

Short: Rethinking Secure Pairing in Drone Swarms

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Background & Motivation

Drone swarms enable critical applications **but**



The Hacker News

You Can Hijack Nearly Any Drone Mid-flight Using This Tiny Gadget

Forbes

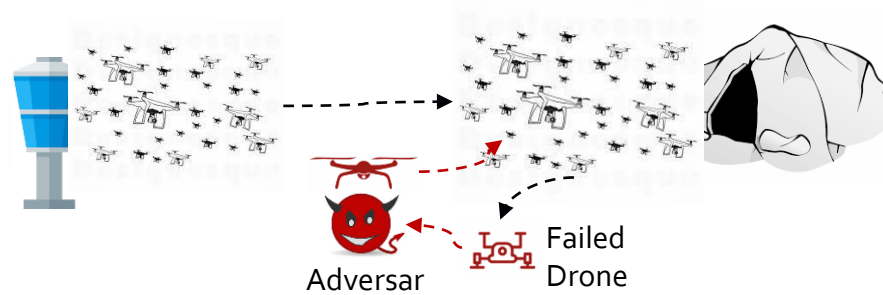
Keeping Foreign Spyware Out Of U.S. - Made Drones Is Harder Than You Think

threat **post**

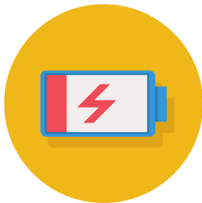
Hack Allows Drone Takeover Via 'ExpressLRS' Protocol

Design Requirements

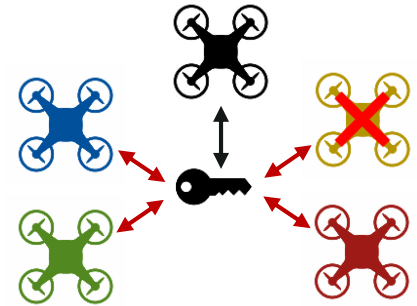
Swarms need a pairing method to establish secure communication channels that protect the confidentiality and integrity of the messages



- R1a:** Person-in-the-middle Attacks
- R1b:** Adversarial Drones
- R1c:** Stolen Credential Attacks



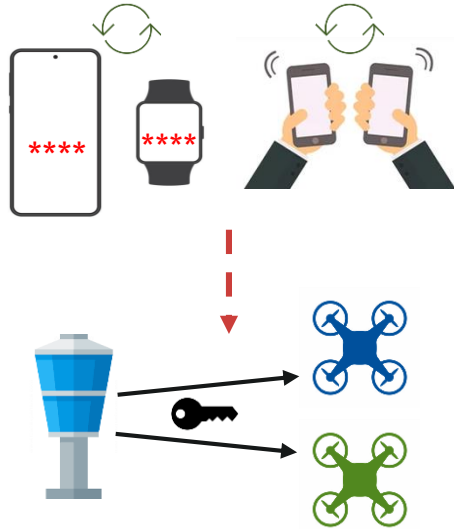
R2: Energy Efficiency and Scalability



R3: Drone Addition and Removal

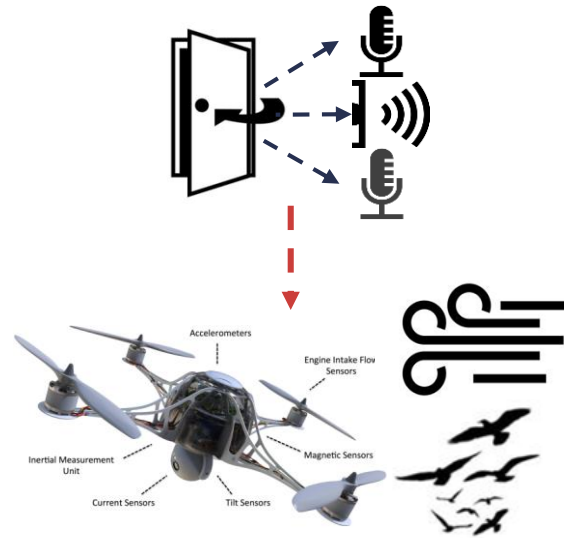
Existing Pairing Solutions

Human-in-the-loop-based



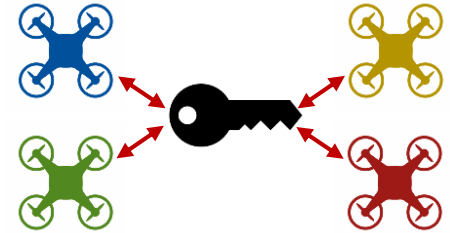
- Vulnerable to stolen credentials
- Key revocation

Context-based



- Malicious drones can observe the same context
- They do not support drone addition

Public key cryptography (PKC)-based



- Vulnerable to stolen credentials
- Scalability issues

Existing Pairing Solutions

Unfortunately, existing pairing solutions fail to meet the design requirements of drone swarms

Pairing Solution	R1a	R1b	R1c	R2	R3
Human-in-the-loop-based	●	●	○	●	◐
Context-based	●	○	○	●	○
PKC-based	●	●	○	○	◐

Research Directions

Protection against stolen credentials

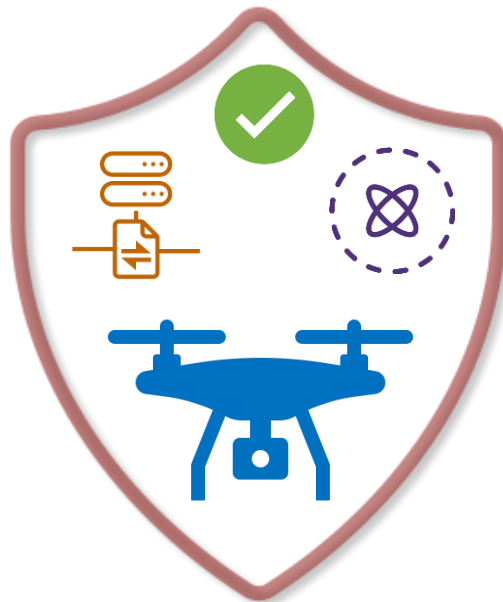


Secure hardware

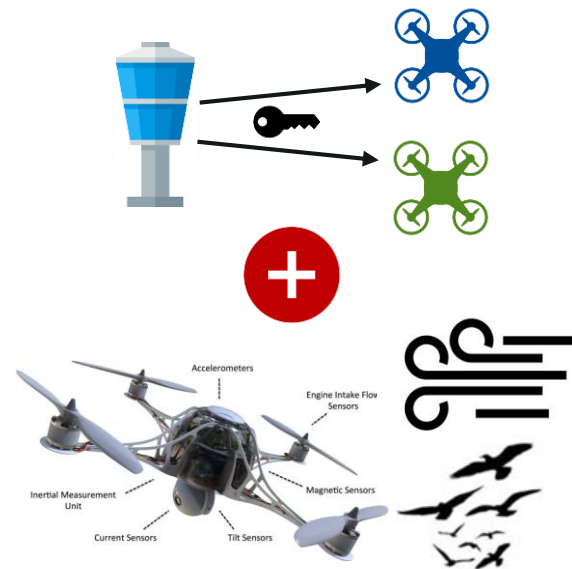


Identifying crashed drones
+ maintaining deny lists

Behavior-based continuous authentication & attestation



Combination of Pairing Solutions



Conclusion

- In this paper:
 - We explore the security and design requirements for effective swarm pairing
 - We show existing pairing techniques are not sufficient to meet the needs of drone swarms
 - We propose research directions for designing swarm pairing methods that satisfy the unique needs of swarms
- These research endeavors are of utmost importance for **secure** and **trustworthy** drone swarms

Thank you! Questions?

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Backup
