Towards Efficient and Secure Agricultural Information Collection Using a Multi-Robot System (#1932300, #1931767, *2020-2023*)

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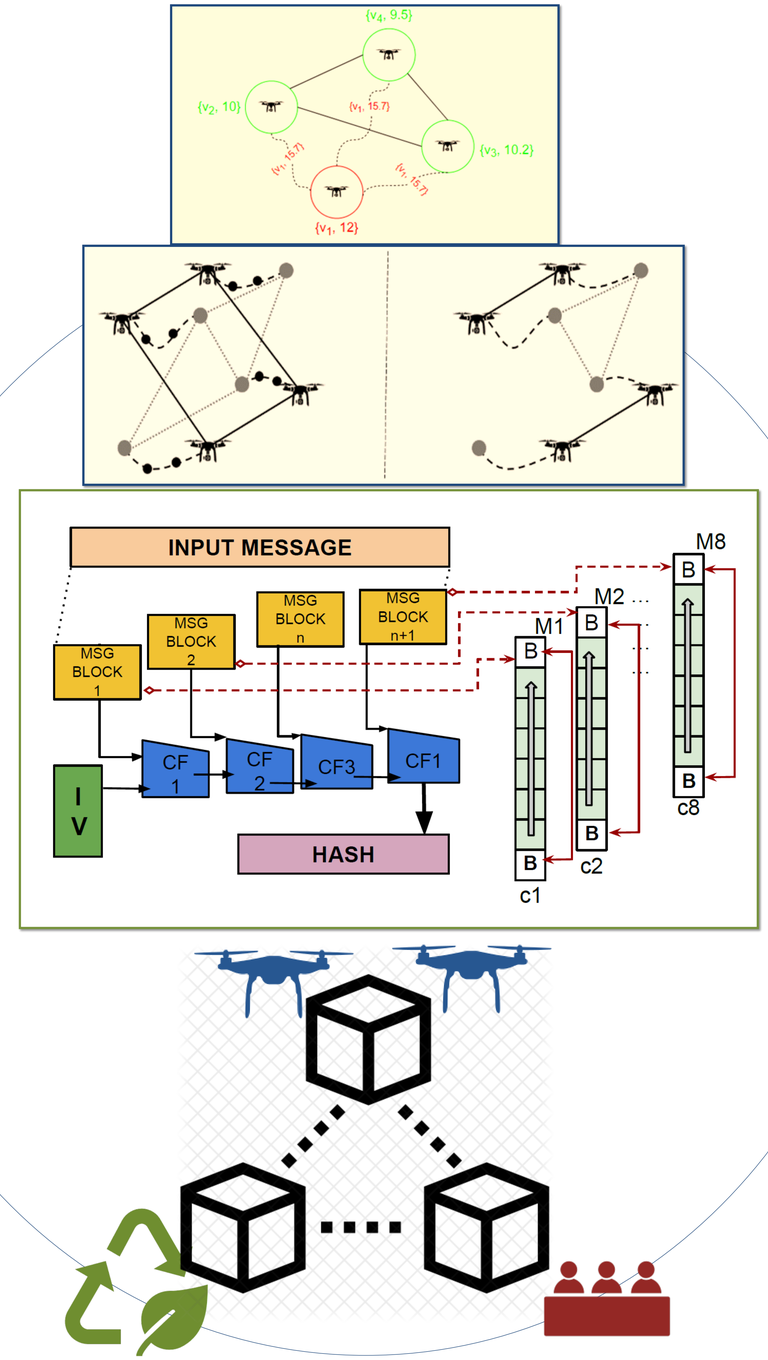
Challenge

- The robots should coordinate the movement and sensing and react in *real time* to incoming information while maximizing information collection
- Ensure that the data received by a robot has not been compromised
- Integration of *resource-intensive* Blockchain-based consensus protocols that might affect device availability



Solution

- Integrated Blockchain-based security consensus protocols with multi-robot information collection techniques
- Developed solutions for continuous, periodic, and opportunistic connectivity.
- Engineering Merkle Tree SHA256 algorithm and Proof of Work (PoW) using the Energy Complexity Model to *reduce the overall energy consumption* in Blockchains

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Scientific Impact

- First to develop *secure* multi-robot information collection techniques.
- First to analyze the *advantages and drawbacks* of using blockchain consensus protocols in information collection for three connectivity protocols.
- Achieved *energy reduction* of up to 98% and 20% in Merkle trees and PoW, respectively.

Broader Impact

- Efficient multi-robot exploration can improve the efficiency in agriculture, forestry, disaster rescue, and monitoring pollution.
- A *lightweight blockchain-powered* robot fleet can be deployed into a hostile environment with resistance to tampering and possible compromised data.
- Involvement of undergraduate, graduate, and Ph.D. students/interns enrich experiences.