Authors’ Response to the Reviewers

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Title: Towards An Autonomous Industry 4.0 Warehouse: A UAV and Blockchain-based System for Inventory and Traceability Applications in Big Data-driven Supply Chain Management
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The authors would like to thank the reviewer for his/her valuable comments, which have certainly helped us to improve the manuscript. Please find below our detailed responses to the comments. In order to ease the labour of the reviewers we have colored in red the major differences with the previous version of the article.

I. RESPONSE TO REVIEWER NO. 2

This paper aims to present an autonomous industry 4.0 warehouse. Specifically, it develops a UAV and blockchain-based system for inventory and traceability applications in big data-driven supply chain management.

My overall assessment is that the paper does not state a clear and specific problem to solve, and falls short in achieving the objective stated on the title of the manuscript. Most of the work reads as a review paper and for the design, methodology, and results, I do not consider there is a contribution.

Thank you for pointing such issues out. To address them, we have emphasized clearly the aim and the contributions of the paper and the problem to be solved. This has been performed in the abstract (lines 14-16 and 22-23), introduction (lines 70-77) and conclusions (lines 575-578).

The introduction presents the general motivation and scope of the paper consisting in Industry 4.0 and UAVs, while the second section presents a very extended literature review (the paper has 84 references). However, the main conclusion of the literature review is generic and the Authors have not been able to bring out the novel aspect of the work: “it is still necessary more research to develop specific systems that consider the following main aspects: Data volume… speed… verification and veracity… versioning… accessibility”. I suggest a shorter literature review but focused on a specific problem. Here the problem is generic.
We agree with the reviewer on his/her observation. Therefore, we added a new Section 2.4 (lines 220-257) that compiles the main shortcomings of the current state-of-the-art and outlines the specifics of the problem to be solved.

The design and implementation sections are rather short and they should be better connected with the strengths and weaknesses of the existing solutions of the specific problem the paper is trying to solve in order to highlight the contribution. Moreover, there are some decisions that must be clarified: the use of a hexacopter, why no other multirotor? the size of the UAV given that the payload is minimum (sensors and RFID reader); the use of a GPS as the experiments are indoors. The only thing that can be appreciated from these sections is the integration of existing technology, which is not a contribution itself.

We do agree with the observations of the reviewer. Both Sections 3 (Design) and 4 (Implementation) have been extended in order to provide more detail on the proposed architecture and on the implementation of the system. Moreover, these sections were linked with the first part of the article through the new subsection “Analysis of the state-of-the-art” (Section 2.4).

Specifically, we have introduced the following enhancements:

- We have included additional information in Table 1.
- The advantages of the application of blockchain respect to other inventory solutions are clarified in Section 3 (lines 270-290) and (305-313).
- The Ethereum testnet scenario is further described in Section 4 (lines 383-396) with special focus on the two different tested testnets: Rinkeby and Ropsten.
- Section 4 (lines 400-439) details how the inventory information is processed by the proposed architecture. An additional Figure 5 illustrates how inventory data is stored on the decentralized database and on Ethereum. Moreover, a new Figure 6 illustrates the data validation steps.

Regarding the specific reviewer questions to be clarified:

a) We have added the justification of the use of an hexacopter in lines 320-325.

b) The explanation of why the GPS is considered although the experiments performed are indoors is presented in lines 333-334.

Finally, the results only include four experiment runs for testing inventory time and signal strength. The results are clearly influenced by factors that are not taken into account in the methodology as the path of the UAV, the departing point, the pilot experience and skills, etc. The experiments must be designed to test the identified aspects presented in the literature review: data volume, speed, verification, veracity. The validation of the proposed approach must include more experiments and they must cover more conditions in order to generalize the findings. The results must include comparisons with other inventory systems based on UAVs such as the ones presented in [14-17] (just to mention some), not against a human operator that will be obviously outperformed.
Regarding the specific reviewer questions to be clarified:

a) Considering the nature of the proposed experiments and the RFID reader reading range, the pilot experience and skills can be considered negligible in the results obtained. This is explained in lines 463-465.

b) Regarding the comparison with other UAV-based inventory system, we highlighted the main shortcomings of the current state-of-the-art in lines 219-257 (new Section 2.4). We consider that a more in-depth comparison is tricky since the proposal of the article integrates aspects that are no covered by current commercial and scientific solutions.

Following the reviewer's indications, we include an additional Section 5.4 that evaluates the performance of the proposed architecture:

- Performance of the decentralized database (new Section 5.4.1). Specifically, the performance of OrbitDB in terms of response latency under six scenarios.
- Performance of the blockchain (new Section 5.4.2). Specifically, the process of update of a smart contract in a Ropsten testnet.