproducibility, and scalability.

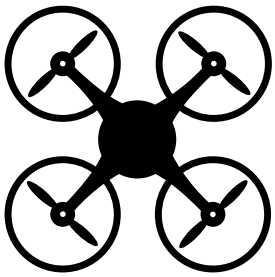
About Drone

Pluto X, by Drona Aviation is the most agile and the modular aerial robotic kit that comes with the Primus X flight controller, which mainly contains 32-bit ARM Cortex M4 microcontroller with Wi-Fi module.

Pluto X is the drone which comes with the ability to tinker with this and make some popular projects in C++ language using its Cygnus IDE.



Project

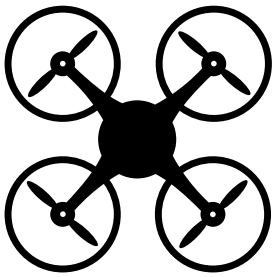


In the project, we are trying to program the drone in such a way that it will respond if any notification ping on your smartphone in 3 ways.

1. **Through screen wake-up detection**
   Most people usually have a setting on their phone called 'Wake up screen on notification.' So when the phone's screen wakes up, the drone will detect the change in the color of the pixels through its wireless camera. In response, its LED will change color. However, it mainly works based on the particular pixels in the wallpaper that you use. It doesn't have the whole color gamut.

2. **Through notification sound**
   In general mode, phone will create a sound when notification come. So if the drone is already flying in that case it will use the external microphone, laptop(in our case) to detect the sound, and in response to the sound, it elevated and lower for some seconds.

Project



3. **Through Wi-Fi**
   I dedicated around 4-5 weeks to learning basic Android development. After learning, I created two Android applications. In the first application, I implemented functionality to create a text file in your phone's file manager. Whenever your phone receives a notification, it will write '1' in the text file.

   The second application I created uses GRPC to communicate with the drone. It reads the text file and performs some functions to aware the person that there are some notification on his phone, its functionality is similar to the Amazon Alexa which changes its ring light color to orange. But there are some problems in integrating both the application because of the problems in not able to use API key of Pluto X. But in the future I can able to resolve this issue with better understanding of API and Android development both

GitHub Link - Human Drone Interaction
Videos Link - Human Drone Interaction

Thank you