Blockchain Technology for Networked Swarms of UAVs

Isaac J. Jensen, Daisy Flora Selvaraj, Prakash Ranganathan , Shree Ram Abayankar*
School of Electrical Engineering and Computer Science
University of North Dakota
Grand Forks, ND, USA
isaac.j.jensen@ndus.edu

Introduction

Unmanned Aerial Vehicle (UAV) technology is being continually developed with an already wide array of current and planned future applications. Because of their "ease of deployment, low maintenance cost, high-mobility and ability to hover" UAVs have been predicted and/or tested to be useful in such areas as search and rescue, remote sensing, structure inspection, agriculture, package delivery, traffic monitoring, surveillance, and wireless network coverage [1].

Blockchain Technology

Though Blockchain is a relatively new technology in the world of cyber-security, it has been the underlying technology that supports Bitcoin system. [2, 3]. Many are speculating the impact it will have on a wide array of applications such as asset management, real estate, healthcare, and Internet of Things (IoT) which contains the UAV domain [3].
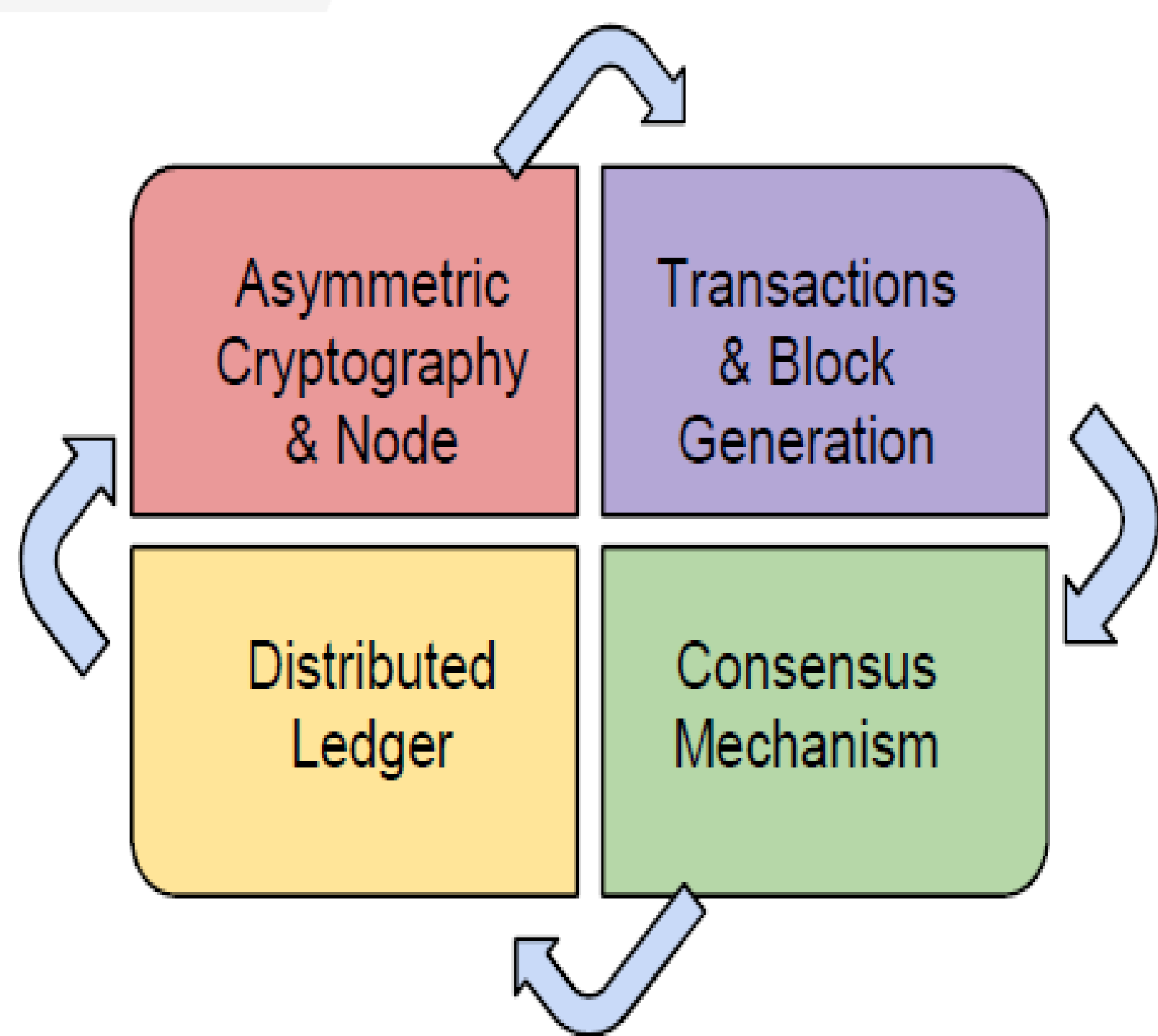

Fig. 1. Depiction of core components of blockchain

When two or more nodes, or network participants, want to transfer or share information, such as digital assets, between one another, they must go through what is referred to as a transaction [3]. When a transaction occurs, the source node generates a file containing information about the transaction; this file is broadcasted to the entire network or selected nodes for validation depending on the consensus mechanism [3]. Validation entails making sure the transaction is not violating network specific regulations, such as spending assets that do not exist. After validation, these transactions are congregated into blocks of other transactions, the size of which depends on application; these blocks are then approved and added to the blockchain again depending on the consensus mechanism being utilized [2, 3].

Research on UAV's and Blockchain

A substantial amount of research is being committed to the search of applications of blockchain to increase the security of systems. Many planned UAV applications will rely on data heavy technologies such as machine learning, cloud technology, image processing and several other complex data collection, sharing, and processing technologies [1]. Therefore, blockchain technology could be crucial in ensuring that data in a system is secure and can be trusted. The following section discusses some of the research and planned applications of blockchain in the UAV and (inherently) the IoT domains.
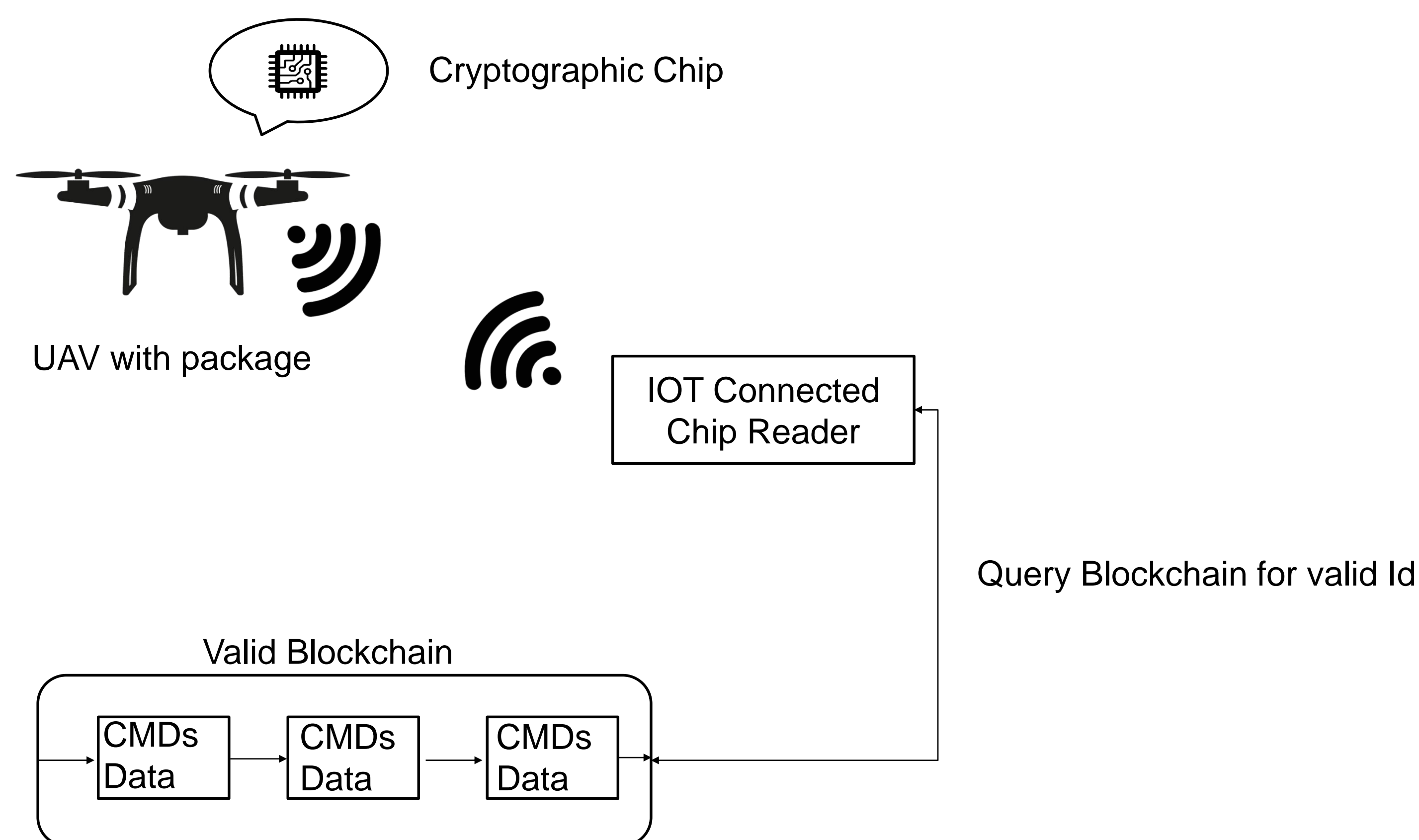

Fig 2. Depiction of Chronicles Package Delivery Solution.

HYPERLEDGER FRAMEWORK

The Hyperledger project began late in the year 2015 under the Linux foundation [6]. The goal of the project was to make improvements upon blockchain technology by increasing both performance and reliability; the end result was six types of Hyperledger frameworks as well as six different tools that can be used by developers for a wide variety of applications. Here, the framework known as Hyperledger Fabric will be discussed in short as well as the advantages it can provide over other blockchain platforms such as Bitcoin or Ethereum. A short hypothetical application of Hyperledger Fabric to a UAV swarm environment is discussed afterwards.
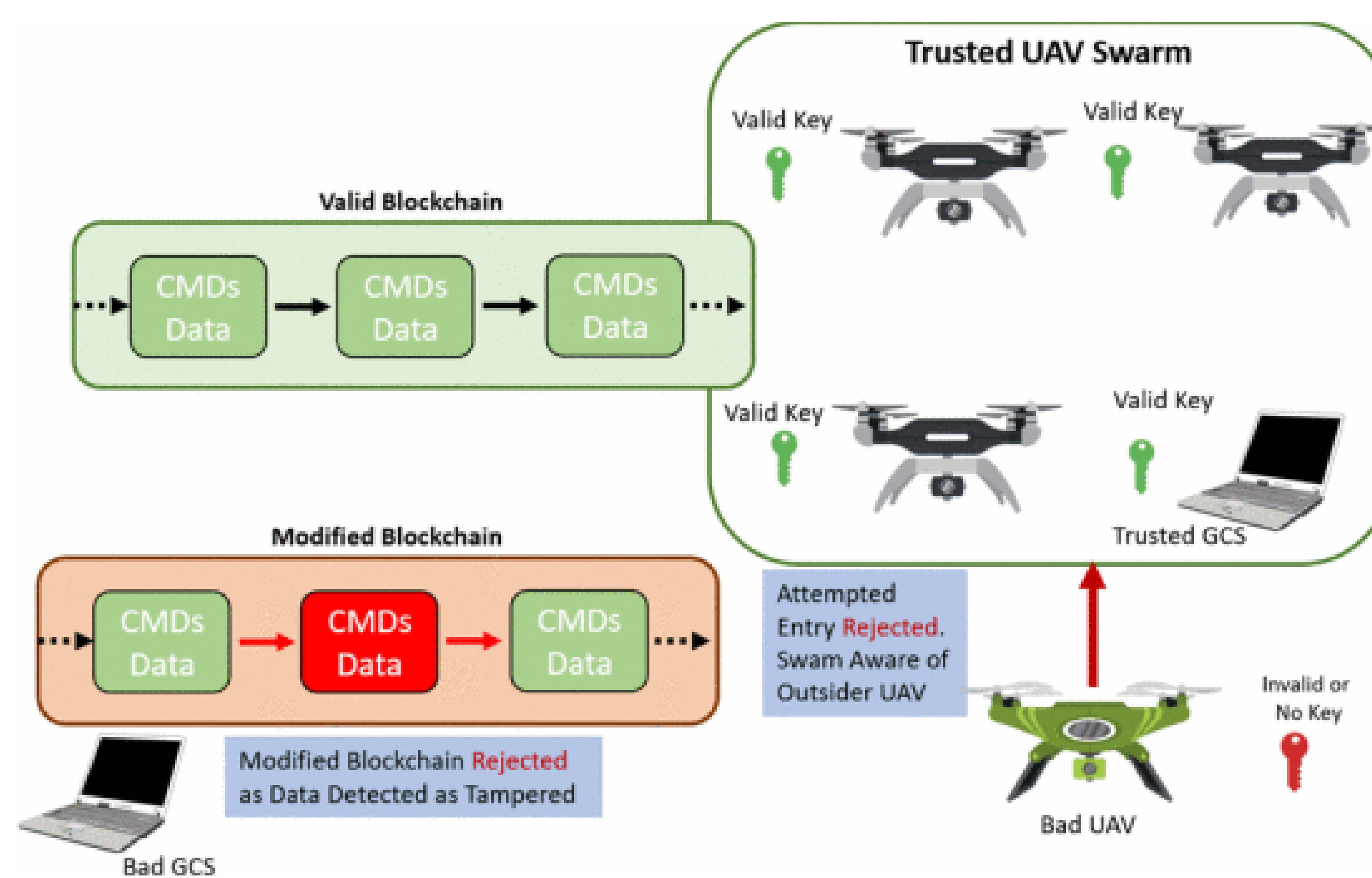

Fig. 3. Depiction of a UAV Swarm utilizing Blockchain technology

Conclusions

The usage of UAVs in industry will only continue to increase, and it is important that the systems that rely on UAV technology are kept as secure as possible from malicious attacks. Blockchain tools (e.g., Hyperledger Fabric) offer promising solutions in preserving CIA properties. Applying blockchain appropriately will allow developers to implement trustworthy UAV systems in domains such as search and rescue, traffic management, infrastructure inspection, and many other areas. Development of custom block chain solutions is also very possible and viable, if trade-off between computational and energy limitations are obtained for UAVs.

References

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Contact

Dr. Prakash Ranganathan
Director of Center for Cyber Security Research (C2SR) Associate Professor, IEEE Senior Member of Electrical Engineering College of Engineering & Mines University of North Dakota
prakash.ranganathan@UND.edu |
701.777.4431